# Weiser River Watershed Subbasin Assessment and Total Maximum Daily Loads

FINAL

Department of Environmental Quality

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Weiser River Soil Conservation District
Adams Soil Conservation District

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# Abbreviations, Acronyms, and Symbols

**§303(d)** Refers to section 303 subsection (d) of the Clean Water Act, or a list of impaired water bodies required by this section

**§** Section (usually a section of federal or state rules or statutes)

**µg/L** micrograms per liter

**Ag Plan** Idaho Agricultural Pollution Abatement Plan

**BMP** best management practice

**BOR** United States Bureau of Reclamation

**BURP** Beneficial Use Reconnaissance Program

**C** Celsius

**CFR** Code of Federal Regulations (refers to citations in the federal administrative rules)

**cfs** cubic feet per second

**cfu** colony forming units

**CWA** Clean Water Act

**DEQ** Department of Environmental Quality

**EPA** United States Environmental Protection Agency

***E. coli*** *Escherichia coli*

**EPT** Ephemeroptera, Plecoptera and Trichoptera

**F** Fahrenheit

**HUC** Hydrologic Unit Code

**IDAPA** Refers to citations of Idaho administrative rules

**$j/m^2/s$** Joules/meter$^2$/second

**kg/day** kilograms per day

**km** kilometer

**$km^2$** square kilometer

**LA** load allocation

**LC** load capacity

**mg/L** milligrams per liter

**mm** millimeter

**MOS** margin of safety

**mpn** most probable number

**NA** not applicable

**NB** natural background

**NPDES** National Pollutant Discharge Elimination System

**NRCS** Natural Resources Conservation Service

**NSMP** nonpoint source management plan

**NTU** nephelometric turbidity unit

**RDI** DEQ's river diatom index

**RFI** DEQ's river fish index

**RMI** DEQ's river macroinvertebrate index

**RPI** DEQ's river physiochemical index

**SBA** subbasin assessment

**SCD** Soil Conservation District

**SFI** DEQ's stream fish index

**SHI** DEQ's stream habitat index

**SMI** DEQ's stream macroinvertebrate index

**SSC** suspended sediment concentration

**SSTEMP** Stream Segment Temperature Model

**TMDL** total maximum daily load

**TSS** total suspended solids

**U.S.** United States

**U.S.C.** United States Code

**USGS** United States Geological Survey

**WAG** Watershed Advisory Group

**WLA** waste load allocation

**WQLS** water quality limited segment

**WQS** water quality standard(s)

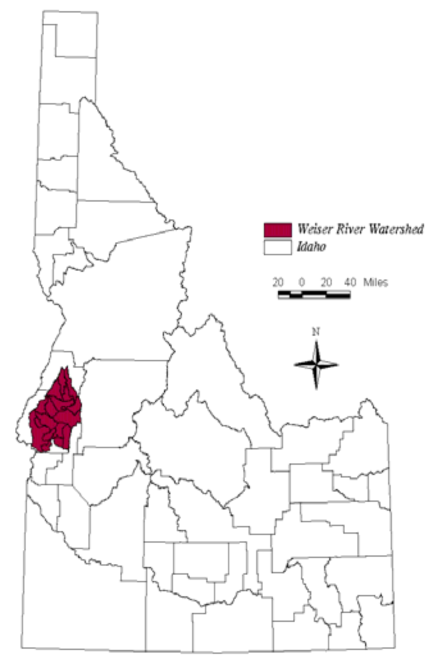
**WWTP** wastewater treatment plant

# Executive Summary

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

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

## Subbasin at a Glance




| Weiser River Watershed | |
|---|---|
| HUC: | 17050124 |
| Water Bodies: | Weiser River (3 Segments), West Fork Weiser River, Mann Creek, Cove Creek Crane Creek, Little Weiser River, Johnson Creek, North Crane Creek, South Crane Creek, and Crane Creek Reservoir |
| Pollutant Sources: | Point and Nonpoint Sources |
| Ecoregions: | Snake River-High Desert Blue Mountains |
| Size: | 1,079,148 Acres |

**Figure A. Weiser River Watershed Vicinity Map.**

The Weiser River Watershed, hydrologic unit code 17050124, encompasses a large area in southwestern Idaho (Figure A). The headwaters for the Weiser River originate in the southern end of the Seven Devil Mountain Range and the west central mountains of Idaho. The watershed size is 1,079,148 acres solely within the state of Idaho. There are no tribal lands within the watershed and the only interstate water is the Snake River, which the Weiser River discharges to.

Land uses in the Weiser River Watershed consist of dry land agriculture, irrigated agriculture, rangeland, forest, and riparian or open water. Land ownership is a mix of private holdings, federally managed lands, and state-managed lands. A majority of the population is associated with small homesteads scattered throughout the watershed. The municipalities of Weiser, Midvale, Cambridge, and Council are the only recognized urban areas in the watershed.

Overall, there are twelve water quality limited segments within the Weiser River Watershed that were placed on the Idaho 1998 §303(d) list:

- One segment is a reservoir: Crane Creek Reservoir. Action on Crane Creek Reservoir will be delayed until 2007 to allow further study and to assess the status and appropriateness of designated uses.
- Three segments of the Weiser River were listed on the Idaho 1998 §303(d) list.
- The remaining water bodies are tributaries to the Weiser River or Crane Creek Reservoir.

Information about these segments is provided in Figure B and Tables A and B:

- Figure B shows the Idaho 1998 §303(d) listed segments in the Weiser River Watershed.
- Table A details each listed segment's impaired uses and pollutant(s) of concern. Each segment will be addressed separately in this executive summary.
- Table B shows a breakdown of the findings in the subbasin assessment and actions to be taken (i.e., delist, list, or develop a total maximum daily load).

Sediment, bacteria, flow alteration, nutrients, and temperature are the listed pollutants of concern. It is through the subbasin assessment process that the segments and any available data are analyzed to determine the support status of the beneficial uses in the segment. These uses include cold water aquatic life, primary or secondary contact recreation, salmonid spawning, water supply, wildlife, and aesthetics.

Those water bodies determined to be not fully supporting their designated or existing beneficial uses and not meeting applicable water quality standards are required to have a total maximum daily load developed. For the Weiser River Watershed, five segments were determined not to be supporting the designated or existing beneficial use. Three segments were determined to be intermittent water bodies, two were determined to be fully supporting designated or existing uses, and the remaining two require further verification. Support status was determined by comparing water quality data to Idaho water quality criteria and assessing biological information.

Total maximum daily loads were developed to address sediment, bacteria, and temperature in the Weiser River Watershed. Additionally, total phosphorus load allocations have been established based on load allocations set in the *Snake River-Hells Canyon Subbasin Assessment and Total Maximum Daily Load* (Idaho DEQ and Oregon DEQ 2004).

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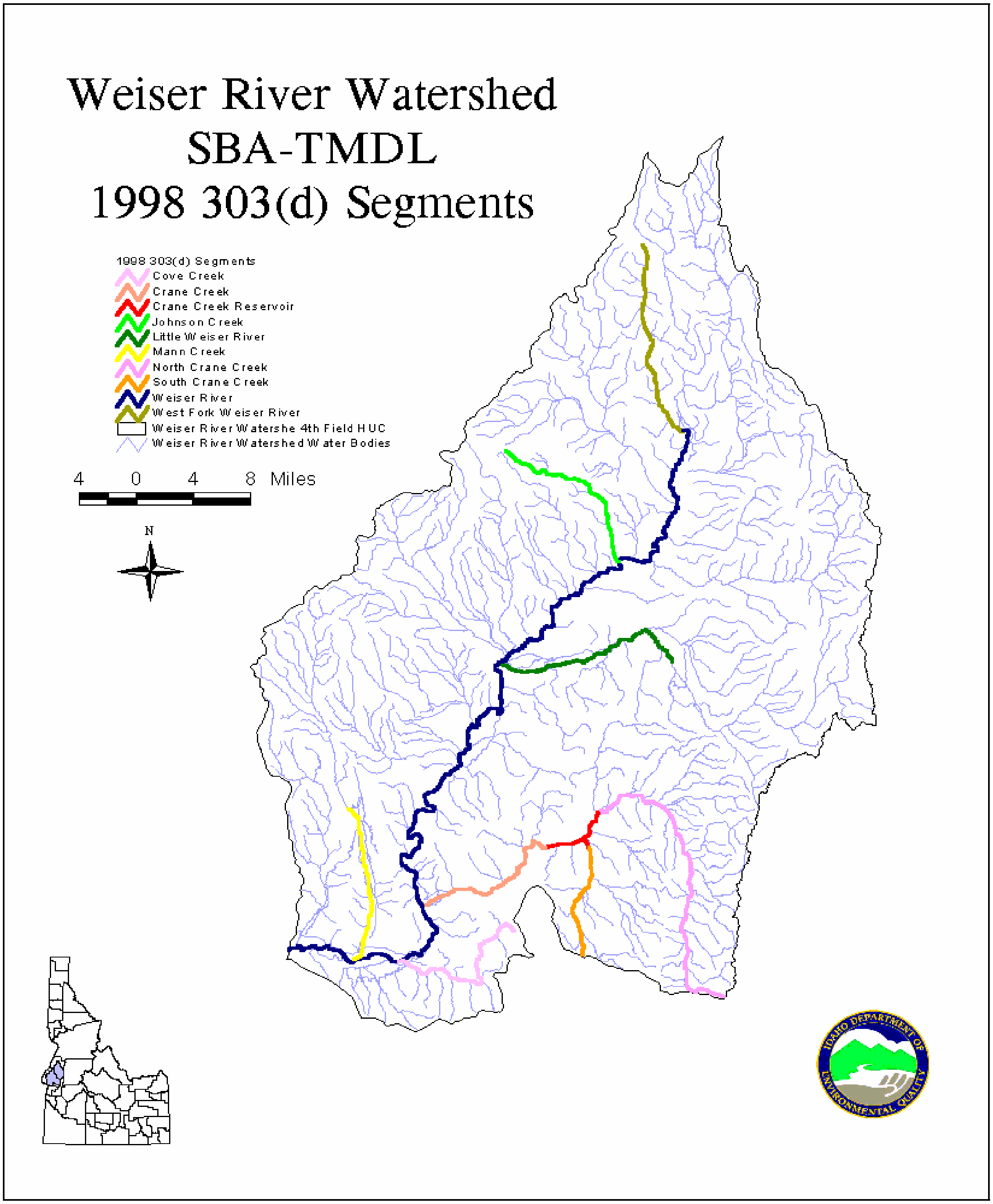


**Figure B. Idaho §303(d) Listed Water Bodies. Weiser River Watershed.**

## Table A. Idaho 1998 §303(d) Listed Segments. Weiser River Watershed.

| Stream | Boundary | Listed Pollutants |
|---|---|---|
| Weiser River | Galloway Dam to Snake River | Nutrients, Sediment, Bacteria, Dissolved Oxygen, and Temperature |
| Weiser River | Little Weiser River to Galloway Dam | Nutrients, Bacteria, and Sediment |
| Weiser River | West Fork Weiser River to Little Weiser River | Nutrients and Sediment |
| Mann Creek | Mann Creek Reservoir to Weiser River | Sediment |
| Cove Creek | Headwaters to Weiser River | Nutrients and Sediment |
| Crane Creek | Crane Creek Reservoir to Weiser River | Bacteria, Nutrients, and Sediment |
| Little Weiser River | Indian Valley to Weiser River | Nutrients and Sediment |
| Johnson Creek | Headwaters to Weiser River | Unknown |
| West Fork Weiser River | Headwaters to Weiser River | Unknown |
| North Crane Creek | Headwaters to Crane Creek Reservoir | Bacteria, Flow, Nutrients, Sediment, and Temperature |
| South Crane Creek | Headwaters to Crane Creek Reservoir | Unknown |
| Crane Creek Reservoir | Reservoir | Nutrients and Sediment |

## Table B. Summary of Assessment Outcomes. Weiser River Watershed.

| Water Body[a] | Assessment Unit (HUC 17050124) | TMDLs/ Allocations Completed | Recommended Changes to §303(d) List | Recommended Schedule Changes | Justification |
|---|---|---|---|---|---|
| Weiser River, (Galloway Dam to Snake River) | SW001_05 | Sediment<br>Bacteria<br>*Total Phosphorus[a]*<br>**PNV temperature** | Remove Dissolved Oxygen and Nutrients as Pollutants of Concern | | Diel monitoring conducted did not indicate exceedence of dissolved oxygen criteria. Nuisance aquatic growth not detected by dissolved oxygen. |
| Weiser River, (Little Weiser River to Galloway Dam) | SW001_05<br>SW007_05a | Sediment<br>*Total Phosphorus*<br>**PNV temperature** | Remove Bacteria and Nutrients as Pollutants of Concern. | | Nuisance aquatic growth not detected by dissolved oxygen monitoring.<br>Geo-metric mean bacteria count did not exceed criteria. |
| Weiser River, (West Fork Weiser River to Little Weiser River) | SW007_04a<br>SW007_05 | **PNV temperature** | | | Other parameters Full Support per *Water Body Assessment Guidance* |
| Mann Creek, (Mann Creek Reservoir to Weiser River) | SW030_03 | **PNV temperature** | | | Other parameters Full Support per *Water Body Assessment Guidance* |
| Cove Creek, (Headwaters to Weiser River) | SW002_02 | | Remove Segment from §303(d) List | | Intermittent Water Body |
| Crane Creek, (Crane Creek Reservoir to Weiser River) | SW003_05 | Sediment<br>Bacteria<br>*Total Phosphorus*<br>**PNV temperature** | Remove Nutrients as Pollutant of Concern | | |
| Little Weiser River, (Indian Valley to Weiser River) | SW008_03<br>SW008_04 | Bacteria<br>Sediment<br>*Total Phosphorus*<br>**PNV temperature** | Remove Nutrients as Pollutant of Concern<br>Add Bacteria as a Pollutant of Concern | | |
| Johnson Creek, (Headwaters to Weiser River) | SW022_02<br>SW022_03 | | Remove Segment from §303(d) List | | Other parameters Full Support per *Water Body Assessment Guidance* |
| West Fork Weiser River (Headwaters to Weiser River) | SW017_02<br>SW017_03 | **PNV temperature** | | | Other parameters Full Support per *Water Body Assessment Guidance* |
| North Crane Cr., (Headwaters to Crane Creek Res.) | SW006_02<br>SW006_03<br>SW006_04 | **PNV temperature** | | | Other parameters Full Support per *Water Body Assessment Guidance* |
| South Crane Cr., (Headwaters to Crane Creek Res.) | SW005_02 | | Remove Segment from §303(d) List | | Intermittent Water Body |
| Crane Creek Reservoir | SW004_04<br>SW004L_04L | Total Phosphorus<br>Sediment | | Delay action until 2007 | Additional study of reservoir water quality and assessment of designated uses |

*a Indicates total phosphorus allocations developed*

**PNV temperature – See Potential Natural Vegetation (PNV) temperature TMDLs in the addendum.**

## Key Findings

Each 1998 §303(d) listed water body will be addressed separately. Pollutants of concerned are discussed within the summary, with additional data and information provided in Section 2. Recommendations are provided along with the rationale for those recommendations.

### Weiser River, Galloway Dam to Snake River

| Water Body | Weiser River,<br>Galloway Dam to Snake River |
|---|---|
| Miles of impaired water body | 12.4 |
| Listed pollutants | Sediment, Temperature, Bacteria, Dissolved Oxygen, and Nutrients |
| Impaired designated uses | Cold water aquatic life and primary contact recreation |
| TMDL/Allocations goals | Nutrients: total phosphorus allocations as established in Snake River-Hells Canyon TMDL<br>Sediment: targets set at literature values for the full support of cold water aquatic life<br>Bacteria: state of Idaho water quality criteria<br>Temperature: state of Idaho water quality criteria (PNV temperature TMDL, see addendum) |
| Further listing recommendations | Remove dissolved oxygen and nutrients as pollutants of concern |
| Potential sources | Stream bank erosion, overland flow, animal feeding operations, wildlife, tributary inflows, and solar radiation |

Biological assessment was completed on the lower Weiser River per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002), and the results of this assessment indicate the following:
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- The River Fish Index score was "below minimal threshold," indicating the segment is not supporting the cold water aquatic life designated use.
- Bacteria (*Escherichia coli* [*E. coli*]) monitoring conducted in 2001 and 2002 showed exceedances of Idaho water quality geometric mean criteria, indicating primary contact recreation is not fully supported.
- Water temperatures showed exceedances of Idaho water quality criteria for maximum daily average temperature and daily average temperature.
- Diel dissolved oxygen concentrations were examined and showed that dissolved oxygen concentrations do not fall below Idaho water quality criteria in the lower Weiser River.

The biological assessment also indicated a high presence of sediment tolerant species. Analysis of macroinvertebrate and periphyton species indicated that sediment is impairing the composition and diversity of the indicator species present in the lower Weiser River. A total maximum daily load for total suspended solids and a substrate target have been established to protect designated beneficial uses:

- A total suspended solid target of a 50 milligrams per liter (mg/L) monthly average will need to be met to protect the designated beneficial uses. A load reduction for total suspended solids will require an overall reduction of 8-11% during high loading periods.
- Additionally, a substrate target of no more than 30% of the substrate as fine sediment (<6 millimeters [mm]) has been established.

A bacteria load for E. coli has been established to achieve full support for primary and secondary contact recreation. A reduction of approximately 90% will be required to meet Idaho water quality criteria for supporting primary and secondary contact recreation.

The *Snake River-Hells Canyon Subbasin Assessment and Total Maximum Daily Load* (Idaho DEQ and Oregon DEQ 2004) placed a total phosphorus concentration target/allocation on the Weiser River and other tributaries that discharge to the Snake River from southwestern Idaho and eastern Oregon. Water quality data for the lower Weiser River showed that the May through September total phosphorus load would need to be reduced by 28-69% to reach the total phosphorus target/allocation set for the Weiser River.

## Weiser River, Little Weiser River to Galloway Dam

| Water Body | Weiser River,<br>Little Weiser River to Galloway Dam |
|---|---|
| Miles of impaired water body | 20.9 |
| Listed pollutants | Sediment, bacteria, and nutrients |
| Impaired designated uses | Cold water aquatic life and primary contact recreation |
| TMDL/Allocation goals | Nutrients: total phosphorus allocations as established in the downstream segment and Snake River-Hells Canyon TMDL<br>Sediment: targets set at literature values for the full support of cold water aquatic life<br>Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove bacteria and nutrients as pollutants of concern |
| Potential sources | Stream bank erosion, overland flow, and tributary inflows |

A biological assessment was completed on the middle Weiser River per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002), and the results of this assessment indicated the following:

- The *River Fish Index* score was "below minimal threshold," indicating the segment is not supporting the cold water aquatic life designated use or salmonid spawning.
- Bacteria monitoring conducted in 2001 and 2002 showed Idaho water quality geometric mean criteria were not exceeded, indicating primary contact recreation is fully supported.
- Water temperatures showed exceedances of Idaho water quality criteria for maximum daily average temperature and daily average temperature; this is a major influence on downstream water temperatures.

The biological assessment also indicated a high presence of sediment tolerant species. Analysis of macroinvertebrate and periphyton species indicated that sediment is impairing the composition and diversity of the indicator species present in the middle Weiser River. Consequently, a total maximum daily load for total suspended solids and a substrate target have been established to protect designated beneficial uses:

- A total suspended solid target of 50 mg/L monthly average will need to be met to protect the designated beneficial uses. A load reduction for total suspended solids will require an overall reduction of 11-45% during high loading periods.
- A substrate target of no more than 30% of the substrate as fine sediment (<6 mm) has also been established.

The *Snake River-Hells Canyon Subbasin Assessment and Total Maximum Daily Load* (Idaho DEQ and Oregon DEQ 2004) placed a total phosphorus concentration target/allocation on the Weiser River. To meet the goals established for the lower Weiser River, total phosphorus reductions from the middle Weiser River and its tributaries need to occur as well. Water quality data for the middle Weiser River showed that the May through September total phosphorus load would need to be reduced by 21-89% to reach the total phosphorus target/allocations set for the lower Weiser River.

See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## Weiser River, West Fork Weiser River to Little Weiser River

| Water Body | Weiser River, West Fork Weiser River to Little Weiser River |
|---|---|
| Miles of impaired water body | 31.5 |
| Listed pollutants | Sediment and nutrients |
| Impaired designated uses | No impairment to designated uses from listed pollutants |
| TMDL goal | Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove from §303(d) list for listed pollutants |
| Potential sources | Not applicable |

A biological assessment was completed on the upper Weiser River per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002). The overall "Condition Rating" for the upper Weiser River segment indicates the segment is fully supporting cold water aquatic life. Neither a nutrient nor a sediment total maximum daily load nor allocations are required. Total phosphorus concentrations are well below the target concentration in the middle-lower Weiser River segments and the target for the Snake River. The upper Weiser River segment is the only segment with permitted point source discharges. Waste load allocations for these permitted facilities will be established based on their current permitted discharge levels. Additional bacteria monitoring showed no exceedence of the geometric mean criteria and primary contact recreation is fully supported.

See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## Mann Creek, Mann Creek Reservoir to Weiser River

| Water Body | Mann Creek, Mann Creek Reservoir to Weiser River |
|---|---|
| Miles of impaired water body | 13.0 |
| Listed pollutants | Sediment |
| Impaired designated uses | No impairment to designated uses from listed pollutants |
| TMDL goal | Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove from §303(d) list for listed pollutant |
| Potential sources | Not applicable |

A biological assessment was completed on Mann Creek per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002), and the overall "Condition Rating" for Mann Creek indicated the segment is fully supporting cold water aquatic life and salmonid spawning. However, Mann Creek is a significant source of total phosphorus and sediment to the lower Weiser River. Further assessment and allocations for tributaries to the lower Weiser River will be required to target critical areas of concern. The final loading analysis completed in the subbasin assessment will assist in identifying critical periods and areas of concern.

See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

### Cove Creek, Headwaters to Weiser River

| **Water Body** | **Cove Creek**<br>**Headwaters to Weiser River** |
|---|---|
| Miles of impaired water body | 14.0 |
| Listed pollutants | Sediment and nutrients |
| Impaired designated uses | Intermittent water body; no designated uses |
| TMDL goal | No TMDL required, intermittent water body |
| Further listing recommendations | Remove water body from §303(d) list |
| Potential Sources | Not applicable |

Cove Creek has been determined to be an intermittent water body, so Idaho water quality standards and criteria for intermittent water bodies apply.

Cove Creek is a source of total phosphorus and sediment to the lower Weiser River. Further assessment and allocations for lower Weiser River tributaries will be required to target critical periods and areas of concern. The final loading analysis completed in the subbasin assessment will assist in identifying these critical periods and areas of concern.

## Crane Creek, Crane Creek Reservoir to Weiser River

| **Water Body** | **Crane Creek,<br>Crane Creek Reservoir to Weiser River** |
|---|---|
| Miles of impaired water body | 12.6 |
| Listed pollutants | Sediment, bacteria, and nutrients |
| Impaired designated uses | Cold water aquatic life and primary contact recreation |
| TMDL/Allocation goals | Nutrients: total phosphorus allocations as established in middle and lower Weiser River<br>Sediment: targets set at literature values for the full support of cold water aquatic life<br>Bacteria: State of Idaho water quality criteria<br>Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove nutrients as a pollutant of concern |
| Potential Sources | Stream bank erosion, overland flow, and Crane Creek Reservoir |

A biological assessment was completed on Crane Creek per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002), and the results of this assessment indicate the following:

- The River Macroinvertebrate Score was "below minimal threshold" indicating the segment is not supporting the cold water aquatic life designated use.
- Bacteria monitoring conducted in 2003 showed exceedances of Idaho water quality criteria (geometric mean) indicating primary contact recreation is not fully supported.
- The biological assessment also indicated a high presence of sediment tolerant species. An analysis of macroinvertebrate and periphyton species indicated that sediment is impairing the composition and diversity of the indicator species present in Crane Creek.
- Total suspended solid data indicated no exceedances of the 50 mg/L recommended criteria for the protection of cold water aquatic life. In lieu of a water column sediment target, a substrate percent fines target has been established as a surrogate measure. This target is no greater than 30% fines 6 mm or smaller.
- A bacteria load for *E. coli* has been established to achieve full support for primary and secondary contact recreation. A reduction of approximately 83% will be required to meet Idaho water quality criteria for supporting primary and secondary contact recreation.
- To meet the target/allocation established for the lower Weiser River, a total phosphorus reduction from the Crane Creek needs to occur. Water quality data for Crane Creek showed that the May through September total phosphorus load would need to be reduced by 64-73% to reach the total phosphorus target for the lower Weiser River.
- See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## Little Weiser River, Indian Valley to Weiser River

| **Water Body** | **Little Weiser River, Indian Valley to Weiser River** |
|---|---|
| Miles of impaired water body | 17.3 |
| Listed pollutants | Sediment and nutrients |
| Impaired designated uses | Cold water aquatic life and primary contact recreation |
| TMDL/Allocation goals | Nutrients: total phosphorus allocations as established in middle and lower Weiser River<br>Sediment: targets set at literature values for the full support of cold water aquatic life<br>Bacteria: State of Idaho water quality criteria<br>Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove nutrients as a pollutant of concern<br>Add bacteria as a pollutant of concern |
| Potential Sources | Stream bank erosion and overland flow |

A biological assessment was completed on the Little Weiser River per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002), and the results of this assessment indicate the following:

- The BURP scores at two sites were "not full support".
- The biological assessment also indicated a high presence of sediment tolerant species. An analysis of macroinvertebrate and periphyton species indicated that sediment is impairing the composition and diversity of the indicator species present in the Little Weiser River.
- Total suspended solid data indicated no exceedances of the 50 mg/L recommended criteria for the protection of cold water aquatic life. In lieu of a water column sediment target, a substrate percent fines target has been established as a surrogate measure. This target is no greater than 30% fines 6 mm or smaller.
- In 2002, routine monitoring showed an exceedence of the single sample criteria for *E. coli*. Additional sampling showed exceedances of Idaho water quality criteria (geometric mean), indicating primary contact recreation is not fully supported.
- To meet the goals established for the lower Weiser River, a total phosphorus reduction from the Little Weiser River may need to occur during the months of May and June. Although a specific allocation has not been established for the water body, a loading analysis has been completed. Further monitoring will be required to determine the proportions of reductions that may need to occur.
- See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

The preliminary biological assessment also indicated a high presence of sediment tolerant species. Total suspended solid data indicated no exceedances of the 50 mg/L recommended criteria for the protection of cold water aquatic life. In lieu of a water column sediment target, a substrate percent fines target has been established as a surrogate measure. This target is no greater than 30% fines 6 mm or smaller. A bacteria load for *E. coli* has been established to achieve full support for primary and secondary contact recreation. A reduction of approximately 81% will be required to meet Idaho water quality criteria for supporting primary and secondary contact recreation.

## Johnson Creek, Headwaters to Weiser River

| Water Body | Johnson Creek,<br>Headwaters to Weiser River |
|---|---|
| Miles of Impaired Water Body | 13.7 |
| Listed Pollutants | Unknown |
| Impaired Designated Uses | No impairment to designated uses |
| TMDL Goal | No TMDL required |
| Further listing recommendations | Remove water body from §303(d) list |
| Potential Sources | Not applicable |

A biological assessment was completed on Johnson Creek per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002). The overall “Condition Rating” for Johnson Creek indicated the segment is fully supporting cold water aquatic life and salmonid spawning.

## West Fork Weiser River, Headwaters to Weiser River

| Water Body | West Fork Weiser River,<br>Headwaters to Weiser River |
|---|---|
| Miles of impaired water body | 15.9 |
| Listed pollutants | Unknown |
| Impaired designated uses | Further verification of biological assessment required |
| TMDL goal | Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove from §303(d)list for listed pollutants |
| Potential sources | Not applicable |

A biological assessment was completed on the West Fork Weiser River per *Idaho Water Body Assessment Guidance* (Grafe et al. 2002). In 2002, Beneficial Use Reconnaissance Program monitoring was conducted. The results from that monitoring indicate this stream segment is fully supporting its all of its beneficial uses.  See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## North Crane Creek, Headwaters to Crane Creek Reservoir

| **Water Body** | **North Crane Creek Headwaters to Crane Creek Reservoir** |
|---|---|
| Miles of impaired water body | 24.7 |
| Listed pollutants | Sediment, Temperature, Bacteria, Nutrients, and Flow |
| Impaired designated uses | Intermittent water body; no designated uses |
| TMDL goal | Temperature: PNV temperature TMDL (see addendum) |
| Further listing recommendations | Remove from §303(d) list for listed pollutants |
| Potential sources | Not applicable |

North Crane Creek has been determined to be an intermittent water body. State of Idaho water quality standards and criteria for intermittent water bodies apply. North Crane Creek may be a source of total phosphorus and sediment to Crane Creek Reservoir. Further assessments and allocations for tributaries will be required to target critical periods and areas of concern for the reservoir. The final loading analysis completed in the subbasin assessment will assist in identifying these critical periods and areas of concern in North Crane Creek. Assessment of *E. coli* bacteria in 2003 showed that during a period of minimum discharge conditions, North Crane Creek is fully supporting primary and secondary contact recreation. See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## South Crane Creek, Headwaters to Crane Creek Reservoir

| **Water Body** | **South Crane Creek Headwaters to Crane Creek Reservoir** |
|---|---|
| Miles of impaired water body | 9.2 |
| Listed pollutants | Unknown |
| Impaired designated uses | Intermittent water body; no designated uses |
| TMDL goal | No TMDL required, intermittent water body |
| Further listing recommendations | Remove from §303(d) list as a intermittent water body |
| Potential sources | Not applicable |

South Crane Creek has been determined to be an intermittent water body. State of Idaho water quality standards and criteria for intermittent water bodies apply. South Crane Creek may be a source of total phosphorus and sediment to Crane Creek Reservoir.

Further assessments and allocations for tributaries will be required to target critical periods and areas of concern for the reservoir. The final loading analysis completed in the subbasin assessment will assist in identifying these critical periods and areas of concern in North Crane Creek.

### Crane Creek Reservoir

| Water Body | Crane Creek Reservoir |
|---|---|
| Miles of impaired water body | Reservoir, 1,507 acres |
| Listed pollutants | Sediment and Nutrients |
| Impaired designated uses | Cold water aquatic life |
| TMDL/Allocation goal | Action on Crane Creek Reservoir will be delayed until 2007 to allow further study and assess the status and appropriateness of designated uses. |
| Further listing recommendations | No changes recommended |
| Potential sources | In-reservoir conditions |

Action on Crane Creek Reservoir will be delayed until 2007 to allow further study and assess the status and appropriateness of designated uses.

## Proposed Listing on Next Idaho §303(d) list

During the development of the Weiser River Watershed subbasin assessment, biological assessments and the analysis of available data have indicated that some water bodies are in full support of designated or existing beneficial uses. In other cases, it was determined that water bodies were not supporting designated or existing beneficial uses, but certain pollutants of concern were not the sources of impairment as presented in the 1998 §303(d) list. In addition, it was determined, in some cases, that additional pollutants of concern should be added as impairing a water body's designated or existing uses. Table C presents the recommendations for changes to future Idaho §303(d) lists.

## Table C. §303(d) Delisting and Additional Listing Recommendations and Overview. Weiser River Watershed.

| Water Body | Proposed Recommendation | Justification for Recommendation |
|---|---|---|
| Weiser River, (Galloway Dam to Snake River) | Remove nutrients and dissolved oxygen | Diel monitoring showed no exceedence of water quality criteria for dissolved oxygen; dissolved oxygen levels did not indicate nuisance aquatic growth |
| Weiser River, (Little Weiser River to Galloway Dam) | Remove bacteria and nutrients; add temperature | Dissolved oxygen levels did not indicate nuisance aquatic growth, water column temperature monitoring showed exceedances of water quality criteria for support of cold water aquatic life |
| Weiser River, (West Fork Weiser River to Little Weiser River) | Delist segment | *Water Body Assessment Guidance* indicated *Full Support* |
| Mann Creek, (Mann Creek Reservoir to Weiser River) | Delist segment | *Water Body Assessment Guidance* indicated *Full Support* |
| Cove Creek, (Headwaters to Weiser River) | Delist segment | Apply intermittent water body standards and criteria |
| Crane Creek, (Crane Creek Reservoir to Weiser River) | Remove nutrients | Dissolved oxygen levels did not indicate nuisance aquatic growth |
| Little Weiser River, (Indian Valley to Weiser River) | Remove nutrients; add bacteria | Dissolved oxygen levels did not indicate nuisance aquatic growth, bacteria monitoring showed exceedances of water quality criteria for support of contact recreation |
| Johnson Creek, (Headwaters to Weiser River) | Delist segment | *Water Body Assessment Guidance* indicated *Full Support* |
| West Fork Weiser River, (Headwaters to Weiser River) | Delist segment | *Water Body Assessment Guidance* indicated *Full Support* |
| North Crane Creek, (Headwaters to Crane Creek Res.) | Delist segment | Apply intermittent water body standards and criteria |
| South Crane Creek, (Headwaters to Crane Creek Res.) | Delist segment | Apply intermittent water body standards and criteria |
| Crane Creek Reservoir | Further study | Recommend limnology study to determine pollutant sources and use attainability analysis to determine appropriate uses |

## Timeframe for Meeting Water Quality Standards

The development of an implementation plan can be completed in a timely manner. However, implementation of best management practices may take years and is dependent on available resources, funding, and prioritization by land management agencies. A long-term monitoring plan will be developed to determine if the total maximum daily loads need to be refined and to assure that goals and targets of the total maximum daily loads are being achieved.

Some biological indicators may respond quickly to reduced sediment input and habitat improvement. Warm water intolerant species may take longer and may not re-establish until benefits from reduced solar radiation and increased ground water effectively cool the water.

## Implementation Strategy

The implementation strategy addresses the cursory development of an implementation plan for the Weiser River Watershed. State and federal agencies and the public will assist in implementing best management practices to achieve the targets and goals identified. The agencies that will be involved are the United States Forest Service, Bureau of Land Management, Natural Resources Conservation Service, Idaho Soil Conservation Commission, and the Department of Environmental Quality.

As with any implementation plan addressing nonpoint sources, an adaptive management approach will be a critical component of any implementation plan developed for the watershed. As more data are collected, future modifications to the load allocation may occur, which will include more accurate water body sediment loading information and a better determination of appropriate existing uses. Although their use is not anticipated, possible regulatory strategies are in place and can be applied through current regulatory authority.

Much of the implementation of best management practices will be dependent on the availability of funding and personnel resources. Current state and federal cost share programs will assist private landowners in addressing load allocations on private holdings. It is expected that the identified state and federal agencies will work closely with the Department of Environmental Quality during all phases of best management practices implementation and best management practices effectiveness evaluation.

Monitoring the target pollutants in the total maximum daily load needs to be conducted to determine

1) if the overall goal of achieving and maintaining compliance with state water quality standards is being meet,
2) if the implemented best management practices are working as designed or if modification needs to occur,
3) if load allocations need to be adjusted, and

4) if best management practices are being implemented in a timely manner to address water quality concerns.

## Identified Data Gaps

Through the Weiser River Watershed assessment process, two major data gaps were identified:

- The first data gap is the total suspended solids results and the comparison to the suspended sediment concentration. It is recognized the use of total suspended solids may underestimate the true amount of larger particles. This is especially true during the high discharge period of March through May, a critical period for sediment loading in the Weiser River Watershed.

- The second major data gap pertains to Crane Creek Reservoir. High turbidity levels and total phosphorus concentrations are believed to be associated with internal sources and not external sources. Further analysis of limnology conditions is required to determine if the sources of those parameters are anthropogenic.

## Public Involvement

The Weiser River Watershed Advisory Group (WAG) was formed in 1998 to assist the Department of Environmental Quality in developing the *Weiser River Watershed Subbasin Assessment and Total Maximum Daily Load*. The Weiser River Watershed Advisory Group was briefed on ongoing and future monitoring that would occur to fill identified data gaps in the watershed.

Additional information was provided to the Weiser River Watershed Advisory Group as follows:

- In March 2003, the Weiser River Watershed Advisory Group was presented the basic approach to developing the *Weiser River Watershed Subbasin Assessment and Total Maximum Daily Loads*. This document provided the overall assessment process to be used in identifying impaired designated or existing uses, along with the approach to be used in determining if the listed pollutants of concern were impairing those uses.

- In July, August, October and November 2003, meetings were held to discuss the *Weiser River Watershed Subbasin Assessment and Total Maximum Daily Load* Technical Review Document (submitted to the Watershed Advisory Group on October 16, 2003). Alternative approaches to temperature TMDLs were discussed.

- With the WAG's approval, the document was sent out for public comment from August 9th through September 24th 2004. This version contained an approach to the temperature issue which mirrored the approach used in the Snake River Hells Canyon TMDL which had previously been approved by the EPA. However, upon further review of the document it was discovered that while this approach was satisfactory for use with the bi-state TMDL between Oregon and Idaho, that it could not be used within the State of Idaho.

- DEQ prepared a draft Potential Natural Vegetation Temperature TMDL for the Weiser River watershed. The draft was presented to the WAG on November 18, 2005.

- In the WAG meeting on February 15, 2006, the group voted unanimously to accept the Potential Natural Vegetation Temperature TMDL and send it out for public comment. They also reaffirmed their acceptance of the original document (with the temperature TMDL revisions).

- Copies of the draft assessment were made available for review at DEQ's Boise Regional Office; the public libraries in Weiser and Boise, Idaho; Washington County Courthouse in Weiser and the Adams County Courthouse in Council; and in PDF format on DEQ's Web site starting Monday, March 13th, 2006. Public comments on the proposed actions were accepted through 5 p.m., Friday, April 14th, 2006.

- The only comments received were from the U.S. Environmental Protection Agency. The response to those comments is included in the Potential Natural Vegetation TMDL Addendum.

- In the WAG meeting on June 22, 2006, the group voted unanimously to accept the Potential Natural Vegetation Temperature TMDL as amended with the inclusion of comments received from the EPA. They also reaffirmed their acceptance of the original document (with the temperature TMDL revisions).

# 1.0 Subbasin Assessment – Watershed Characterization

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

The overall purpose of this subbasin assessment and TMDL is to characterize and document pollutant loads within the Weiser River Watershed. The first portion of this document, the subbasin assessment, is partitioned into four major sections: watershed characterization, water quality concerns and status, pollutant source inventory, and a summary of past and present pollution control efforts (Sections 1 – 4). This information will then be used to develop a TMDL for each pollutant of concern for the Weiser River Watershed (Section 5).

## 1.1 Introduction

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

### Background

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

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

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

## Idaho's Role

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

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

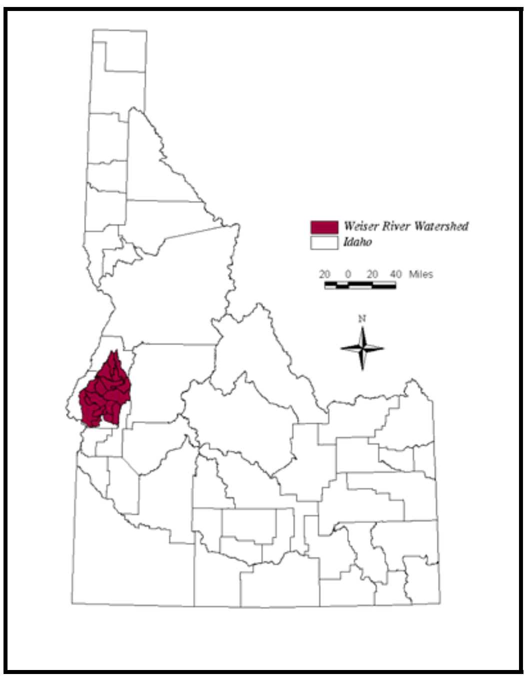
- Aquatic life support – cold water, seasonal cold water, warm water, salmonid spawning, modified

- Contact recreation – primary (swimming), secondary (boating)
- Water supply – domestic, agricultural, industrial
- Wildlife habitats, aesthetics

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

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

- Determine the degree of designated beneficial use support of the water body (i.e., attaining or not attaining water quality standards).
- Determine the degree of achievement of biological integrity.
- Compile descriptive information about the water body, particularly the identity and location of pollutant sources.
- When water bodies are not attaining water quality standards, determine the causes and extent of the impairment.




Weiser River Watershed

| | |
|---|---|
| HUC: | 17050124 |
| Water Bodies: | Weiser River (3 Sections), West Fork Weiser River, Little Weiser River, Mann Creek, Cove Creek, Johnson Creek, Crane Creek, North Crane Creek, South Crane Creek, and Crane Creek Reservoir |
| Pollutant Sources: | Point and Nonpoint Sources |
| Ecoregions: | Snake River-High Desert, Blue Mountains |
| Size: | 1,077,048 Acres |

**Figure 1. Subbasin at a Glance. Weiser River Watershed.**

## 1.2 Physical and Biological Characteristics

The Weiser River Watershed is located in southwestern Idaho and is a major tributary to the Snake River (Figure 1). The hydrologic unit code (HUC) is 17050124. The river has a general hydrological flow from north to south. The Weiser River's confluence with the Snake River is near river mile 352. The watershed originates in the southern end of the Seven Devils Mountain Range in the Blue Mountain Ecoregion and drains generally south into the Snake River-High Desert Ecoregion of southwestern Idaho.

Overall there are only three large impoundments in the watershed that would have any type of influence on water discharge and flows: Lost Valley Creek Reservoir, Mann Creek Reservoir, and Crane Creek Reservoir. However, none of these impoundments have much influence on controlling spring snowmelt or widespread flooding, and all have a primary purpose for irrigation water storage. Figure 2 shows the location of the Weiser River Watershed. Figure 3 shows the overall hydrology of the watershed.

Land ownership is diverse, with private and public lands throughout the watershed. The watershed is entirely within Idaho, with no recognized tribal lands within the watershed. Land use is also diverse, with irrigated cropland, irrigated pasture, dry land agriculture, upland rangeland, forested areas, municipalities, and flood prone river bottom riparian areas.

The major municipalities in the watershed are the cities of Weiser, Midvale, Cambridge, and Council. However, most of the population is associated with agricultural homesteads on private lands.

Point sources of pollutants in the watershed consist of municipal discharges from wastewater treatment plants (WWTPs) and animal feeding operations. Animal feeding operations may or may not be National Pollution Discharge Elimination System (NPDES) permitted facilities. , but the WWTPs are permitted facilities. The City of Midvale does not have a WWTP, and the City of Weiser's WWTP discharges to the Snake River downstream of the confluence of the Weiser River.

The elevation in the watershed ranges from approximately 700 meters (2,300 feet) near the confluence with the Snake River to approximately 2,500 meters (8,100 feet) at Council and West Mountain. The topography can range from steeply sloped, forested mountains in the higher elevations, to relatively shallow slopes in the lower elevations and river bottom lands, to relatively flat terraces and benches associated with alluvial deposits.

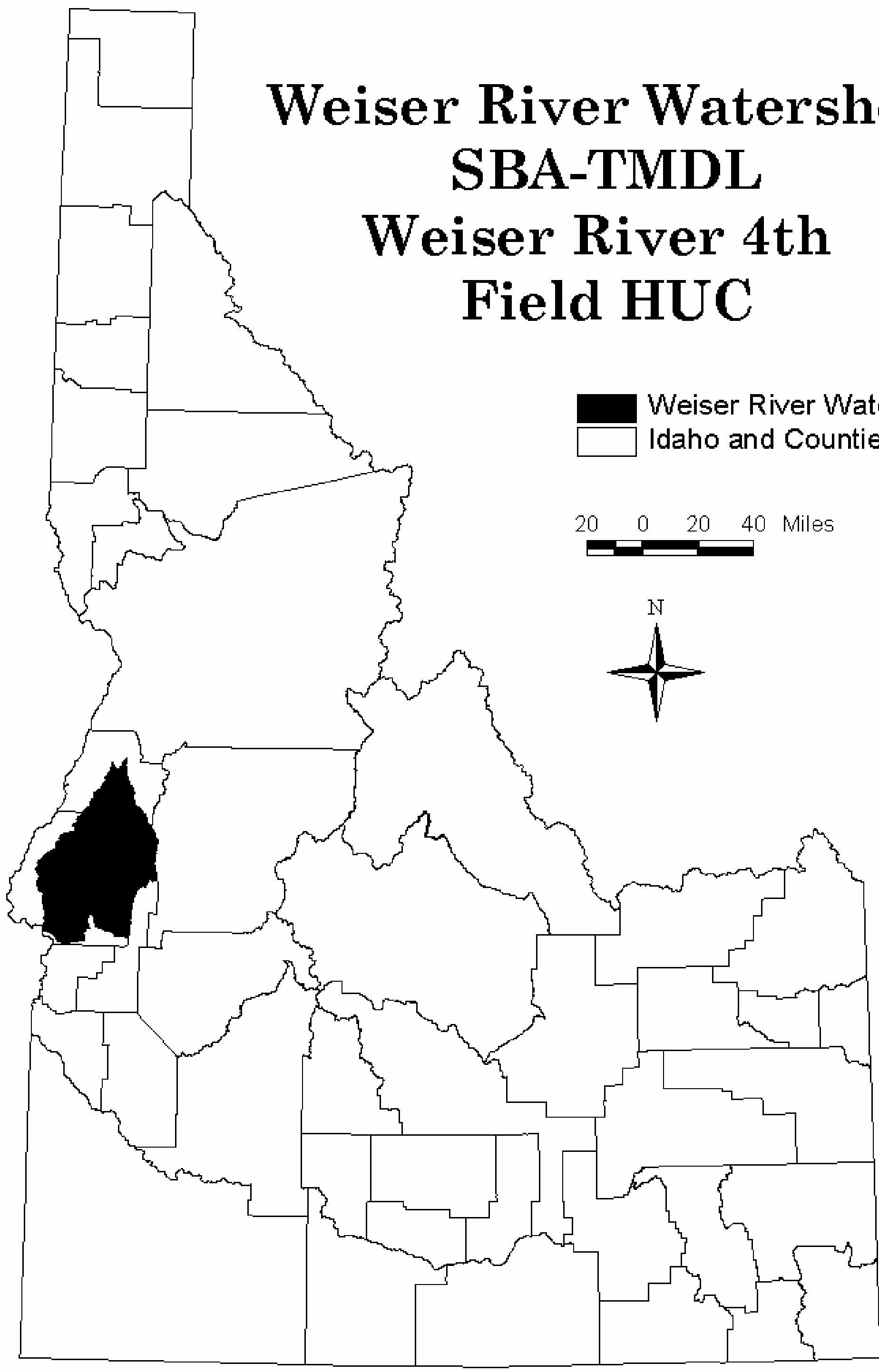



**Figure 2. Weiser River Watershed.**

## Climate

There are three historic and current weather-monitoring stations in the Weiser River Watershed: at Cambridge, Weiser, and Council, Idaho (Western Regional Climate Center 2003). There are also four United States Department of Agriculture Natural Resources Conservation Service (NRCS) SNOTEL monitoring sites: Bear Saddle, Squaw Flat, Van Wyck, and West Branch (Natural Resources Conservation Service 2003). (More discussion of snow accumulation and snowmelt will follow in the hydrology section.)

The Weiser River Watershed ambient air temperature can vary, depending on seasonal variability and elevation. The maximum air temperature in the summer months can easily exceed 100 °F throughout the watershed, and the minimum winter ambient air temperature can dip well below zero during winter months. Table 1 shows the average temperatures and precipitation in the Weiser River Watershed, and Figure 3 shows expected average precipitation.

As with much of southwestern Idaho, the Weiser River Watershed is subject to wet and cool winters, when a majority of the precipitation events occur. Summer months are usually dry with occasional brief and sometimes heavy precipitation events. The upper elevations of the watershed can have considerable snow accumulation, with an expected permanent winter snow pack above 5,000 feet. However, it is not uncommon for substantial snow accumulation of a foot or more in lower elevations (below 5,000 feet), which may or may not be present throughout the entire winter.

Rains on snow events are a common occurrence in the lower elevations and usually occur in late December and January. It was one of these events, in December 1996 and January 1997, that caused extensive flooding throughout the watershed. Record discharge (31,000 cubic feet per second [cfs]) was recorded on the Weiser River at Weiser, Idaho, in early January 1997. Heavy snow accumulation was recorded in the lower elevations in December, followed by warmer ambient air temperatures and steady rains at the end of the month and the first of January. (More discussion on the hydrology of the Weiser River will follow in the hydrology section.)

**Table 1. Climatic Summary. Available Weather Information (Western Regional Climatic Center 2003). Weiser River Watershed.**

| Climate Parameter | Weiser, Idaho Elevation: 2,110 feet Station Number: 109638 | Cambridge, Idaho Elevation: 2,650 feet Station Number: 101408 | Council, Idaho Elevation: 3,150 feet Station Number: 102187 |
|---|---|---|---|
| Average Maximum Temperature (°C / °F) | 17.9 / 64.3 | 16.9 / 62.4 | 16.1 / 61.9 |
| Average Minimum Temperature (°C / °F) | 2.3 / 36.1 | 0.8 / 33.5 | 1.6 / 35.0 |
| Average Maximum Temperature (June-August) (°C / °F) | 31.4 / 88.5 | 31.1 / 88.0 | 30.5 / 86.9 |
| Average Minimum Temperature (December-February) (°C / °F) | -6.2 / 20.9 | -8.7 / 16.4 | -7.8 / 18.0 |
| Average Annual Precipitation (inches) | 11.7 | 20.1 | 24.7 |
| Average Total Snowfall (inches) | 18.4 | 51.8 | 48.2 |

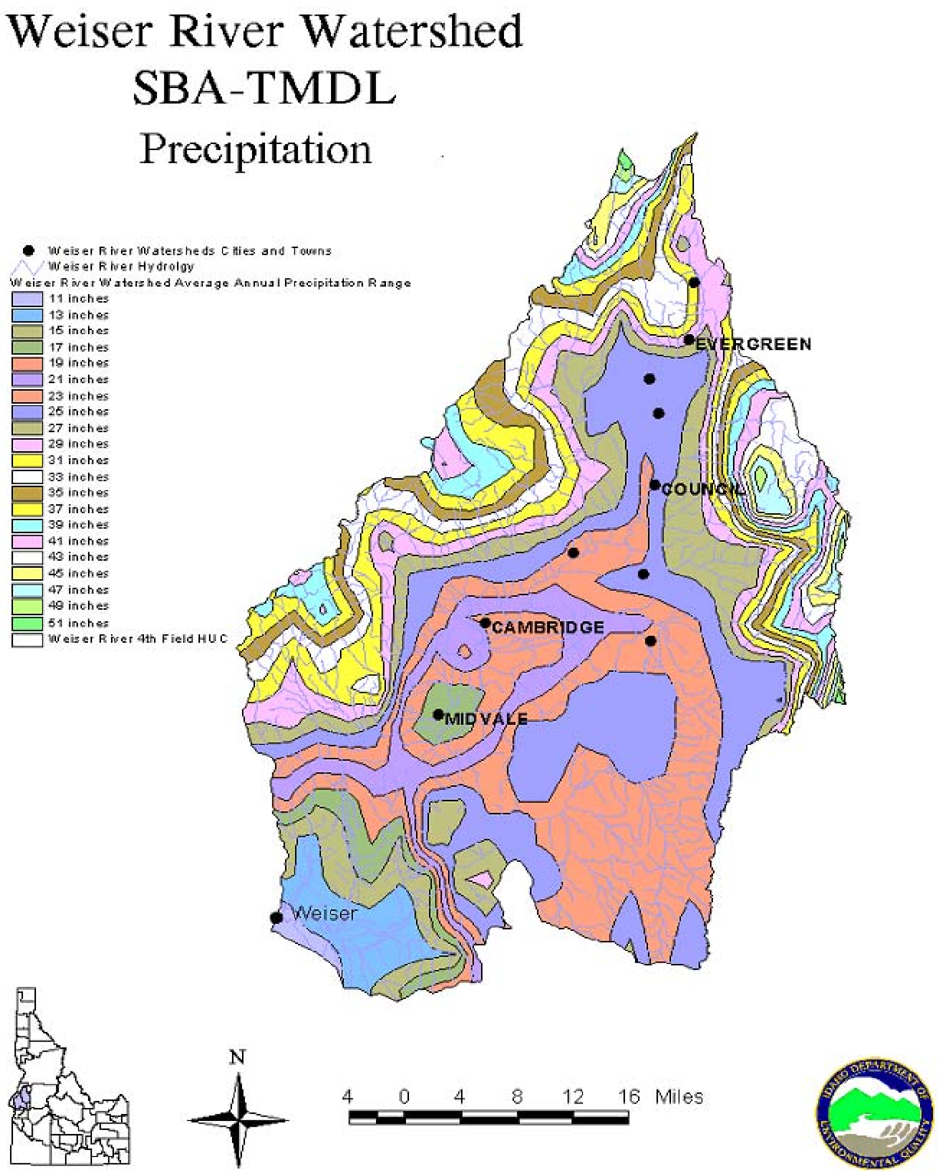



**Figure 3. Precipitation Range. Weiser River Watershed.**

## Subbasin Characteristics

### Hydrology

Most of the Weiser River would be classified as having unregulated flow. Only the Crane Creek and Mann Creek Watersheds have significantly sized structures that could provide enough storage to assist in controlling high spring discharges. Both Mann Creek and Crane Creek Reservoirs' water storage is primarily for irrigation water supply.

However, river diversions are located throughout the watershed. These diversions can be found in the Little Weiser River Watershed, the upper portion of the watershed on the main Weiser River and the West Fork Weiser River, and the lower portion of the watershed near the Weiser Cove area. The main diversion in the lower section is the Galloway Dam, which provides irrigation water for the Weiser Flat area through the Galloway Canal. Approximately 1 mile upstream, water is diverted to the Sunnyside Canal. There are other in-river diversions between the cities of Cambridge and Midvale, along with numerous in-river diversions on the Little Weiser River near Indian Valley.

The lower section of the Weiser River (Galloway Dam to the Snake River) could be classified as a Rosgen type F channel (Rosgen 1996). The confinement of the river in this channel type is associated with a series of dikes built for flood control. Even with these flood control dikes, out-of-bank events still occur, as happened in the 1997 flood event.

If the series of dikes were not present, the Weiser River is this area would probably be classified as a Rosgen type D channel. This type of channel is associated with braided channels and low gradient systems where high amounts of sediment from upstream sources would influence the natural channel morphology. This channel morphology is also noted in other areas where the valley type does not confine the channel. These areas are associated with the areas near the Midvale-Cambridge, Indian Valley, and Council portions of the watershed. Access to the historic floodplain is limited in these areas due to manmade confinement. While out-of-bank events do occur, they are not with the frequency of pre-historic conditions.

Other sections of the river can also be described as Rosgen type F channels, but confinement is more associated with valley slope rather than anthropogenic conditions. These are usually higher gradient systems than those segments associated with the other type F channels. Meandering, sinuosity, and lateral movement are limited by the confinement of the valley slope rather than the manmade dike system.

The watershed can be broken into two distinctive segments. As shown in Figure 4, the Weiser River becomes a fifth order stream at the confluence of Hornet Creek and the West Fork of the Weiser River. The Crane Creek drainage also constitutes a fifth order water body. With these classifications, the Weiser River becomes a sixth order water body from Crane Creek to the confluence with the Snake River.

*Influence of Hydrology on Sediment*

Floodplains of these D channel types (Galloway Dam to the Snake River) tend to store sediment in bank deposits and will be more stable as vegetation becomes established. High flow events are more likely to move sediment deposits from these channels where vegetation is sparse. The channel as it exists today tends to move sediment through to the Snake River because the old braided system is no longer in existence to potentially store sediment.

The primary mechanism of sediment transport in the Weiser River Watershed is surface water flow. High flows can transport large amounts of sediment in a wide range of particle sizes and weights. Lower flows preferentially transport lighter, smaller particle fractions. Sediment particles are deposited in areas of streams and rivers where flows decrease and sediments fall out proportionately with size and weight distributions. Sediments deposited in this manner accumulate in areas of the channel where flows are reduced. They can be re-suspended due to increasing flow and carried further downstream. Sparse vegetation and timing of snowmelt in areas of the Weiser River Watershed produce conditions favoring high surface runoff and sediment transport.

Additionally, land use patterns may influence sediment transport and delivery within the watershed:

- Flood and furrow irrigation ditches, if they are aligned and sloped toward streams and rivers, act to direct snowmelt runoff to surface water systems. In contrast, sediment basins and settling ponds or other treatment mechanisms on agricultural lands can help to contain snowmelt and stormwater runoff and reduce or remove suspended sediments from both agricultural flows and precipitation events.

- Similarly, a high density of impervious surface (commonly associated with urban development) increases the volume of runoff from storm events. If properly managed, this stormwater can be diverted to catchbasins or other mechanisms where velocity is decreased and entrained materials are allowed to settle out before water enters surface or ground water systems.

Unfortunately, the relative impact of land use practices is not quantifiable with the available data for the Weiser River TMDL.

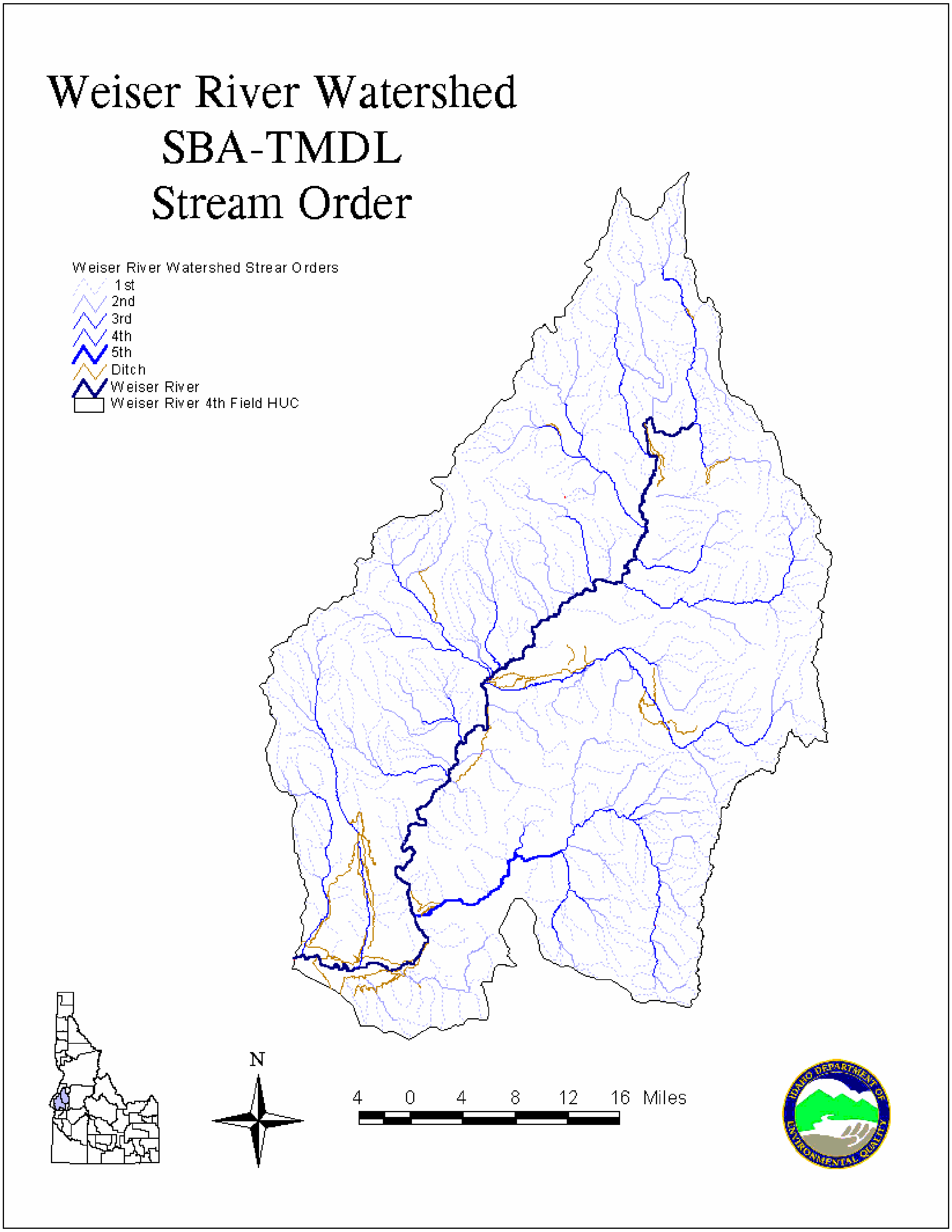
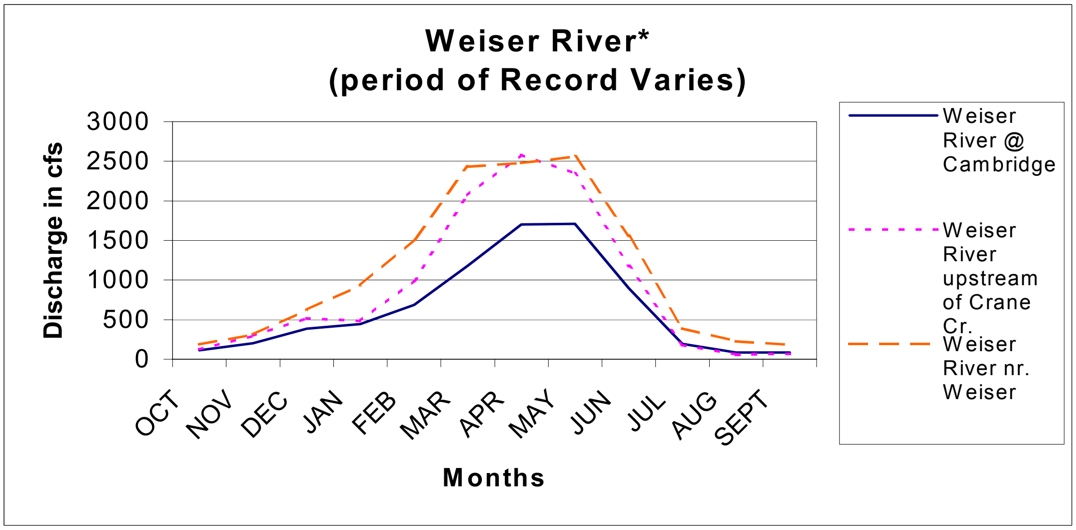



**Figure 4. Overall Hydrology and Stream Order. Weiser River Watershed.**

As shown in Figure 5, flows in the mid to late spring period usually account for a majority of discharge in the watershed. However, rain-on-snow events in mid-winter/early spring can result in large discharges during this period. Of course, this is dependent on climatic conditions that will vary from year to year. Figure 6 shows the discharge associated with Crane Creek Reservoir, which indicates that a majority of spring runoff is maintained in the reservoir for later season irrigation use.




** Period of Record, Weiser River at Cambridge 1939-2000, Weiser River above Crane Creek 1939-2003, Weiser River near Weiser 1890-1891, 1894-1896, 1897-1899, 1900-1904, 1910-1914, 1952-2003.*

**Figure 5. Weiser River Historic Discharges, Three U.S. Geological Survey Gage Sites: No. 13258500, No. 13263500, and No. 13266000. Weiser River Watershed.**

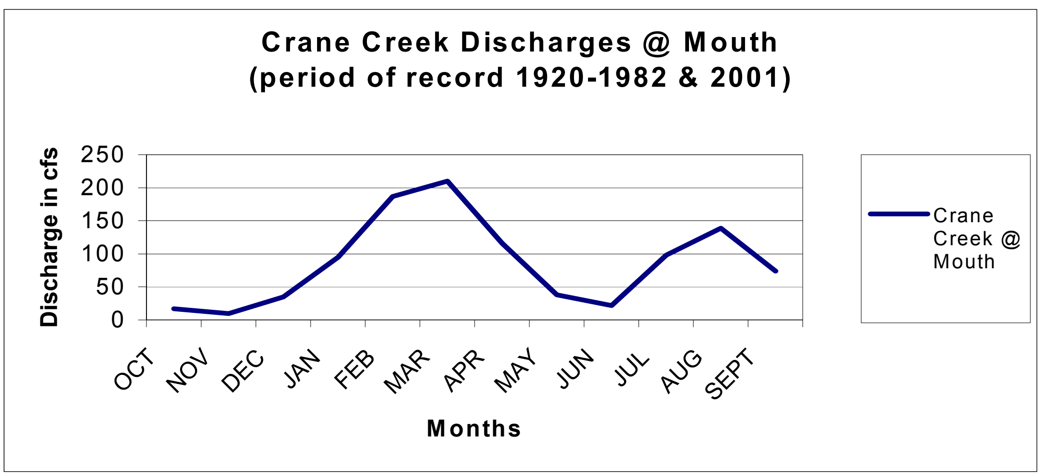



**Figure 6. Weiser River Historic Discharges, Crane Creek at Mouth, Gage Site No. 13265500. Weiser River Watershed.**

The Weiser River Watershed has numerous historic U.S. Geological Survey (USGS) discharge gage sites. Many of these sites have not been active since the 1920s, but the historic information does provide for adequate reference for a variety of watershed characteristics. This information demonstrates the intermittent flows encountered in the southern and lower elevation water bodies, while the northern and higher elevation water bodies generally demonstrate perennial flow conditions (waterdata.usgs.gov/id/nwis/monthly/) (USGS 2003*a*).

Many of the sites shown in Figure 7 provide information on irrigation water diversion throughout the watershed. Overall there are 38 historic and current gage sites in the watershed. Some monitor discharges in natural stream channels, while others monitor the amount of water diverted into manmade conveyances.

The constructed dams in the Weiser River Watershed were mainly developed for irrigation water storage. Figure 8 shows the major impoundments in the watershed that meet the criteria of 40 feet or higher. , and Table 2 provides specific information on each structure.

As shown in Figure 6, Crane Creek Reservoir provides irrigation water storage to be used later in the irrigation season, when Weiser River flows become low and unpredictable. Water is released from the reservoir in mid-summer, and then allowed to flow down the natural channel and enter the Weiser River. The river is partially diverted further downstream at Galloway Dam into the Galloway Canal and the Sunnyside Canal. Crane Creek Dam may provide some early spring flood control due to its low elevation. , but, its primary purpose is irrigation water storage.

Mann Creek Dam provides water storage for irrigation use in the Mann Creek Watershed. Most irrigation water is diverted from the natural channel, with the dam used mainly for water storage rather than diversion. Some irrigation water is actually diverted into the Monroe Creek Watershed, located to the west of the Mann Creek Watershed.

**Table 2. Dams, Year Constructed, Water Body, Ownership, Owner, and Size. Weiser River Watershed.**

| Dam Name | Year Constructed | Impounded Water Body | Ownership | Owner | Size of Impoundment (acres) |
|---|---|---|---|---|---|
| C Ben Ross | 1937 | Little Weiser River | Private | Little Weiser River Irrigation District | 353 |
| Crane Creek | 1912 | Crane Creek | Private | Crane Creek Reservoir Adm. Board | 3,000 |
| Fairchild | 1975 | Sage Creek | Private | Private Individual | 104 |
| Mann Creek | 1967 | Mann Creek | Federal | Bureau of Reclamation | 315 |

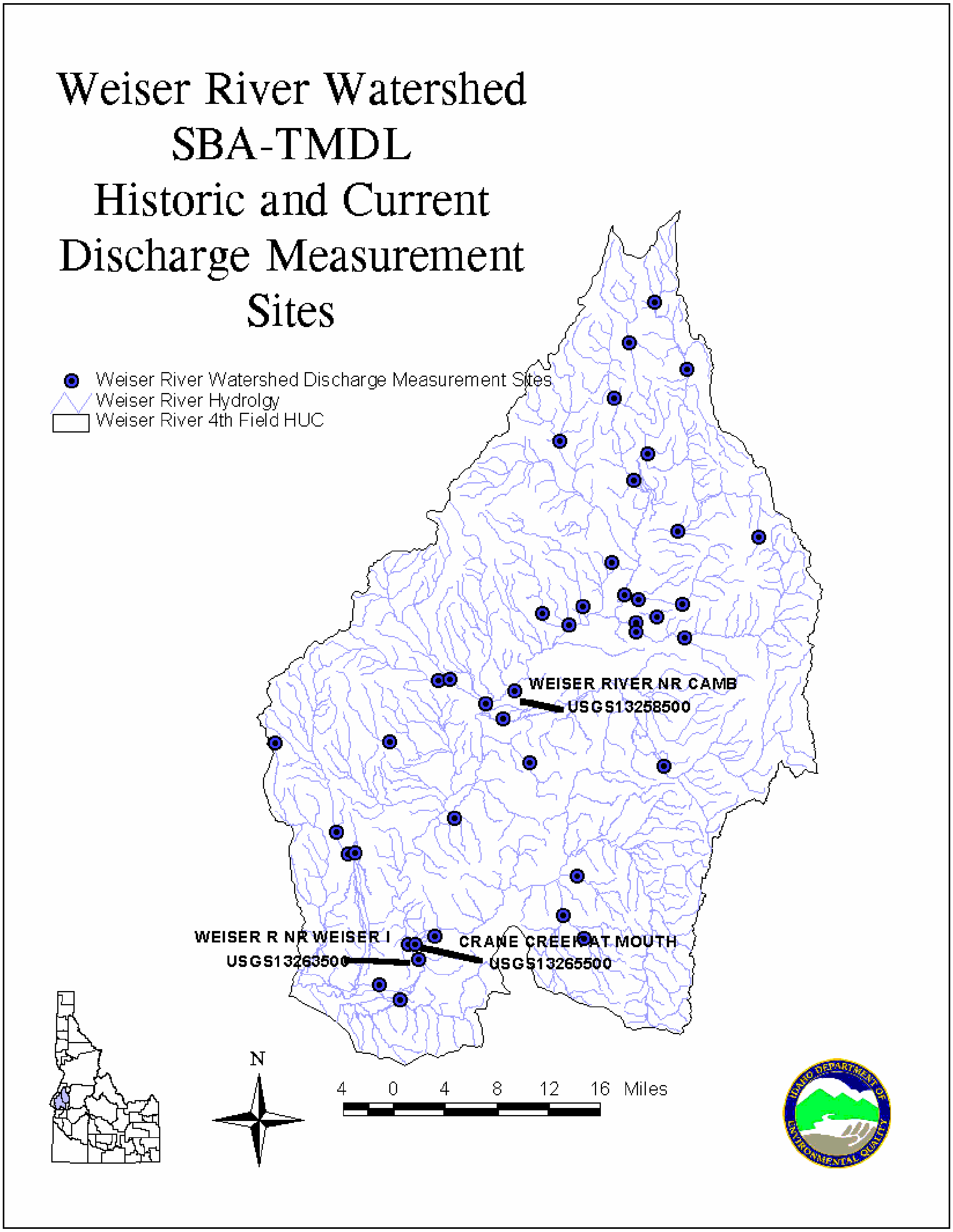



**Figure 7. Current and Historic Gage Sites. Weiser River Watershed.**

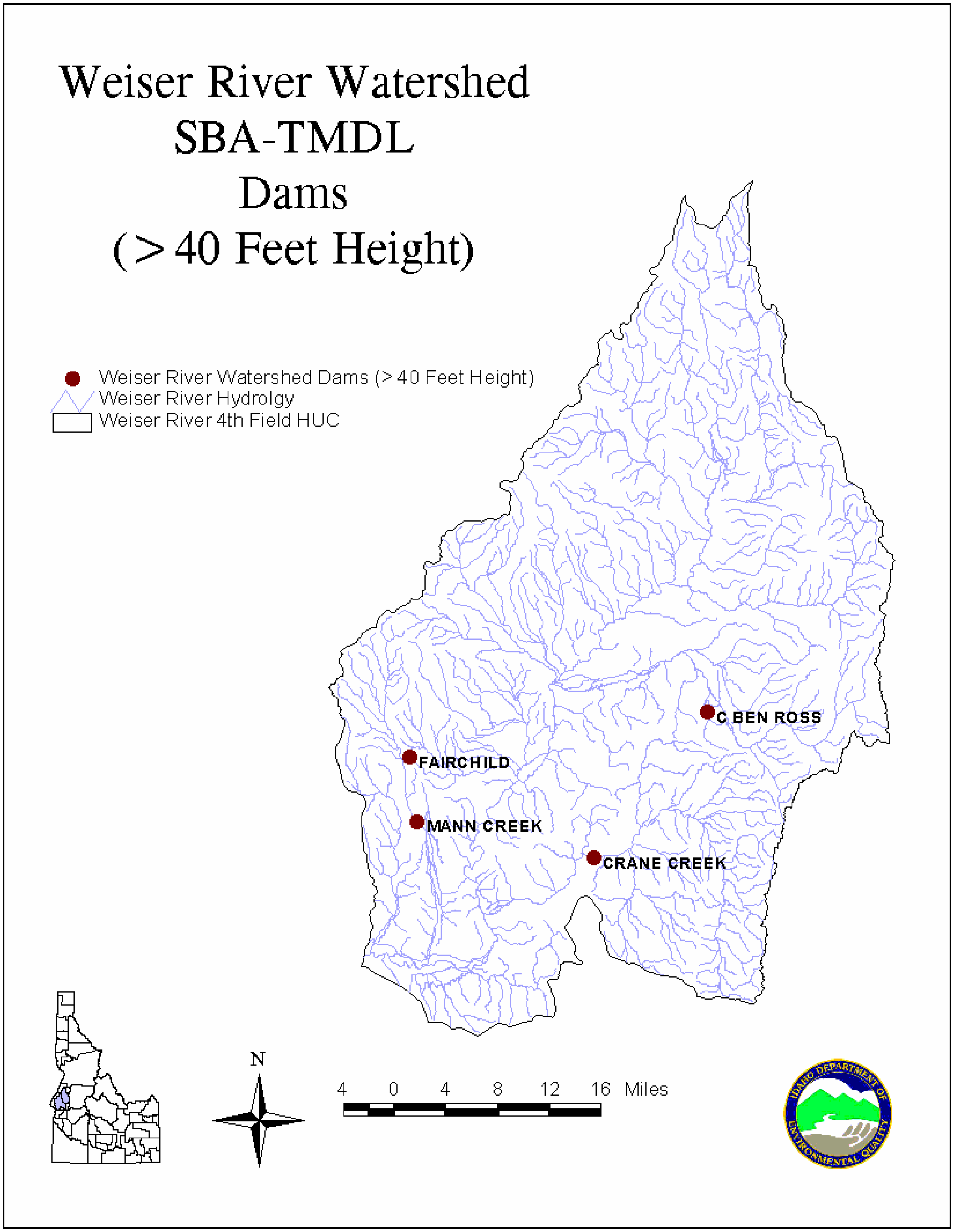



**Figure 8. Dams. Weiser River Watershed.**

## Geology

The geology (Figure 9) of the Weiser River Subbasin is dominated by basalts of the Columbia River Basalt Group. Miocene (23.7 to 5.3 million years ago) basalt flows dominated by the Grande Ronde basalt formation occupy the northern half of the subbasin. Miocene plateau basalt dominated by the Weiser basalt formation is found in the southern half of the subbasin. Together these flows constitute a feature known as the Weiser embayment, which is a part of the southernmost lobe of the Columbia Plateau.

Pieces of pre-Columbia River basalt terrain occur at the margins of the subbasin. A mixture of Mesozoic (older than 66 million years) intrusives, volcanic rocks, and metabasalts occur on the western boundary of the subbasin forming Cuddy Mountain and Sturgill Peak. On the eastern side of the subbasin, at Council Mountain, a region of Cretaceous (144 to 66 million years ago) granitic intrusive rocks stick out above the lava formations.

Valleys in the central and southern portions of the subbasin are filled with Quaternary (1.6 million years ago to present) alluvium and older Miocene stream and lake deposits. The very southernmost tip of the subbasin on the south side of the Weiser River contains Pliocene stream and lake deposits presumably from lakes formed as lava blocked the normal path of water (Alt and Hyndman 1989).

### *Major Geologic and Geomorphic Features*

The Columbia River Basalt Groups of the Columbia Plateau form three embayments into western Idaho (Fitzgerald 1982). The southernmost embayment, occupying the Weiser River Subbasin, is known as the Weiser embayment. The Weiser embayment is bounded on the east by the Salmon River Mountains, on the west by the Snake River canyon, on the north by the Seven Devil Mountains, and on the south by the Snake River Plain. The embayment occupies some 7,500 square kilometers ($km^2$), is about 130 km north to south, and is 75 km wide at the interface with the Snake River Plain. Elevations range from less than 3,000 feet up to about 7,000 feet.

The Weiser River system bisects the interior of the embayment, exposing deep youthful canyons in the Crane Creek drainage, north of Council and south of Cambridge. In some places the water has cut over 800 feet through basalt. The Snake River and its tributaries on the west side of the embayment (west of the Weiser River Subbasin) and the Payette River on the east side have cut even farther to the sub-basalt rock.

### *Geologic Descriptions and History*

The oldest rocks exposed in the subbasin consist of Triassic to Cretaceous metavolcanic, metasedimentary, and intrusive formations underlying steptoes (island-like high areas) and ancestral highlands along the western and eastern edges of the subbasin. These rocks are visible in deep eroded canyons.

The rocks on the western edge of the subbasin were formed primarily from oceanic crust and consist of metabasalts, submarine volcaniclastics, and associated marine detrital rocks. These rocks are exposed in the Seven Devil Mountains, Cuddy Mountain, Sturgill Peak, and Peck Mountain.

On the eastern side of the subbasin, the West Mountains and Council Mountain are of continental origin and consist of metamorphosed granitic intrusive rocks associated with the Idaho batholith.

Columbia Plateau eruptions occurred 17 to 14 million years ago. Within the Weiser embayment, basalts of the Imnaha Basalt Formation were formed first, followed by basalts of the Grande Ronde Basalt Formation. The Imnaha Basalt formed the majority of the Weiser embayment outline, with lava up to 700 meters thick. The Grande Ronde flows were more limited in extent and were about 150 to 300 meters thick. Between eruptive episodes of both the Imnaha and Grande Ronde Formations were periods of sediment deposition that were covered over by the next lava flow forming interbeds of the "lower" Payette Formation.

Down warping of the Grande Ronde Basalt occurred especially at the southern end of the embayment causing local volcanism known as the Weiser volcanic episode. Up to 350 meters of Weiser Basalt accumulated in localized flow-on-flow sequences. Sediment and ash accumulations occurred simultaneously, producing the "upper" Payette Formation interbeds. These features are located generally within the Miocene plateau basalt flows of western Idaho on Figure 9.

After the Miocene eruptions, the basement rocks underwent uplifting into a series of fault blocks. Sediments continued to accumulate, especially in the down-warped areas of the central and southern portion of the embayment. At the same time, the Snake River was forming its new path south of the embayment and west of the Seven Devils steptoes. Sediments accumulated along the southern margin of the Weiser embayment from ancient lakes, known as the Idaho Formation sediments. These lakes were Snake River backwaters that helped the erosion process occur through Hells Canyon.

The fault block basin and range type activity that was occurring regionally under the embayment resulted in the Long Valley fault system, the Paddock Valley fault system, and the Snake River fault system to the northwest. There was continued down-warping of the central Indian Valley trough, a synclinal depression, and up-warping of the Seven Devils. There was weak anticlinal-synclinal folding parallel to the Paddock Valley fault system, which is more pronounced southwest of Cuddy Mountain through the Sturgill Peak area to Dead Indian Ridge.

Fitzgerald (1982 p125-126) describes the present-day features as follows:

> *Structural growth of present-day features continued following the eruption of the Weiser Basalt. A new cycle of stream development began as basins and uplands became more pronounced. Continued movement of the Paddock Valley fault*

*system left the Weiser River in an antecedent position across structural features, such as the Cambridge fault, while its tributaries developed in consequent and subsequent positions, as in the up-dip Pine Creek graben. Crane Creek, developing primarily in post-Weiser Basalt time from runoff gathered in the Indian Valley trough, became incised across the developing step-fault blocks of the Paddock Valley fault system. Weiser Basalt units near Mann Creek Reservoir were slightly uplifted as the Sturgill Peak block and anticline continued to rise. This is indicated by the incision of the Weiser River course across the Sturgill Peak anticline and adjacent Weiser Basalt units southeast of Shoe Peg Valley.*

*Development of the present day topography and structures formed primarily by continued movement of the major faults, by the development of subsequent streams along fault zones, and by the development of consequent streams on dip-slopes and depressions. A thick accumulation of Idaho Formation sediments was deposited along the southern margin of the embayment and similar sediment partially filled fault-block troughs of the Long Valley fault system. The basement-derived arkosic composition of the these sediments suggests that the drainage system and structural controls at the eastern margin of the embayment were well developed by the Pliocene (5.3 to 1.6 million years ago), so that most post-Miocene structural activity was a continuation of an already established pattern.*

*Soils*

Soil groups for the Weiser River Subbasin are shown on Figure 10. Individual soil units are further described in Table 3. In the higher elevations (4,000 to 6,000 feet) along the northwest and northeast margins of the subbasin, where low order headwater streams are located, soils are of the Bluebell-Ticanot-Demast group (Figure 10). These soils vary from shallow to very deep, are well drained, and have moderate to slow permeability (Table 3). Slopes vary considerably from 5% to 65% and, thus, runoff varies from medium in speed to very rapid. The slopes have a moderate to very severe erosion hazard. Bluebell soils are very cobbly loams over basalt and support predominantly ponderosa pine woodland vegetation. Ticanot very cobbly loam inclusions tend to form on open mountain sagebrush rangelands on shallow soils over basalt. Demast loam soils are on the steep mountainsides supporting mixed fir and pine vegetation.

Further down the drainage on lower elevation (3,500 to 5,000 feet) rangelands the Riggins-Meland-Klicker soil group predominates. These soils are very stony on rolling and undulating hills. They are moderate to shallow in depth over basalt. Riggins soils occur on steep, south facing slopes (up to 75% incline) that have very rapid runoff and a very severe erosion hazard. Vegetation on these soils is big sagebrush/Idaho fescue or big sagebrush/bluebunch wheatgrass rangelands. Meland soils are not quite as steep and support bitterbrush/Idaho fescue rangelands. Klicker soils are found under the woodland canopies of Douglas fir and ponderosa pine on steep slopes.

The lower elevation (2,200 to 3,500 feet) valley soils of the upper half of the subbasin north of Cambridge are largely of the Shoepeg-Catherine-Dagor soil group. These soils are very deep and somewhat poorly drained. These loam to silt loam soils lie on areas with very low slope and have slow runoff and only slight erosion. They are used primarily for croplands; the Dagor soils are also used for hay and pastureland.

The southern half of the subbasin is dominated by the Gem-Reywat-Bakeoven group over basalts. Gem soils are extremely stony to stony clay loams on a variety of slopes (up to 60%). They are moderately deep, well drained soils, but with slow permeability. Runoff can be rapid and the erosion hazard can be severe on steeper slopes. They typically support big sagebrush/bluebunch wheatgrass rangelands. Gem soils form complexes with Reywat and Bakeoven soils. Gem-Reywat complex soils tend to be shallow and very stony to very gravelly loams and clay loams. Gem-Bakeoven complexes are very shallow and the vegetation gives way to stiff sagebrush/Sandberg bluegrass rangelands.

Occupying the central portion of the subbasin below Cambridge on Miocene stream and lake deposits are the Brownlee-Deshler-Deterson and Newell-Langrell-Onyx groups. Brownlee soils are deep, sandy loams on a variety of slopes up to 35%. Unlike the Shoepeg group to the north, Brownlee soils have a moderate amount of available soil water and, thus, support primary hay and pastureland. Deshler soils are moderately deep silty clay loams on volcanic tuff or siltstone. There are a variety of slope types (up to 60%) that support hay/pastureland and rangelands at higher slopes. Deterson silt loams are deep soils on steep (30 – 60%) slopes supporting big sagebrush/bluebunch wheatgrass rangelands.

Newell-Langrell-Onyx soils are deep, loamy soils on lower slopes. Newell clay loams (up to 8% slope) tend to support croplands, while the stony clay loams (up to 12%) form mostly rangelands. Flat Langrell soils are loams and gravelly loams that support ponderosa pine woodlands, hay/pasturelands, and wild rye/bluebunch wheatgrass communities. Onyx silt loams (0 – 3% slopes) are used for croplands.

Miocene and Quaternary lake deposits and alluvium in the southernmost portion of the subbasin include a variety of soil groups (Agerdelly-Glasgow-Deshler, Lololita-Lanktree-Payette, Greenleaf-Bissell-Nyssaton, and Baldock-Moulton-Falk). Agerdelly-Glasgow-Deshler soils occur on ridges and bluffs in the lower Crane Creek, Mann Creek, and Monroe Creek areas. Agerdelly is a deep clay soil on big sagebrush/bluebunch wheatgrass rangeland slopes up to 60%. Glasgow soils are clay loams on volcanic tuff, with similar depth and slopes as Agerdelly soils. Glasgow soils may support croplands and hay/pastureland in addition to rangelands. Deshler soils described earlier are silty clay loams on volcanic tuff.

Lololita-Lanktree-Payette soils occupy the bluff between lower Mann Creek and the Weiser River. Lololita soils are deep sandy loams on slopes up to 30%. Lower slopes are used for cropland and hay/pastureland, while upper slopes are rangelands. Lanktree soils include loams, clay loams, and very cobbly loams on lower slopes (to 30%). These soils are deep and can be used for cropland or rangeland depending on slope. Payette soils are coarse sandy loams up to 60% and are largely big sagebrush/bluebunch wheatgrass rangelands.

The Greenleaf-Bissell-Nyssaton group occurs at the mouths of Mann and Monroe Creeks and in spring fed areas on the south side of the lower Weiser River. These soils as a group are generally deep silt loams and clay loams on flats and low slopes used for cropland. Greenleaf silt loams are on lands up to 12% slope and are used for hay/pastureland at these higher slopes.

Baldock-Moulton-Falk soils occur in the lower Weiser River valley from the city of Weiser to the point where the river drains from the north. All of the soils in this group are deep, but poorly drained, and used for cropland. Baldock soils are silt loams and clay loams, whereas the other two are fine sandy loams.

The southernmost tip of the subbasin consists of Pliocene lake deposits of the Idaho Formation which form soils of the Haw-Payette-Van Dusen group. Haw silt loams are very deep soils on a variety of slopes up to 60% that are used for rangelands and dryland farming. Payette coarse sandy loam soils were described previously. Van Dusen soils are deep loams that occur in association with Payette soils on steep slopes or as complexes with Haw soils.

Cretaceous granitic intrusive rock or plutons in the Council Mountain area produce soils of two Bryan groups. Bryan soils are coarse sandy loams on forested steep slopes (40% – 60%). Grand fir and Douglas fir typically dominate these areas.

*Soil K Factors*

A soil's erodability, or K factor, represents both the susceptibility of soil to erosion and the rate of runoff, as measured under standard conditions. Soils high in clay have low K values (0.05 to 0.15) because they resist detachment. Coarse textured soils, such as sandy soils, have low K values (0.05 to 0.2) because of high permeability and low runoff, even though these soils are easily detached. Medium textured soils, such as the silt loam soils, have moderate K values (0.25 to 0.4) because they are moderately susceptible to detachment and they produce moderate runoff. Soils having a high silt content are the most erodable of all soils. They are easily detached and tend to crust, producing high rates of runoff. Values of K for these soils tend to be greater than 0.4.

When viewing a soil's potential to experience overland erosion, one should take into account steepness, as represented by rapid runoff and severe erosion hazard rankings and the soil's K factor (Table 3). Critically important soils from an overland erosion perspective are those that are steep and have moderately high K factors (>0.3). In the Weiser Subbasin, Meland, Gem, Brownlee, Deterson, Payette, Haw, and some Lanktree soils are at greatest risk. Also, valley bottom soils with high K factors (>0.4) are at risk of erosion from bank sloughing and excessive irrigation application. These soils include Onyx, Greenleaf, Haw, and Nyssaton.

## Table 3. Soil Unit Characteristics. Weiser River Watershed.

| Soil Unit | Elevation (ft) | Precipt (in.) | Air Temp (°F | Growing Season (days) | Depth | Drainage | Permeability | Available Water | Runoff | Erosion Hazard | Surface Erosion K Factor |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Bluebell | 4100 - 6100 | 22 to 26 | 39 - 42 | 65 - 75 | mod. (24") | well drained | mod. slow | very low | med. to very rapid | mod. to very severe | 0.2 |
| Ticanot | 3800 - 6000 | 22 to 26 | 38 - 42 | 65 - 75 | shallow (15") | well drained | slow | very low | med. to rapid | mod. to very severe | 0.17 |
| Demast | 4000 - 5500 | 22 to 25 | 33 - 40 | 70 - 80 | very deep (60") | well drained | moderate | moderate | med. to very rapid | mod. to very severe | 0.24 |
| Riggins | 3500 - 5000 | 18 to 22 | 45 - 47 | 110 - 130 | shallow (19") | well drained | mod. slow | very low | med. to very rapid | slight to very severe | 0.1 |
| Meland | 3200 - 5000 | 18 to 22 | 47 - 49 | 110 - 130 | mod. (34") | well drained | mod. slow | low | med. to rapid | mod. to severe | 0.2 to 0.37 |
| Klicker | 3500 - 5000 | 26 to 30 | 43 - 45 | 110 - 120 | mod. (34") | well drained | slow | low | very rapid | severe | 0.24 |
| Shoepeg | 2200 - 3500 | 14 to 18 | 50 - 54 | 130 - 150 | very deep (60") | somewhat poorly | moderate | high | slow | slight | 0.28 to 0.32 |
| Catherine | 2500 - 3500 | 18 to 22 | 48 - 52 | 130 - 140 | very deep (60") | somewhat poorly | moderate | high | slow | slight | 0.28 |
| Dagor | 2500 - 3000 | 17 to 19 | 45 - 47 | 120 - 130 | very deep (60") | well drained | moderate | high | slow | slight | 0.28 |
| Gem | 3000 - 4800 | 12 to 16 | 45 - 50 | 130 - 140 | mod. (29") | well drained | slow | low | med. to rapid | mod. to severe | 0.15 to 0.32 |
| Reywat | 3000 - 4800 | 12 to 14 | 45 - 49 | 130 - 140 | shallow (19") | well drained | mod. slow | very low | med. to rapid | mod. to severe | 0.15 |
| Bakeoven | 3000 - 4800 | 12 to 16 | 46 - 50 | 130 - 140 | very shallow (9") | well drained | mod. slow | very low | med. to rapid | mod. to severe | 0.1 |
| Brownlee | 2700 - 4000 | 15 to 17 | 45 - 47 | 110 - 120 | very deep (60") | well drained | mod. slow | moderate | med. to rapid | slight to severe | 0.37 |
| Deshler | 2500 - 4500 | 13 to 16 | 45 - 47 | 130 - 140 | mod. (30") | well drained | slow | low | med. to very rapid | slight to very severe | 0.1 to 0.24 |
| Deterson | 2500 - 4500 | 12 to 16 | 46 - 50 | 135 - 150 | very deep (60") | well drained | slow | high | very rapid | very severe | 0.32 |
| Newell | 2200 - 3400 | 12 to 16 | 47 - 51 | 110 - 130 | very deep (60") | well drained | mod. slow | high | slow to medium | slight | 0.32 to 0.37 |
| Langrell | 3000 - 3500 | 18 to 22 | 47 - 51 | 110 - 140 | very deep (60") | well drained | moderate | low | very slow | slight | 0.17 to 0.2 |
| Onyx | 3100 - 3200 | 14 to 16 | 48 - 52 | 135 - 145 | very deep (60") | well drained | moderate | high | very slow | slight | 0.43 |
| Ager | 2300 - 3000 | 12 to 14 | 50 - 52 | 135 - 145 | very deep (60") | well drained | slow | high | med. to very rapid | mod. to severe | 0.24 |
| Glasgow | 2300 - 3000 | 10 to 14 | 48 - 52 | 135 - 145 | mod. (38") | well drained | slow | moderate | slow to very rapid | slight to very severe | 0.28 |
| Deshler | see above | | | | | | | | | | |
| Lolalita | 2300 - 3000 | 10 to 12 | 48 - 52 | 145 - 155 | very deep (60") | somewhat excessive | mod. rapid | moderate | med. to rapid | slight to severe | 0.17 |
| Lanktree | 2200 - 3500 | 10 to 12 | 49 - 52 | 140 - 150 | very deep (60") | well drained | slow | mod. to high | slow to rapid | slight to severe | 0.17 to 0.43 |
| Payette | 2300 - 3000 | 12 to 13 | 48 - 51 | 140 - 150 | very deep (60") | well drained | mod. rapid | low | med. to very rapid | mod. to very severe | 0.32 |
| Greenleaf | 2100 - 2400 | 10 to 12 | 49 - 52 | 150 - 155 | very deep (60") | well drained | mod. slow | high | slow to medium | slight to moderate | 0.49 |
| Bissell | 2100 - 2500 | 10 to 13 | 48 - 52 | 150 - 155 | very deep (60") | well drained | mod. slow | high | slow | slight | 0.28 |
| Nyssaton | 2100 - 2400 | 10 to 12 | 50 - 52 | 150 - 155 | very deep (60") | well drained | slow | high | very slow | slight | 0.49 |
| Baldock | 2100 - 2300 | 10 to 12 | 48 - 52 | 150 - 155 | very deep (60") | poorly drained | moderate | high | slow | slight | 0.32 to 0.37 |
| Moulton | 2100 - 2300 | 10 to 12 | 48 - 52 | 150 - 155 | very deep (60") | poorly drained | mod. to mod. rapid | moderate | slow | slight | 0.24 to 0.37 |
| Falk | 2100 - 2300 | 11 to 13 | 49 - 51 | 150 - 155 | very deep (60") | somewhat poorly | mod. rapid | moderate | very slow | slight | 0.2 |
| Haw | 2300 - 2700 | 12 to 13 | 47 - 51 | 145 - 155 | very deep (60") | well drained | mod. slow | moderate | med. to very rapid | slight to very severe | 0.43 |
| Payette | 2300 - 3000 | 12 to 13 | 48 - 51 | 140 - 150 | very deep (60") | well drained | mod. rapid | low | med. to very rapid | mod. to very severe | 0.32 |
| Van Dusen | 2400 - 3000 | 12 to 14 | 48 - 51 | 130 -140 | very deep (60") | well drained | mod. slow | high | very rapid | very severe | 0.24 |
| Bryan | 4200 - 6000 | 25 to 35 | 36 - 42 | 30 - 80 | very deep (60") | excessively drained | rapid | low | very rapid | very severe | 0.17 |

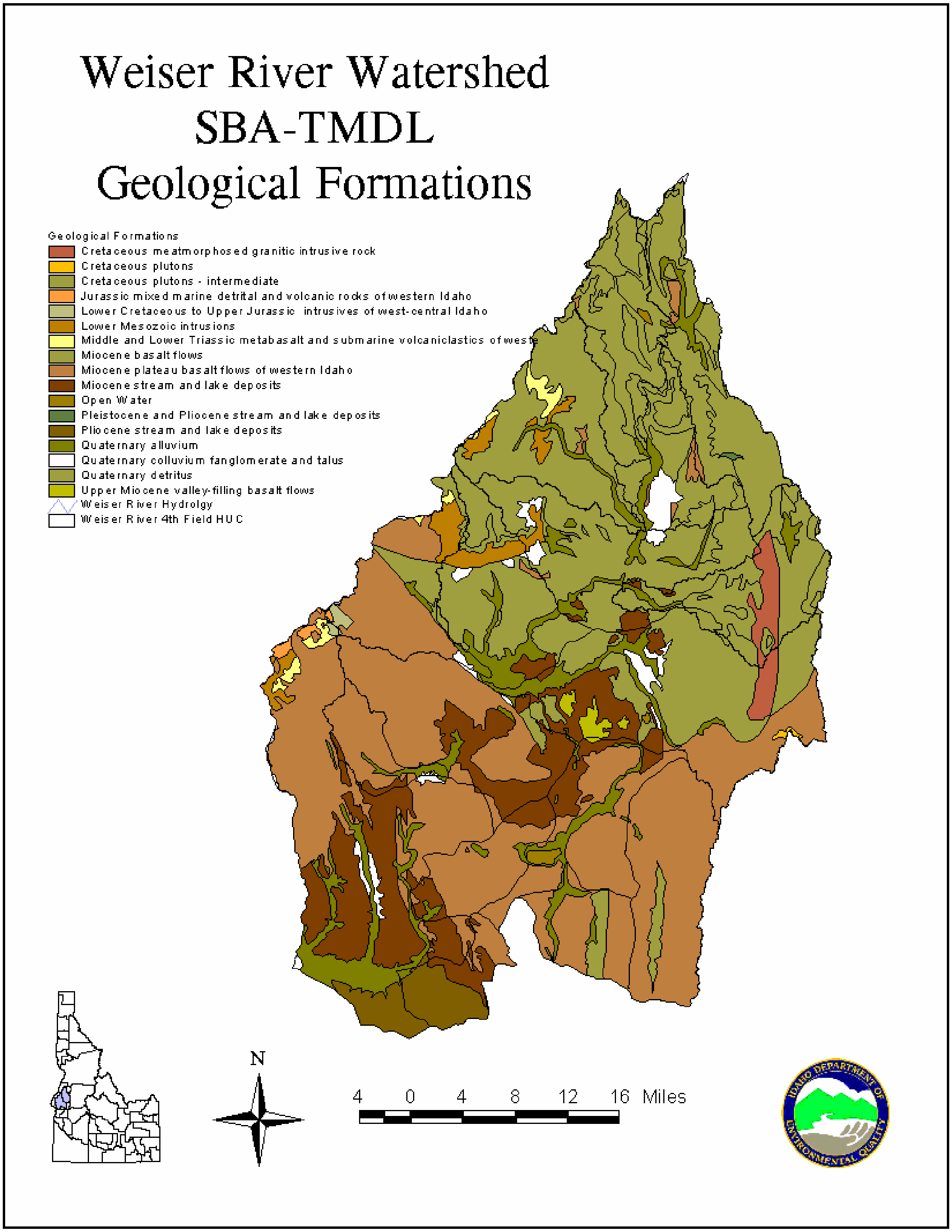



**Figure 9. Geology. Weiser River Watershed.**

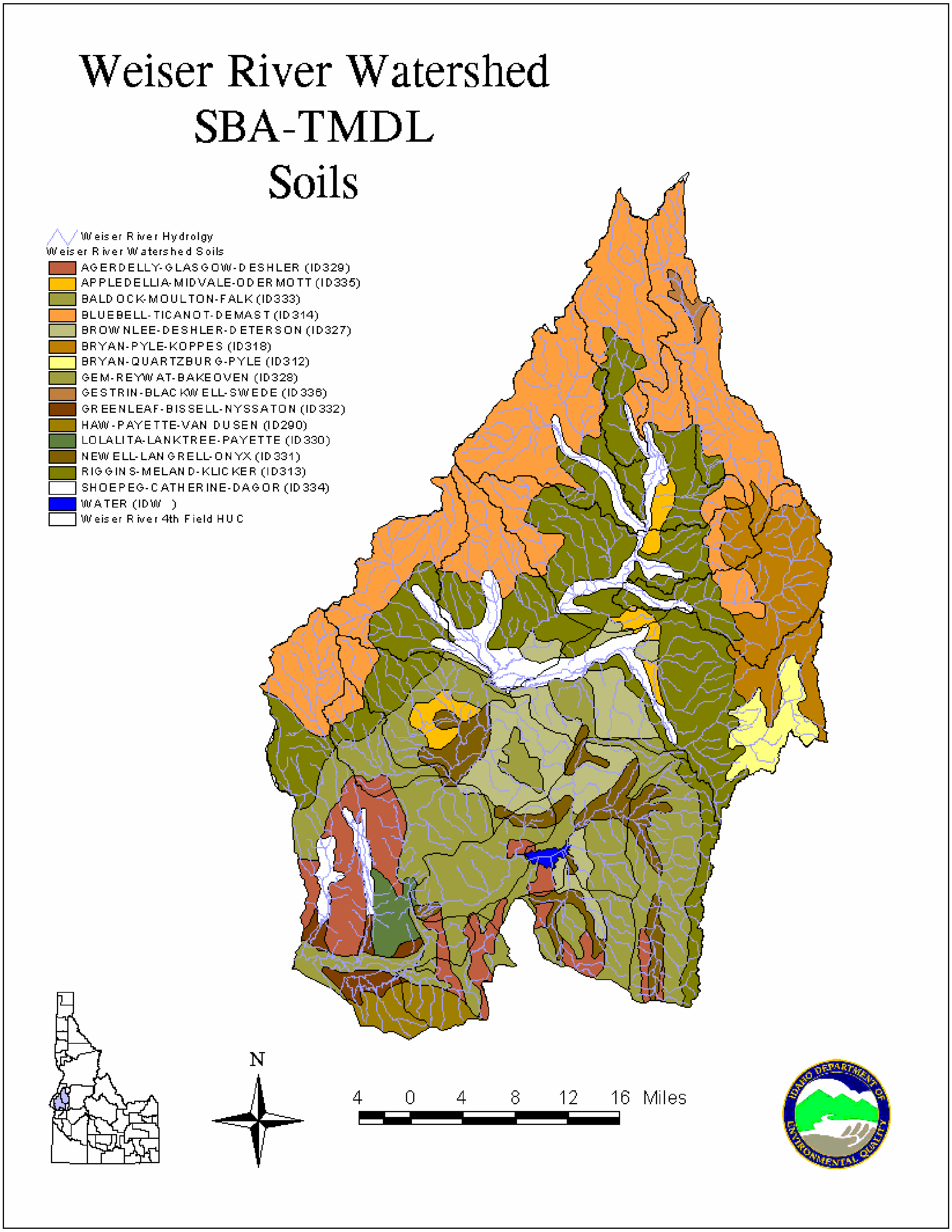



**Figure 10. Soils. Weiser River Watershed.**

## Topography

Topography varies greatly throughout the Weiser River Watershed. The watershed is bounded by high elevation, forested mountains to the west, east, and north. The highest elevations are at No Business Mountain and Council Mountain in the West Mountain Range to the east, Cuddy Mountain and Sturgel Peak to the west, and the southern end of the Seven Devil Mountains to the north. The elevation changes from a low elevation of 604 meters (2,115 feet) near the confluence of the Weiser River and the Snake River near Weiser, Idaho, to a high elevation of 2,471 meters (8,459 feet) at Council Mountain. The changes in elevation are represented in Figure 11.

The higher elevation locations on the eastern side of the watershed are steeply sloped (between 30% and 50% slope), while the lower elevations are much flatter (between 0% and 10% slope). The steeper slopes are usually dominated by bare rock or sub-alpine ecosystems. Moderately sloped areas in the higher elevations are dominated by a mixture of pines and firs, with vegetation type usually dependent on slope aspect. Lower elevations, below the permanent winter snow pack, are usually grass and shrublands. Figure 12 shows the elevation contours in the Weiser River Watershed. Figure 13 shows the slopes.

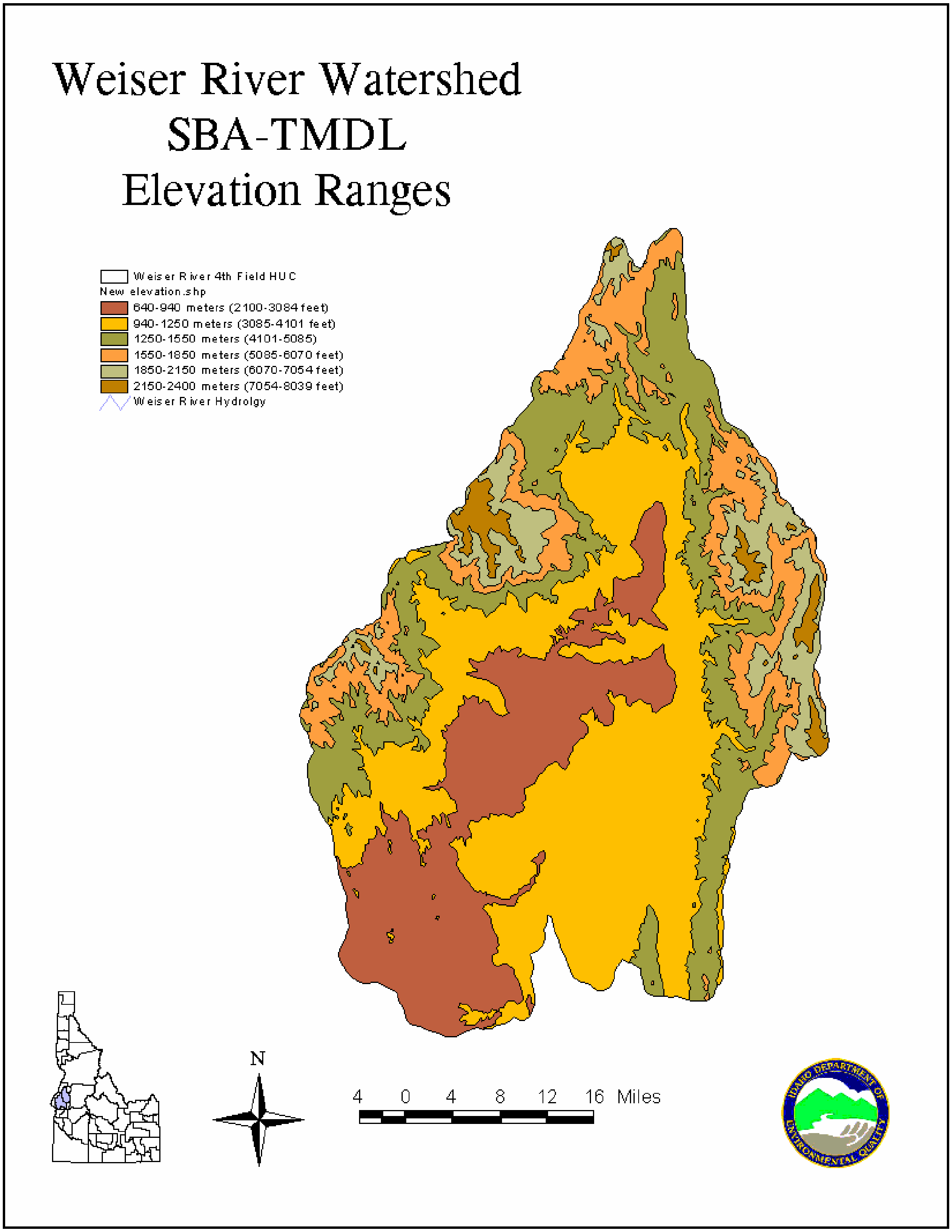



**Figure 11. Elevations. Weiser River Watershed.**

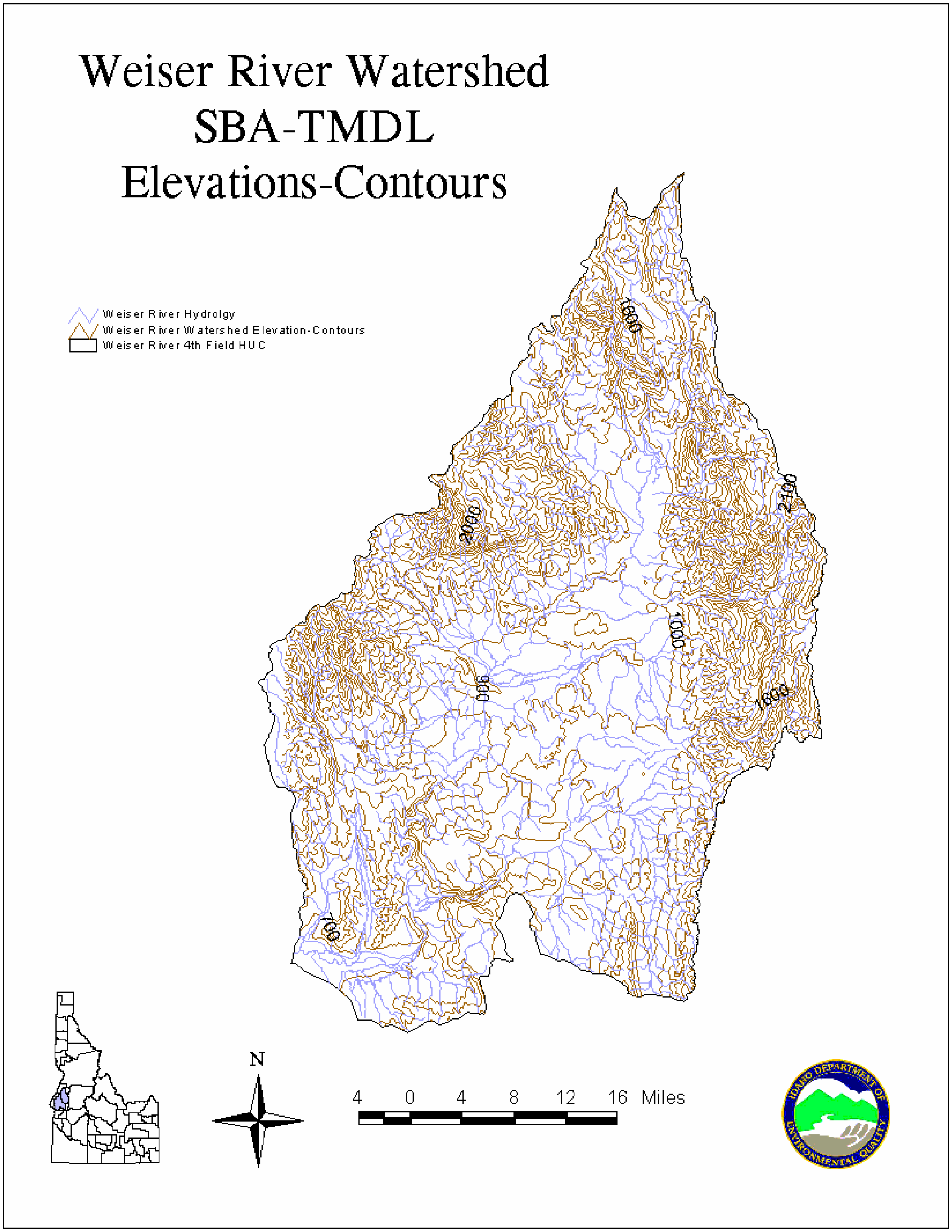



**Figure 12. Contours and Elevations in Meters. Weiser River Watershed.**

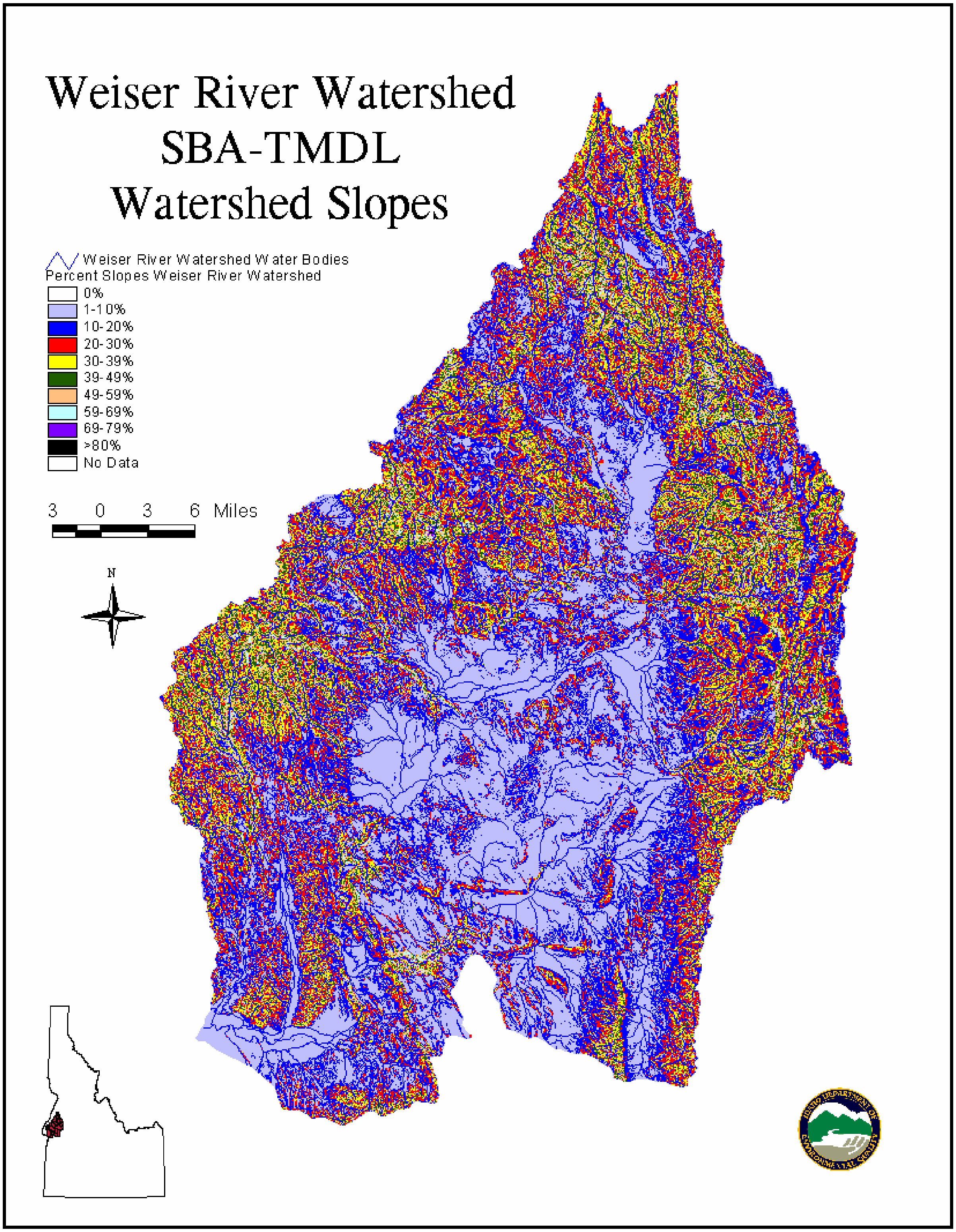



**Figure 13. Slopes. Weiser River Watershed. (DEM Generated Map, Scale Different from Other GIS Generated Maps)**

## Vegetation

Vegetation varies as the elevation changes in the Weiser River Watershed. Lower elevation uplands that have not been brought into domestic cultivation are primarily sagebrush/steppe vegetation. Disturbance by fire or other natural activities may have altered the vegetation in some areas by allowing invasive plant species, such as cheatgrass (*Bromus tectorum*), to become established. Other areas may have been altered to enhance rangeland and potential feed production for livestock.

River floodplain vegetation can also vary with elevation and anthropogenic changes. In areas where river channels have been modified, the native vegetation may have been replaced or altered. In areas where the water's access to the historic floodplain has been limited, the native cottonwood species (*Populus* sp.) have been replaced with cultivated agricultural or more hydrophobic species. Areas that are still flood prone, however, still show the presence of native cottonwood or deciduous forest communities. For example, a stand of cottonwoods is located downstream of the confluence of the Little Weiser River and the Weiser River near Cambridge, Idaho. This is an area where the river water has access to the historic floodplain. Cottonwoods can also be found in thin bands along the river where high flows still have an opportunity to provide enough "free" water to maintain hydrophilic species.

Willow (*Salix* sp.) species can also be found in these areas where hydrophilic species can still exist. Grasses may also consist of a mixture of hydrophilic and hydrophobic species, depending on soil moisture content. Grass species may include, but are not limited to, sedges (*Carex* sp.), rushes (*Juncus* sp.), spiked rushed (*Eleocharis* sp.), fescue (*Festucae* sp.), bunchgrasses, and bluegrass (*Poa* sp.).

Smaller, higher gradient water bodies may have native willow (*Salix* sp.) species and other hydrophilic species associated with free water. Alteration from natural wet meadows along stream corridors to cultivated areas or pasture areas may have introduced non-native, herbaceous species such as bromegrass (*Bromus* sp.), reed carnarygrass (*Phalaris* sp.), tall wheatgrass (*Agropyron* sp.), orchard grass (*Dactylis* sp.), and rye grass (*Elymus* sp.), along with other non-native species.

Within the Snake River-High Desert Ecoregion, vegetation in the uplands primarily consists of mountain big sagebrush (*Artemisia tridentata*) in wetter, north facing areas and low sagebrush (*Artemisia arbuscula*) in lower, drier locations. Native grasses consist of fescue (*Festucae* sp.), bunchgrasses, and bluegrass (*Poa* sp.).

Woody conifers are usually associated with higher precipitation areas and elevations above 1,140 meters (4,000 feet). Conifer species found in these areas include ponderosa pine (*Pinus ponderosa*), lodgepole pine (*Pinus contorta*), Douglas fir (*Pseudotsuga menziesii*), white-grand fir (*Picea* sp.), and larch-tamarack (*Larix occidentalis*). There may also be some isolated western juniper (*Juniperus occidentalis*) on the western side of the watershed. Figure 14 shows the land cover in the Weiser River Watershed.

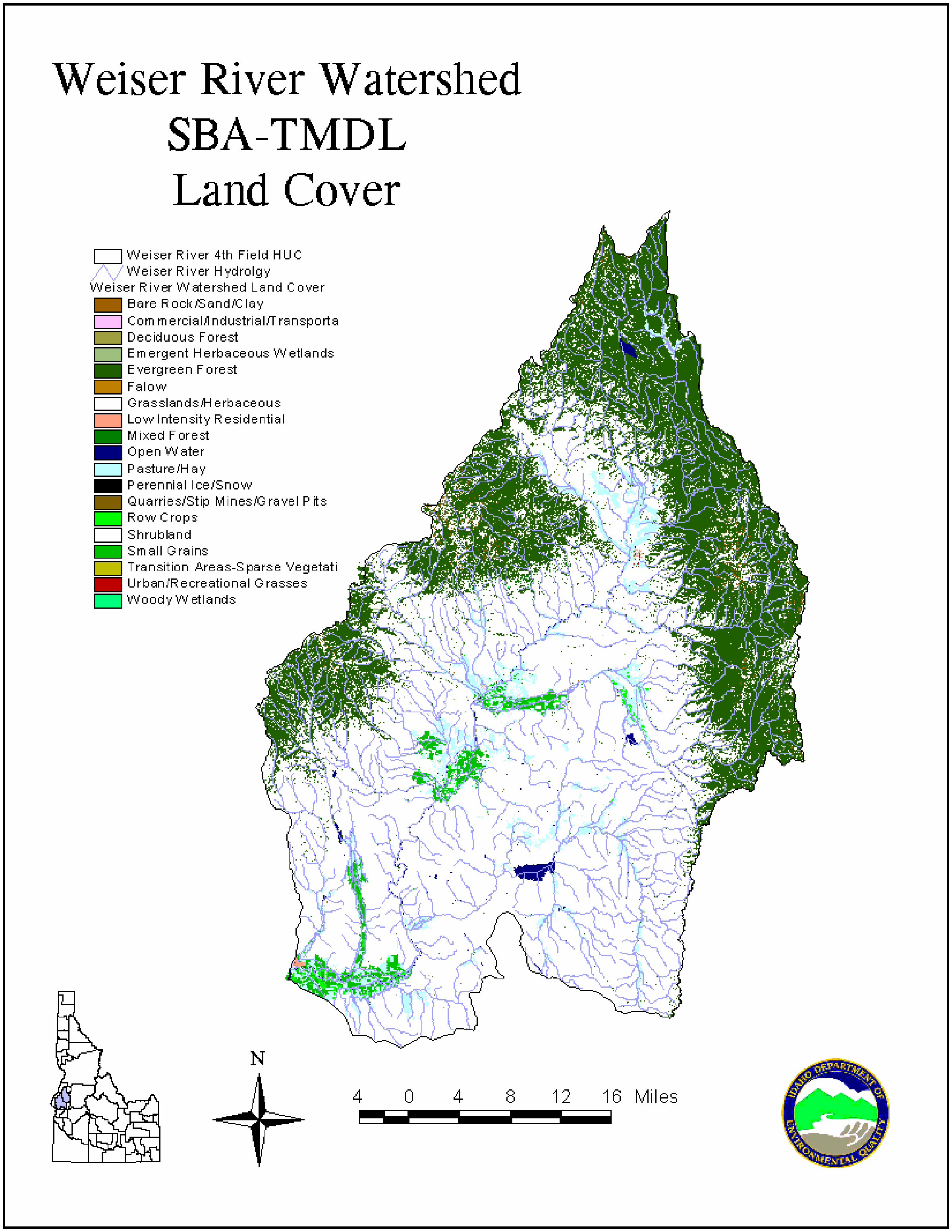



**Figure 14. Land Cover. Weiser River Watershed.**

**Fisheries**

Fishery data are available for many water bodies in the Weiser River Watershed. The Idaho Department of Fish and Game (IDFG) completed extensive fish surveys on many segments of the river itself. IDFG and United States Forest Service (USFS) completed numerous studies in smaller watersheds to address bull trout issues. DEQ has conducted limited Beneficial Use Reconnaissance Program (BURP) studies in smaller second and third order water bodies since 1993.

Much of the lower elevation portion of the Weiser River Watershed is dominated by warm water, non-game species, while more cold water species dominate the fisheries higher in the watershed (Cambridge and upstream). Table 4 shows the species encountered at the different locations on the Weiser River.

**Table 4. IDFG Fish Survey Results. Weiser River Watershed.**

| Water Body | Location | Species Encountered[a] | Cold Water Species | Cold Water Species Number | Survey Date |
|---|---|---|---|---|---|
| Weiser River | Below Galloway Dam | BLS, CRP, CSL, LND, MWF, NSF, RSS, SMB, SPD, WRB | MWF WRB | MWF, 26 WRB, 2 | July 1, 1999 |
| Weiser River | Near Weiser, ID | BLS, CSL, LND, MWF, NSF, SMB, SPD, CAT, LSS, SPD | MWF | MWF, 9 | July 1, 1999 |
| Weiser River | In Canyon | BLS, CRP, CSL, MWF, NSF, SMB, SPD, CAT, RSS, SCP, LSS, WRB | MWF WRB | MWF, 3 WRB, 5 | June 30, 1999 |
| Weiser River | Upper Canyon | BLS, CRP, CSL, LND, LSS, MWF, NSF, RSS, SCP, SMB, SPD, WRB | MWF WRB | MWF, 9 WRB, 9 | June 29, 1999 |
| Weiser River | Midvale | BLS, CSL, LND, LSS, MWF, NSF, RSS, SMB, SPD, WRB | MWF WRB | MWF, 7 WRB, 4 | June 29, 1999 |
| Weiser River | Cambridge | BLS, CSL, LSS, MWF, NSF, RSS, SMB, WRB, HRB, MNS | MWF WRB HRB | MWF, 75 WRB, 40 HRB, 1 | June 28, 1999 |

*a BLS-bridgelip sucker, CRP-carp, CSL-chiselmouth bass, LND-longnose dace, LSS-largescale sucker, MWF-mountain whitefish, NSF-northern pike minnow, RSS-redsided shinner, SMB-smallmouth bass, SPD-speckeld dace, WRB-redband trout, CAT-channel catfish, SCP-sclulpin, HRB-rainbow trout (hatchery), MNS-mountain sucker*

The data presented in Table 4 demonstrate that cold water fish species (trout and whitefish) are present throughout the Weiser River, from Cambridge to the Snake River. However, the dominance of cold water species increases from downstream to upstream segments. This increase in cold water species could possibly be attributed to a variety of conditions, including habitat and/or water quality.

Species found in Weiser River tributaries are identified in Table 5. Most of the data presented to DEQ by IDFG represent two different years and mainly address Keithly Creek, Sheep Creek, and tributaries in the Mann Creek Watershed. It is unclear if only game species were evaluated during some of the surveys conducted on these smaller water bodies.

**Table 5. IDFG Fish Data from Small Tributaries: 1995, 1999, and 2001. Weiser River Watershed.**

| Water Body[a] | Location | Species Encountered[b] | Cold Water Species | Cold Water Species Number | Survey Date |
|---|---|---|---|---|---|
| Fourth of July Creek (01) | R5WT14N Sec 8 or 9? | WRB | WRB | 51 and 75 | July 7, 1995 and June 28, 1999 |
| Hitt Creek | R5W T14N Sec 22 | WRB | WRB | 52 and 36 | July 19, 1995 and July 20, 1995 |
| Spring Creek (02) (Mann Creek) | Not Available | WRB | WRB | 84 | July 18, 1995 |
| Bear Creek (03) | R5W T14N Sec 16 | WRB | WRB | 89 | July 21, 1995 |
| Adams Creek (04) | R5W T13N Sec 9 | WRB | WRB | 84 | July 21, 1995 |
| Fourth of July Creek (05) | R5W T14N Sec 23 | WRB | WRB | 33 | July 17, 1995 |
| Keithly Creek (01+1) | R4W T14N Sec 29 | WRB | WRB | 36 and 26 | July 27, 1995 and July 18, 2001 |
| Mulmick Gulch (Mann Creek) | Not Available | WRB | WRB | 33 and 23 | July 23, 1995 and July 17, 2001 |
| Sheep Creek | Near Cambridge | BLS, RSS, SPD | None | None | June 18, 2001 |

*a as identified in Idaho Fish and Game Report*
*b BLS-bridgelip sucker, RSS-redsided shinner, SPD-speckeld dace, WRB-redband trout*

The portion of the Weiser River Watershed upstream from the confluence of the Little Weiser River has been identified as a key watershed for bull trout (*Salvelinus confluentus*). The bull trout has been listed as a threatened species under the Endangered Species Act (United States Fish and Wildlife Service 2002). Local populations of bull trout have been found in the upper Little Weiser River, the East Fork Weiser River, and upper Hornet Creek. Figure 15 shows the key bull trout watershed.

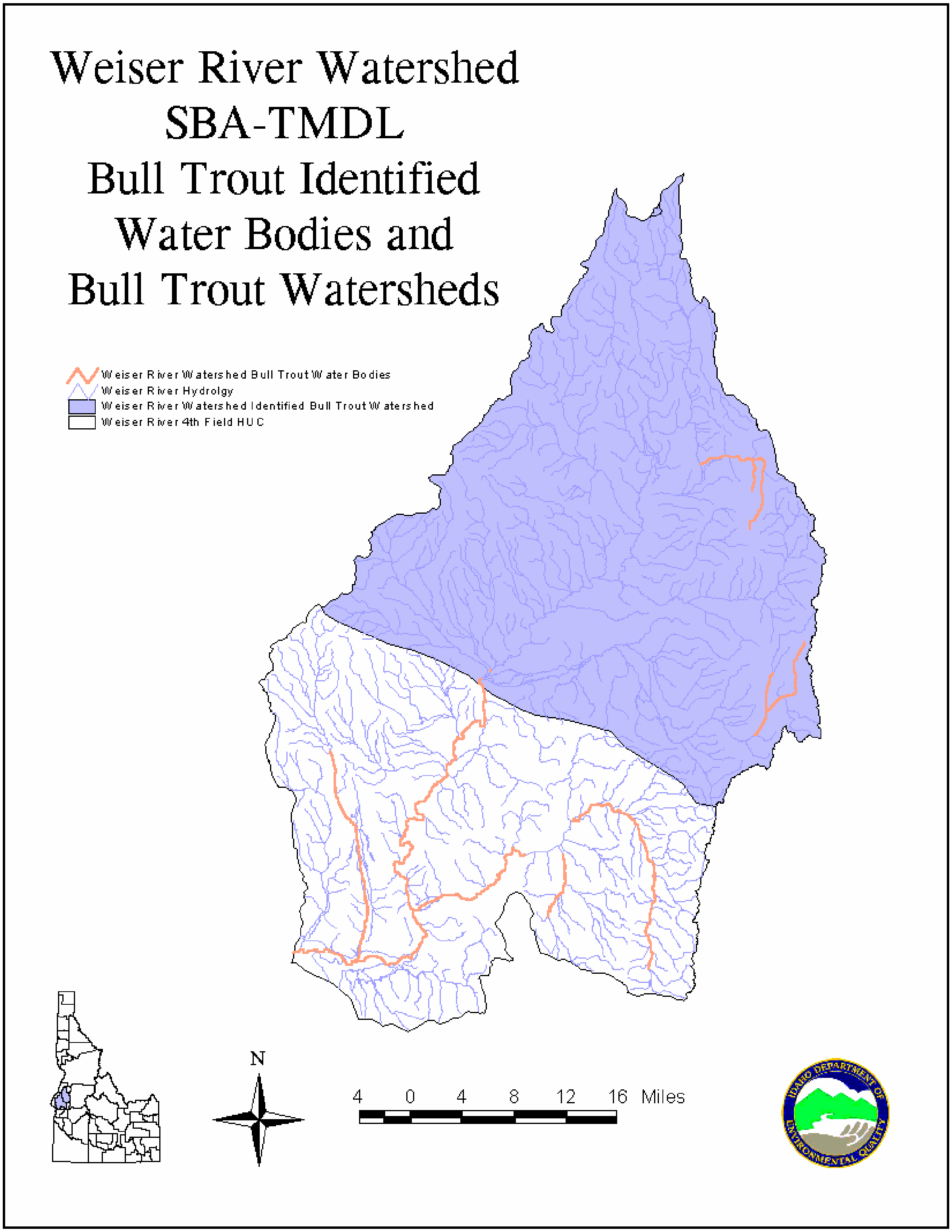



**Figure 15. Key Bull Trout Watersheds. Weiser River Watershed.**

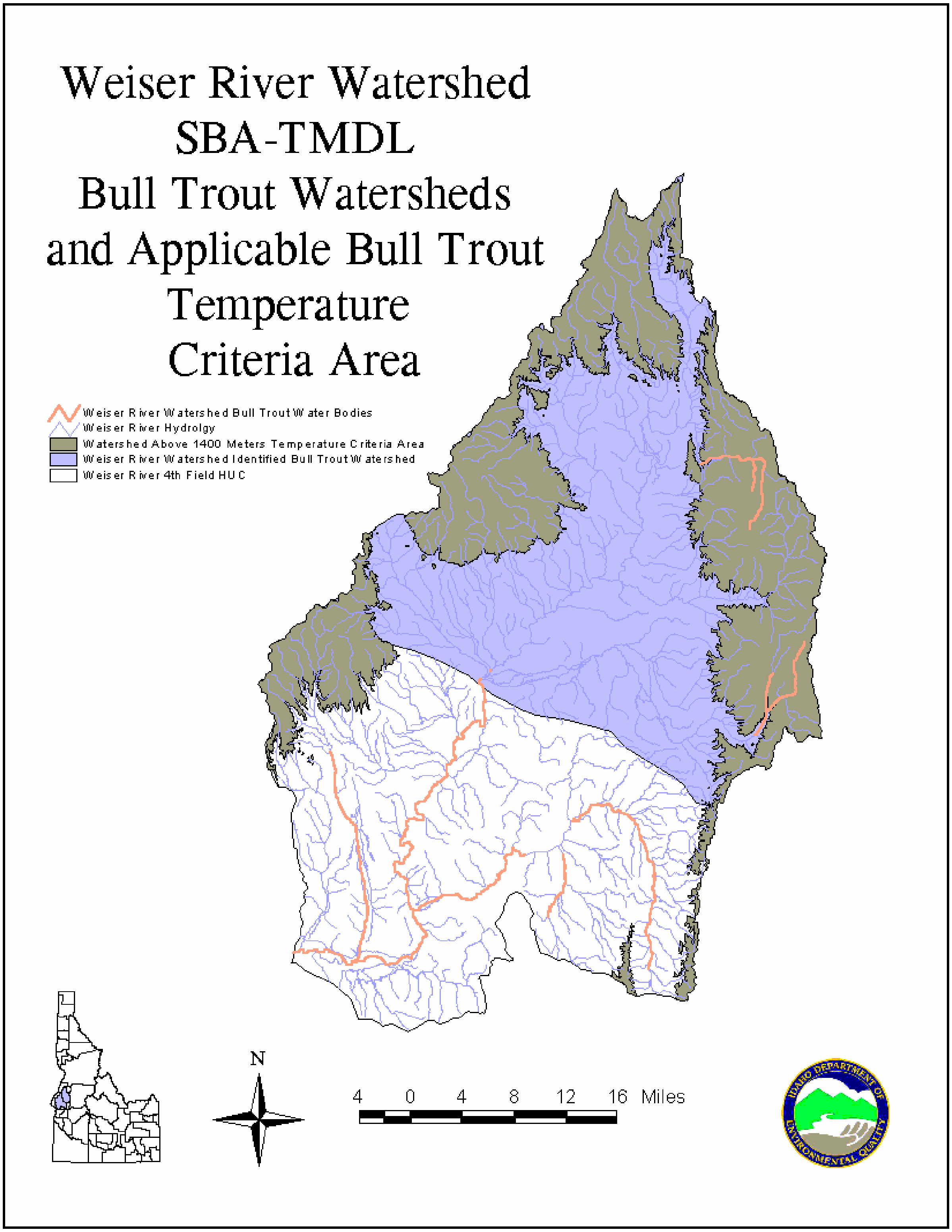



**Figure 16. Key Bull Trout Watersheds and Applicable State Water Quality Temperature Criteria Area. Weiser River Watershed.**

**Subwatershed Characteristics**

Most of the fifth field Hydrologic Unit Code (HUC) watersheds do not have the §303(d) listed segments originating in the watershed itself. The only fifth field HUCs that have §303(d) listed segments originating in the watershed are the following:

- Big Flat (North Crane Creek)
- Goodrich-Bacon (Johnson Creek)
- Little Weiser (Little Weiser River)
- Monroe-Mann (Mann Creek)
- West Fork (West Fork Weiser River).

The remaining fifth field HUCs either have a portion of a §303(d) listed segment flowing through them or do not have any listed segments within the fifth field boundary.

Table 6 describes the general characteristics of the fifth field HUCs and any §303(d) listed segments within their boundaries. Figure 17 shows the individual fifth field HUCs and acreage within each. Table 7 describes land use, landform, general elevation, and general characteristics of water bodies discharges.

**Table 6. Fifth Field Hydrologic Unit Codes (HUCs), Total Acres, and § 303(d) Listed Segments. Weiser River Watershed.**

| Fifth Field HUC No. | Fifth Field HUC Name | Total Acres | §303(d) Listed Segment | 1998 §303(d) Listed Segment Name |
|---|---|---|---|---|
| 1705012418 | Big Flat | 64,811 | yes | North Crane Creek |
| 1705012417 | Crane Creek Reservoir | 54,327 | yes | Crane Creek Reservoir |
| 1705012408 | Goodrich-Bacon | 76,498 | yes | Johnson Creek |
| 1705012409 | Hornet Creek | 70,715 | no | |
| 1705012405 | Keithly Creek | 80,693 | yes | Weiser River |
| 1705012414 | Little Weiser River | 129,343 | yes | Little Weiser River |
| 1705012404 | Lower Crane Creek | 56,671 | yes | Crane Creek |
| 1705012413 | Middle Fork Weiser River | 57,714 | no | |
| 1705012410 | Mill-Warm Spring | 39,298 | no | |
| 1705012401 | Monroe-Mann | 166,268 | yes | Mann Creek and Weiser River |
| 1705012406 | Pine Creek | 52,666 | no | |
| 1705012407 | Rush | 59,983 | yes | Weiser River |
| 1705012403 | Sage Creek | 20,677 | no | |
| 1705012419 | Soulen Reservoir | 31,286 | yes | South Crane Creek |
| 1705012412 | Upper Weiser River | 62,086 | no | |
| 1705012411 | WF Weiser River | 54,013 | yes | West Fork Weiser River |

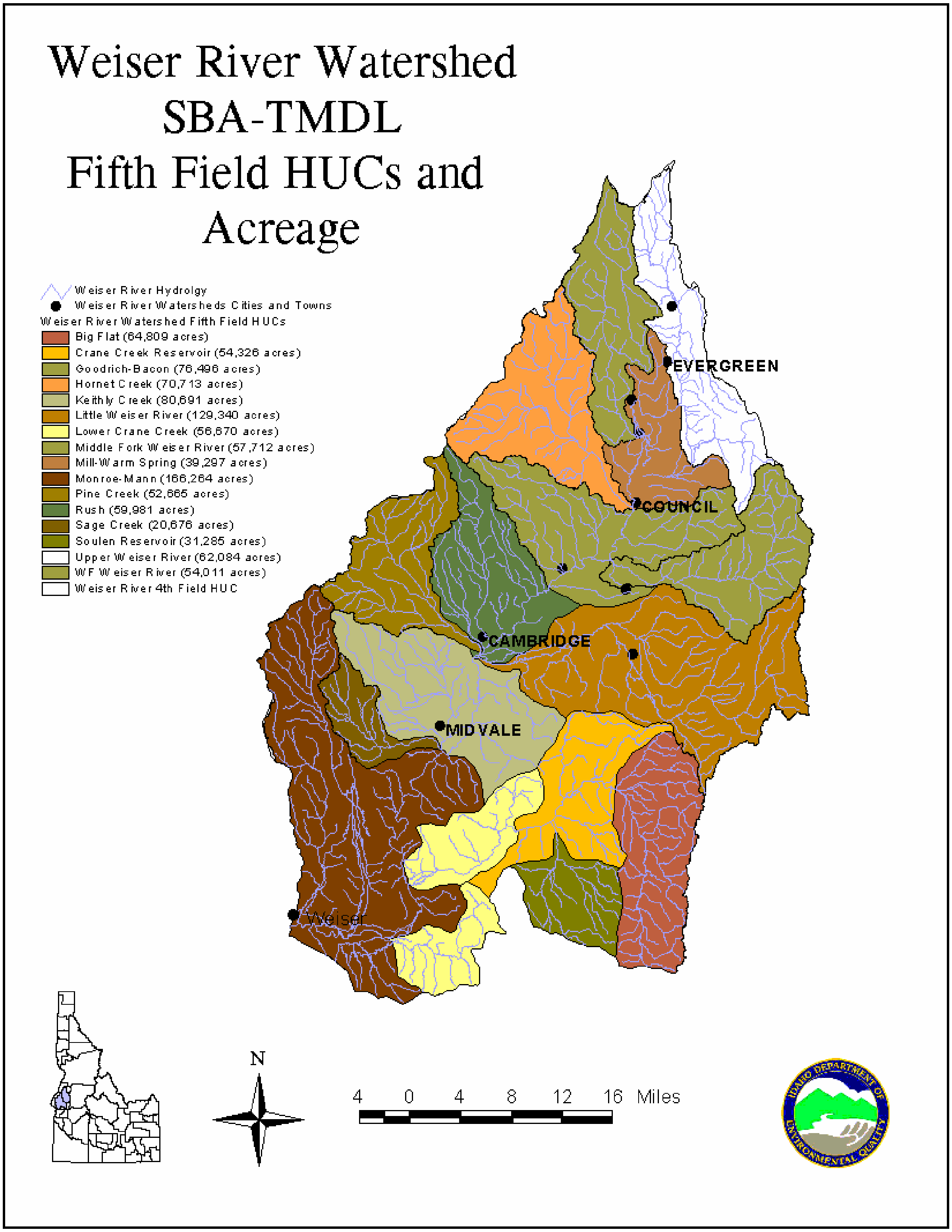



**Figure 17. Fifth Field HUCs and Acreage. Weiser River Watershed.**

**Table 7. Fifth Field HUCs, General Land Use/Landform, Elevation Change, and Hydrologic Regimes. Weiser River Watershed.**

| Fifth Field HUC[a] Name | Land Use/ Landform | Approx. Highest Elevation (meters) | Approx. Lowest Elevation (meters) | General Water Body Hydrologic Regimes |
|---|---|---|---|---|
| Big Flat | Irrigated Agriculture, Rangeland, Rolling Hills | 1,400 | 1,000 | Ephemeral, Intermittent, and Perennial |
| Crane Creek Reservoir | Irrigated Agriculture, Rangeland, Rolling Hills | 1,000 | 1,000 | Ephemeral, Intermittent, and Perennial |
| Goodrich-Bacon | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,400 | 900 | Ephemeral, Intermittent, and Perennial |
| Hornet Creek | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,300 | 1,000 | Ephemeral, Intermittent, and Perennial |
| Keithly Creek | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,200 | 900 | Ephemeral, Intermittent, and Perennial |
| Little Weiser River | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,300 | 900 | Ephemeral, Intermittent, and Perennial |
| Lower Crane Creek | Irrigated Agriculture, Rangeland, Rolling Hills | 1,000 | 800 | Ephemeral, Intermittent, and Perennial |
| Middle Fork Weiser River | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,400 | 900 | Ephemeral, Intermittent, and Perennial |
| Mill-Warm Spring | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,200 | 1,000 | Ephemeral, Intermittent, and Perennial |
| Monroe-Mann | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,200 | 640 | Ephemeral, Intermittent, and Perennial |
| Pine Creek | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,300 | 900 | Ephemeral, Intermittent, and Perennial |
| Rush | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,300 | 900 | Ephemeral, Intermittent, and Perennial |
| Sage Creek | Irrigated Agriculture, Rangeland, Rolling Hills | 1,700 | 800 | Ephemeral, Intermittent, and Perennial |
| Soulen Reservoir | Irrigated Agriculture, Rangeland, Rolling Hills | 1,500 | 1,000 | Ephemeral, Intermittent, and Perennial |
| Upper Weiser River | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,300 | 1,000 | Ephemeral, Intermittent, and Perennial |
| West Fork Weiser River | Irrigated Agriculture, Rangeland, Rolling Hills, Steep Mountains, Forested | 2,100 | 1,000 | Ephemeral, Intermittent, and Perennial |

*a HUC = hydrologic unit code*

The highest elevation in the fourth field Weiser River Watershed is Council Mountain at an elevation of 2,474 meters (8,107 feet). The lowest elevation is at the confluence of the Weiser River and the Snake River at an elevation of 638 meters (2,093 feet). As seen in Table 8, a majority of the watershed's elevation is between 840 meters and 1,250 meters (2,577 feet and 4,101 feet). Approximately 50% of the entire watershed acreage is within this elevation range. Table 8 provides the breakdown of the percentage of total acreage within each elevation range. Figure 11 showed the elevations within the fourth field Weiser River Watershed. Figure 13 showed the slopes that could be encountered in the watershed.

**Table 8. Fifth Field HUCs, Elevations by Watershed. Weiser River Watershed.**

| 5th Field HUC[a] Name | Percent Elevation 638-842 (meters) | Percent Elevation 842-1,046 (meters) | Percent Elevation 1,046-1,249 (meters) | Percent Elevation 1,249-1,442 (meters) | Percent Elevation 1,442-1,657 (meters) | Percent Elevation 1,657-1,861 (meters) | Percent Elevation 1,861-2,064 (meters) | Percent Elevation >2,064 (meters) |
|---|---|---|---|---|---|---|---|---|
| Monroe-Mann | 38.5% | 27.8% | 12.8% | 8.3% | 6.5% | 4.2% | 1.5% | 0.5% |
| Sage Creek | 5.4% | 19.3% | 46.3% | 20.2% | 7.9% | 0.9% | 0.0% | 0.0% |
| Lower Crane Creek | 27.9% | 33.8% | 38.3% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Keithly Creek | 27.3% | 47.3% | 11.2% | 6.1% | 4.1% | 2.6% | 1.1% | 0.2% |
| Pine Creek | 1.2% | 9.7% | 27.0% | 27.6% | 12.6% | 8.6% | 5.9% | 5.9% |
| Rush | 15.7% | 39.0% | 16.7% | 8.4% | 2.9% | 3.2% | 5.7% | 7.5% |
| Goodrich-Bacon | 1.0% | 38.4% | 17.0% | 11.1% | 8.5% | 8.8% | 9.6% | 5.1% |
| Hornet Creek | 0.0% | 10.6% | 23.2% | 29.1% | 18.4% | 7.5% | 6.4% | 4.2% |
| Mill-Warm Spring | 0.0% | 39.2% | 25.6% | 19.0% | 9.0% | 3.9% | 2.5% | 0.9% |
| WF Weiser River | 0.0% | 7.3% | 16.1% | 14.7% | 36.6% | 20.2% | 4.7% | 0.5% |
| Upper Weiser River | 0.0% | 0.0% | 4.3% | 39.3% | 26.7% | 18.7% | 9.1% | 1.8% |
| Middle Fork Weiser River | 0.0% | 9.7% | 8.9% | 11.9% | 19.4% | 20.2% | 19.7% | 8.9% |
| Little Weiser River | 4.2% | 41.0% | 13.3% | 13.9% | 10.9% | 7.1% | 5.5% | 3.7% |
| Crane Creek Reservoir | 0.0% | 67.4% | 32.6% | 0.0% | 0.0% | 0.0% | 0.0% | 0.0% |
| Big Flat | 0.0% | 10.6% | 58.1% | 26.2% | 5.2% | 0.0% | 0.0% | 0.0% |
| Soulen Reservoir | 0.0% | 25.5% | 61.8% | 11.3% | 1.4% | 0.0% | 0.0% | 0.0% |
| Percent of Total Watershed Acreage | 11.1% | 28.1% | 21.7% | 14.6% | 10.5% | 4.6% | 2.5% | 2.5% |

*a HUC = hydrologic unit code*

The general aspect (exposure) of the Weiser River Watershed varies, with a little over 29% of the total acreage in the fourth field HUC having a south to southwest exposure (See Table 9 and Figure 18).

The landforms in the southern portion of the watershed are mostly rolling hills with low to moderate slopes. Cultivated agricultural in this area is associated with near river flood prone areas in some places. Numerous irrigation canals provide water to areas miles from the water source. However, most of the land use in the southern section is rangeland, with sparsely forested areas in the Mann Creek Watershed. Sections of the Weiser River flow through canyons where irrigation is not feasible.

### Table 9. Fifth Field HUCs, Aspects. Weiser River Watershed.

| Fifth Field HUC[a] | Aspect North-Northeast (Acres) | Percent of Total Acreage | Aspect East-Southeast (Acres) | Percent of Total Acreage | Aspect South - Southwest (Acres) | Percent of Total Acreage | Aspect West - Northwest (Acres) | Percent of Total Acreage |
|---|---|---|---|---|---|---|---|---|
| Monroe-Mann | 44,943.1 | 27.0% | 38,187.2 | 23.0% | 49,963.6 | 30.0% | 33,177.7 | 20.0% |
| Sage Creek | 5,182.7 | 25.1% | 6,558.6 | 31.7% | 6,540.6 | 31.6% | 2,389.4 | 11.6% |
| Lower Crane Creek | 16,962.5 | 29.9% | 9,509.2 | 16.8% | 17,615.0 | 31.1% | 12,591.1 | 22.2% |
| Keithly Creek | 23,582.5 | 29.2% | 21,348.1 | 26.5% | 20,498.1 | 25.4% | 15,263.6 | 18.9% |
| Pine Creek | 15,006.1 | 28.5% | 14,433.0 | 27.4% | 15,380.6 | 29.2% | 7,843.9 | 14.9% |
| Rush | 12,889.8 | 21.5% | 19,143.5 | 31.9% | 21,720.0 | 36.2% | 6,235.5 | 10.4% |
| Goodrich-Bacon | 17,569.4 | 23.0% | 20,467.0 | 26.8% | 22,447.0 | 29.3% | 16,013.5 | 20.9% |
| Hornet Creek | 22,097.1 | 31.2% | 22,306.4 | 31.5% | 14,133.4 | 20.0% | 12,179.2 | 17.2% |
| Mill-Warm Spring | 5,335.0 | 13.6% | 7,091.3 | 18.0% | 14,596.0 | 37.1% | 12,280.0 | 31.2% |
| WF Weiser River | 13,726.2 | 25.4% | 15,365.9 | 28.4% | 16,753.9 | 31.0% | 8,165.7 | 15.1% |
| Upper Weiser River | 17,359.2 | 28.0% | 12,376.9 | 19.9% | 18,051.3 | 29.1% | 14,286.4 | 23.0% |
| Middle Fork Weiser River | 9,916.6 | 17.2% | 11,606.6 | 20.1% | 17,415.1 | 30.2% | 18,774.6 | 32.5% |
| Little Weiser River | 25,401.7 | 19.6% | 21,615.9 | 16.7% | 39,664.8 | 30.7% | 42,655.3 | 33.0% |
| Crane Creek Reservoir | 18,228.1 | 33.6% | 77,13.5 | 14.2% | 11,067.0 | 20.4% | 17,319.4 | 31.9% |
| Big Flat | 14,047.6 | 21.7% | 10,744.6 | 16.6% | 17,152.6 | 26.5% | 22,866.6 | 35.3% |
| Soulen Reservoir | 8,889.1 | 28.4% | 3,599.0 | 11.5% | 8,776.8 | 28.1% | 10,020.2 | 32.0% |
| Total | | 25.2% | | 22.6% | | 29.1% | | 23.1% |

*a HUC = hydrologic unit code*

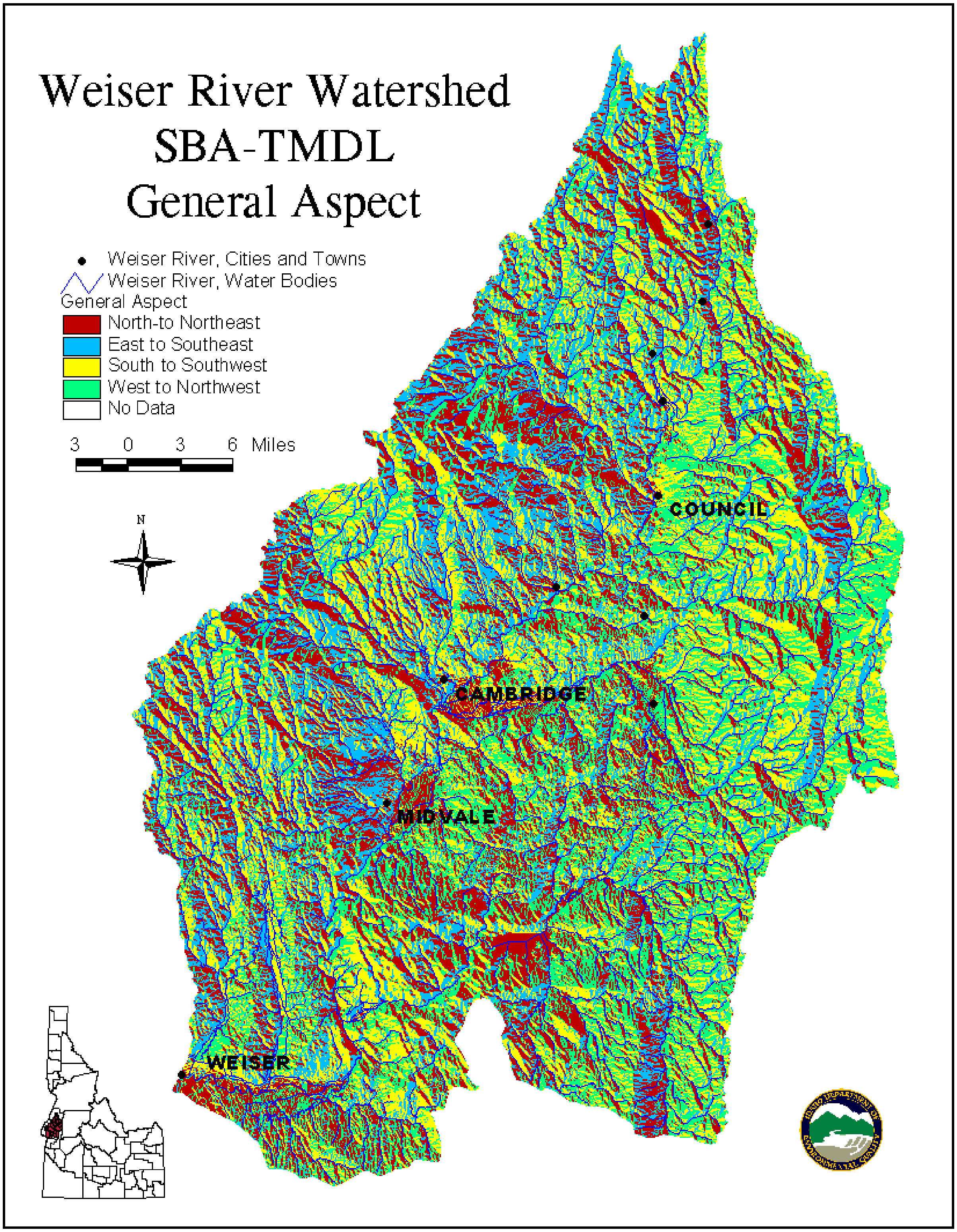



**Figure 18. General Aspect. Weiser River Watershed. (DEM Generated Map, Scale Different from Other GIS Generated Maps)**

## 1.3 Cultural Characteristics

### Land Use

Land use in the Weiser River Watershed is diverse, with forest areas in the upper elevations, cultivated agriculture in the lower valleys, rangelands, and some urban areas. The watershed lies within two counties: Washington and Adams (See Figure 19). The recognized, established communities include the cities of Weiser, Midvale, Cambridge, and Council.

Gravity irrigated agriculture can be found throughout the watershed. Most of the surface irrigated areas are adjacent or near major rivers and streams. Near the confluence of the Weiser River with the Snake River and the town of Weiser, much of the irrigated areas are on benches (Sunny Slope, for example) or in the Weiser Flats area. In Indian Valley, irrigation water is either diverted from the river, delivered from storage water from the Ben Ross Reservoir, or pumped to the desired location. Near Midvale, irrigation water is diverted from the Weiser River and delivered via irrigation canals. Some dry land agriculture exists as well, but the acreage is small due to the lack of precipitation events during summer months.

Forestlands and rangelands account for the largest percentage of the land. Rangeland is used primarily for open range cattle grazing and is managed through federal allotments or private holdings. Forested areas are primarily managed by federal and state agencies, although some private holdings can also be found.

Table 10 shows the acreage and percent of total land use in the Weiser River Watershed. Figure 20 shows the land use in the watershed.

**Table 10. Land Use Classification and Total Acres. Weiser River Watershed.**

| Land Use | Total Acres | Percent of Total |
|---|---|---|
| Forested | 368,706 | 34.3% |
| Rangeland | 625,135 | 58.1% |
| Irrigated Flow | 62,730 | 5.8% |
| Irrigated Sprinkler | 15,547 | 1.4% |
| Riparian | 1,135 | 0.1% |
| Urban | 883 | 0.1% |
| Open Water | 2,212 | 0.2% |
| | | |
| Total | 1,076,348 | 100% |

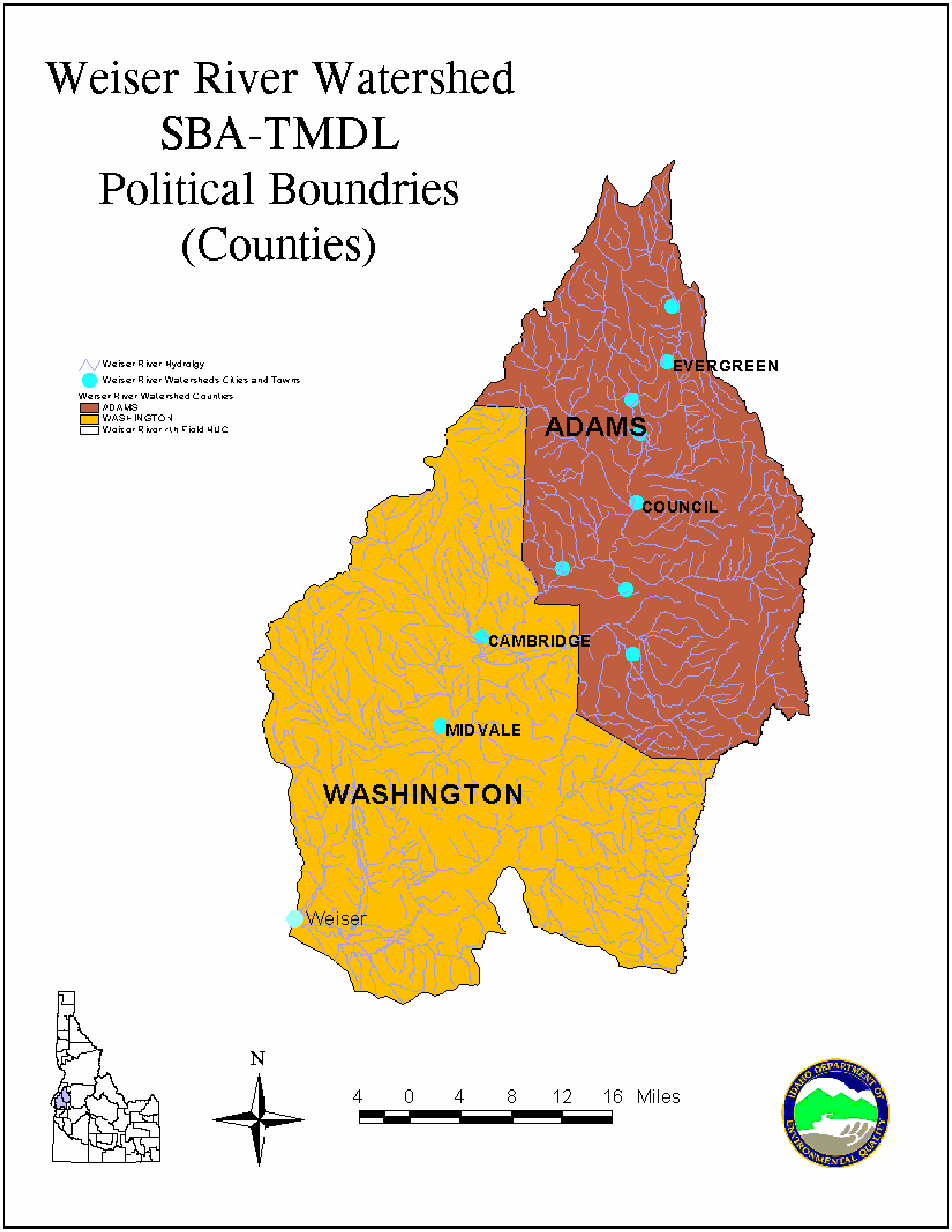



**Figure 19. County Boundaries. Weiser River Watershed.**

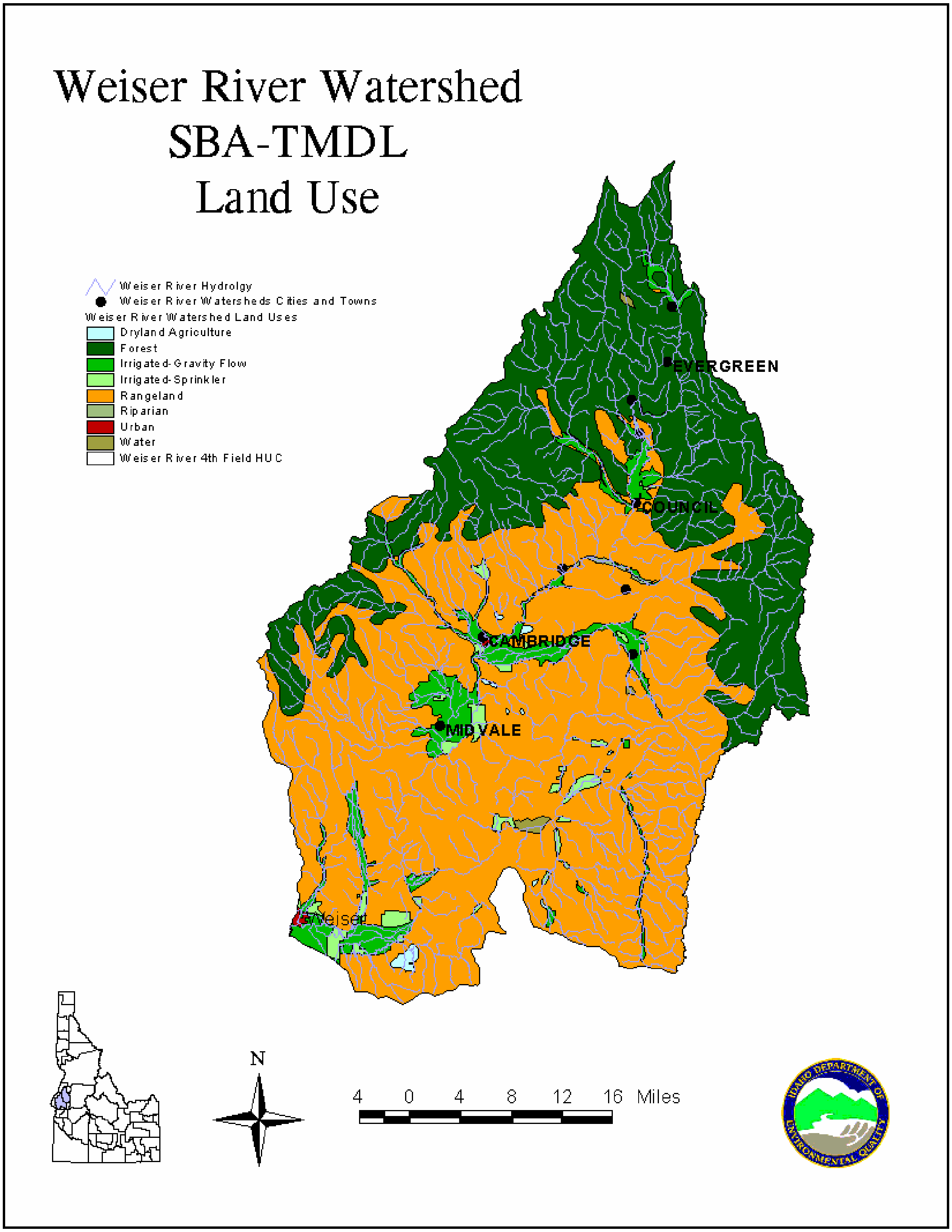



**Figure 20. Land Use. Weiser River Watershed.**

## Land Ownership, Cultural Features, and Population

Land ownership is a mixture of private holdings and state, county, city, and federally managed lands. Much of the private holdings are associated with agricultural areas; a majority of which are family owned homesteads. In the past few years, a growth of “hobby” ranches has emerged between Midvale and Council, Idaho. These tracks are usually 5-40 acres and are derived from larger ranches that once dominated the upland landscape. However, many of these larger ranches still exist as well. These large ranches, in many cases, are cow/calf operations that rely on open rangeland for summer feed. On the irrigated lands associated with the large operations, grass, hay, and small grains are grown for winter feed.

In the more fertile valley bottoms associated with the larger water bodies, irrigated tracks are found throughout the region. Irrigation water is supplied by diverting river water and from irrigation wells. Early water rights date back to approximately the 1880s.

Federal and state lands are usually associated with the rangeland and forested areas. State lands, which are managed for the public school endowment fund, are used primarily for animal grazing or forest products. The Idaho Department of Lands is the primary land manager for state endowment lands.
The Unites States Forest Service and Bureau of Land Management are responsible for managing much of the federal lands within the watershed. Federally managed lands are usually associated with animal grazing, forest products, or recreational uses. Table 11 shows the breakdown by acreage of ownership in the Weiser River Watershed. Figure 21 presents ownership/management in the watershed.

### Table 11. Land Ownership/Management. Weiser River Watershed.

| Owner/Manager | Total Acres | Percent of Total |
|---|---|---|
| Private Holdings | 541,854 | 50.2% |
| State of Idaho | 61,134 | 5.7% |
| Open Water | 3,490 | 0.3% |
| U.S Forest Service | 308,406 | 28.6% |
| Bureau of Land Management | 164,259 | 15.2% |
| | | |
| Total | 1,079,143 | 100.0% |

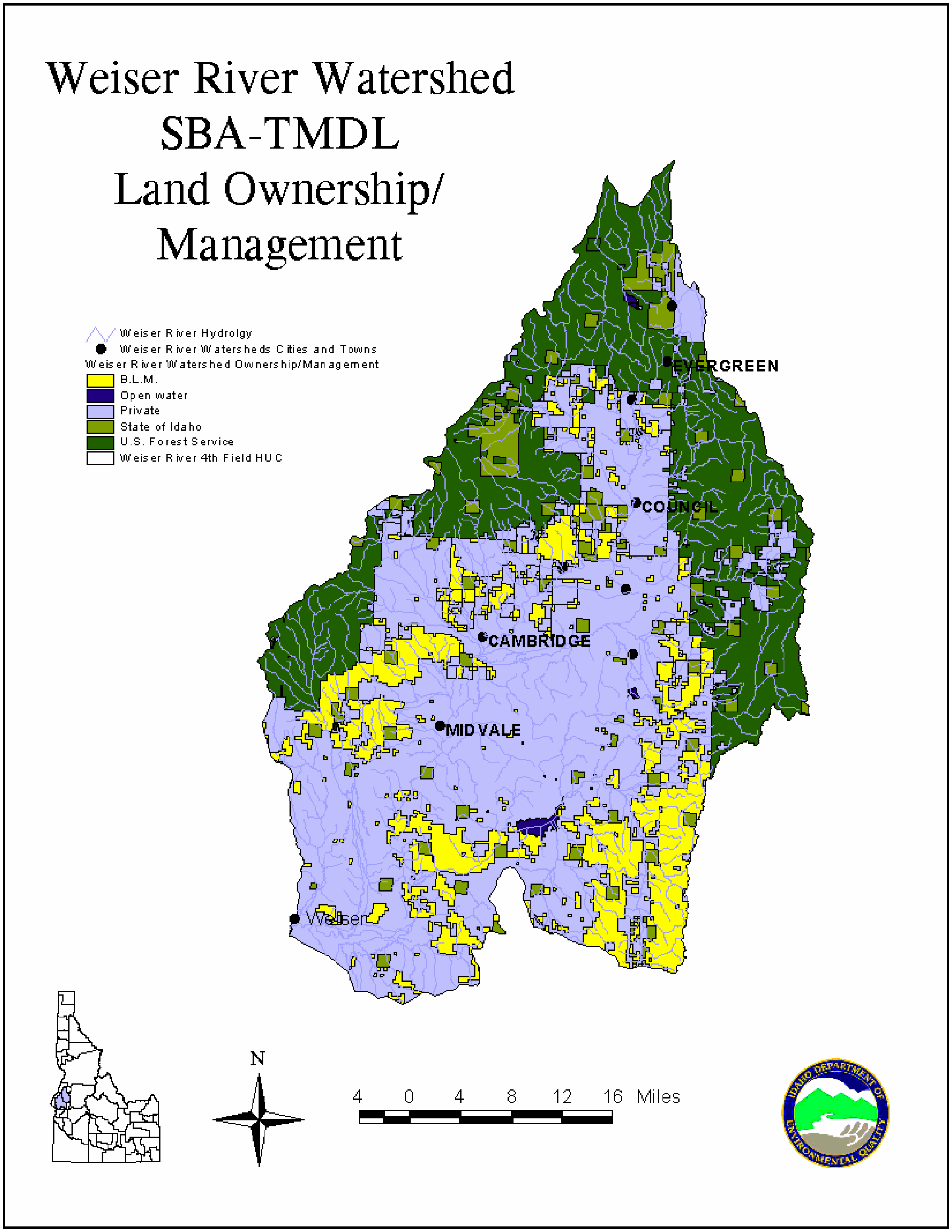



**Figure 21. Ownership/Land Management. Weiser River Watershed.**

Adams County is almost 100% rural, while Washington County has an almost even split between urban and rural populations. Throughout the entire watershed, the population is associated with agriculture in one way or another. Most of the population is found on small homesteads in the valleys.

Municipalities in the watershed include the cities of Weiser, Midvale, Cambridge, and Council (See Figure 19). Smaller unincorporated communities include Tamarack, Fruitvale, and Indian Valley. These small, unincorporated townships at one time served the agriculture community, but changing economics has forced much of the agricultural infrastructure to the larger cities. Table 12 shows the breakdown of the general demographics between the two counties in the Weiser River Watershed. All statistics in Table 12 were obtained from Idaho Department of Commerce (2001) and the 2000 census (http://www.idoc.state.id.us/idcomm/profiles/index.html) (Idaho Department of Commerce 2001).

**Table 12. General Demographics of Adams and Washington Counties. Weiser River Watershed.**

| Demographics | Adams County | Washington County |
|---|---|---|
| Total County Population | 3,448 | 9,977 |
| Population Rural | 60.9% | 45.2% |
| Population Urban | 39.1% | 54.8% |
| Population Change since 1990 | +6.8% | +16.7% |
| Median Age | 44 | 39.2 |
| Populations of Urban Centers | | |
| Council | 816 | |
| New Meadows[a] | 533 | |
| Cambridge | | 360 |
| Weiser | | 5,343 |
| Midvale | | 176 |

*a Outside Watershed*

# 2.0 Subbasin Assessment – Water Quality Concerns and Status

The federal Clean Water Act (CWA) requires that states and tribes restore and maintain the chemical, physical, and biological integrity of the nation's waters. Pursuant to Section 303 of the CWA, States and tribes are required to adopt water quality standards necessary to protect fish, shellfish, and wildlife while providing for recreation in and on the waters whenever possible. Section 303(d) of the CWA establishes requirements for states and tribes to identify and prioritize water bodies that are water quality limited (i.e., water bodies that do not meet water quality standards). Currently, states and tribes are required to publish a priority list of impaired waters every two years. For waters identified on this list, states and tribes must develop ~~a~~ total maximum daily loads (TMDLs) for the pollutants, with the goal of achieving federal water quality standards.

This document addresses the water bodies in the Weiser River Watershed that have been placed on the §303(d) list.

## 2.1 Introduction

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

### Background

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

Section 303 of the CWA requires DEQ to adopt water quality standards, with EPA approval, and to review those standards every three years. Additionally, DEQ must monitor waters to identify those water bodies not meeting water quality standards. For those water bodies not meeting standards, DEQ must establish TMDLs for each pollutant impairing the waters. Further, DEQ must set appropriate controls to restore water quality and allow the water bodies to achieve their designated uses.

These requirements result in a list of impaired waters called the "§303(d) list." This list describes water bodies that do not meet water quality standards and require further analysis. A subbasin assessment and TMDL provide a summary of the water quality status and allowable TMDL for water bodies on the §303(d) list. The *Weiser River Watershed Subbasin Assessment and Total Maximum Daily Loads* provides this summary for the currently listed waters in the Weiser River Watershed.

The subbasin assessment section of this report (Chapters 1–4) includes an evaluation and summary of the current water quality status, pollutant sources, and control actions to date in the Weiser River Watershed. While this assessment is not a requirement of the TMDL, DEQ performs the assessment to ensure impairment listings are up to date and accurate. The TMDL is a plan to improve water quality by limiting pollutant loads. Specifically, a TMDL is an estimation of the maximum pollutant amount that can be present in a water body and still allow that water body to meet water quality standards (Water quality planning and management, 40 CFR 130). Consequently, a TMDL is water body- and pollutant-specific.

The TMDL also includes individual pollutant allocations among various sources discharging the pollutant. EPA considers certain unnatural conditions pollution, such as flow alteration, a lack of flow, or habitat alteration, even when it is not the result of the discharge of specific pollutants. A TMDL is not required for a water body impaired by pollution. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

### Idaho's Role

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

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

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

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

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

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

- Determine the degree of achievement of biological integrity.

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

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

## 2.2 Water Quality Limited Segments Occurring in the Subbasin

The water bodies listed on the Idaho 1998 §303(d) list are the Weiser River itself and tributaries to the river. Three segments of the Weiser River are listed as not supporting their beneficial uses, while nine other segments are also listed for not supporting beneficial uses. The uses determined not to be fully supported include cold water aquatic life, salmonid spawning, and primary contact recreation or secondary contact recreation.

The pollutants listed as impairing these uses include sediment, temperature, bacteria, nutrients, and flow alteration. Figure 22 shows the current §303(d) listed segments, those segments added in 1998, and those segments removed (de-listed) in 1998. Table 13 shows Idaho 1998 §303(d) listed segments in the Weiser River Watershed, a description of each listed water body, the length of the impaired water body, and the pollutant of concern. The Idaho §305(b) Report (Idaho DEQ 1988) and BURP monitoring provided the basis for most listings.

The water bodies described in Table 13 are either identified in the WQS for the protection of designated beneficial uses or are undesignated. In accordance with Idaho WQS, those water bodies that have designated uses are to be protected for those uses where attainable (IDAPA 52.01.02.100). For those water bodies not identified in the WQS, they are to be protected for the existing uses (IDAPA 52.01.02.100). Table 14 shows the water bodies that have designated uses as described in the WQS and what those uses are. Table 14 also lists those streams without designated uses.

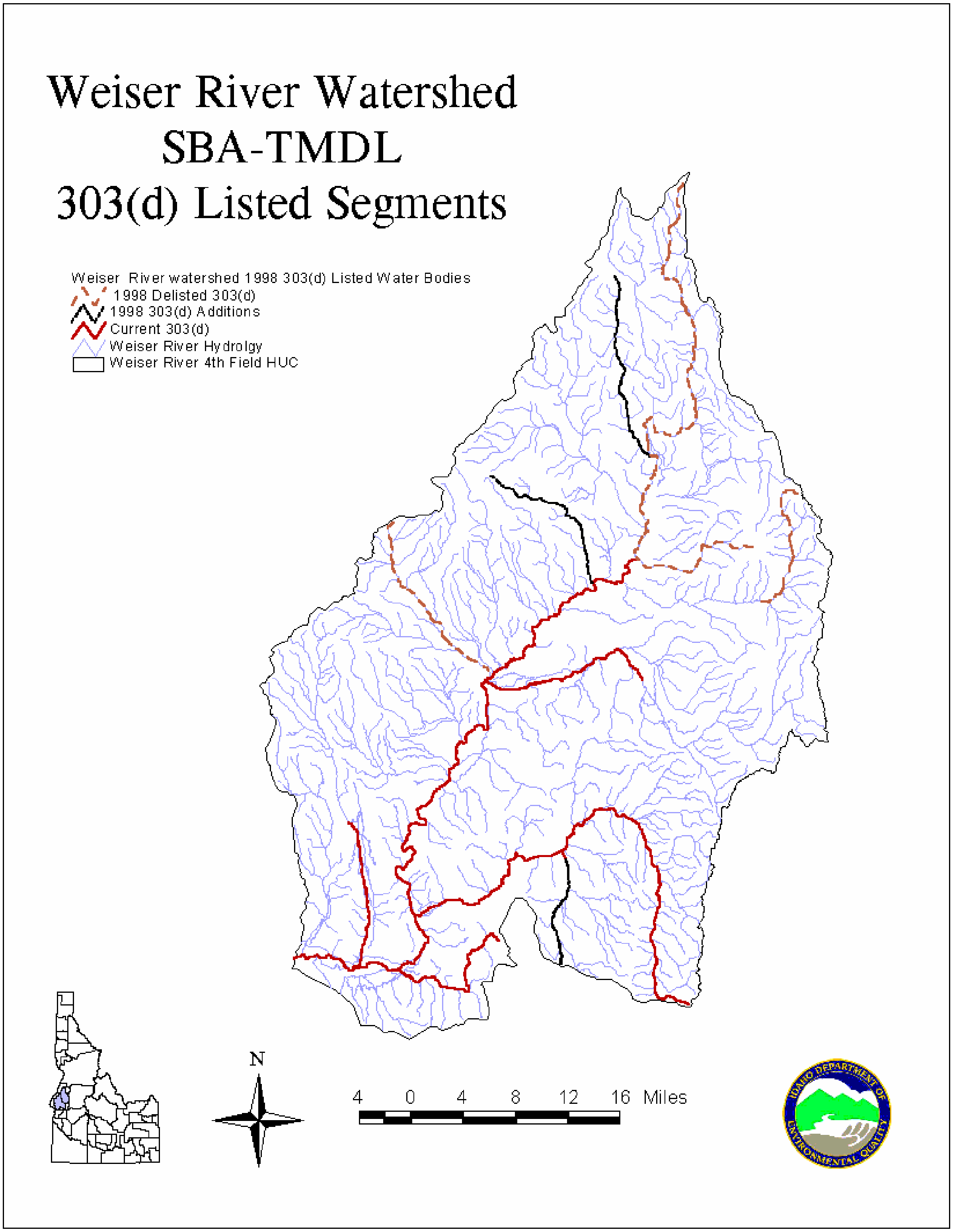



**Figure 22. Idaho's §303(d) listed water bodies and delisted water bodies. Weiser River Watershed.**

Another important factor in the development of the SBA is the downstream receiving waters. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has set a load allocation for its tributaries. Load allocations have been set for the Weiser River and other tributaries to meet both sediment and nutrient targets for the Snake River.

**Table 13. Idaho 1998 §303(d) listed Water Bodies, Water Body Description, Pollutants of Concern, and Miles of Impaired Sections. Weiser River Watershed.**

| Water Body | Boundary | Pollutant(s) | Miles/Acres of Impaired Water Bodies |
|---|---|---|---|
| Weiser River | Galloway Dam to Snake River | Nutrients, Sediment, Bacteria, Dissolved Oxygen, and Temperature | 12.4 miles |
| Weiser River | Little Weiser River to Galloway Dam | Nutrients, Sediment and Bacteria | 31.5 miles |
| Weiser River | West Fork Weiser River to Little Weiser River | Nutrients and Sediment | 20.9 miles |
| Mann Creek | Mann Creek Reservoir to Weiser River | Sediment | 13.0 miles |
| Cove Creek | Headwaters to Weiser River | Nutrients and Sediment | 14.0 miles |
| Crane Creek | Crane Creek Reservoir to Weiser River | Bacteria, Nutrients, and Sediment | 12.6 miles |
| Little Weiser River | Indian Valley to Weiser River | Nutrients and Sediment | 17.2 miles |
| West Fork Weiser River | Headwaters to Weiser River | Unknown | 15.9 miles |
| Johnson Creek | Headwaters to Weiser River | Unknown | 13.7 miles |
| North Crane Creek | Headwaters to Crane Creek Reservoir | Bacteria, Flow, Nutrients, Sediment, and Temperature | 24.7 miles |
| South Crane Creek | Headwaters to Crane Creek Reservoir | Unknown | 9.2 miles |
| Crane Creek Reservoir | Reservoir | Nutrients and Sediment | 1,507 acres |

**Table 14. Idaho 1998 §303(d) list Water Bodies, Designated Uses, and IDAPA Citations. Weiser River Watershed.**

| Water Body | Designated Uses | IDAPA Citation |
|---|---|---|
| Weiser River<br>(Keithly Creek to Mouth) | Cold Water Aquatic Life<br>Primary Contact Recreation<br>Drinking Water Supply | 58.01.02.140.18.SW-1 |
| Weiser River<br>(Source to Keithly Creek) | Cold Water Aquatic Life<br>Primary Contact Recreation<br>Drinking Water Supply<br>Special Resource Water | 58.01.02.140.18.SW-7 |
| Mann Creek<br>(Reservoir to Mouth) | Cold Water Aquatic Life<br>Salmonid Spawning<br>Primary Contact Recreation | 58.01.02.140.18.SW-30 |
| Cove Creek | No Designated Uses | |
| Crane Creek | Cold Water Aquatic Life<br>Primary Contact Recreation | 58.01.02.140.18.SW-3 |
| Little Weiser River | Cold Water Aquatic Life<br>Salmonid Spawning<br>Primary Contact Recreation<br>Drinking Water Supply | 58.01.02.140.18.SW-8 |
| Johnson Creek | Cold Water Aquatic Life<br>Salmonid Spawning<br>Primary Contact Recreation | 58.01.02.140.18.SW-22 |
| West Fork Weiser River | Cold Water Aquatic Life<br>Salmonid Spawning<br>Primary Contact Recreation<br>Drinking Water Supply<br>Special Resource Water | 58.01.02.140.18.SW-17 |
| North Crane Creek | No Designated Uses | |
| South Crane Creek | No Designated Uses | |
| Crane Creek Reservoir | Cold Water Aquatic Life<br>Primary Contact Recreation | 58.01.02.140.18.SW-4 |

## 2.3 Applicable Water Quality Standards

### Beneficial Uses

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

### Existing Uses

Existing uses under the CWA are "those uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." The existing in stream water uses and the level of water quality necessary to protect the uses shall be maintained and protected (IDAPA 58.01.02.003.35, .050.02, and 051.01 and .053). Existing uses include uses actually occurring, whether or not the level of quality to fully support the uses exists.

### Designated Uses

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

### Presumed Uses

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

### Changes to Water Quality Standards

Water quality standards include designated uses and water quality criteria. One or both of these components of water quality standards may change or be removed from a water body, or site-specific criteria may be developed to reflect increased understanding of the factors that affect water quality. Changes in water quality standards necessarily affect TMDL objectives, targets and load allocations. During the development of this TMDL, questions from stakeholders regarding the appropriateness of certain designated uses and criteria have been raised and are currently under investigation. The outcome of these investigations will be reviewed by DEQ and, in consultation with the WAG a determination will be made whether to initiate the process to change uses or criteria. If a change is made to a designated use or a water quality criteria applicable to a water body for which this TMDL has been developed, DEQ shall, in consultation with the WAG, evaluate whether the TMDL or implementation plans should be modified to reflect the change in the use or criteria. Changes in the TMDL shall be accomplished pursuant to the requirements of state and federal law, including the requirements for public participation, and be submitted to the US EPA for approval.

## Beneficial Use Support Status

To determine if a water body is fully supporting the designated and existing uses, IDAPA 58.01.02.053 is applied, which outlines measures to be taken to determine use support. Accordingly, IDAPA 58.01.02.053.01 and .053.02 state the following:

> In determining whether a water body fully supports designated and existing beneficial uses, the Department shall determine whether all of the applicable water quality standards are being achieved, including any criteria developed pursuant to these rules, and whether a healthy, balanced biological community is present. The Department shall utilize biological and aquatic habitat parameters listed below and in the current version of the "Water Body Assessment Guidance," as published by the Idaho Department of Environmental Quality, as a guide to assist in the assessment of beneficial use status. Revisions to this guidance will made be after notice and an opportunity for public comment. These parameters are not to be considered or treated as individual water quality criteria or otherwise interpreted or applied as water quality standards. (4-5-00)
>
> **01. Aquatic Habitat Parameters**. These parameters may include, but are not limited to, stream width, stream depth, stream shade, measurements of sediment impacts, bank stability, water flows, and other physical characteristics of the stream that affect habitat for fish, macroinvertebrates or other aquatic life; and (3-20-97)
>
> **02. Biological Parameter**s. These parameters may include, but are not limited to, evaluation of aquatic macroinvertebrates including Ephemeroptera, Plecoptera and Trichoptera (EPT), Hilsenhoff Biotic Index, measures of functional feeding groups, and the variety and number of fish or other aquatic life to determine biological community diversity and functionality. (3-20-97)

IDAPA 58.01.02.053.03 addresses natural conditions and states the following:

> **03. Natural Condition**s. There is no impairment of beneficial uses or violation of water quality standards where natural background conditions exceed any applicable water quality criteria as determined by the Department, and such natural background conditions shall not, alone, be the basis for placing a water body on the list in IDAPA 58.01.054.1 of water quality limited water bodies described in Section 054. (3-15-02)

### Assessment Process to Determine Beneficial Use Support Status

As described in IDAPA 58.01.02.053, the *Water Body Assessment Guidance* (Grafe et al 2002) will be used as a guide in assessing the support status of beneficial uses. The guidance document addresses both numeric criteria established in the WQS and the habitat and biological assessment requirements to determine the support status for aquatic life, recreation use, water supply uses, and salmonid spawning. Figure 23 shows an example of the process used to determine whether enough data are available to support a status determination for a water body and the criteria used to make the status determination for aquatic life. Additional schematics for other uses can be found within the Water Body Assessment Guidance (Grafe et al. 2002).

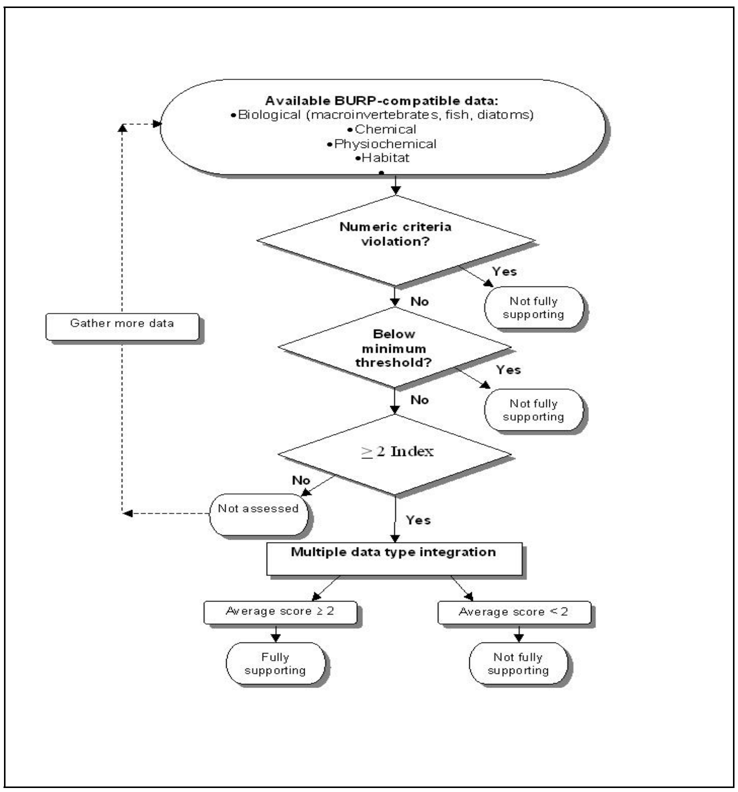



**Figure 23. Aquatic Life Support Determination Flow-Chart. Weiser River Watershed.**

Numeric criteria exceedances are usually a straightforward comparison of water quality data to the numeric criteria established in the WQS. The *Water Body Assessment Guidance* (Grafe et al. 2002) includes criteria adopted from guidance established by EPA's *Guidelines for Preparation of the Comprehensive State Water Quality Assessments (305 (b) Reports)* for the conventional pollutants dissolved oxygen, pH, and temperature. To determine support status, water bodies with equal to or less than 10% exceedence of these parameters in a given data set are considered fully supporting of aquatic life uses. Greater than 10% exceedence would be considered not fully supporting.

To evaluate aquatic life use, DEQ applies multimetric indices based on rapid bioassessment concepts developed by EPA (Barbour et al. 1999). Measurements of biological, physical habitat or physicochemical conditions known as metrics comprise the indices. The indices include several characteristics to gage overall ecosystem health. The multimetric index value for a sample site is the sum of individual metric scores. Multimetric index scores are unitless and, therefore, easily comparable.
The strength of such an approach is the integration of biological, physical, and chemical characteristics of the water body at different scales—individual, population, community, and ecosystem (Karr et al. 1986). This integration allows DEQ to determine water quality impairment cost-effectively and present the information in an intelligible format.

Table 15 describes the metrics used, what is evaluated, and additional references.

Appendix B provides the metric analysis and scoring used in the final assessment process for water bodies in the Weiser River Watershed.

## Table 15. Multimetric Analysis Approach. Weiser River Watershed.

| Index | Analysis Approach | Reference Material |
|---|---|---|
| ***Streams***[a] | | |
| Stream Macroinvertebrates Index | Direct biological measurement using key macroinvertebrate species indicators | *Development of a multimetric index for biological assessment of Idaho streams using macroinvertebrates* (Jessup and Gerrritsen 2000), *Rapid bioassessment for use in streams and wadeable rivers: periphyton, benthic macroinvertebrates and fish* (Barbour et al. 1999) |
| Stream Fish Index | Direct biological measurement using key fish species indicators | *Stream fish inde*x (Mebane 2000) |
| Stream Habitat Index | Direct measurement of habitat and riparian indicators | *Stream Habitat Index* (Fore and Bollman 2000) |
| ***Rivers***[b] | | |
| River Macroinvertebrate Index | Direct biological measurement using key macroinvertebrate species indicators | *River Macroinvertebrate Index* (Royer and Mebane 2000) *Bioassessment methods for Idaho rivers; validation and summary* (Royer and Minshall 1999) |
| River Diatom Index | Direct biological measurement using key periphyton species indicators | *River Diatom Ind*ex (Fore and Grafe 2000) |
| River Fish Index | Direct biological measurement using key fish species indicators | *River fish inde*x (Mebane 2000) |
| River Physicochemical Index[c] | Measurement of key water quality indicators | *Oregon water quality index: A tool for evaluating water quality management effectiveness* (Cude in press) *River Physicochemical Index* (Brandt 2000) |

*a usually water bodies less than 5th order*
*b usually water bodies greater than or equal to 5th order water bodies*
*c river physicochemical usually supplied as informational only and not incoporated into final metric score*

### Intermittent Water Bodies

Some water bodies in Idaho may have discharge for short periods of time. These water bodies may flow only as a result of snow melt or heavy precipitation events. In either case, it can not be expected that these water bodies provide full support of beneficial uses. As such, Idaho has adopted WQS to address intermittent waters as follows (IDAPA 58.01.02.53):

> **Intermittent Waters**. A stream, reach, or water body which has a period of zero (0) flow for at least one (1) week during most years. Where flow records are available, a stream with a 7Q2 hydrologically based flow of less than one-tenth (0.1) cfs is considered intermittent. Streams with natural perennial pools containing significant aquatic life uses are not intermittent.

The following Idaho WQS (IDAPA 58.01.02.070.06.) apply to the cold water aquatic life and primary and secondary contact recreation beneficial uses:

> **Application of Standards to Intermittent Water**s. Numeric water quality standards only apply to intermittent waters during optimum flow periods sufficient to support the uses for which the water body is designated. For recreation, optimum flow is equal to or greater than five (5) cubic feet per second (cfs). For aquatic life uses, optimum flow is equal to or greater than one (1) cfs.

### TMDLs and Other Appropriate Action

If a water body is determined to be not fully supporting the designated or existing uses, IDAPA 58.01.02.054.01 and .054.02 would apply. These standards state the following:

> **01. After Determining That Water Body Does Not Support Use**. After determining that a water body does not fully support designated or existing beneficial uses in accordance with Section 053, the Department, in consultation with the applicable basin and watershed advisory groups, 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. This evaluation may include the following: (3-20-97)
>
> a. Identification of significant sources of pollution affecting the water body by past and present activities; (3-20-97)
>
> b. Determination of whether the application of required or cost-effective interim pollution control strategies to the identified sources of pollution would restore the water body to full support status within a reasonable period of time; (3-20-97)
>
> c. Consultation with appropriate basin and watershed advisory groups, designated agencies and landowners to determine the feasibility of, and assurance that required or cost-effective interim pollution control strategies can be effectively

applied to the sources of pollution to achieve full support status within a reasonable period of time; (3-20-97)
d. If pollution control strategies are applied as set forth in this Section, the Department shall subsequently monitor the water body to determine whether application of such pollution controls were successful in restoring the water body to full support status. (3-20-97)

**02. Water Bodies Not Fully Supporting Beneficial Uses**. After following the process identified in Subsection 054.01, water bodies not fully supporting designated or existing beneficial uses and not meeting applicable water quality standards despite the application of required pollution controls shall be identified by the Department as water quality limited water bodies, and shall require the development of TMDLs or other equivalent processes, as described under Section 303(d) (1) of the Clean Water Act. A list of water quality limited water bodies shall be published periodically by the Department in accordance with Section 303(d) of the Clean Water Act and be subject to public review prior to submission to EPA for approval. Informational TMDLs may be developed for water bodies fully supporting beneficial uses as described under Section 303(d)(3) of the Clean Water Act, however, they will not be subject to the provisions of this Section. (3-20-97)

## 2.4 Target Analysis

Idaho utilizes both numeric and narrative criteria to determine if beneficial uses are supported or not supported. The numeric criteria, such as temperature or pH, applies a value or range to protect beneficial uses, while the narrative criteria applies a general condition or status, such as nuisance aquatic growth for nutrients, to determine compliance.

### Numeric Criteria

The numeric criteria provide specific targets that are to be achieved for the full support of the uses. If the specific criteria are exceeded, then it is determined that the use is not fully supported due to that exceedence. For the Weiser River Watershed, specific numeric criteria apply to the cold water aquatic life, salmonid spawning, and contact recreation beneficial uses.

#### Cold Water Aquatic Life

For the protection of cold water aquatic life, numerous numeric criteria have been adopted to protect the beneficial use. Most of the numeric criteria can be found in IDAPA 58.01.02.250.02, which states the following:

**02. Cold Water**. Waters designated for cold water aquatic life are not to vary from the following characteristics due to human activities: (3-15-02)

a. Dissolved Oxygen Concentrations exceeding six (6) mg/l at all times. In lakes and reservoirs this standard does not apply to: (7-1-93)

i. The bottom twenty percent (20%) of water depth in natural lakes and reservoirs where depths are thirty-five (35) meters or less. (7-1-93)

ii. The bottom seven (7) meters of water depth in natural lakes and reservoirs where depths are greater than thirty-five (35) meters. (7-1-93)

iii. Waters of the hypolimnion in stratified lakes and reservoirs. (7-1-93)

b. Water temperatures of twenty-two (22) degrees C or less with a maximum daily average of no greater than nineteen (19) degrees C. (8-24-94)"

**Contact Recreation**

The WQS describe applicable standards and criteria for the full support of both primary and secondary contact recreation. These standards also describe minimal sampling requirements. IDAPA 58.01.02.080.03.a and .03.b state the following:

**03. E. coli Standard Violation**. A single water sample exceeding an *E. coli* standard does not in itself constitute a violation of water quality standards, however, additional samples shall be taken for the purpose of comparing the results to the geometric mean criteria in Section 251 as follows: (4-5-00)

a. Any discharger responsible for providing samples for *E. coli* shall take five (5) additional samples in accordance with Section 251. (4-5-00)

b. The Department shall take five (5) additional samples in accordance with Section 251 for ambient *E. coli* samples unrelated to dischargers' monitoring responsibilities.

A description of applicable physical attributes that must be addressed before a determination of possible violations is addressed in IDAPA 58.01.02.100.02.a and .02.b, which state the following:

**02. Recreation**. (7-1-93)

a. Primary contact recreation (PCR): water quality appropriate for prolonged and intimate contact by humans or for recreational activities when the ingestion of small quantities of water is likely to occur. Such activities include, but are not restricted to, those used for swimming, water skiing, or skin diving. (4-5-00)

b. Secondary contact recreation (SCR): water quality appropriate for recreational uses on or about the water and which are not included in the primary contact category. These activities may include fishing, boating, wading, infrequent swimming, and other activities where ingestion of raw water is not likely to occur. (4-5-00)

The numeric criteria to determine if a water body is supporting either primary or secondary contact recreation are found in IDAPA 58.01.02.251.01. These criteria state the following:

**01. E. Coli Bacteria.** Waters designated for recreation are not to contain E.coli bacteria, used as indicators of human pathogens, in concentrations exceeding: (4-11-06)

**a.** Geometric Mean Criterion. Waters designated for primary or secondary contact recreation are not to contain E. coli bacteria in concentrations exceeding a geometric mean of one hundred twenty-six (126) E. coli organisms per one hundred (100) ml based on a minimum of five (5) samples taken every three (3) to seven (7) days over a thirty (30) day period. (4-11-06)

**b.** Use of Single Sample Values. A water sample exceeding the E. coli single sample maximums below indicates likely exceedance of the geometric mean criterion, but is not alone a violation of water quality standards. If a single sample exceeds the maximums set forth in Subsections 251.01.b.i., 251.01.b.ii., and 251.01.b.iii., then additional samples must be taken as specified in Subsection 251.01.c.: (4-11-06)

i. For waters designated as secondary contact recreation, a single sample maximum of five hundred seventy-six (576) E. coli organisms per one hundred (100) ml; or (4-11-06)

ii. For waters designated as primary contact recreation, a single sample maximum of four hundred six (406) E. coli organisms per one hundred (100) ml; or (4-11-06)

iii. For areas within waters designated for primary contact recreation that are additionally specified as public swimming beaches, a single sample maximum of two hundred thirty-five (235) E. coli organisms per one hundred (100) ml. Single sample counts above this value should be used in considering beach closures. (4-11-06)

**c.** Additional Sampling. When a single sample maximum, as set forth in Subsections 251.01.b.i., 251.01.b.ii., and 251.01.b.iii., is exceeded, additional samples should be taken to assess compliance with the geometric mean E. coli criteria in Subsection 251.01.a. Sufficient additional samples should be taken by the Department to calculate a geometric mean in accordance with Subsection 251.01.a. This provision does not require additional ambient monitoring responsibilities for dischargers.

## Sources of Bacteria

In the past, DEQ has prepared bacteria TMDLs for other rivers in Idaho, and EPA has approved them. Recognizing the need to prioritize best management practices to reduce bacterial sources, the lower Boise River Watershed Advisory Group (WAG) applied for and received a federal §319 grant to conduct bacterial DNA source testing throughout the watershed. The goals of the DNA testing program were to attempt to define sources of bacteria at sampling locations in the river and tributaries and to help illustrate the applicability of the testing methodology for use in other watersheds.

The study results suggested that humans, pets, avian/waterfowl, agriculture, and wildlife contributed to bacteria concentrations in the river. Locations surrounded by urban land uses showed a proportionally higher number of human and pet sources than locations surrounded by agricultural lands. Conversely, locations surrounded by agricultural land uses showed a higher number of agricultural sources of bacteria. Avian/waterfowl sources comprised the largest percentage at nearly every location, regardless of land use.

While the aforementioned results suggest that uncontrollable sources of bacteria, such as avian and waterfowl exist in the watershed, the results also suggest the existence of controllable sources, such as human, pet, and agricultural. Therefore, the implementation of best management practices in the watershed is being initiated such that controllable source pathways will be managed.

Similar methods of study could be applied to the Weiser River Watershed. Because the bacterial concentrations from each respective source group (humans, pets, etc.) cannot be quantified, data from previous studies cannot be used to adjust the load allocations. . For this reason, the best application of the study and resulting data would be in a manner similar to that used in the lower Boise River, which is to focus the spending of valuable implementation resources on identified controllable sources. (CH2M Hill, 2003).

## Temperature

The Weiser River TMDL reach is listed for temperature from the Little Weiser River to the Snake River. See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. This TMDL utilizes IDAPA 58.01.02.053. BENEFICIAL USE SUPPORT STATUS which states:

> **Natural Conditions**. There is no impairment of beneficial uses or violation of water quality standards where natural background conditions exceed any applicable water quality criteria as determined by the Department, and such natural background conditions shall not, alone, be the basis for placing a water body on the list of water quality limited water bodies described in Section 054. (3-15-02)

It is projected that implementation projects associated with improved riparian areas will result in reduced inflow temperatures in the smaller drains and tributaries to the Weiser River as many of the approved methods for the reduction of temperature are based on streambank revegetation and similar methodologies that will increase shading.

Anthropogenic temperature influence assessments, similar to those conducted for the Lower Boise River and the Snake River-Hells Canyon TMDL reach will be completed as part of the tributary TMDL processes.

### Changes to State of Idaho Water Quality Standards

Language regarding standard exceedances from naturally occurring sources is also contained in the following:

> When natural background conditions exceed any applicable water quality criteria...the applicable water quality criteria shall not apply, instead, pollutant levels shall not exceed the natural background conditions, except that temperature levels may be increased above natural background conditions when allowed under Section 401 (IDAPA 58.01.02.200.09 [2002]).

This standard was approved by DEQ Board and the Idaho State Legislature and came into effect on March 15, 2002.

## Narrative Criteria

Idaho has adopted narrative criteria to address two pollutants of concern in the Weiser River Watershed. The general surface water quality criteria, IDAPA 58.01.02.200, address sediment and nutrients. Both narrative criteria imply that impairment to the beneficial uses must be demonstrated before a violation or an exceedence is occurring.

### Nutrient Criteria

The general surface water quality criteria for nutrients are found in IDAPA 58.01.02.200.06, which states the following:

> **200. GENERAL SURFACE WATER QUALITY CRITERIA.** The following general water quality criteria apply to all surface waters of the state, in addition to the water quality criteria set forth for specifically designated waters. (4-5-00)
>
> **06. Excess Nutrient**s. 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. (8-24-94)

Nutrients are essential elements for all living organisms and are found naturally in the soil, the air, the water, and the biota. Natural chemical, physical, and biological activity can process different forms of nutrients. Some forms of nutrients are bio-available while others are not. Unto themselves, most forms of nutrients are not toxic to biota. However, excessive nutrients can cause harm to biota.

Nutrients are necessary in water to provide a healthy and diverse biological community, yet an overly nourished system can cause an over abundance of plant growth, toxic-nuisance aquatic growth, human and animal health risks, and a change in plant and animal community structures.

In Idaho, the narrative criteria have been applied to various beneficial uses, including contact recreation, agriculture water supply, and cold water aquatic life, and have been used in TMDLs in a variety of waters (e.g., Middle Snake River [Idaho DEQ 2000*a*], Cascade Reservoir [Idaho DEQ 1997], and Snake River – Hells Canyon [Idaho DEQ and Oregon DEQ 2002]). The narrative nutrient criteria have also been used as a mechanism to recommend the removal or listing of nutrients as a pollutant of concern on various water bodies in the state (e.g., Lower Payette River [Idaho DEQ 1999*a*] and Upper Owyhee River [Idaho DEQ 2003]).

The following are examples of how the nutrient criteria have been applied to create a "linkage" to nutrient levels and beneficial use support:

- *The Cascade Reservoir Phase One Watershed Management Plan* (*Cascade Reservoir SBA-TMDL*) (Idaho DEQ 1996) linked nuisance aquatic growth to a toxin that was associated with the death of 23 cattle in 1994. The blue-green algae growth in Cascade Reservoir was determined to be caused by excessive nutrients in the reservoir. Thus, the water body was not fully supporting agricultural water supply. This was addressed in the TMDL.

- *The Middle Snake River TMDL* (Idaho DEQ 2000) addressed the effect of nuisance aquatic growth on recreational uses, such as the clogging of jet boat intakes by rooted macrophytes growth in the river. Excessive nutrients contributed to this nuisance aquatic growth. Thus, the water body was not fully supporting secondary contact recreation, and a TMDL was developed to address excessive nutrients.

- The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) linked nutrient levels and dissolved oxygen sags associated with respiration periods and fish kills that occurred in the early 1990s. The dissolved oxygen sags were linked to the rapid die-off of phytoplankton associated with high-nutrient levels earlier that spring. Thus, the water body was not fully supporting cold water aquatic life, and a TMDL was developed to address excessive nutrients.

- *The Lower Payette River SBA-TMDL* (Idaho DEQ 1999*a*) determined that nutrient concentrations were a factor in aquatic growth but did not impair beneficial uses in the Payette River. The conclusion was based on 24-hour dissolved oxygen monitoring which indicated that dissolved oxygen concentrations did not fall below the water quality standard and was not causing an impairment to cold water aquatic life.

- *The Upper Owyhee Watershed SBA-TMDL* (Idaho DEQ 2003) noted low dissolved oxygen concentrations in Deep Creek located in the Owyhee River drainage area. Twenty-four-hour monitoring indicated that dissolved oxygen levels had dropped below the water quality standard during the evening and nighttime period. The preliminary conclusion was that nuisance aquatic growth could be the cause. It was recommended that dissolved oxygen be listed as a pollutant of concern.

As demonstrated in the above examples, the link between nutrients and impairment of beneficial uses can be either indirect (dissolved oxygen sags associated with respiration periods) or direct (death of cattle from algae or impaired recreational use due to aquatic growths). Although the direct impairment might be the simplest way of determining impairment, most impairments occurring in surface waters are not straightforward and are not always well documented.

Another approach used for TMDLs in Idaho is to use literature values from EPA's *Quality Criteria for Water (Gold Book)* (EPA 1986) as an appropriate target to determine whether or not impairment exists (e.g., *Bruneau River SBA-TMDL* [Idaho DEQ 2000*b*]). The development of TMDLs based on this information is also based on the interpretation of the Idaho standards narrative criteria stating that "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". (IDAPA 58.01.02.200.06 [1994])

This approach may have merit when it is determined that a designated use may not be an existing use due to impairment and when water quality data indicate nutrient concentrations are at levels that can cause impairment. However, additional information, or a link, should be provided that would demonstrate the cause and effect of the nutrients and the probable impact to the use or uses, such as complaints concerning aquatic growth (slime growth), eutrophic conditions, odors, recreational health issues, or other possible impairment associated with nuisance aquatic growth.

Few states or tribes have incorporated numeric criteria into their WQS, and most rely on narrative criteria, including Idaho. In some states, site-specific criteria have been established for water bodies, primarily lakes and reservoirs, to prevent eutrophic conditions and impairment to beneficial uses. However, no site-specific, numeric criteria for nutrients have been established in Idaho.

EPA has issued several documents that address nutrients and ambient water quality (EPA 1986 and EPA 2000). EPA *Quality Criteria for Water (Gold Book)* (EPA 1986) provides researched threshold values and recommends nutrient criteria. The *Ambient Water Quality Criteria Recommendations: Information Supporting the Development of State and Tribal Nutrient Criteria for Rivers and Streams in Nutrient Ecoregion III* (EPA 2000) provides recommended regional nutrient criteria based on analysis of data from different regions in the xeric (dry) western United States.

Additional literature values based on either a controlled environment or actual environmental case studies have been completed throughout the world. Although many studies focused on individual water bodies or receiving waters, many studies have provided threshold values that can be applied to most water bodies. These studies usually provide an endpoint where it has been shown that eutrophic conditions can begin. Some of these endpoints are directed at the causal variable (e.g., nitrate, total phosphorus, dissolved ortho-phosphate, etc.). However, some endpoints are directed at the response variable (e.g., chlorophyll *a,* water clarity, etc.) associated with eutrophic conditions.

With research, water quality monitoring, and mathematical modeling, some states have incorporated response variable endpoints into their WQS (e.g., Oregon's 15 µg/L chlorophyll *a* concentrations [Oregon 340-41-950]). Although not direct numeric criteria for nutrients, these variable response indicators are for eutrophic conditions and can be used as a target or goal for water quality. With these indicator targets or goals established, numerous mathematical models can be applied to determine a water body's assimilation capacity for nutrients (e.g., *Snake River-Hells Canyon SBA-TMDL* CE-QUALE2 model [Idaho DEQ and Oregon DEQ 2004]). This is a type of backdoor approach to achieve and support a beneficial use. This approach appears to be more acceptable than a one size fits all application of a causal variable numeric criterion.

In the Weiser River Watershed, seven rivers and one reservoir are listed for nutrients. One segment, the lower Weiser River, has dissolved oxygen listed as a pollutant of concern, which may or may not be associated with nutrient enrichment. For the rivers and streams, 24-hour dissolved oxygen measurements were taken to determine if the listed water bodies are impaired by nutrients. This monitoring showed that dissolved oxygen concentrations did not fall below the water quality standard and was not causing an impairment to cold water aquatic life. Further information can be found in Figure 34 and in the accompanying narrative on page 91.

Table 16 provides a synopsis and reference for applicable WQS for nutrients, literature/research values, targets/goals for similar water bodies in the region, and established WQS criteria in other states.

**Table 16. Water Quality Standards, Criteria, and Literature Reviews. Weiser River Watershed.**

| Applicable Criteria | Citation |
|---|---|
| Narrative Criteria | |
| 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. | IDAPA 58.01.02.200.06 |
| **Total Phosphorus Targets (casual variable)** | |
| Total phosphorus concentration of 0.025 mg/L | *Cascade Reservoir TMDL* (Idaho DEQ 1996) |
| Flowing waters total phosphorus concentration[a] 0.042 mg/L[b]. | *Ambient Water Quality Criteria Recommendations; Rivers and streams in Nutrient Region III, Xeric West* (EPA 2000) |
| Flowing waters total phosphorus concentration 0.10 mg/L.<br>Flowing waters discharging to lake or reservoir 0.05 mg/L.<br>Lakes and Reservoirs 0.025 mg/L. | EPA Recommended Criteria for Total Phosphorus, *Quality Criteria for Water Quality* (EPA Gold Book) (EPA 1986) |
| **Indicator Targets (response variable)** | |
| Chlorophyll *a* concentration of 15 µg/L[c]. | State of Oregon Water Quality Standard 340-41-150 |
| Chlorophyll *a* concentration[a] of 11 µg/L. | *Ambient Water Quality Criteria Recommendations; Lakes and Reservoirs in Nutrient Region III, Xeric West* (EPA 2001) |
| Chlorophyll *a* concentration of 10 µg/L. | *Cascade Reservoir TMDL* (Idaho DEQ 1996) |
| Chlorophyll *a* concentration of 20 µg/L. | Carlson (1977) *Trophic Status of Lakes* |

*a represents median value for 25th percentile of all data*
*b milligrams per liter*
*c micrograms per liter*

## Sediment Criteria

The general surface water quality criteria for sediment are found in IDAPA 58.01.02.200.08, which states the following:

> **08. Sedimen**t. Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Section 350. (4-5-00)

Impairment to designated uses is usually associated with two forms of water column sediment: bedload and suspended sediment. Impairment by sediment may also be exacerbated by lack of suitable habitat for cold water aquatic life (e.g., pools and riffles).

Bedload sediment can be defined as the sediment that is transported along the substrate. This transport is associated with the rolling or short-term suspension of sediment.

Bedload sediment transport is a direct result of stream velocity, substrate roughness, and available energy. Available energy is usually determined by the amount of sediment already in suspension or bedload being moved through the system. This is not to say that suspended sediment cannot become bedload sediment. As stream velocity decreases and/or available energy decreases, suspended sediment will drop from the water column and may continue to be transported as bedload sediment.

Bedload sediment, especially fine sediment of less than 6 mm in diameter, can cause impairment of uses in a variety of ways. Bedload sediment can fill in gravels associated with salmonid spawning, cover redds and reduce intergravel dissolved levels, encase fry, fill in interstitial spaces required for fry development and salmonid food sources, reduce pool volume required for salmonid refugia areas, and cover substrate required for primary food (periphyton) production areas.

Presently, no bedload data are available on the lower Weiser River. This is due in part to the difficulty in monitoring this parameter, especially on a large river system where the high velocity associated with peak flows prevents such monitoring. However, surrogate measures could be implemented to assist in determining the amount of bedload sediment. These surrogate measures can include substrate evaluation, pool filling, riffle-pool ratio, and number or ratio of pools in a given segment.

Suspended sediment and total suspended solids (TSS) are usually associated with that fraction of the sediment load suspended within the water column. Suspended sediment and TSS, as with bedload sediment, is directly related to stream velocity and available energy for sediment transport. The transport of suspended sediment can also vary depending on the size of the sediment and/or buoyancy of the particle being transported. That is, some sediment may be colloidal in nature, have high-surface tension, and/or be highly buoyant and remain suspended even in a stagnant water column, such as a lake or reservoir.

Suspended sediment and TSS can affect designated uses by hampering sight-feeding fishes' the ability to find food, aggravating fishes' gills, and reducing fishes' and macroinvertebrates' ability to utilize dissolved oxygen.

Numerous studies have been conducted on the effects of sediment on salmonid species. Sigler, Bjorn, and Forest (1984) determined turbidity levels as low as 25 nephelometric turbidity units (NTUs) can inhibit fish growth, and levels between 100-300 NTUs will cause fish to die or seek refuge in other channels. Suspended sediment concentrations at levels of 100 milligrams per liter (mg/L) have been shown to reduce the survival of juvenile rainbow trout (Herbert and Merkens 1961).

Newcombe and Jensen (1996) reported the effects of suspended sediment on fish, summarizing 80 published reports on suspended sediment in streams and estuaries. For rainbow trout, the lethal effects of suspended sediment were observed at concentrations of 50 to 100 mg/L when those concentrations are maintained for 14 to 60 days. Similar effects are observed for other species. Adverse effects on habitat, especially spawning and rearing habitat, were noted at similar sediment concentrations.

Sediment loads can influence turbidity, nutrient concentrations, absorption of toxic substances and bed form characteristics. Sediment distribution through water-based transport is essential in many ecological processes (e.g., fertilization of land through annual flooding), but increased sediment loads resulting from extreme meteorological events or human activities can adversely affect an aquatic ecosystem. (NRCS, 2001).

Total suspended solids data have been used as a surrogate for the assessment of sediment within this system. Both TSS and suspended sediment concentration (SSC) values may include algae and other organic matter that do not directly correlate with inorganic sediment concentrations in the water column.

*Common Sources*

Common sources of sediment within the Weiser River TMDL reach are predominantly erosion-based as well as from instream biological productivity. Sediment may originate from natural causes, such as landslides, forest or brush fires, high flow events or from anthropogenic sources, such as erosion from roadways, agricultural lands, urban/suburban stormwater runoff, and construction sites. Sediment loads within the system are highest in the spring when high flow volumes and velocities result from snowmelt in higher elevations.

Although quantitative information on common sources of sediment in the Weiser River TMDL is unavailable, it is recognized that a substantial amount of sediment can be generated and transported relatively long distances by extreme precipitation events, such as the January 1997 rain-on-snow event in the Weiser River Watershed. It has been estimated that, although they occur only rarely, such events can account for the movement of a greater volume of sediment in a single event than would be expected to occur in an entire water year under average conditions (DEQ, 1998c; BCC, 1996)

As with the total phosphorus analysis, sediment data for the lower Weiser River is limited to the studies and monitoring mentioned in this document. However, different agencies have conducted sediment monitoring by using different analytical methods. Table 17 shows the years that monitoring was conducted, by whom it was conducted, which form of analysis was used, and the characteristics of each analytical method.

**Table 17. Sediment Analysis Techniques Used on Suspended Sediment Monitoring for the Weiser River. Weiser River Watershed.**

| Agency | Years of Data | Analyte | Analytical Method | Analytical Method Characteristics |
|---|---|---|---|---|
| Bureau of Reclamation | 1987-1989 | Non-Filterable Residue (Total Suspended Solids) | EPA 160.2<br>SM1 2540D | May underestimate some suspended sediment; aliquot sample heated to 180 $^oC$ |
| U.S. Geological Survey | 1996-1998 and 2000 | Suspended Sediment | SM1 D3977-97 | Entire sample evaporated at 110 $^oC$ |
| DEQ | 1982-1983<br><br>2000-2001 | Suspended Sediment<br><br>Total Suspended Solids | SM1 D3977-97<br><br>EPA 160.2 | Entire sample evaporated at 110 $^oC$<br>May underestimate some suspended sediment; aliquot sample heated to 180 $^oC$ |
| Idaho Department of Agriculture | 2000-2002 | Total Suspended Solids | EPA 160.2<br>SM1 2540D | May underestimate some suspended sediment; aliquot sample heated to 180 $^oC$ |

*Sediment Literature Values and Research*

Lloyd (1987) suggested turbidity levels up to 23 NTUs for moderate level protection of salmonid species. For a high level of protection, Lloyd (1987) suggested keeping turbidity levels up to 7 NTUs. For example, Nevada has set a numeric turbidity standard of less than or equal to 25 NTUs to protect aquatic life, water supply, and recreational use in Lake Mead (Nevada NAC §445A.195).

Most studies have demonstrated that turbidity levels exceeding 25-30 NTUs will impair aquatic life use by causing reduced fish growth, reduced survival, reduced abundance, respiratory stress, and increased ventilation. Avoidance, reduced energy intake, and displacement can occur at turbidity levels of 22 to greater than 200 NTUs (Bash, Berman, and Bolton 2001).

Suspended sediment concentrations at levels of 100 mg/L or greater has shown reduced survival of juvenile rainbow trout (Herbert and Merkens 1961), and sediment covered spawning gravels decreases the survivability of young fish during the incubation and emergence period (Bash, Berman, and Bolton 2001). Additionally, chronic turbidity during emergence and rearing of young anadromous salmonids could affect the quantity and quality of fish production (Sigler, Bjorn, and Forest 1984). Sediment can also alter the hyporheic conditions, reducing ground water flows and increasing water temperature (Poole and Berman 2001).

Surface fines can impair benthic species and fisheries by limiting the interstitial space used for protection and suitable substrate for nest or redd construction. Certain primary food sources for fish, including Ephemeroptera, Plecoptera, and Trichoptera species

(EPT), respond positively to a gravel-to-cobble substrate (Waters 1995). Substrate surface fine targets are difficult to establish. However, as described by Relyea, Minshall, and Danehy (2000), macroinvertebrates (Plecoptera) that are sediment-intolerant are found primarily where substrate cover is larger than 6 mm in size and less than 30% fines. More sediment-tolerant macroinvertebrates are found where the substrate cover is less than 6 mm in size and greater than 30% fines.

Most sediment studies have focused on smaller, A, B, and C channel-type streams (Rosgen 1996). Studies conducted on Rock Creek in Twin Falls County, Idaho, and Bear Valley Creek in Valley County, Idaho, found that embryo survival is impaired when fines exceed 30% (Idaho DEQ 1990). Overton et al. (1995) found natural accumulation of percent fines were about 34% in C channel types. Most C channel types exhibit similar gradient as F channel types, <2.0% (Rosgen 1996).

The smallmouth bass (*Micropeterus dolomieui*), which are found throughout the Weiser River Watershed, require adequate substrate for nest building. This substrate can be either sand or gravel (Simpson and Wallace 1982).

The sucker species found in the area (*Catostomus macrohelus*) prefer gravel to rocky substrate.

The northern pike minnow (*Ptychocheilus oregonensis*) uses streams and rivers for spawning activity but is more of a broadcast spawner than nest builder (Simpson and Wallace 1982).

Sculpin (*Cottus baird*) are also known to inhabit waters in the Weiser River Watershed. Sculpin prefer clean water and clean gravel for habitat.

Salmonid species require clean, well-oxygenated gravels for spawning, incubation, and emergence. Intergravel space is required for fry development, primary food sources, and refuge. Pools are required for mature fish development and provide areas of refugia during high water temperature and for prey protection (Burton 1991)

## Table 18. Water Quality Standards, Criteria and Literature Reviews. Weiser River Watershed.

| Applicable Criteria | Citation |
|---|---|
| ***Narrative Criteria*** | |
| Sediment shall not exceed quantities specified in Sections 250 and 252, or, in the absence of specific sediment criteria, quantities which impair designated beneficial uses. Determinations of impairment shall be based on water quality monitoring and surveillance and the information utilized as described in Section 350 | IDAPA 58.01.02.200.08 |
| ***Suspended Sediment-TSS Targets*** | |
| 100 mg/L[b] Suspended Sediment | Herbert and Merkens (1961) |
| 25 mg/L TSS Water Body Specific Criteria (e.g. East Fork Owyhee River) | State of Nevada NAC §445A.223 |
| 50 mg/L suspended sediment concentrations not to exceed 60 days and 80 mg/L suspended sediment concentrations not to exceed 14 days | Boise River SBA-TMDL (DEQ 1999*b*) |
| 50 mg/L (Average) TSS not to exceed 28 day period | Rowe, Essig and Jessup (2003) |
| ***Turbidity-Substrate Targets*** | |
| 25 NTUs[a] Site Specific Criteria for Lake Mead, Nevada | State of Nevada NAC §445A.195 |
| 25-30 NTUs | Bash, Berman, and Bolton (2001) |
| 23 NTUs | Lloyd (1987) |
| 25 NTUs | Sigler, Bjorn, and Forest (1984) |
| Substrate < 30% at 6.0 mm[c] | Rock Creek, Twin Falls County (Idaho DEQ 1990) |
| Substrate < 34% at 6.0 mm | Overton (1995) |
| Substrate < 30% at 6.0 mm | Relyea, Minshall, and Danehy (2000) |

*a milligrams per liter*
*b nephelometric turbidity units milligrams per liter*
*c millimeter*

### Water Column Sediment Target

The Weiser River water column sediment target was derived by evaluating the lower Boise River water column sediment target. As part of the lower Boise River sediment TMDL, an extensive evaluation of water column sediment conditions was completed to determine an appropriate target for the protection of cold water aquatic life and salmonid spawning. The Boise River evaluation resulted in the identification of a two-tiered sediment target of less than or equal to 50 mg/L suspended sediment concentration (SSC) for no more than 60 days (chronic events); and less than or equal to 80 mg/L SSC for no more than 14 days (acute events); both calculated as a geometric mean over the duration.

It is important to note that, while lower Boise River water column sediment target was developed as part of the lower Boise River TMDL process, the target itself is not necessarily specific to the lower Boise River. The research on which the lower Boise River sediment target is based on maintaining a self-sustaining trout community, regardless of where the community is located. As such, using the Boise River target as a starting point for the Weiser River TMDL is appropriate.

**Rationale for basing the Weiser River target on TSS**

As noted above, the lower Boise River water column sediment target is based on SSC, while the Weiser River target is based on TSS. Unfortunately, very little SSC data were available for the Weiser River when the TMDL effort began. However, a sufficient amount of TSS data was available. In developing a method by which the TSS data could be used, a correlation between the two variables was developed. The intent of the correlation was to determine whether TSS could be used in place of SSC. The correlation was based on paired data (data collected at the same place and time) collected during the 2003 irrigation season. During the sampling period, the correlation showed that TSS and SSC concentrations were relatively similar in the Weiser River. As such, the decision to use TSS instead of SSC was made.

Upon further review, the decision to use TSS instead of SSC makes the Weiser River target slightly less conservative than the Lower Boise River TMDL[1]. Stated another way, if a more robust data set were available through additional sampling years, the ratio of SSC to TSS would likely increase instead of remain equal. Since suspended sediment is more damaging to aquatic life than suspended solids, the target is slightly less conservative.

**Recommendation for the exposure duration period**

As noted above, the exposure duration associated with 50 mg/L in the lower Boise River is 60 days, while the exposure duration in the Weiser River is 30 days. Due to the likelihood (as described above) that using TSS to replace SSC as the water column sediment parameter will decrease the margin of safety in the Weiser River TMDL, the chronic exposure duration should remain 30 days. This decision will add an additional level of protectiveness to the target. However, if additional paired data shows that the TSS/SSC correlation is truly close to 1:1, a 60-day exposure duration should be reconsidered.

**Recommendation for determining target compliance**

While not stated in either the Weiser River TMDL or the Lower Boise River TMDL, it is generally understood that compliance with the targets would best be determined using daily concentration values. Unfortunately, a daily sampling regime does not exist in the Weiser River Subbasin, and implementing such a regime would be costly. Therefore, it is recommended that the following considerations be made to determine compliance with the targets:

1. A minimum of one sample per week should be collected over the exposure duration.

---

[1] During an extensive review of paired TSS and SSC data, Gray et. al (2000) found that in natural waters SSC values tend to increase at a greater rate than their corresponding paired TSS values.

2. If the environmental conditions creating the water column sediment concentrations are known to change between sampling events, the sampling frequency should be adjusted accordingly to capture the change.

**Summary**

Based on the information provided above, the adjusted Weiser River water column sediment target is written as follows:

> Less than or equal to 50 mg/L total suspended solids (TSS) for no more than 30 days; and less than or equal to 80 mg/L TSS for no more than 14 days; both calculated as a geometric mean over the exposure duration.

These targets represent a valid interpretation of the narrative sediment standard and will result in supporting the designated beneficial uses within the system. This two-tiered target protects the fishery and also allows consideration for naturally occurring events over which landowners and managers have little control.

Where a TMDL is required to address sediment, target selection will be discussed in Section 5.0.

### Allocations

Where it is determined that designated uses are not impaired by nutrients, allocations for total phosphorus may still be required to meet targets for the Snake River – Hells Canyon TMDL (Idaho DEQ and Oregon DEQ 2004). These allocations may be established for different segments of the Weiser River and its tributaries. Section 3.2 will address allocations.

## Design and Approach of the Subbasin Assessment

Two main reasons exist for analyzing the Weiser River Watershed.

1. to determine the status of the beneficial uses of the 1998 §303(d) listed water bodies.
2. to examine the nutrient load to the Snake River and the total phosphorus target assigned to the watershed through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

In examining the beneficial uses in the watershed, the first step was to examine the flow regime of the different water bodies. If a water body exhibited zero discharge for more than seven days at a time, the water body was classified as intermittent, and the appropriate WQS were applied (See Section 2.3).

Most of the water bodies listed as water quality limited in the Weiser River Watershed have designated uses, including cold water aquatic life, salmonid spawning, primary contact recreation, etc., as established in the WQS (IDAPA 58.01.02.109).Two factors were examined when determining if the designated uses were supported or not supported.

1. First, biological indicators including community structure, sensitive grouping, and trophic status were analyzed. Analysis was completed using the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002) to determine support status. If, through the use of biological indicators, it was determined a water body was supporting the designated uses it was recommended the water body be removed from the §303(d) list. However, if a water body had been placed on the 1998 Idaho §303(d) list because of non-support for recreational uses, it was evaluated further.

2. Second, if it was determined through biological assessment a water body was not supporting designated uses, water quality data and information were examined to determine if any numeric criteria were exceeded (e.g., bacteria, dissolved oxygen, temperature). If the water quality data showed exceedances of criteria it was determined the water body was not supporting its designated uses.

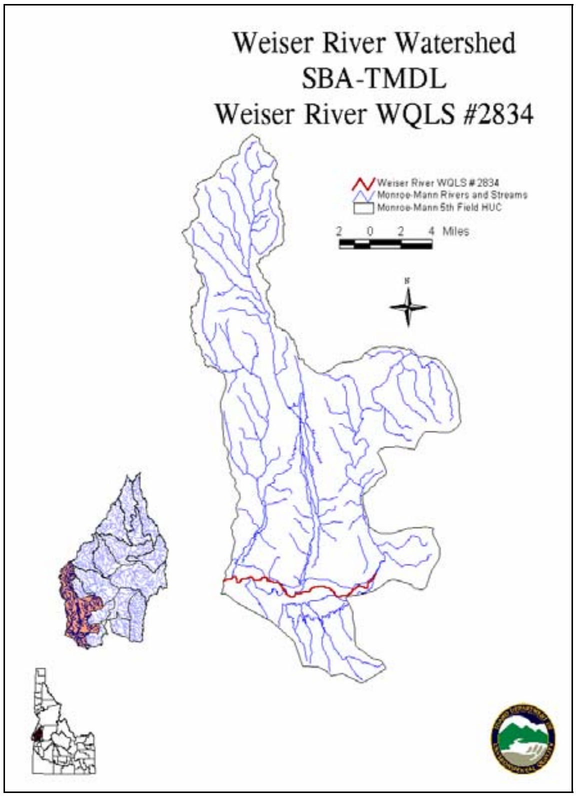
Further analysis of biological indicators is required to determine if a specific pollutant of concern is responsible for impaired designated uses. Since Idaho utilizes a narrative criterion for nutrients and sediment, it must be demonstrated these pollutants are impairing the designated uses. For example, if a stream was listed for sediment and it was determined the biological community structure is mainly composed of sediment-tolerant species; a link was established between the pollutant of concern and the biological indicators.

For nutrient analysis, dissolved oxygen levels were examined to determine if nutrients are impairing the designated uses. If dissolved oxygen levels drop below the WQS criteria for the support of cold water aquatic life, a link was established indicating that nuisance aquatic growth was causing a depletion or sag of dissolved oxygen. However, since a load allocation or target for total phosphorus has been established by the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004), a nutrient target is already established without showing impairment to a beneficial use.

For much of the Weiser River and its tributaries, concentrations and loads will be examined to determine their total phosphorus contribution to the Snake River. Appropriate load allocations will be addressed in Section 3.2.

# 2.5 Water Quality Status of Listed Segments

## Weiser River, Galloway Dam to Snake River




| Water Body | Weiser River,<br>Galloway Dam to Snake River |
|---|---|
| Miles of impaired water body | 12.4 |
| Listed pollutants | Sediment, Temperature, Bacteria, Dissolved Oxygen, and Nutrients |
| Possible impaired designated uses | Cold water aquatic life and primary and secondary contact recreation |
| Potential sources | Streambank erosion, overland flow, animal feeding operations, wildlife, septic systems, tributary inflows, solar radiation |

### Discharge (Flow) Characteristics

No permanent discharge gage exists on the lower Weiser River from Galloway Dam to the Snake River. The USGS discharge gage (13266000) located near Weiser is approximately 5 miles upstream of Galloway Dam and approximately 2 miles below Crane Creek. From the gage site downstream to Galloway Dam, two major irrigation water diversions are located on the river. These two diversions are the Sunnyside Canal and the Galloway Canal. Very little discharge information is available for the Sunnyside diversion. Extensive discharge records exist from the years 1920-1996 for the Galloway Canal at USGS discharge station 13266500. Irrigation season is usually from April through September. Available discharge data and the source of that data are located in Table 19.

Diversions below Galloway Dam are few due to the incisement of the river channel. One notable diversion is located below Mann Creek. Other diversions may be occurring in the lower elevations along the river; however, there are no data that would assist in quantifying these withdrawals.

Inflows include three tributaries (Mann Creek, Monroe Creek, and Cove Creek) and four irrigation water return ditches. These ditches are the Sunnyside Canal, Frazier Gulch, Smith Drain, and Lower Payette return ditches. Other irrigation water inflow is associated with irrigated areas adjacent to the river.

**Table 19. Estimated Mass Balance Discharge for Monthly Outflows (Canal Diversions) and Inflows to the Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

| Months | Outflows (Canals)[a] Average (cfs)[b] | In-flows Average (cfs) |
|---|---|---|
| May | 207 | 197 |
| June | 222 | 84 |
| July | 217 | 70 |
| August | 199 | 38 |
| September | 152 | 25 |

*a Based on regression analysis for USGS gage data*
*b cubic feet second*

To complete the overall water balance, additional inflows were calculated. These inflows are located between the USGS gage station (13266000) and Galloway Dam. These additional inflows are First Creek and Bear Creek and are minor contributions to the overall flow budget for the lower Weiser River.

Table 19 shows the mass balance results. The following assumptions are built into the overall discharge mass balance: irrigation return flows remain constant and are not affected by climatic conditions; no net loss or gain exists to or from ground water (i.e., neither a losing nor a gaining reach), and data presented for in-flows are represented as normal discharge with the available data. Appendix C contains data source descriptions.

Figure 24 shows the average monthly flows that can be expected at the USGS discharge gage site (13266000). Figure 25 shows the estimated discharge budget and the discharges monitored by different agencies at various times.

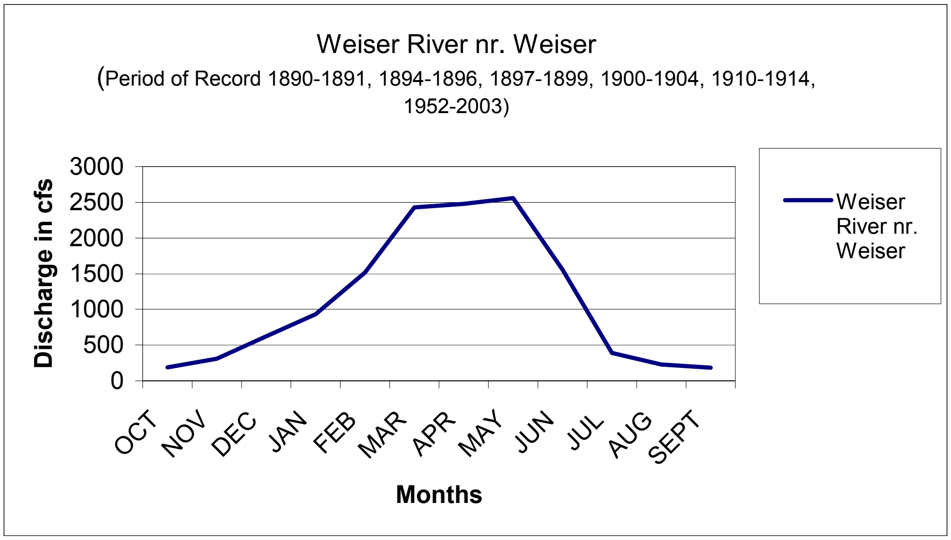



**Figure 24. Historic Discharge Data. Weiser River near Weiser, ID. USGS Station ID 13266000. Weiser River, Galloway Dam to the Snake River.**

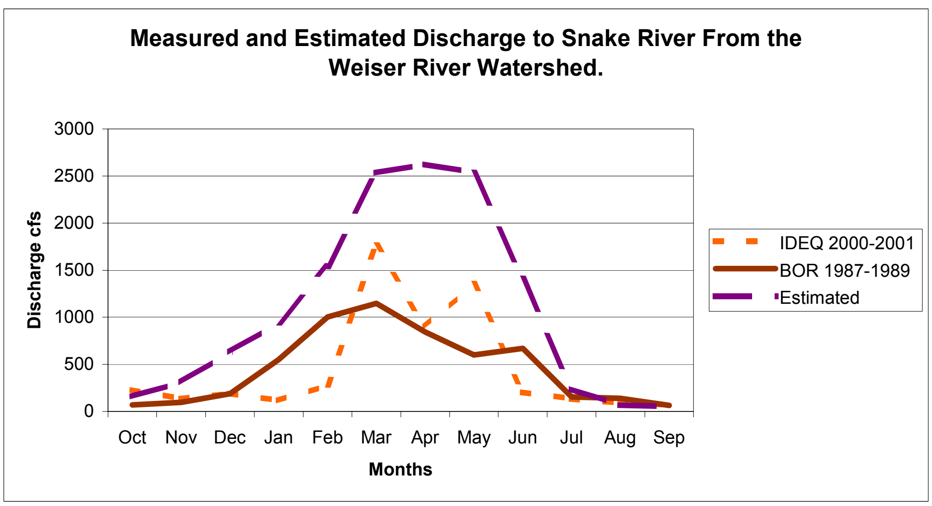



**Figure 25. Measured Discharge at Highway 95 Bridge and Estimated Discharge to the Snake River. Weiser River at Weiser, ID. Weiser River, Galloway Dam to the Snake River.**

Estimated flows included in Figure 25 are determined from long-term discharge data at the USGS gage site located near Weiser (15 miles upstream of the confluence with the Snake River); data from diversions of the two major canals at and above Galloway Dam; data concerning inflows from Mann Creek, Cove Creek, and Monroe Creek; and data concerning the irrigation return drains located below Galloway Dam. Inflows from below Galloway Dam to the Snake River can account for 2% to 58% of the total discharge budget to the lower Weiser River. This is dependent on time of year, with the largest contribution usually occurring late in the summer (August-September).

The data collected by DEQ (2000-2001) and the Bureau of Reclamation (BOR) (1987-1989) may only be reliable for those dates when measurements were taken. Neither set of measurements can be extrapolated to represent long-term discharge at the Weiser River site located at Weiser, Idaho, or to the Snake River.

**Biological and Other Data**

Since Idaho WQSs apply narrative criteria to certain pollutants, namely sediments and nutrients (IDAPA 58.01.02.200), the biological communities should be examined prior to examining water quality information. For the lower Weiser River, three biological communities were examined: periphyton, fisheries, and macroinvertebrates. The data collected on these communities will assist in determining if designated uses are impaired and if the listed pollutants are impairing those uses. Appendix C contains data source descriptions.

*Periphyton*

Periphyton samples were collected at three locations on the lower Weiser River. These sites included the Weiser River at the Highway 95 Bridge (WR-001), the Weiser River at Unity Bridge (WR-002), and the Weiser River below Galloway Dam (WR-003). Samples were collected by methods described in the *Idaho DEQ Beneficial Uses Reconnaissance Program* (Idaho DEQ 1998b).

Three sets of samples were collected in 2000 and 2001 at a total of eight stations on the Weiser River. Three of these sample sets were collected at sites below Galloway Dam. Samples were sent to Loren Bahls, Ph.D., operator of the laboratory Hannaea of Helena, Montana, for analysis and biological community interpretation. Dr. Bahls provided written narratives to describe species composition and structure of the periphyton communities found at these locations (Bahls 2000 and Bahls 2001).

In Idaho, periphyton has been used for biological assessments in the development of SBA-TMDLs in the South Fork Owyhee SBA-TMDL and the Upper Owyhee SBA-TMDL (Idaho DEQ 1999*c* and Idaho DEQ 2003). The use of periphyton assisted in determining if listed pollutants were impairing uses. The use of periphyton for biological assessment has been well documented as an indicator of impaired uses and the cause of that impairment (Plafkin et al. 1998 and Stevenson and Bahls 1999). Overall, the principal reasons why periphyton are appropriate indicators are as follows:

- Periphyton are present in all water bodies
- Periphyton have rapid reproductive rates
- Periphyton are primary producers
- Periphyton are easy to collect and identify with little disturbance to the ecosystem
- Periphyton have standard methods for identification and evaluation of composition and structure

- Periphyton literature and taxonomic expertise is readily available
- Public perception of periphyton growth
- Periphyton can show the level of biological integrity of an ecosystem
- Periphyton can show ecosystem stress

Dr. Bahls (2000 and 2001) described a dramatic change in structure and composition of periphyton communities from the site located above Galloway Dam to the Highway 95 Bridge site at Weiser, Idaho. The Pollution Tolerance Index declined and the Siltation Index increased indicating moderate to severe impairment and partial support to non-support of beneficial uses including cold water aquatic life. Figure 26 shows the results of the Siltation Index for the three samples from the lower Weiser River sampling sites. Figure 27 show the results for the Pollution Tolerance Index.

Figure 27 indicates that the presence of motile species have increased the Siltation Index score to the point that sediment is impairing the designated uses in the lower Weiser River. Most of the results are at or near a threshold value. Figure 27 indicates borderline or moderate impairment based on the Pollution Tolerance Index. This index may indicate the presence of high organic loading in this segment (Bahls 2000).

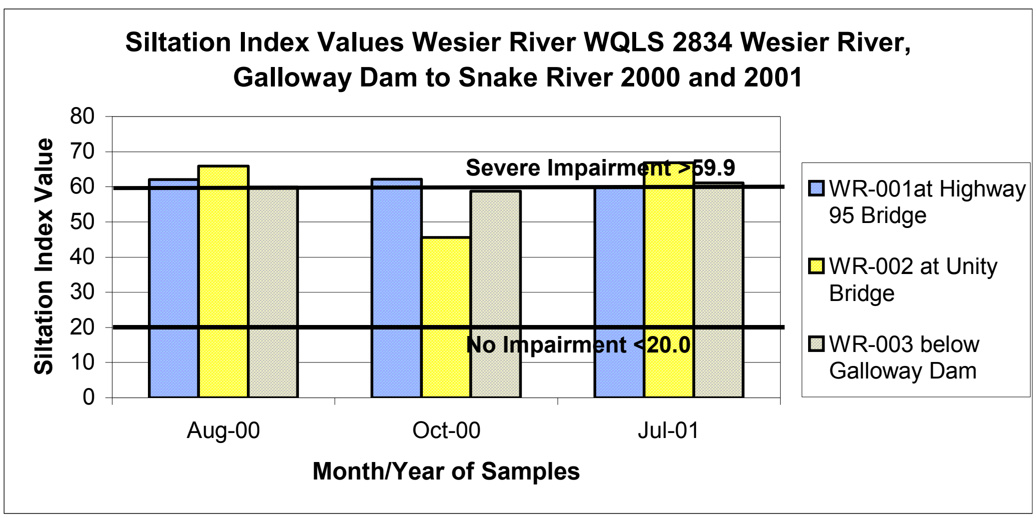



**Figure 26. Siltation Index Values. Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

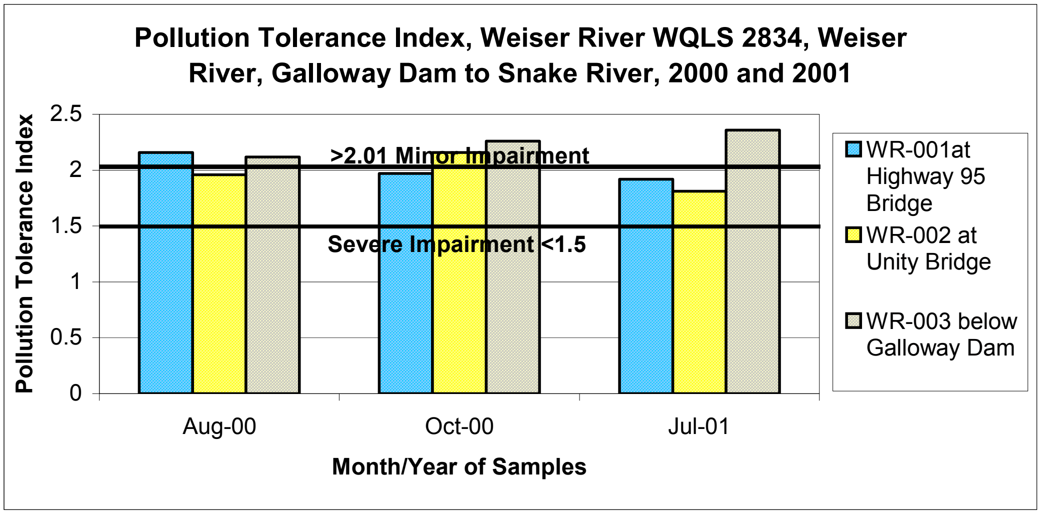



**Figure 27. Pollution Tolerance Index Values. Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

DEQ has developed a periphyton index scoring mechanism, called the River Diatom Index (RDI), to assist in determining support status in fourth to sixth order (medium to large) water bodies (Grafe et al. 2002). The scoring involves nine metrics, as shown in Table 20. These metrics were derived from an intensive study throughout Idaho (Fore and Grafe 2000) where different periphyton metrics were examined for community and structure based on relative disturbance (e.g., channel morphology, land use, recreational use, etc.). The nine metrics used in the RDI were selected based on statistical analysis to determine the most appropriate metrics from a total of 30 different metrics where literature has shown a response to disturbance (Grafe et al 2002 and Fore and Grafe 2000).

The results from the examination of the RDI scores for the lower Weiser River place all three stations in a Category 1.  When combined with at least one other index, such as the River Macroinvertebrate Index (RMI) or River Fish Index (RFI), and the total category score is less than 2, then the water body is determined to be not fully supporting cold water aquatic life. However, for the purpose of water quality assessment in the lower Weiser River, the different metrics provide insight into the pollutants that impairing the designated uses, mainly the percent of very motile species present in the samples.

The percent of very motile species, or those species that are very tolerant of sediment, exceeds 20% at all sites in the lower Weiser River. That is, over 20% of the periphyton species found at these river locations were composed of very sediment-tolerant species. Less than 7% of the total abundance consisting of very motile species would indicate little to no human disturbances in the watershed.

**Table 20. River Diatom Index Scores. Weiser River, Galloway Dam to the Snake River.**

| Metric | Weiser River at Highway 95 Bridge at Weiser, Idaho (Metric Score) | Weiser River at Highway 95 Bridge at Weiser, Idaho (RDI[a] Score) | Weiser River at Unity Bridge (Metric Score) | Weiser River at Unity Bridge (RDI Score) | Weiser River below Galloway Dam (Metric Score) | Weiser River below Galloway Dam RDI Score) |
|---|---|---|---|---|---|---|
| % Pollutant Intolerant | 32.3 | 1 | 22.9 | 1 | 28.9 | 1 |
| % Pollutant Tolerant | 15.9 | 1 | 27.2 | 1 | 16.5 | 1 |
| Eutrophic Taxa Richness | 26 | 1 | 25 | 1 | 24 | 1 |
| % Nitrogen Heterotrophs | 36.1 | 1 | 52.1 | 1 | 38.2 | 1 |
| % Polysaprobic | 18.3 | 1 | 28.4 | 1 | 22.7 | 1 |
| Alkaliphilic Taxa Richness | 33 | 1 | 28 | 3 | 29 | 3 |
| % Requiring High Oxygen | 5.2 | 1 | 7.4 | 1 | 10.3 | 1 |
| % Very Motile | 27.8 | 1 | 21.4 | 3 | 35.5 | 1 |
| % Deformed | 0 | 5 | 0 | 5 | 0 | 5 |
| | | | | | | |
| Final River Diatom Index (RDI) Score | | 13 | | 17 | | 15 |
| River Diatom Index (RDI) Condition Rating | | 1 | | 1 | | 1 |

*a River Diatom Index RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

## *Fisheries*

Most fish species identified by the IDFG are classified as non-game species. However, at the location below Galloway Dam, 26 mountain whitefish were collected, along with two wild redband trout. Both species are classified as cold water aquatic life species and are desirable catchable species. Smallmouth bass, a cool water species, were also collected at both sites. Fewer mountain whitefish and no trout were collected at the site at Weiser, Idaho. Table 21 shows the overall synopsis of fish species found at the Galloway Dam and Weiser, Idaho sites.

Fish data collected in 1999 were evaluated using the RFI. The Galloway Dam site received a score of 39, while the Weiser, Idaho, site received an RFI score of 41. According to the *Water Body Assessment Guidance* (Grafe et al. 2002), these RFI scores are below the "threshold" limit. With this in mind, the water body would be classified as not fully supporting cold water aquatic life. Other metric scores that could be used include the RMI, the RDI, and the River Physiochemical Index (RPI). If the average score of two or more of the indices is less than 2, the system is classified as not fully supporting the cold water aquatic life use. However, since the RFI is below the threshold value, the water body would be classified as not fully supporting beneficial uses, regardless of the other scores (Grafe et al. 2002).

**Table 21. Number and Percentage of Fish Species in the Weiser River at Weiser, Idaho. July 1999. Weiser River, Galloway Dam to the Snake River.**

| Species Found | Weiser River near Weiser, Idaho | | Weiser River below Galloway Dam | |
|---|---|---|---|---|
| | Count | Percent of Total | Count | Percent of Total |
| Bridgelip sucker | 17 | 26.2% | 24 | 8.5% |
| Channel catfish | 1 | 1.5% | 0 | 0.0% |
| Chiselmouth mouth | 16 | 24.6% | 55 | 19.4% |
| Largescale sucker | 1 | 1.5% | 41 | 14.5% |
| Mountain whitefish | 9 | 13.8% | 26 | 9.2% |
| Northern pike minnow | 2 | 3.1% | 46 | 16.3% |
| Smallmouth bass | 18 | 27.7% | 55 | 19.4% |
| Speckled dace | 1 | 1.5% | 2 | 0.7% |
| Common carp | 0 | 0.0% | 13 | 4.6% |
| Longnose dace | 0 | 0.0% | 5 | 1.8% |
| Redside shiner | 0 | 0.0% | 14 | 4.9% |
| Redband trout | 0 | 0.0% | 2 | 0.7% |
| Sculpin | 0 | 0.0% | 0 | 0.0% |
| Rainbow trout | 0 | 0.0% | 0 | 0.0% |
| Mountain sucker | 0 | 0.0% | 0 | 0.0% |
| Total Number | 65 | 100% | 283 | 100% |

*Macroinvertebrates*

Macroinvertebrate samples were collected at three sites on the lower Weiser River: Weiser River at the Highway 95 Bridge at Weiser, Idaho; Weiser River at Unity Bridge near Weiser, Idaho; and Weiser River at Galloway Dam. Two sets of samples were collected in 2001 and one set was collected in 2002. The samples collected in 2001 were collected in August and October. These samples were analyzed with the use of the RMI developed by DEQ (Grafe et al. 2002). The results are reported in Tables 22, 23, and 24. The results from 2002 have not been received by DEQ's Boise Regional Office.

The results from the samples collected in 2001 indicate the biological communities found at all stations from Galloway Dam to the Snake River represent good water quality. All samples were above the threshold scoring levels and received the highest condition rating score that can be obtained using the RMI (Grafe et al. 2002). However, since one of the indices is less than the threshold value (RFI), then the water body is not fully supporting the beneficial uses regardless of the other index scores.

**Table 22. River Macroinvertebrate Index Scores. Weiser River at Highway 95 Bridge at Weiser, Idaho. Lower Weiser River, Galloway Dam to Snake River.**

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 29 | 5 | 36 | 5 |
| Number EPT[b] Taxa | 11 | 3 | 6 | 1 |
| Percent Elmidae | 0.38% | 3 | 2.17% | 5 |
| Percent Dominate Taxa | 1.52% | 5 | 15.87% | 5 |
| Percent Predators | 0.76% | 1 | 2.17% | 1 |
| Total RMI Index Score | | 17 | | 17 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3"*
*b Ephemeroptera-Plecoptera-Trichoptera*

**Table 23. River Macroinvertebrate Index Scores. Weiser River at Unity Bridge near Weiser, Idaho. Weiser River, Galloway Dam to Snake River.**

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 27 | 5 | 29 | 5 |
| Number EPT[b] Taxa | 13 | 3 | 11 | 3 |
| Percent Elmidae | 4.87% | 5 | 4.12% | 5 |
| Percent Dominate Taxa | 1.69% | 5 | 1.37% | 5 |
| Percent Predators | 1.69% | 1 | 2.55% | 1 |
| Total RMI Index Score | | 19 | | 19 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3"*
*b Ephemeroptera-Plecoptera-Trichoptera*

**Table 24. River Macroinvertebrate Index Scores. Weiser River at Galloway Dam. Weiser River, Galloway Dam to Snake River.**

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 36 | 5 | 32 | 5 |
| Number EPT[b] Taxa | 20 | 5 | 17 | 3 |
| Percent Elmidae | 12.36% | 5 | 15.21% | 5 |
| Percent Dominate Taxa | 18.44% | 5 | 13.91% | 5 |
| Percent Predators | 7.22% | 3 | 5.01% | 3 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3"*
*b Ephemeroptera-Plecoptera-Trichoptera*

Since the RFI score indicates the river is not supporting its beneficial uses, the high RMI score may seem irrelevant; however, the use of the individual metrics and other indices can be useful in determining what pollutant may be impairing the uses. As pointed out by Clark (2003), the presence or absence of certain Plecoptera (stonefly) species can assist in determining if sediment is a pollutant affecting the beneficial uses.

In the macroinvertebrate analysis of samples collected on the lower Weiser River, Clark (2003) noted the lack of Plecoptera species that would be classified as sediment intolerant, which indicates fine sediments are impairing the beneficial uses designated for the lower Weiser River. Most of the species analyzed by Clark indicated that fine sediment dominated the substrate in the lower Weiser River (more than 30% of the sediment was fine sediment [<6 mm]).

**Water Column Data**

A great deal of data has been collected on the Weiser River below Galloway Dam. These data include water chemistry data, physical data (temperature, dissolved oxygen, conductivity, etc.), discharge data, bacteria data, and pesticide data. However, most of the long-term data are associated with the USGS gage station (13266000) located above Galloway Dam. Appendix C contains information on available data that can assist in determining beneficial use support status and assist in determining load allocations for this segment.

Along with the available data, there have been two water quality status reports developed concerning this area (Clark 1985 and Tangarone and Bogue 1976). The Tangarone and Bogue study, *Weiser-Lower Payette Water Quality Surveys*, focused on only two sets of data. The first data set was collected in August 1975 and the second was collected in December of the same year. The Clark report, *Water Quality Status Report Lower Weiser River, Washington County, Idaho* (1985), focused on the 1983-1984 water year.

In the years 2000-2001, DEQ conducted a more intense study that addressed the pollutants on the 1998 §303(d) list (Ingham 2000). This study examined in closer detail the listed pollutants and the possible impacts associated with the listed pollutants. Some of the parameters selected in the 2000-2001 study focused on numeric criteria established in the WQS to support the designated uses for the segment. The parameters used to determine compliance with the established designated uses included bacteria, temperature, and dissolved oxygen. Nutrient and sediment samples were collected to assist in meeting the load allocation established by the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). The nutrient and sediment data were also collected to determine possible additional reductions that could be required after further examination of biological data and the support status of the designated uses of the Weiser River below Galloway Dam.

Each of the listed pollutants of concern will be discussed separately. Recommendations will then be made on actions to address those pollutants related to the Weiser River or to address the targets established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

*Bacteria*

The lower Weiser River from Galloway Dam to the Snake River is designated for primary contact recreation (IDAPA 58.01.02.140.18.SW-1). An explanation of applicable WQS and contact recreation criteria is provided in Section 2.4.
Data collected in the years 2000, 2001, and 2002 focused on the *Escherichia coli* (*E. coli*) criteria. Those studies in 2001 and 2002 also focused on obtaining a geometric mean to determine compliance with IDAPA 58.01.02.251.01.c. Previous studies focused on the fecal coliform indicator for the support of primary and secondary contact recreation. In 2000, Idaho changed the criteria to the use of *E. coli* as the indicator for the support, or non-support, of contact recreation. It has been determined the use of *E. coli* over fecal coliform is a much better indicator for human health concerns. Also, the method used for determining fecal coliform counts resulted in numerous false positive results associated with non-fecal material.

Results obtained in 2001 and 2002 and the geometric mean data available are shown in Table 25. The data indicate that the primary contact recreation geometric mean criterion is exceeded for the two years the intensive study was conducted. The data also demonstrate that most of the segment does not support primary contact recreation. However, the geometric mean criterion is not exceeded at Galloway Dam.

**Table 25. Geometric Mean *E. coli* Results, Years 2001 and 2002. Weiser River, Galloway Dam to the Snake River.**

| Station Location | Month and Year of Data | Number of Samples | E. coli Geometric Mean (cfu/100 ml)[a] |
|---|---|---|---|
| Weiser River at Highway 95 at Weiser, ID | August 2001 | 5 | 172 |
| Weiser River at Galloway Dam | August 2001 | 5 | 88 |
| Weiser River at Highway 95 at Weiser, ID (Duplicate) | August 2001 | 5 | 163 |
| Weiser River at Highway 95 at Weiser, ID | August 2002 | 5 | 225 |
| Weiser River at Unity Bridge | August 2002 | 5 | 202 |
| Weiser River at Galloway Dam | August 2002 | 5 | 44 |

*a colony forming units per 100 milliliters*

*Temperature*

The lower Weiser River is designated for cold water aquatic life (IDAPA 58.01.02.140.18.SW-1). The presence of cold water fish, as demonstrated in Section 2.5, Table 21, indicates that cold water aquatic life is an existing use. Both mountain whitefish and wild redband trout are considered to be cold water species (Zaroban et al.1999). An explanation of temperature criteria and cold water aquatic life is presented in Section 2.4**.**

Most of the water temperature data collected prior to 2001 for the lower Weiser River were instantaneous measurements collected during monitoring events (Clark 1985 and Tangarone and Bogue 1976). In 2001, DEQ (Ingham 2000) initiated a continuous water temperature monitoring effort at two sites in the lower Weiser reach. One of the sites was near the confluence with the Snake River and the other was located at the USGS discharge monitoring site (13266000), which is upstream of this section of the river. Figures 28 and 29 show the continuous temperature results for the lower Weiser River. The temperature logger was located near the Highway 95 Bridge, at Weiser, Idaho.

In all likelihood, the three greatest influences on water temperature are warm water temperatures entering the segment, direct solar radiation, and ambient air temperature. These three influences will be examined during the development of a TMDL to address temperature. Figure 30 shows the possible influence ambient air temperature may have on water temperature. Figure 31 shows water temperature from above the segment.

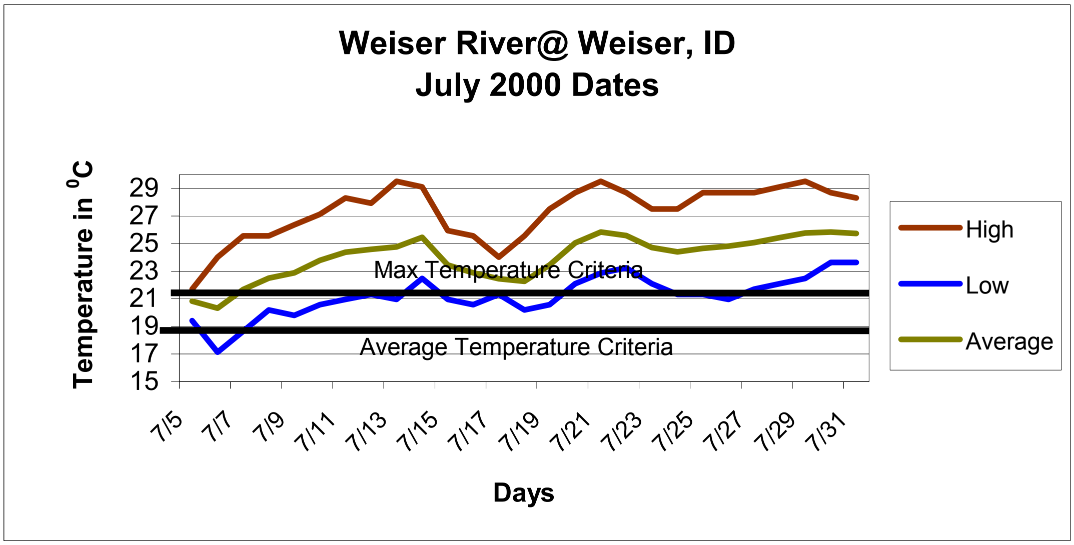



**Figure 28. Water Temperature, Weiser River at Weiser, Idaho. July 2000. Weiser River, Galloway Dam to the Snake River.**

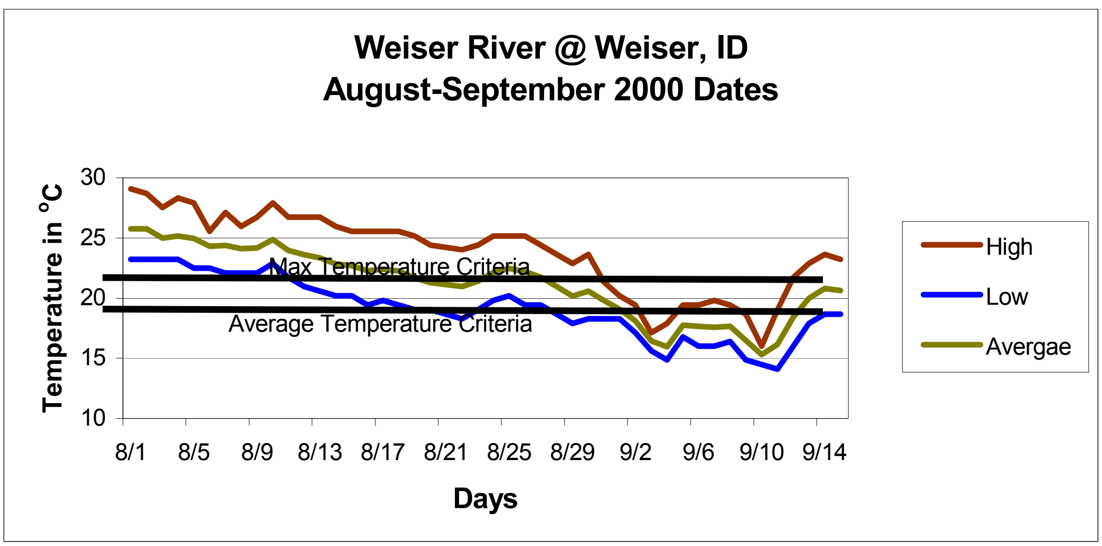



**Figure 29. Water Temperature, Weiser River at Weiser, Idaho. August-September 2000. Weiser River, Galloway Dam to the Snake River.**

Both graphs presented above show that both the maximum daily temperature and maximum daily average criteria are exceeded, and in most cases these exceedances occur for 100% of the measurements.

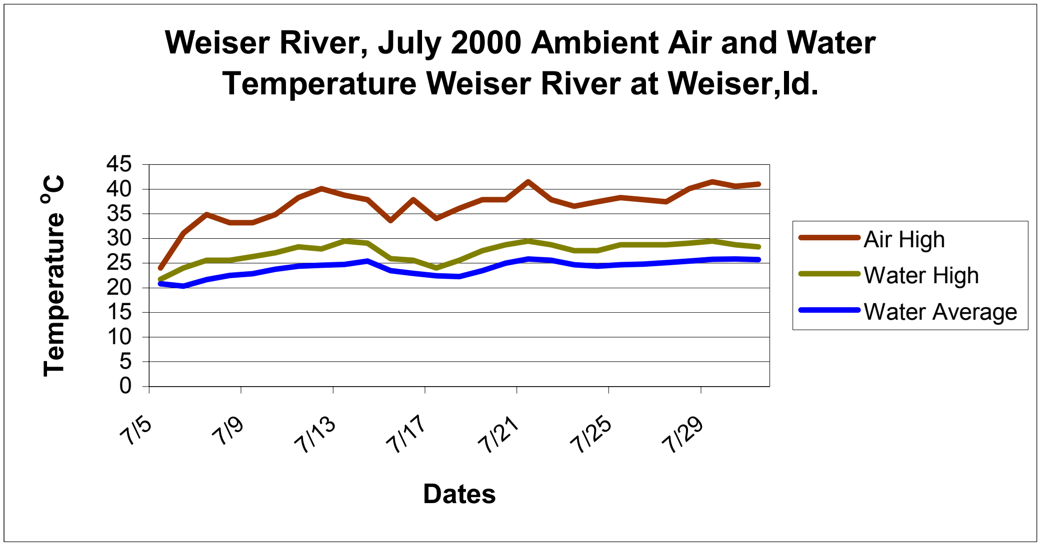



**Figure 30. Ambient Air and Water Temperature. Weiser River at Highway 95 Bridge, Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

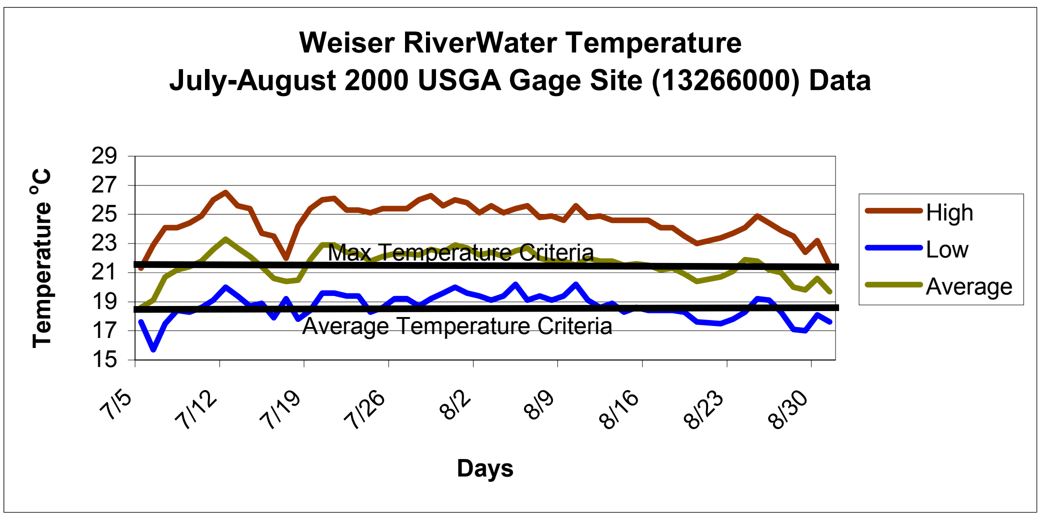



**Figure 31. Water Temperature. Weiser River at USGS Gage No. 13266000 near Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

As demonstrated in both graphs presented above, ambient air temperature and water temperature from upstream sources both play a role in warmer water temperatures in the lower Weiser River. See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

*Dissolved Oxygen*

Cold water aquatic life is a designated use in the lower Weiser River (IDAPA 58.01.02.140.18.SW-1). With this designation, numeric criteria apply to protect this use. An explanation of how the dissolved oxygen criteria are applied to cold water aquatic life is presented in Section 2.4.

Historic water column dissolved oxygen monitoring conducted by BOR from 1987 to 1989 showed that 12.5% of the samples collected during the period dropped below the minimum concentration established in the WQS. Instantaneous dissolved oxygen measurements were taken at the time of the sampling event. Figure 32 shows the results from the 1987-1989 monitoring events.

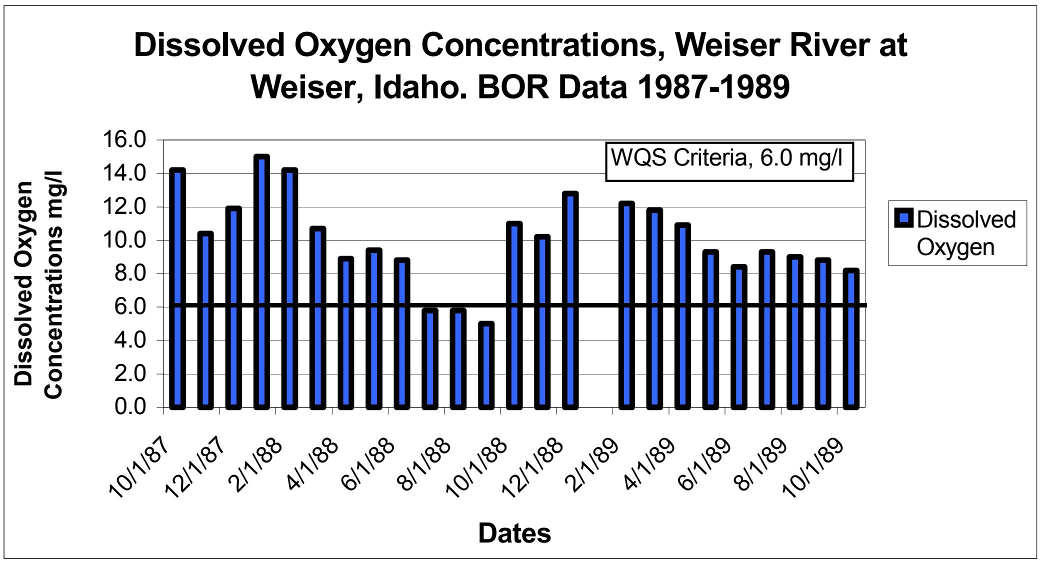



**Figure 32. Instantaneous Dissolved Oxygen Results, BOR 1987-1989. Weiser River at Highway 95 Bridge at Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

In 2000, DEQ conducted intensive water quality monitoring on many water bodies in the Weiser River Watershed. This monitoring included both instantaneous and diel dissolved oxygen monitoring. Figure 33 shows the results from the 2000 instantaneous dissolved oxygen monitoring effort. Figure 34 shows the results from the diel dissolved oxygen monitoring conducted during a 24-hour period on August 14 and 15, 2000.

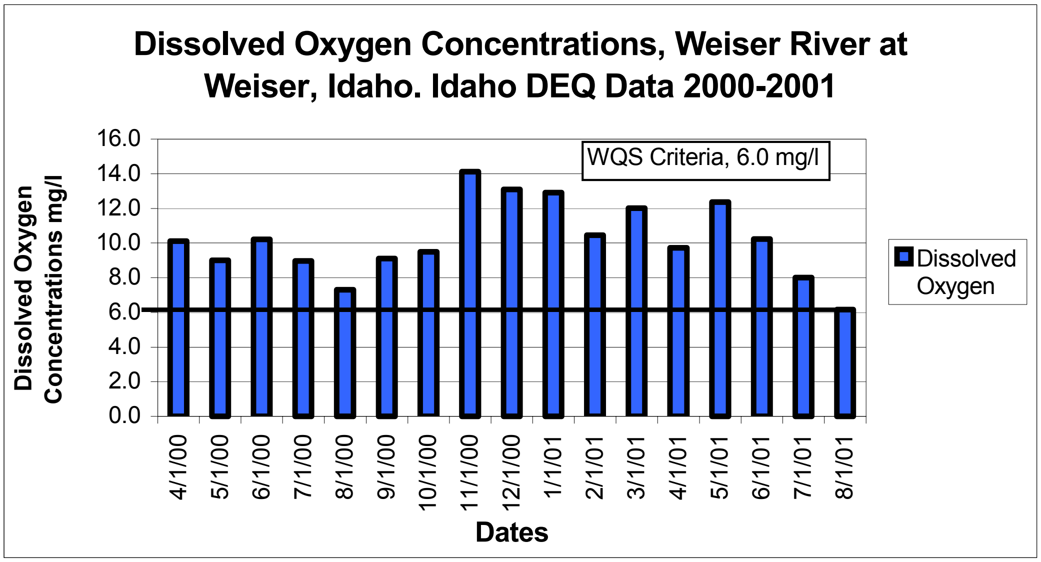



**Figure 33. Instantaneous Dissolved Oxygen Results, DEQ 2000. Weiser River at Highway 95 Bridge at Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

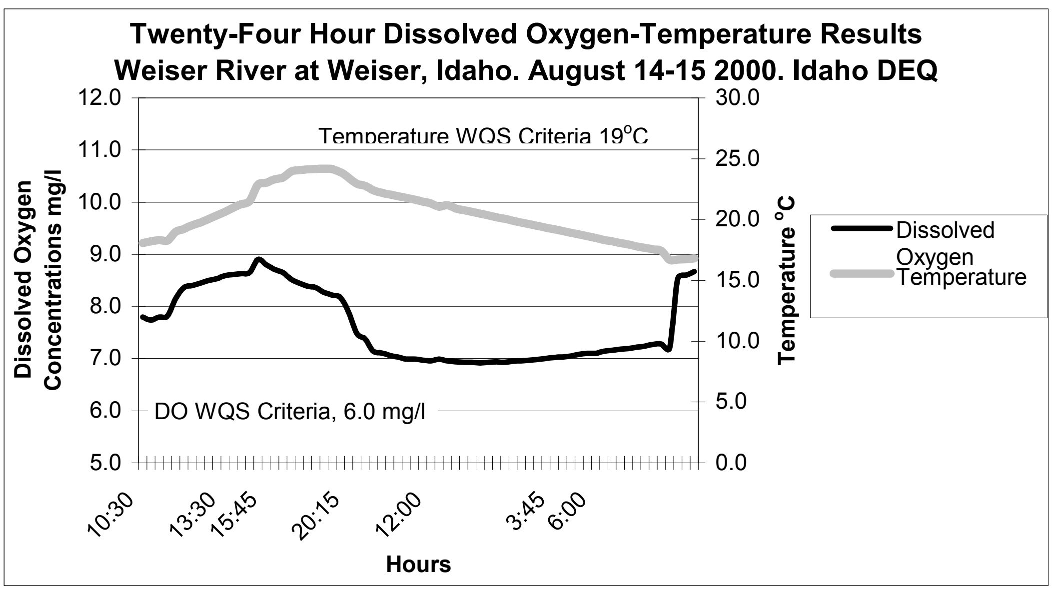



**Figure 34. Diel Dissolved Oxygen Results, DEQ 2000. Weiser River at Highway 95 Bridge at Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

The 2000 data collected by DEQ showed one period when the dissolved oxygen level dropped below the WQS criterion for the protection of cold water aquatic life. This represented 5% of the total number of instantaneous measurements collected in 2000 and 2001.

To fully understand dissolved oxygen's reaction to the environment, 24-hour monitoring should be conducted. Diel monitoring can assist in identifying the possible cause of dissolved oxygen saturation or dissolved oxygen sags. The results displayed in Figure 34 show dissolved oxygen sags, which could be associated with aquatic plant growth. That is, when water temperatures were dropping, water column dissolved oxygen concentrations should have been rising due to increased saturation potential at lower temperatures. However, this was not the case, so other factors were considered. Since dissolved oxygen levels sagged during the period of respiration and once again rose during periods of photosynthesis (daylight hours), algae growth could be affecting water column dissolved oxygen levels. However, other factors can contribute to dissolved oxygen fluctuations as well, such as biochemical oxygen demanding materials and chemical oxygen demanding materials.

DEQ diel monitoring conducted in 2000 took place during a historic low-flow period and during the hottest part of the summer months. Although dissolved oxygen concentrations sagged, they never dropped below the critical level of 6.0 mg/L. Dissolved oxygen readings were never at a point that would have had detrimental impacts to the biological communities in the Weiser River. Additionally, no significant fish kills have ever been reported on the Weiser River. Low dissolved oxygen is often the cause of fish kills in lotic ecosystems (e.g., in the Snake River in 1990).

A review of the complaint log at DEQ's Boise Regional Office could not locate any complaints concerning odors or concerns about aesthetic value. There have been no health warnings issued that could be associated with aquatic growth.

*Nutrients*

Unlike the constituents discussed above, there are no numeric criteria WQS for nutrients. The WQS for nutrients is a narrative criterion as described in IDAPA 52.01.02.200.06 under the general surface water criteria, IDAPA 52.01.02.200. Further explanation the nutrient criterion is located in Section 2.4.

Decreased dissolved oxygen can be an indicator of excess nutrients in the water column. This is especially true during diel evaluations. The dissolved oxygen concentrations decreased at night, indicating that respiration of aquatic plants was occurring. However, with the decrease in water temperature during the same period, higher dissolved oxygen levels should have been noted due to increased saturation potential. The data indicate the presence of aquatic plant growth in the Weiser River, but the diel dissolved oxygen survey did not indicate the aquatic plant growth was at a level that could be classified as a nuisance and/or at levels that impair the designated uses.

Although it has been determined that nutrients are not impairing the designated uses in the lower Weiser River, it has been determined that nutrients entering the Snake River from the Weiser River Watershed are contributing to the impairment of the Snake River's beneficial uses. The *Snake River-Hells Canyon SBA TMDL* (Idaho DEQ and Oregon DEQ 2004) has identified phosphorus as the nutrient of concern originating from the

Weiser River Watershed and other watersheds discharging to the Snake River. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has set a total phosphorus target of 0.07 mg/L to prevent eutrophic conditions. This target has also been assigned to the major tributaries to the Snake River in southwestern Idaho and eastern Oregon (i.e., Payette River, Boise River, Malheur River, Owyhee River, and Weiser River). Current total phosphorus levels in the Weiser River exceed the total phosphorus target of 0.07 mg/L.

Using historic flow and total phosphorus data The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2002) has established a load allocation for total phosphorus at 144 kilograms per day (kg/day), which is an average concentration of 0.07 mg/L total phosphorus. This is an approximate 63% reduction from current loading. This load reduction applies during the period from May through September. This period has been identified as the critical period to prevent nuisance aquatic growth in the Snake River and Brownlee Reservoir.

One purpose of this SBA is to examine, in more detail, existing water quality data and refine the Snake River total phosphorus load allocation assigned to the Weiser River. Discussion of possible load allocations from the lower Weiser River is found in Section 3.2.

*Sediment*

As demonstrated in the biological assessment of the lower Weiser River, sediment is impairing the designated cold water aquatic life use. The WQS address sediment through narrative criteria in IDAPA 58.01.02.200.8; this is discussed in detail in Section 2.3.

The biological assessment has determined that sediment is impairing the designated uses. This impairment is based on the presence of sediment tolerant and/or the absence of sediment intolerant species. The periphyton species present indicated an abnormally high percentage (>20%) of motile species that are tolerant of sediment. The lack of sediment intolerant macroinvertebrate species also indicates sediment is impairing the designated uses.

Total suspended solids (TSS) and suspended sediment concentrations varied for the four different years that data are available for the Weiser River below Galloway Dam (See Table 26). Suspended sediment concentrations were only monitored in 1983 (Clark 1985). Except for trend water quality monitoring conducted by the USGS, all other studies focused on TSS. An intensive study and comparison of suspended sediment and TSS showed that the analytical method used for TSS may underestimate the total sediment load (Gray et al. 2000).

**Table 26. Total Suspended Solids and Suspended Sediment Results for Weiser River at the Highway 95 Bridge at Weiser, Idaho, and at Unity Bridge near Weiser, Idaho, 1983, 1988-1989, and 2000-2001.**

| | Weiser River Highway 95 at Weiser, Idaho 1988 TSS[a] (mg/L)[b] | Weiser River Highway 95 at Weiser, Idaho 1989 TSS (mg/L) | Weiser River Highway 95 at Weiser, Idaho 2000 (Apr-Sep) TSS (mg/L) | Weiser River Highway 95 at Weiser, Idaho 2001 TSS (mg/L) | Weiser River at Unity Bridge near Weiser, Idaho 1983 SS[c] (mg/L) |
|---|---|---|---|---|---|
| Average | 16 | 33 | 39 | 34 | 47 |
| Standard Deviation | 11 | 34 | 18 | 44 | 59 |
| Maximum | 37 | 145 | 64 | 160 | 229 |
| Minimum | 4 | 1 | 10 | 2 | 4 |

*a Total Suspended Solids*
*b Milligrams per Liter*
*c Suspended Sediment*

With the data available for the years shown in Table 26, a sediment rating curve was developed to evaluate TSS loads and concentrations throughout the calendar year based on the function of discharge. The TSS data were normalized into natural log values. The regression analysis for the measured TSS and discharge are shown in Figure 35.

The use of normalized data is used to adjust for the high variability of discharge that can occur in the watershed from year to year. The data were addressed in this fashion to assist in predicting what the average, or normal, discharge would have on loading analysis. Most of the analysis of the actual discharge measurements and loads compared to the normalized discharge and loads showed that the normalized data had a less square root error than what was found on the actual results.

The first step in the analysis was to calculate the sediment load based on the flows and TSS concentrations recorded for the date samples were collected. With available average daily discharge recorded at the USGS site 12 miles upstream and a water budget developed for outflows and inflows, an overall estimated discharge to the Snake River was calculated. This estimated daily discharge value was then applied to the sediment rating curve developed for the Highway 95 Bridge site.

$$\ln(y) = 1.6351\ln(x)$$
$$r^2 = 0.6775$$

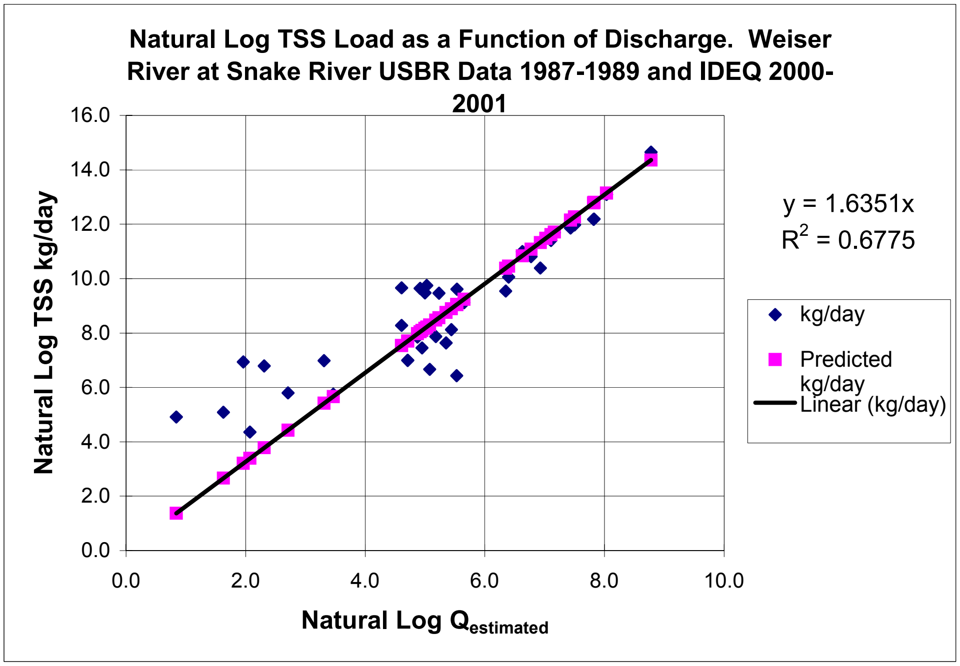



**Figure 35. Natural Log Plots for Measured Total Suspended Solids Load (Y axis) as a Function of Measured Flows (X axis). Weiser River, Galloway Dam to the Snake River.**

The value obtained as the estimated suspended sediment-solids load for that day's normal (average) flow is shown as **y**. The variable ln**(x)** is the natural log value for the average (normal) flow for that date. So, the estimated suspended sediment load would appear as:

$$\text{TSS Load } \ln(y) = 1.6351\ln(x) \text{ or}$$

$$\text{TSS Load } (y) = \exp(1.6351n(x))$$

As an example, for the date July 26, 2000, the following natural log values were obtained:

Measured TSS = 46 mg/L

Natural Log Measured Discharge = 5.7301 (308 cfs)

Natural Log Measured TSS Load = 10.4533 (34,657 kg/day)

For July 26, the estimated discharge, TSS load, and concentration would be:

Natural Log Average Daily Discharge (Budget) = 4.6674 (106 cfs)

Estimated TSS Load = 2,063 kg/day

Estimated TSS Concentration = 8 mg/L

The values presented in Table 27 show the statistical analysis for the dates when actual monitoring was conducted. The results presented in Table 28 are the monthly and overall average values when the sediment rating curve was applied to all the normalized discharges for one year. The results from the sediment rating curve model provide a more detailed monthly sediment analysis and even a more detailed daily load and concentration analysis. However, the results from the modeling effort may underestimate high-yield slugs of TSS associated with the rising hydrograph and/or storm events. The sediment curve rating may equally overestimate long- and short-term TSS averages. These over/under estimations will be examined in more detail in the development of a TMDL for this parameter.

**Table 27. Measured and Estimated Discharge, Total Suspended Solid Loads, Total Suspended Solids Concentration, and Error Bias. Weiser River, Galloway Dam to the Snake River.**

| | Measured Discharge (cfs)[a] | Measured TSS[b] Concentrations (mg/L)[c] | Measured TSS Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated TSS Concentration (mg/L) | Estimated TSS Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 841 | 28.5 | 83,069 | 1,002 | 26.0 | 103,971 |
| Standard Deviation | 1,281 | 33.0 | 157,616 | 947 | 18.0 | 125,791 |
| Maximum | 6,577 | 160.0 | 917,377 | 2,695 | 54.7 | 360,428 |
| Minimum | 48.0 | 1.0 | 989 | 6.3 | 1.3 | 20 |
| Count | 42 | 42 | 42 | 42 | 42 | 42 |
| | | | | | Square Root Error | 1,038,467 |
| | | | | | % Difference Measure | 10.6% |
| | | | | | % Difference Estimated | 10.0% |

*a cubic feet per second*
*b total suspended solids*
*c milligrams per liter*
*d kilograms per day*

**Table 28. Estimated Monthly Discharge and Total Suspended Solids Loads and Concentrations for Weiser River at the Highway 95 Bridge at Weiser, Idaho. Weiser River, Galloway Dam to the Snake River.**

| | Estimated Discharge at Snake River (cfs)[a] | Estimated TSS[b] Concentrations at Snake River (mg/L)[c] | Estimated TSS Loads at Snake River (kg/day)[d] |
|---|---|---|---|
| Oct | 186 | 14.0 | 6,413 |
| Nov | 308 | 19.5 | 15,470 |
| Dec | 615 | 31.3 | 48,753 |
| Jan | 927 | 41.0 | 99,155 |
| Feb | 1,536 | 57.5 | 235,780 |
| Mar | 2,409 | 79.0 | 470,904 |
| Apr | 2,488 | 80.9 | 492,982 |
| May | 2,547 | 82.2 | 512,739 |
| June | 1,550 | 58.1 | 234,926 |
| July | 388 | 22.7 | 23,385 |
| Aug | 227 | 16.0 | 8,928 |
| Sep | 181 | 13.7 | 6,086 |

*a cubic feet per second*
*b total suspended solids*
*c milligrams per liter*
*d kilograms per day*

### *Substrate Sediment*

As discussed in Section 2.4, substrate composition will affect biological communities and structure. In August 2003, DEQ evaluated the substrate at three locations on the lower Weiser River. Table 29 shows the percentage of the substrate that is less than 6.0 mm in size.

**Table 29. Percent Substrate Less Than 6 Millimeters in Size. Weiser River, Galloway Dam to the Snake River.**

| | Weiser River at Highway 95 Bridge at Weiser, Idaho | Weiser River at Unity Bridge near Weiser, Idaho | Weiser River below Galloway Dam | Average for Segment |
|---|---|---|---|---|
| Percent of Substrate Less than 6 mm in Size | 74.8% | 29.9% | 20.3% | 41.7% |

### Status of Beneficial Uses

Both the narrative and numeric criteria were examined for the listed pollutants of concern to determine beneficial use support status in the Weiser River. A biological assessment was conducted and compared to indices developed and published in the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). Further analysis of the biological communities revealed that the pollutants of concern listed in the 1998 Idaho §303(d) list are impairing the designated uses established for the lower Weiser River. Table 30 provides information on the final assessment and status of the designated beneficial uses.

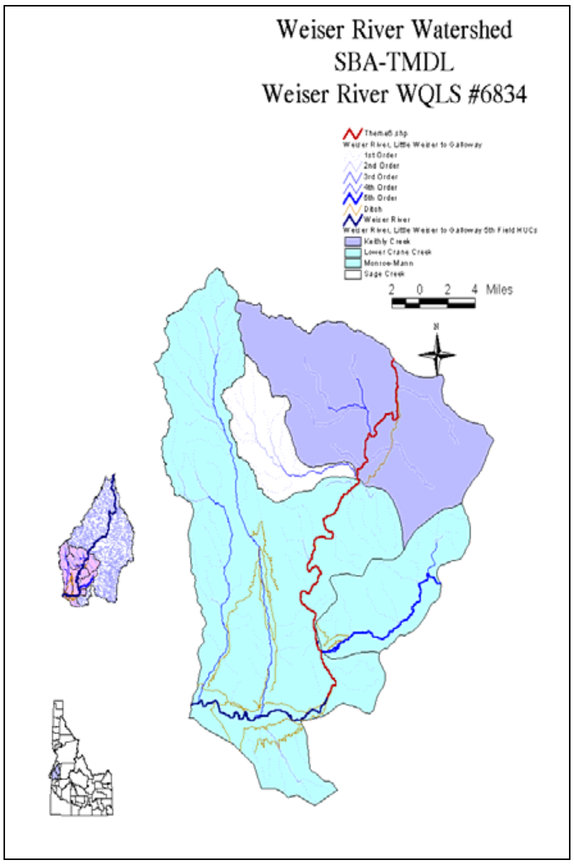
**Table 30. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Lower Weiser River at Confluence with Snake River. Weiser River, Galloway Dam to the Snake River.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendations |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not Supported | Temperature and Sediment | Numeric Criteria Exceeded for Temperature; Biological Assessment Indicated Impairment for Sediment | Develop TMDL to Address Temperature. Develop TMDL to Address Sediment. Develop Total Phosphorus Allocations.[a] |
| Primary Contact Recreation | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Secondary Contact Recreational | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Drinking Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

In addition to the designated uses for the lower Weiser River, nutrient targets have been established through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Although evaluation and modeling for total phosphorus in the lower Weiser River have shown a reduction, levels must be decreased further in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). A discussion of the total phosphorus load allocation is located in Section 3.2.

## Weiser River, Little Weiser River to Galloway Dam




| Water Body | Weiser River, Little Weiser River to Galloway Dam |
|---|---|
| Miles of impaired water body | 20.9 |
| Listed pollutants | Sediment, Bacteria, and Nutrients |
| Potential Impaired designated uses | Cold water aquatic life and primary contact recreation |
| Potential sources | Overland flow, irrigated induced erosion, stream bank erosion, animal feeding operations, wildlife, septic systems |

### Discharge (Flow) Characteristics

The USGS discharge gage (13266000), located near Weiser, is approximately 5 miles upstream of Galloway Dam and approximately 2 miles below Crane Creek. Diversions are limited to one in-river diversion located approximately 20 miles upstream of the gage site and approximately 5 miles downstream of the confluence with the little Weiser River. Major tributaries to this section of the Weiser River include the Little Weiser River, Sage Creek, Keithly Creek, and Crane Creek. Crane Creek has the most impact to late season flows due to irrigation water releases from Crane Creek Reservoir. Figure 36 shows the normalized discharge recorded at USGS Gage No.13266000 and above Crane Creek at historic USGS Gage No. 132585000. Appendix C contains information on data sources and descriptions of current and historic discharge measurements for middle Weiser River.

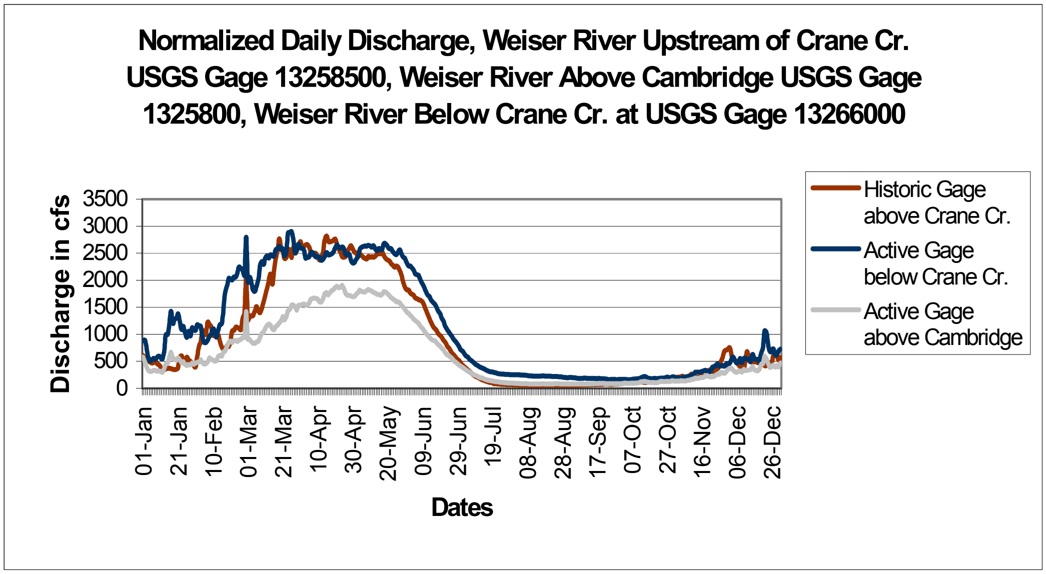



**Figure 36. Normalized Average Daily Discharge at USGS Gage No. 13266000, Historic Discharge Weiser River above Crane Creek at USGS Gage No. 13263500, and above Cambridge at USGS Gage No. 13258500. Weiser River near Weiser, ID.**

Of the inflow tributaries, Sage, Keithly, and Crane Creeks and the Little Weiser River, only Crane Creek has an active USGS discharge gage (13265500). Historic discharge data are available for two sites, one on the Weiser River upstream of Crane Creek (1363500) and the other on the Little Weiser River near the confluence. Crane Creek is the only tributary to the Weiser River Watershed other than Mann Creek that could be classified as a regulated water body.

Irrigation water is stored in Crane Creek Reservoir and released for late season irrigation water that is diverted from the Weiser River via the Sunnyside and Galloway Canals. A USGS site (13258500) that is currently maintained near Cambridge offers discharge data upstream of the Little Weiser River (See Figure 36). Figure 37 shows the discharge from the two major tributaries (Crane Creek and Little Weiser River), the increased discharge associated with irrigation water demand from the Crane Creek Watershed (Crane Creek Reservoir), and an earlier seasonal peak discharge occurring in the Crane Creek Watershed compared to the Little Weiser Watershed.

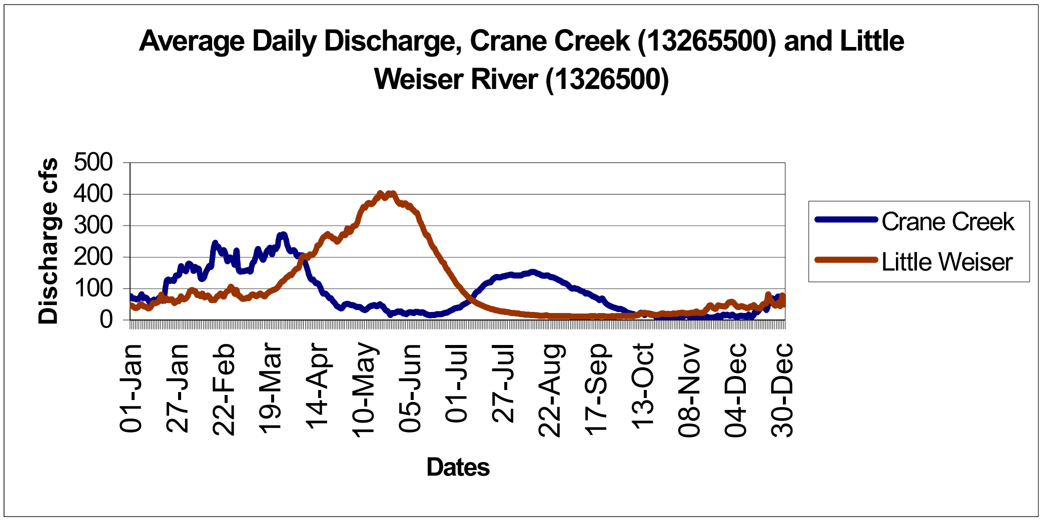



**Figure 37. Normalized Average Daily Discharge at USGS Gage No. 13265500 (Crane Creek) and Historic Discharge from USGS Gage No. 1326500 (Little Weiser River).**

## Biological and Other Data

Since Idaho WQSs apply narrative criteria to certain pollutants, namely sediments and nutrients (IDAPA 58.01.02.200), the biological communities should be examined prior to reviewing water quality information. For the Weiser River, three biological communities were examined: periphyton, fisheries, and macroinvertebrates. The data collected on these communities will assist in determining if designated uses are impaired and if the listed pollutants are impairing those uses.

### *Periphyton*

Periphyton samples were collected at three locations on the middle Weiser River: Weiser River above Crane Creek (WR-004), Weiser River above Midvale (WR-005), and Weiser River below the confluence with the Little Weiser River (WR-006). Samples were collected by methods described in *Idaho DEQ Beneficial Use Reconnaissance Project* (Idaho DEQ 1998*b*). A site below Galloway Dam (WR-003) also received monitoring. Although WR-003 is not within listed segment 6834, it does provide information on the expected periphyton communities in the Weiser River below Galloway Dam (WR-003). The only substantive difference that would be expected between the segments downstream and upstream of Galloway Dam is a difference in discharge. This primarily would impact habitat.

Samples were collected in 2000 and 2001 at a total of eight stations on the Weiser River. Samples were sent to Loren Bahls, Ph.D., (Hannaea) of Helena, Montana, for analysis and biological community interpretation. Dr. Bahls provided written narratives to describe species composition and structure of the periphyton communities found at these locations (Bahls 2000 and Bahls 2001).

Dr. Bahls (2000 and 2001) described a dramatic change in structure and composition of periphyton communities from the site located above Crane Creek to the Highway 95 Bridge site at Weiser, Idaho. Pollution Tolerance Index scores declined and Siltation Index scores increased indicating moderate to severe impairment and partial support to non-support of beneficial uses including cold water aquatic life for sites below Galloway Dam. It may be extrapolated that the biological communities found directly below Galloway Dam can also be found directly above; that is, the only difference above and below the dam is the amount of discharge. It is not expected that concentrations of pollutants would change. However, the overall pollutant load would decrease due to diversion of water to irrigation canals. Figure 38 shows the results of the Siltation Index for the three samples from the middle Weiser River sampling sites. Figure 39 show the results for the Pollution Tolerance Index.

Figure 38 indicates an increase the Siltation Index scores below Galloway Dam. However, the index does not indicate non-support due to sediment. The index showed minor to no impairment to the periphyton communities upstream of Crane Creek. Below the confluence with Little Weiser River, the Siltation Index showed a slight increase in the index value, indicating slight to minor impairment of the periphyton communities.

For the Pollution Tolerant Index (Figure 39), the scores indicated minor to no impairment for the Weiser River site above Crane Creek. Below Little Weiser River, the Pollution Tolerant Index indicated excellent conditions to slight impairment.

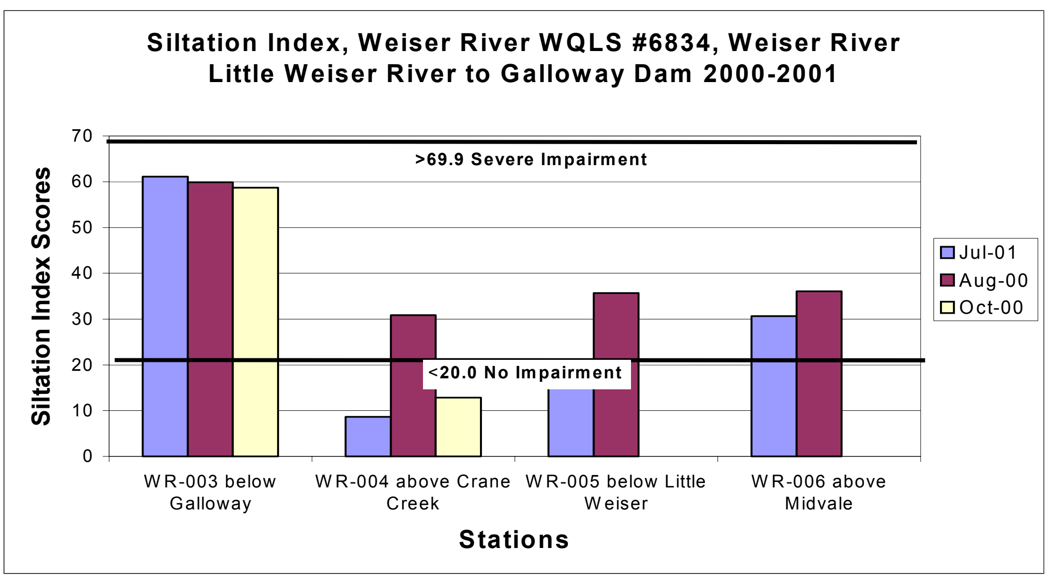



**Figure 38. Siltation Index Values. Middle Weiser River. Weiser River, Little Weiser River to Galloway Dam.**

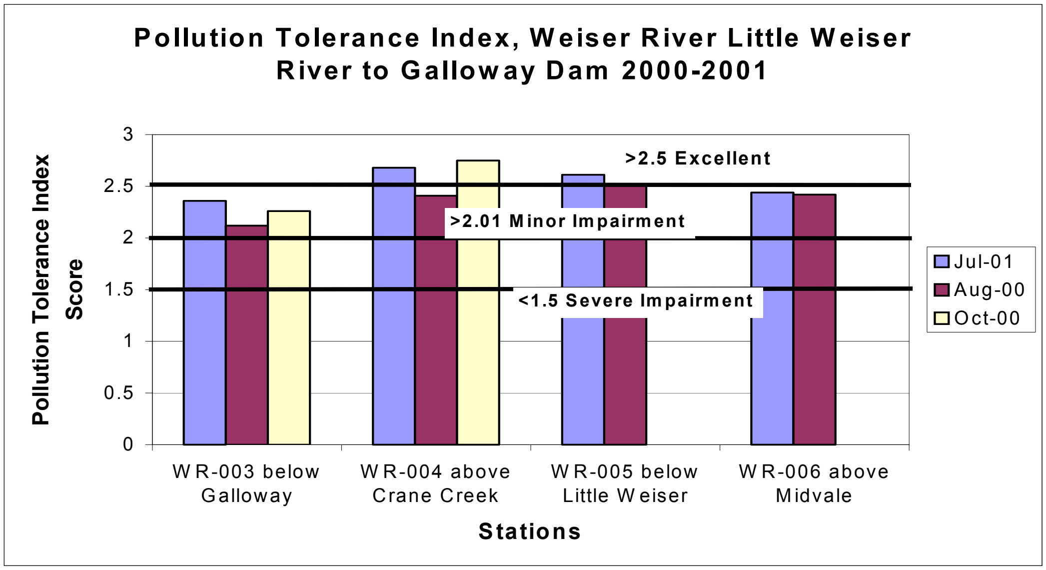



**Figure 39. Pollution Tolerance Index Values. Middle Weiser River. Weiser River, Little Weiser River to Galloway Dam.**

The results from the examination of RDI scores for the middle Weiser River showed mixed results for the four stations evaluated with the 2000 periphyton data (Table 31). To get a better picture of the water quality, the RDI should be looked at with other index scores. When combined with at least one other index, such as the RMI or RFI, if the total category score is less than 2, then the water body is determined to be not fully supporting cold water aquatic life.

*Effects of Temperature on Periphyton*

All species of algae have a temperature range under which they can reach optimum biomass. The range for temperate species, such as the diatoms found throughout Southwest Idaho, is 15 $^{o}$C to 30 $^{o}$C (Hustedt 1956). Temperatures below the optimum range may cause a decrease in community composition and abundance. Temperatures above the optimum range (>30 $^{o}$ C) often leads to a complete shift in the algal community, whereby diatoms are replaced by blue-green algae (Patrick 1969).

Water temperatures in the Weiser River from the Little Weiser River to the Snake River fluctuate according to the season. The water is relatively cool in the spring, but when algal communities are developing in the late spring and in the summer, water temperatures routinely reach and exceed 24 $^{o}$C. Despite this trend, water temperatures rarely deviate from the range 15 $^{o}$C to 30 $^{o}$C during the growing season. As a result, it is unlikely that water temperature (whether it be too hot or too cold) limits algae growth in the Weiser River.

**Table 31. River Diatom Index Scores. Weiser River, Little Weiser River to Galloway Dam.**

| Metric | Weiser River below Galloway Dam Metric Score | Weiser River below Galloway Dam RDI[a] Score | Weiser River above Crane Creek Metric Score | Weiser River above Crane Creek RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 28.9% | 1 | 46.9% | 1 |
| % Pollutant Tolerant | 16.5% | 1 | 5.7% | 3 |
| Eutrophic Taxa Richness | 24 | 1 | 24 | 1 |
| % Nitrogen Heterotrophs | 38.2% | 1 | 28.2% | 1 |
| % Polysaprobic | 22.7% | 1 | 19.2% | 1 |
| Alkaliphilic Taxa Richness | 29 | 3 | 28 | 3 |
| % Requiring High Oxygen | 10.3% | 1 | 6.4% | 1 |
| % Very Motile | 35.5% | 1 | 25.7% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index (RDI) Score | | 15 | | 17 |
| Final Condition Category Rating | | 1 | | 1 |

*a River Diatom Index, RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

**Table 31 (Continued). River Diatom Index Scores. Weiser River, Little Weiser River to Galloway Dam.**

| Metric | Weiser River above Midvale Metric Score | Weiser River above Midvale RDI Score | Weiser River below Little Weiser River Metric Score | Weiser River below Little Weiser River RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 60.3% | 3 | 53.4% | 1 |
| % Pollutant Tolerant | 9.7% | 3 | 11.1% | 3 |
| Eutrophic Taxa Richness | 16 | 3 | 21 | 1 |
| % Nitrogen Heterotrophs | 19.5% | 3 | 21.7% | 1 |
| % Polysaprobic | 10.0% | 1 | 17% | 1 |
| Alkaliphilic Taxa Richness | 21 | 3 | 23 | 3 |
| % Requiring High Oxygen | 8.2% | 1 | 11.3% | 1 |
| % Very Motile | 28% | 1 | 25.1% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index (RDI) Score | | 23 | | 17 |
| Final Condition Category Rating | | 2 | | 1 |

*a River Diatom Index, RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

For the purpose of the assessment of water quality in the middle Weiser River, the different metrics also provides an insight to the pollutants impairing the designated uses. The percent of very motile species, or those species that are very tolerant of sediment, exceeds 20% at all sites in the lower Weiser River. That is, over 20% of the periphyton species found at these river locations were sediment tolerant species. If less than 7% of the total abundance consisted of very motile species, this would indicate little to no human disturbances in the watershed.

*Fisheries*

In 1999, IDFG conducted a fish survey on the middle Weiser River. Two sites are located in the canyon between Galloway Dam and just below Midvale. The last two locations are located in an area known as the canyon, with limited access. Cold water species were found in all locations. Table 32 shows the overall synopsis of fish species found within the canyon reach and at Midvale, Idaho. Table 21 presented data for below Galloway Dam, which also should be representative of species found directly upstream.

Fish data collected in 1999 were evaluated with the RFI. According to the *Water Body Assessment Guidance* (Grafe et al. 2002), all of the RFI scores are below the threshold limit. With this in mind, the water body would be classified as not fully supporting cold water aquatic life.

**Table 32. Species Count and River Fish Index Scores, Weiser River Lower Canyon Section, Upper Canyon Section, and Near Midvale, Idaho. Weiser River Little Weiser River to Galloway Dam.**

| Species Found | Weiser River, Lower Canyon | | Weiser River, Upper Canyon | | Weiser River near Midvale, Idaho | |
|---|---|---|---|---|---|---|
| | Count | Percent of Total | Count | Percent of Total | Count | Percent of Total |
| Bridgelip sucker | 9 | 6.0% | 22 | 8.7% | 5 | 3.8% |
| Channel catfish | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Chiselmouth | 7 | 4.7% | 31 | 12.3% | 17 | 12.9% |
| Largescale sucker | 7 | 4.7% | 50 | 19.8% | 29 | 22.0% |
| Mountain whitefish | 3 | 2.0% | 9 | 3.6% | 7 | 5.3% |
| Northern pike minnow | 20 | 13.4% | 47 | 18.6% | 22 | 16.7% |
| Smallmouth bass | 65 | 43.6% | 54 | 21.3% | 7 | 5.3% |
| Speckled dace | 0 | 0.0% | 7 | 2.8% | 2 | 1.5% |
| Common carp | 9 | 6.0% | 1 | 0.4% | 0 | 0.0% |
| Longnose dace | 0 | 0.0% | 4 | 1.6% | 1 | 0.8% |
| Redside shiner | 22 | 14.8% | 10 | 4.0% | 38 | 28.8% |
| Redband trout | 5 | 3.4% | 10 | 4.0% | 4 | 3.0% |
| Sculpin | 2 | 1.3% | 8 | 3.2% | 0 | 0.0% |
| Rainbow trout | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Mountain sucker | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| | | | | | | |
| Total Number | 149 | 100% | 253 | 100% | 132 | 100% |
| RFI Score[a] | 35 | | 41 | | 45 | |

*a River Fish Index, RFI Score <54=condition rating "below minimum threshold" RFI Score 55-69=condition rating "1" RFI Score70-75=condition rating "2" RFI Score>75=condition rating "3"*

### *Macroinvertebrates*

Macroinvertebrate samples were collected at two sites on the middle Weiser River: Weiser River above Crane Creek near Weiser, Idaho, and Weiser River above Midvale, Idaho. One set of samples was collected in August 2001 and one set was collected in 2002. The 2001 samples were analyzed with the use of the RMI developed by DEQ (Grafe et al. 2002). The results from 2001 are reported in Table 33. The results from 2002 have not been received by DEQ's Boise Regional Office.

The results from the samples collected in 2001 indicate the macroinvertebrate communities found at the two stations from Little Weiser River to Galloway Dam represent good water quality. All samples were above the threshold scoring levels and were the highest condition rating score that can be obtained by using the RMI (Grafe et al. 2002). When combined with at least one other index score, such as the RDI or the RFI, and the average condition rating score is greater than 2, the water body would be determined to be fully supporting its beneficial uses. However, as is the case of the middle Weiser River, if one of the indices is less than the threshold value, then the water body is not fully supporting the beneficial uses. For the middle Weiser River, the RFI score was below the threshold value (Grafe et al. 2002).

**Table 33. River Macroinvertebrate Index Scores, Weiser River above Crane Creek near Weiser, Idaho, and above Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.**

| Metric | Above Crane Creek August 2001 RMI[a] Metric Result | Above Crane Creek August 2001 RMI Metric Score | Above Midvale August 2001 RMI Metric Result | Above Midvale August 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 35 | 5 | 32 | 5 |
| Number EPT[b] Taxa | 20 | 5 | 16 | 3 |
| Percent Elmidae | 6.66% | 5 | 4.94% | 5 |
| Percent Dominate Taxa | 1.33% | 5 | 14.99% | 5 |
| Percent Predators | 4.66% | 3 | 6.92% | 3 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index, RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3"*
*b Ephemeroptera-Plecoptera-Trichoptera*

Since the RFI score indicates the river is not supporting its beneficial uses, the high RMI score may seem irrelevant. However, the use of individual metrics and other indices can be useful in determining what pollutant may be impairing the uses. As pointed out by Clark (2003), the presence or absence of certain Plecoptera (stonefly) species can assist in determining if sediment is a pollutant affecting the beneficial uses. In the macroinvertebrate analysis of samples collected on the lower Weiser River, Clark (2003) noted the lack of Plecoptera species that would be classified as sediment intolerant, which indicates fine sediments are impairing the beneficial uses designated for the lower Weiser River. Most of the species analyzed by Clark indicated that fine sediment dominated the substrate in the lower Weiser River (more than 30% of the sediment was fine sediment [<6 mm]).

### Water Column Data

Unlike the lower Weiser River from Galloway Dam to the Snake River, the middle segment has limited water quality data. Appendix C contains available data that will assist in determining the support status of the designated uses and the loading capacity required for the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ 2003) and for the lower Weiser River.

The USGS has conducted sporadic monitoring on the Little Weiser River, Weiser River, and some of the tributaries located within the hydraulic boundaries of this segment. Most of the sampling consisted of monitoring of one or two parameters over a short duration. EPA monitoring conducted in the year 1975 was a portion of the overall watershed monitoring conducted by Tangarone and Bogue (1976). The Tangarone and Bogue (1976) study provides little information and is mainly a snapshot of a short monitoring effort that lasted only a few days. However, it is one of the few published reports concerning this segment.

In the years 2000-2001, DEQ conducted a more intense study that addressed the pollutants on the Idaho 1998 §303(d) list (Ingham 2000). This study examined in closer detail the listed pollutants and the possible impacts associated with the listed pollutants. Some of the parameters selected in the 2000-2001 study focused on numeric criteria established in the WQS to support the designated use for this segment. The parameters used to determine compliance with the established designated uses included bacteria, temperature, and dissolved oxygen. Nutrient and sediment samples were collected to assist in meeting the load allocation established by the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). Nutrient and sediment data were also collected to determine any additional reductions that might be required after further examination of biological data and the support status of the designated uses is determined for the Weiser River from the Little Weiser River to Galloway Dam.

Each of the listed pollutants of concern will be discussed separately. Recommendations will then be made on actions to address those pollutants related to the Weiser River or to address the targets established in the *Snake River-Hells Canyon TMDL* (Idaho DEQ 2003).

*Bacteria*

The middle Weiser River, from the Little Weiser River to Galloway Dam, is designated for primary contact recreation (IDAPA 58.01.02.140.18.SW-1). A discussion of the application of bacteria criteria and contact recreation is located in Section 2.3.

Past water quality monitoring conducted on this segment for fecal coliform triggered additional monitoring because elevated levels were found (past studies focused on the fecal coliform indicator for the support of primary and secondary contact recreation; in 2000, Idaho changed the criteria to the use of *E. coli*). The results from USGS monitoring for fecal coliform (conducted in 1997 and 2000) are shown in Appendix C. With the change in the criteria to *E. coli* in the year 2000, it was decided that additional monitoring for *E. coli* would be required to determine if the middle Weiser River is supporting the primary contact recreation designation under the new criteria.

Data collected in the years 2000, 2001, and 2002 focused on the *E. coli* criteria. Those studies in 2001 and 2002 also focused on obtaining a geometric mean to determine compliance with IDAPA 58.01.02.251.01.c. The individual results for *E. coli* obtained in the two years of monitoring conducted by DEQ are shown in Appendix C. The results for the geometric mean data for Galloway Dam and Midvale are shown in Table 34. It is assumed that *E. coli* concentrations are not going to be different upstream and downstream of Galloway Dam. The only difference between upstream and downstream would be the overall *E. coli* load due to irrigation water withdrawal from the Weiser River.

The data indicate that the primary and secondary contact recreation geometric mean criterion is not exceeded at the two sites receiving the intensive monitoring. The data demonstrate the segment is fully supporting the primary contact recreation designated use.

**Table 34. *E. coli* Geometric Mean Results, Years 2001 and 2002. Weiser River, Little Weiser River to Galloway Dam.**

| Station Location | Month and Year of Data | Number of Samples | *E. coli* Geometric Mean (cfu/100 ml)[a] |
|---|---|---|---|
| Weiser River at Midvale | August 2001 | 5 | 126 |
| Weiser River at Midvale | August 2002 | 5 | 114 |
| Weiser River at Galloway Dam | August 2001 | 5 | 88 |
| Weiser River at Galloway Dam | August 2002 | 5 | 44 |

*a colony forming units per 100 milliliters*

*Nutrients*

One of the main indicators of whether nutrients are affecting water quality is dissolved oxygen. This is especially true for diel evaluations. One of the physical properties of water is that it has a higher oxygen saturation level as temperature decreases; therefore, higher dissolved oxygen levels should be noted at night than during the day. However, the dissolved oxygen levels decreased at night. This indicates that respiration or decay of aquatic plants is occurring.

The Weiser River data indicate the presence of aquatic plant growth in the middle Weiser River above Galloway Dam. However, the diel dissolved oxygen levels do not indicate that the aquatic plant growth is at a level that could be classified as a nuisance or at a level that impairs the designated uses by affecting the dissolved oxygen levels. Figure 40 shows the results of the diurnal monitoring conducted in August 2001. Figures 41, 42, and 43 show the instantaneous dissolved oxygen levels recorded by USGS in 1996-1998 and 1999-2000 and DEQ data from 2000-2001.

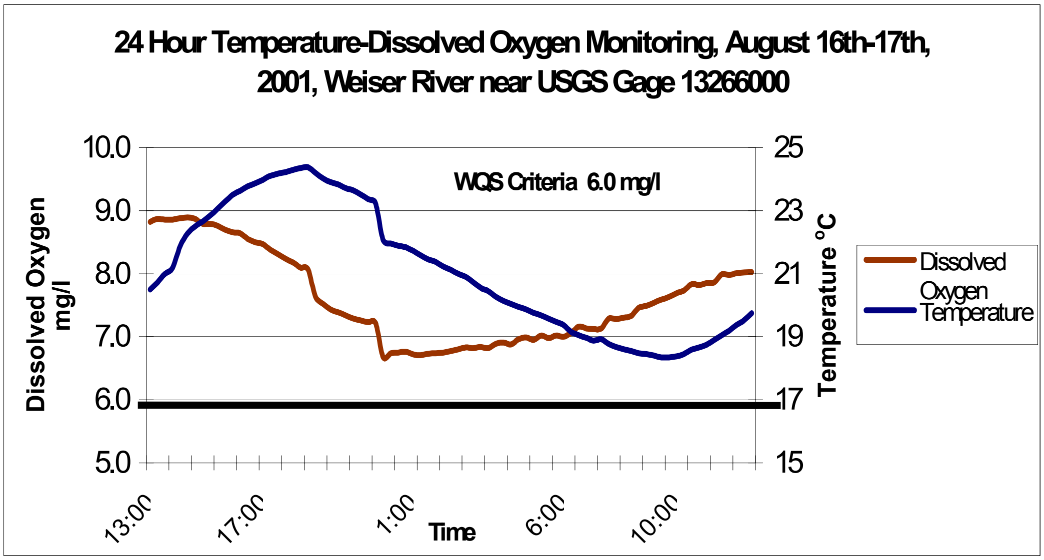



**Figure 40. Twenty-Four Hour Temperature-Dissolved Oxygen Monitoring August 16-17, Weiser River near USGS Gage No. 13266000. Weiser River, Little Weiser River to Galloway Dam.**

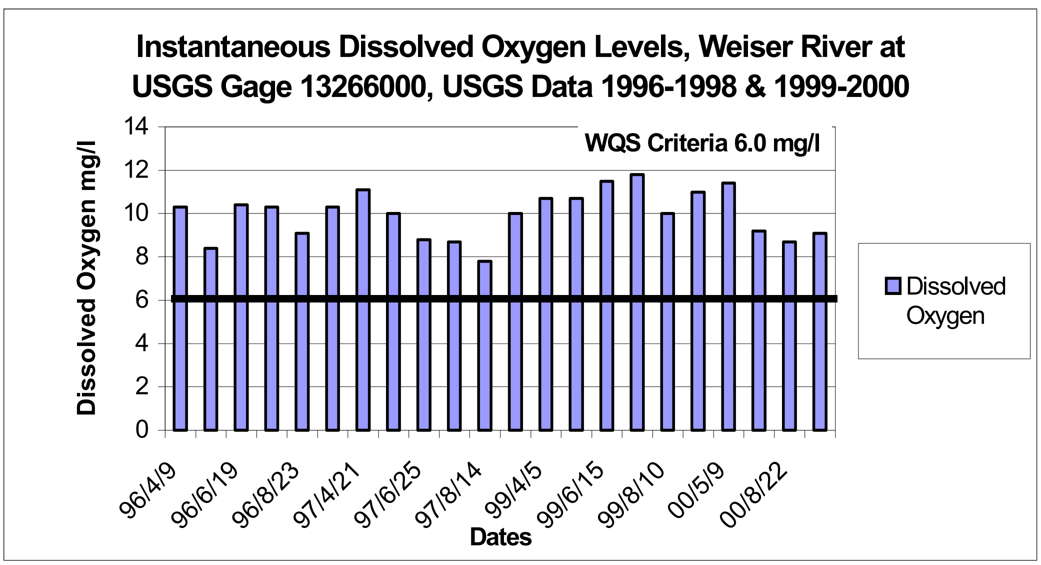



**Figure 41. Instantaneous Dissolved Oxygen Levels, Weiser River near USGS Gage No. 13266000. USGS Data 1996-1998 and 1999-2000. Weiser River, Little Weiser River to Galloway Dam.**

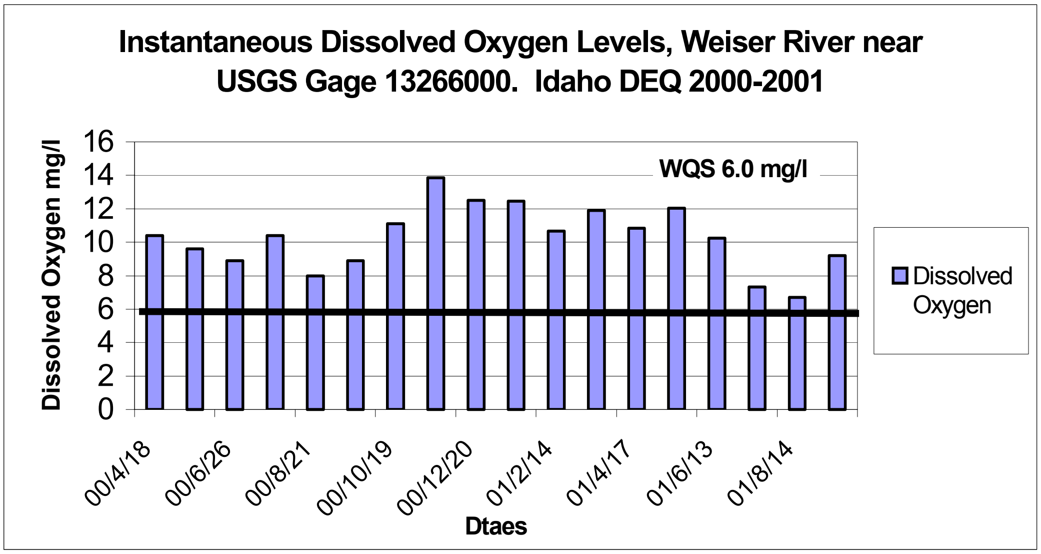



**Figure 42. Instantaneous Dissolved Oxygen Levels, Weiser River near USGS Gage No. 13266000. DEQ Data 2000-2001. Weiser River, Little Weiser River to Galloway Dam.**

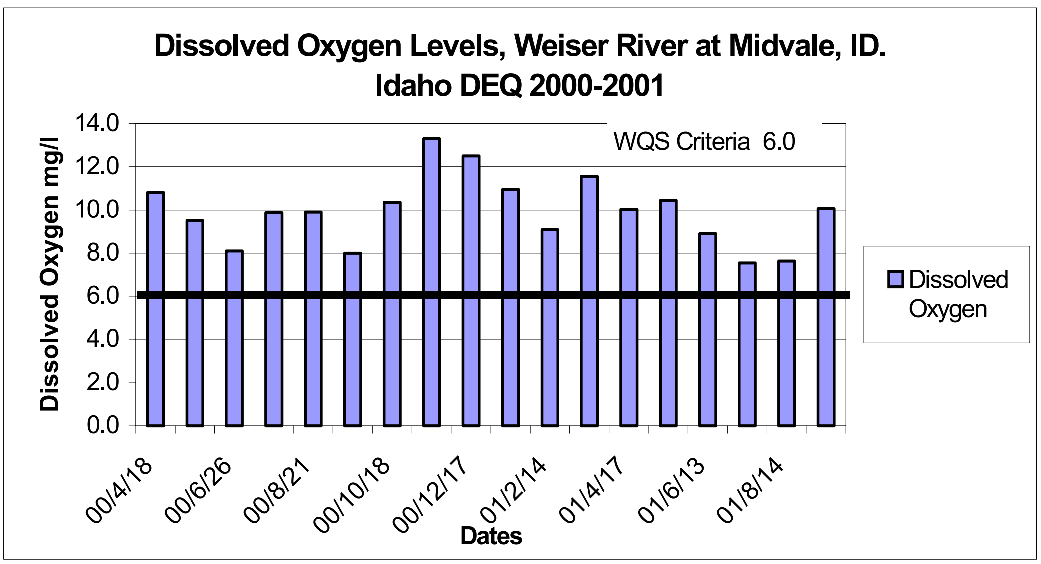



**Figure 43. Instantaneous Dissolved Oxygen Levels, Weiser River at Midvale, Idaho. DEQ Data 2000-2001. Weiser River, Little Weiser River to Galloway Dam.**

Although it has been determined that nutrients are not impairing the designated uses in the lower Weiser River, it has been determined that nutrients entering the Snake River from the Weiser River Watershed are impairing the Snake River's beneficial uses. The *Snake River-Hells Canyon SBA- TMDL* (Idaho DEQ and Oregon DEQ 2004) has identified phosphorus as the nutrient of concern originating from the Weiser River

Watershed and other watersheds discharging to the Snake River. The *Snake River-Hells Canyon SBA- TMDL* (Idaho DEQ and Oregon DEQ 2004) has set a total phosphorus target of 0.07 mg/L to prevent eutrophic conditions. This target has also been assigned to the major tributaries to the Snake River in southwestern Idaho and eastern Oregon (i.e., Payette River, Boise River, Malheur River, Owyhee River, and Weiser River). Current total phosphorus levels in the Weiser River exceed the total phosphorus target of 0.07 mg/L. This target will need to be met during the period from May through September. This period has been identified as the critical period to prevent nuisance aquatic growths in the Snake River and Brownlee Reservoir. A discussion of total phosphorus load allocations is found in Section 3.2.

*Sediment*

Sediment is a pollutant of concern listed for the middle Weiser River. Periphyton analysis indicates that sediment is impairing the designated uses within the middle Weiser River. Additionally, the loading analysis for sediment for the lower Weiser River indicates that a reduction in sediment loading from upstream must be achieved to meet the targets for the lower segment.

Data from DEQ 2000-2001 monitoring efforts (Ingham 2000) are presented in Table 35. Loading to the lower Weiser River may vary due to irrigation water withdrawals from the Sunnyside and Galloway Canals.

**Table 35. Measured Total Suspended Solid Concentrations, Discharge, and Total Suspended Solid Load, DEQ 2000-2001 Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.**

| | TSS[a] Concentration (mg/L)[b] | Discharge (cfs)[c] | TSS Load (kg/day)[d] |
|---|---|---|---|
| Average | 28 | 693 | 66,997 |
| Standard Deviation | 19 | 843 | 92,919 |
| Maximum | 64 | 2,601 | 272,274 |
| Minimum | 2.0 | 55.0 | 989 |
| Count | 18 | 18 | 18 |

*a total suspended solids*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

As with total phosphorus loads calculated for the lower Weiser River and middle Weiser River, normalized discharge should also be calculated for TSS at the USGS gage site. The normalization of the discharge will assist in establishing TSS loads and concentrations based on average daily discharges. Figure 44 shows the results of the regression analysis based on normalized discharge. Table 36 presents the normalized concentrations, discharge, and total suspended solids load.

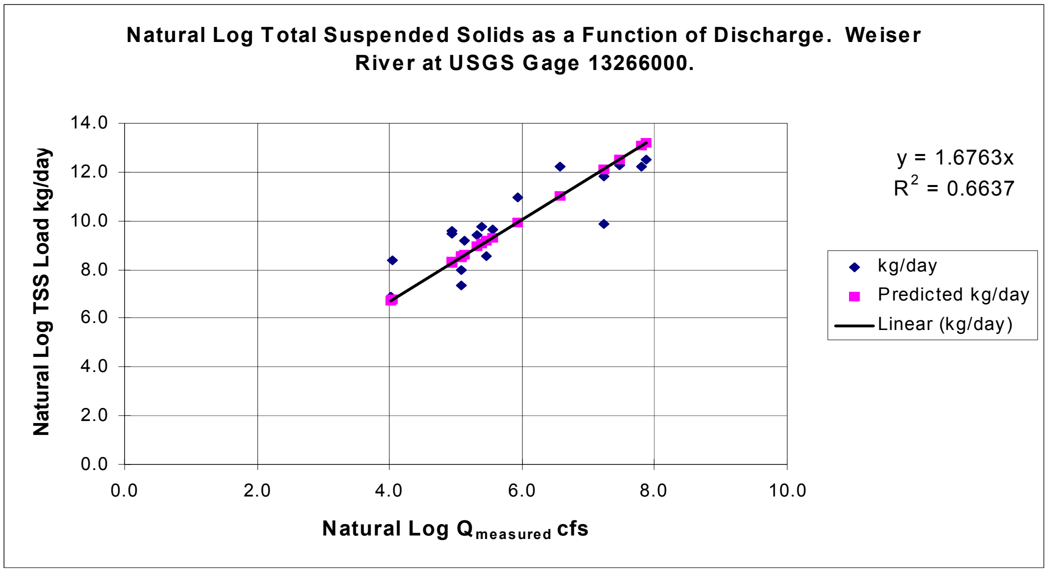



**Figure 44. Regression Analysis for Total Suspended Solid Loads as a Function of Discharge. Weiser River at USGS Gage No. 13266000. DEQ 2000-2001. Weiser River, Little Weiser River to Galloway Dam.**

Further statistical analysis and comparison of measured and estimated TSS concentrations and loads are presented in Appendix C. Measured TSS loads and estimated TSS loads were analyzed to determine error or bias in calculations. Overall the measured TSS load provided a lower percent difference than the estimated load.

**Table 36. Measured and Estimated Total Suspended Solid Concentrations, Discharge, and Suspended Solid Load, DEQ Data 2000-2001. Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.**

| | Measured Discharge (cfs)[a] | Measured TSS[b] Concentration (mg/L)[c] | Measured TSS Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated TSS Concentration (mg/L) | Estimated TSS Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 693 | 28 | 66,997 | 1,182 | 45 | 197,196 |
| Standard Deviation | 843 | 19 | 92,919 | 1,013 | 29 | 217,621 |
| Max | 2,601 | 64 | 272,274 | 2,614 | 84 | 535,093 |
| Min | 55.0 | 2.0 | 989 | 178.0 | 14 | 5,921 |
| Count | 18 | 18 | 18 | 18 | 18 | 18 |
| | | | | | Square Root Error | 1,196,632 |
| | | | | | % Difference Measure | 5.8% |
| | | | | | % Difference Estimated | 16.5% |

*a cubic feet per second*
*b total suspended solids*
*c milligrams per liter*
*d kilograms per day*

Table 37 shows the estimated monthly flows, TSS loads, and TSS concentrations for the middle Weiser River at USGS Gage No. 13266000. The overall load may change due to irrigation water withdrawals from the Sunnyside and Galloway Canals, but it is assumed that concentrations below the withdrawals will not be affected. Further analysis of tributary inflows and sediment load will assist in evaluation of sediment load from tributaries and upstream sediment sources.

The results from the sediment rating curve model provide a more detailed monthly sediment analysis and an even more detailed daily load and concentration analysis. However, the results from the modeling effort may underestimate high yield slugs of TSS associated with the rising hydrograph and/or storm events. The sediment curve rating may equally overestimate long- and short-term TSS averages. These over/under estimations will be examined in more detail in the development of a TMDL for this parameter.

**Table 37. Estimated Discharge and Total Suspended Solids Concentrations and Load, Weiser River at USGS Gage No. 13266000. Weiser River, Little Weiser River to Galloway Dam.**

| Month | Estimated Discharge at Snake River (cfs)[a] | Estimated TSS[b] Concentration at Snake River (mg/L)[c] | Estimated TSS Load at Snake River (kg/day)[d] |
|---|---|---|---|
| Oct | 186 | 14.0 | 6,413 |
| Nov | 308 | 19.5 | 15,470 |
| Dec | 615 | 31.3 | 48,753 |
| Jan | 927 | 41.0 | 99,155 |
| Feb | 1,536 | 57.5 | 235,780 |
| Mar | 2,409 | 79.0 | 470,904 |
| Apr | 2,488 | 80.9 | 492,982 |
| May | 2,547 | 82.2 | 512,739 |
| June | 1,550 | 58.1 | 234,926 |
| July | 388 | 22.7 | 23,385 |
| Aug | 227 | 16.0 | 8,928 |
| Sep | 181 | 13.7 | 6,086 |

*a cubic feet per second*
*b total suspended solids*
*c milligrams per liter*
*d kilograms per day*

Upstream of USGS Gage No. 13266000, DEQ conducted river monitoring at Midvale, Idaho (Ingham 2000). This station was established to obtain a sample of the water quality of the river before it enters the inaccessible canyon upstream of Crane Creek. The results of that monitoring are displayed in Table 38.

**Table 38. Measured Total Suspended Solid Concentrations, Discharge, and Total Suspended Solid Load, DEQ Data 2000-2001, May through September. Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.**

| | TSS[a] Concentration (mg/L)[b] | Discharge (cfs)[c] | TSS Load (kg/day)[d] |
|---|---|---|---|
| Average | 10.1 | 635.4 | 37,500 |
| Standard Deviation | 12.0 | 909.1 | 71,900 |
| Maximum | 40.0 | 3,215.0 | 244,000 |
| Minimum | 2.0 | 34.0 | 215 |
| Count | 18 | 18 | 18 |

*a total suspended solids*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

Total suspended solid concentrations increased by about 107%, and TSS load concentrations increased by about 380% between the Weiser River at Midvale and the USGS gage site. Total suspended solid concentration and load increases are probably associated with Crane Creek inflows.

*Substrate Sediment*

As discussed in Section 2.3, substrate composition will affect biological communities and structure. In August 2003, DEQ evaluated the substrate at three locations on the middle Weiser River. Table 39 shows the percentage of the substrate that is less than 6.0 mm in size.

**Table 39. Percent Substrate Less Than 6 Millimeters in Size. Weiser River, Little Weiser River to Galloway Dam.**

| | Weiser River at Presley Bridge | Weiser River below Little Weiser River | Average for Segment |
|---|---|---|---|
| Percent of Substrate Less than 6 mm in Size | 19.8% | 22.5% | 21.2% |

**Status of Beneficial Uses**

Both the narrative and numeric criteria were examined for the listed pollutants of concern to determine beneficial use support status in the middle Weiser River. A biological assessment was conducted and compared to indices developed and published in the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002).

Analysis of the biological communities revealed that sediment, a pollutant of concern listed on the 1998 Idaho §303(d) list, is impairing the designated uses established for the middle Weiser River. Through both water quality monitoring and biological assessment, it was determined that *E. coli* bacteria and nutrients are not impairing designated uses on the middle Weiser River. Table 40 provides information on the final assessment and status of the designated beneficial uses.

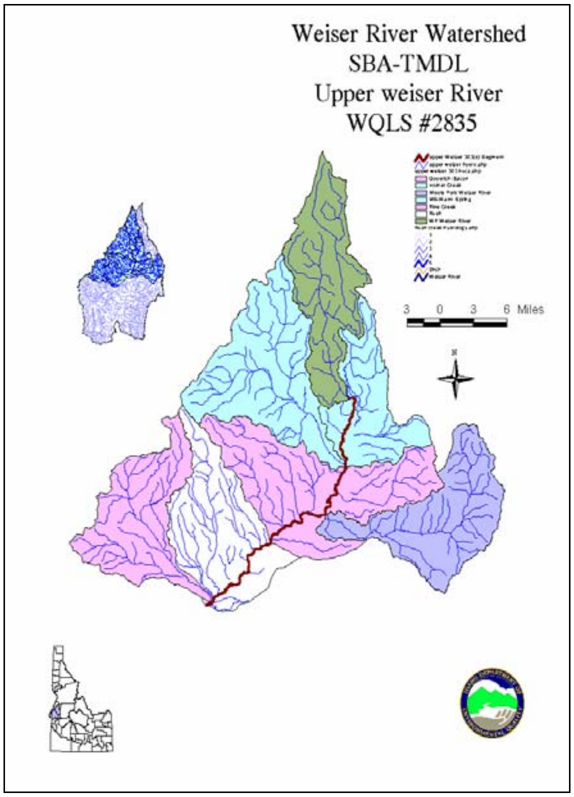
**Table 40. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Middle Weiser River at Galloway Dam. Weiser River, Little Weiser River to Galloway Dam.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendations |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not Supported | Sediment | Biological Assessment Indicated Impairment | Develop TMDLs to Address Sediment. Develop Total Phosphorus Allocations.[a] |
| Primary Contact Recreation | Fully Supported | | Numeric Criteria Not Exceeded | No Action to be Taken |
| Secondary Contact Recreational | Fully Supported | | Numeric Criteria Not Exceeded | No Action to be Taken |
| Drinking Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Special Resource Waters | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

In addition to protecting the designated uses for the middle Weiser River, nutrient targets have been established through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus in the middle Weiser River have shown that reductions must occur in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). Section 3.2 addresses total phosphorus load allocations.

## Weiser River, West Fork Weiser River to Little Weiser River




| Water Body | Weiser River, West Fork Weiser River to Little Weiser River |
|---|---|
| Miles of impaired water body | 31.5 |
| Listed pollutants | Sediment and Nutrients |
| Potential impaired designated uses | Cold water aquatic life, salmonid spawning, primary contact recreation |
| Potential sources | Municipal wastewater treatment plants, overland flow, irrigated induced erosion, stream bank erosion |

### Discharge (Flow) Characteristics

The USGS discharge gage (1325800) is located on the Weiser River approximately 2 miles upstream of Cambridge, Idaho, and about 5 miles upstream of the confluence of the Little Weiser River. There are two major tributaries between the USGS gage site and the Little Weiser River: Rush Creek and Pine Creek. In addition to other small tributaries, the Cambridge and Council wastewater treatment plants (WWTPs) discharge into this section of the Weiser River.

Figure 45 shows the normalized discharge recorded at USGS Gage No. 13258500, located near Cambridge, Idaho. A summary of the discharge data is available in Appendix C.

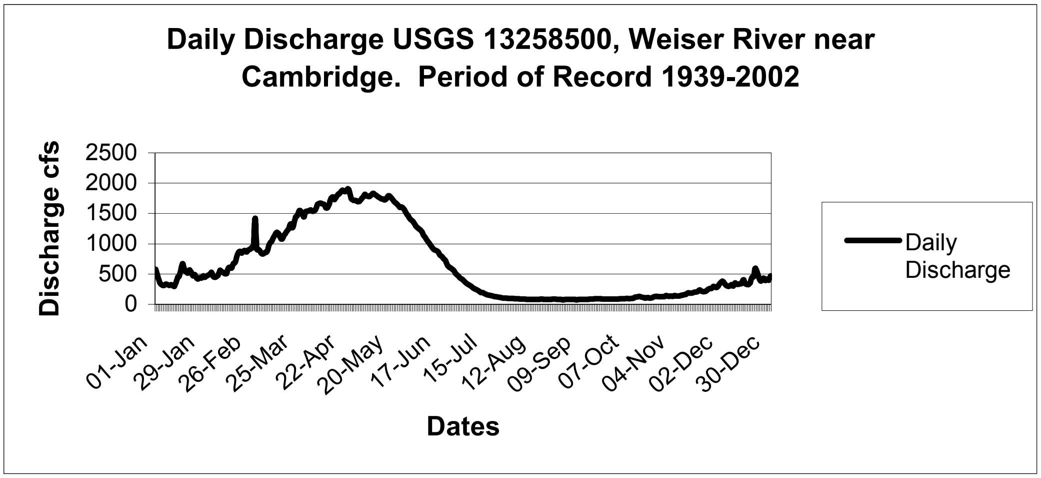



**Figure 45. Normalized Average Daily Discharge at USGS Gage No. 13258500. Weiser River near Cambridge, ID. Weiser River, West Fork Weiser River to Little Weiser River.**

The discharge data presented in Figure 45 are from the years 1939 to 2002. Data from other discharge measurements conducted in this portion of the watershed are described in Appendix C.

In the years 2000-2001, DEQ conducted an intensive monitoring effort in the Weiser River Watershed. One monitoring site was on the Weiser River upstream of the Council WWTP (Ingham 2000). The other site was at the USGS gage near Cambridge. However, both sites relied on either existing discharge data or data available for analysis from current USGS discharge data corresponding to the date of sampling.

**Biological and Other Data**

Biological information is limited to three sites on the Weiser River. These data were collected as a part of DEQ monitoring efforts in the years 2000 and 2001 (Ingham 2000) and a 1999 IDFG fisheries survey. All sites are all within the §303(d) listed segment of the upper Weiser River. Further analysis was applied to all three sets of data with an emphasis on the overall support/nonsupport status of designated uses for this segment. Appendix C contains descriptions of and information on biological data sources.

*Periphyton*

Periphyton samples were collected by DEQ at two sites, Goodrich and Council in August 2000 and again in July 2001.

Dr. Loren Bahls submitted detailed reports interpreting periphyton community structure and composition (Bahls 2000 and 2001). Dr. Bahls determined that the beneficial uses were fully or partially supported at the two sites receiving periphyton analysis. Both sites' pollution indices indicated good water quality and no organic loading impairing the uses.

However, at the Goodrich site, the Siltation Index was at a level of slight impairment from sediment. At the Council site, the Siltation Index did not indicate impairment. Table 41 shows the scores for the indices mentioned in Bahls (2000 and 2001).

**Table 41. Periphyton Result for Specific Indices. Weiser River, West Fork Weiser River to Little Weiser River.**

| Site | 2000 Pollution Index Score[a] | 2000 Siltation Index Score[b] | 2000 Percent Dominant[c] | 2001 Pollution Index Score | 2001 Siltation Index Score | 2001 Percent Dominate |
|---|---|---|---|---|---|---|
| Weiser River at Goodrich WR-007 | 2.38 | 44.52 | 25.24 | 2.27 | 38.50 | 14.41 |
| Weiser River at Council WR-008 | 2.50 | 29.33 | 9.29 | 2.82 | 14.44 | 48.74 |

*a >2.5 No Impairment, 2.01-2.50 Minor Impairment, 2.00-1.5 Moderate Impairment, <1.5 Severe Impairment.*
*b <20.0 No Impairment, 20.0-39.9 Minor Impairment, 40.0-59.9 Moderate Impairment, >60.0 Severe Impairment.*
*c <25.0 No Impairment, 25.0-49.9 Minor Impairment, 50.0-74.9 Moderate Impairment, >74.9 Severe Impairment*

The overall RDI scores indicates a condition rating of a 1 at the Goodrich site, while at Council the condition rating was 2 (Table 42). When combined with other indices (RMI, RFI, or RPI), a total condition rating of less than 2 would indicate not fully supporting designated uses for cold water aquatic life (Grafe et al. 2002).

However, to determine if a certain pollutant is impairing a designated use, the overall high percentage of very motile species would indicate sediment is affecting the expected community structure and composition. The high pollution tolerant percentage may also indicate organic loading (Bahls 2000 and 2001). Table 42 shows RDI metric scores and final RDI scores.

**Table 42. River Diatom Index Scores. Weiser River, West Fork Weiser River to Little Weiser River.**

| Metric | Weiser River at Council Metric Score | Weiser River at Council RDI[a] Score | Weiser River at Goodrich Metric Score | Weiser River at Goodrich RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 51.7% | 1 | 51.3% | 1 |
| % Pollutant Tolerant | 2.8% | 1 | 13.2% | 3 |
| Eutrophic Taxa Richness | 18 | 5 | 24 | 1 |
| % Nitrogen Heterotrophs | 5.3% | 3 | 12.9% | 3 |
| % Polysaprobic | 27.5% | 5 | 15.8% | 1 |
| Alkaliphilic Taxa Richness | 24 | 1 | 30 | 3 |
| % Requiring High Oxygen | 5.6% | 3 | 13.0% | 1 |
| % Very Motile | 15.4% | 3 | 27.5% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index Score | | 27 | | 19 |
| Final Condition Category Rating | | 2 | | 1 |

*a River Diatom Index, RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

*Fisheries*

Most fish species identified during the IDFG survey are non-game species. However, numerous cold water species, such as mountain whitefish and wild rainbow trout, were present at the Cambridge site. Both species are classified as cold water aquatic life species and are desirable catchable species. Smallmouth bass were also collected at this site, indicating the existence of a cool water game fishery. Table 43 provides information about the fish found during the IDFG survey.

Fish data collected in 1999 were entered into DEQ's RFI database. The Cambridge site had a score of 58. According to the *Water Body Assessment Guidance* (Grafe et al. 2002), this score would place the upper Weiser River into a condition rating of 2. When combined with a least one other index score (such as scores from the RMI, the RDI, or the RPI) and the mean score of at least two of the indices is less than 2, the system is classified as not fully supporting the cold water aquatic life use. Or, if one of the category values is below the threshold value the water body would be determined to be not fully supporting beneficial uses (Grafe et al. 2002).

**Table 43. Presence/Absence of Fish Species. Weiser River, West Fork Weiser River to Little Weiser River.**

| Weiser River at Cambridge June 1999 | | |
|---|---|---|
| **Species Found** | **Count** | **Percent of Total** |
| Bridgelip sucker | 15 | 3.5% |
| Channel catfish | 0 | 0.0% |
| Chiselmouth mouth | 31 | 7.3% |
| Largescale Sucker | 114 | 26.9% |
| Mountain whitefish | 74 | 17.5% |
| Northern pike minnow | 51 | 12.0% |
| Smallmouth bass | 4 | 0.9% |
| Speckled dace | 0 | 0.0% |
| Common carp | 0 | 0.0% |
| Longnose dace | 0 | 0.0% |
| Redside shiner | 93 | 21.9% |
| Redband trout | 40 | 9.4% |
| Sculpin | 0 | 0.0% |
| Rainbow trout | 1 | 0.2% |
| Mountain succor | 1 | 0.2% |
| | | |
| Total Number | 424 | 100% |

*Macroinvertebrates*

Macroinvertebrate samples were collected during the same period that periphyton samples were collected. Unfortunately, the macroinvertebrate sample results for 2001 have not been received by DEQ's Boise Regional Office. As these results are received, amendment to either the draft or final document will be made. The River Macroinvertebrate Index results from the year 2000 are shown in Table 44.

**Table 44. River Macroinvertebrate Index Scores. Weiser River, West Fork Weiser River to Little Weiser River.**

| Metric | Weiser River at Council Metric Result | Weiser River at Council RMI[a] Metric Score | Weiser River at Goodrich Metric Result | Weiser River at Goodrich RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 42 | 5 | 27 | 5 |
| Number EPT[b] Taxa | 32 | 5 | 17 | 5 |
| Percent Elmidae | 3.08% | 5 | 8.22% | 5 |
| Percent Dominate Taxa | 19.08% | 5 | 1.76% | 5 |
| Percent Predators | 4.62% | 3 | 1.96% | 1 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index, RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3" b Ephemeroptera-Plecoptera-Trichoptera*

When combined with the RFI and RDI, the use of the RMI condition rating gives an overall condition rating of 2. This overall condition rating greater than or equal to 2 indicates the upper Weiser River, West Fork to Little Weiser River, is fully supporting beneficial uses.

**Water Column Data**

The USGS has performed extensive water quality evaluations in the upper Weiser River. Most of the monitoring was conducted at USGS Gage No. 13258500 approximately 2 miles upstream of Cambridge, Idaho. Most of the nutrient and sediment data go back to the late 1970s and early 1980s. DEQ conducted water quality monitoring at the same location in the years 2000-2001. Appendix C contains data that will assist in determining the support status of the designated uses and/or the loading capacity required for the lower and middle Weiser River and for the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

As required by the National Pollution Discharge Elimination System (NPDES), all point sources discharging to waters of the United States must obtain a permit from EPA or a state agency. In Idaho, EPA has primacy over point source discharges and administers the NPDES program.

Each of the listed pollutants of concern will be discussed separately. Recommendations will then be made to address those pollutants related to lower, middle and upper Weiser River and to address the targets established in the *Snake River-Hells Canyon TMDL* (Idaho DEQ and Oregon DEQ 2004).

*Bacteria*

The Weiser River is designated for primary contact recreation (IDAPA 58.01.02.140.18.SW-7). A discussion of contact recreation definitions and criteria is presented in Section 2.3.

Bacteria is not listed as a pollutant of concern in the upper Weiser River (Idaho DEQ 1998*a*). During intensive water quality monitoring conducted by DEQ during the years 2000-2001 (Ingham 2000), two *E. coli* samples exceeded the single sample criteria. These single sample exceedances triggered additional monitoring to determine compliance with the geometric mean criterion for *E. coli* bacteria and the WQS. Additional monitoring was conducted in June and July 2003 to obtain the five-day geometric mean. The results are presented in Appendix C. Table 45 shows the geometric mean for the Weiser River near Cambridge. The data indicate that primary contact recreation is fully supported.

**Table 45. *E. coli* Geometric Mean Results for 2003. Weiser River, West Fork Weiser River to Little Weiser River.**

| Station Location | Month and Year of Data | Number of Samples | E. coli Geometric Mean (cfu/100 ml)[a] |
|---|---|---|---|
| USGS Gage near Cambridge, Idaho | June 26 through July21, 2003 | 5 | 38 |

*a Colony forming units per 100 milliliters*

*Nutrients*

Unlike the constituents discussed above, a numeric criterion for nutrients does not exist to determine if WQS are exceeded. A discussion of the nutrient criteria and beneficial use support can be found in Section 2.4.

Instantaneous dissolved oxygen levels taken by DEQ in the years 2000-2001 showed no exceedances of the Idaho WQS for water column dissolved oxygen levels. Twenty-four-hour monitoring was not conducted. Figure 46 shows the results of the instantaneous dissolved oxygen monitoring effort.

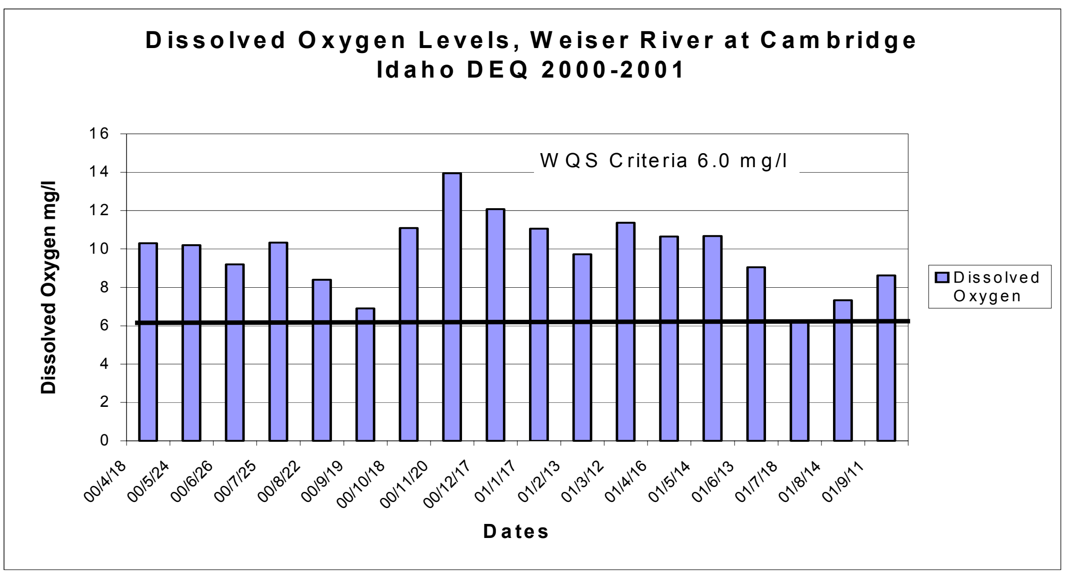



**Figure 46. Instantaneous Dissolved Oxygen Levels, Upper Weiser River near Cambridge. DEQ Data 2000-2001. West Fork Weiser River to Little Weiser River.**

Overall, the dissolved oxygen data indicate neither an exceedence of the WQS nor an indication that a nuisance aquatic growth exists in the upper Weiser River. Periphyton data did not show organic loading that may indicate that nutrients are impairing the designated uses in the upper Weiser River.

*Sediment*

Sediment is a pollutant of concern listed for the upper Weiser River. Periphyton analysis indicates that sediment is causing a slight impairment to the designated uses within the river. The overall percentage of high motile periphyton species (15.4% at Council and 25.4% at Goodrich) indicates sediment is an issue. However, in an independent evaluation, Bahls (2000-2001) stated that this score only indicates slight impairment and no other indications of sediment impairment were noted in the results.

*Substrate Sediment*

As discussed in Section 2.3, substrate composition will affect biological communities and structure. In August 2003, DEQ evaluated the substrate at three locations on the upper Weiser River. Table 46 shows the percentage of the substrate that is less than 6.0 mm in size.

**Table 46. Percent Substrate Less Than 6 Millimeters in Size. Weiser River, West Fork Weiser River to Little Weiser River.**

| | Weiser River at Cambridge |
|---|---|
| Percent of Substrate Less than 6 mm in Size | 16.9% |

**Status of Beneficial Uses**

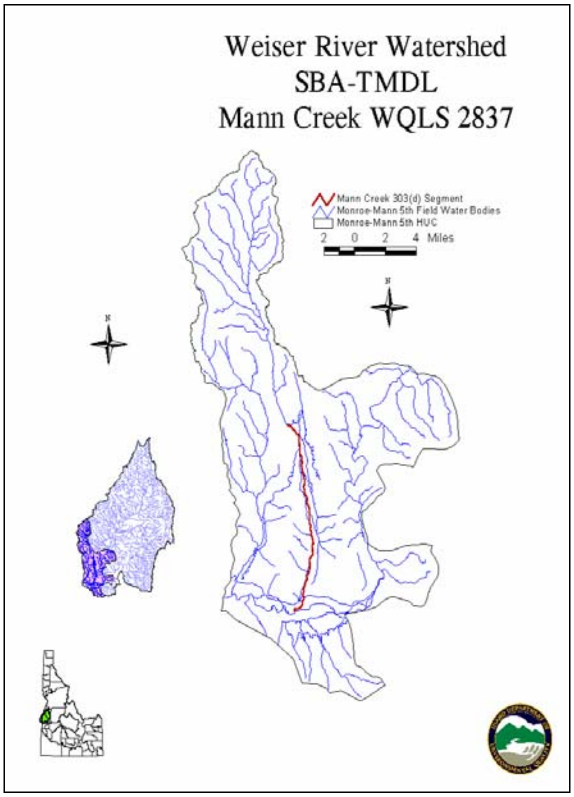
Both the narrative and numeric criteria were examined for the listed pollutants of concern to determine beneficial use support status in the Weiser River. A biological assessment was conducted and compared to indices developed and published in the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). Further analysis of the biological communities revealed that sediment, a pollutant of concern listed on the 1998 Idaho §303(d) list, may be impairing the designated uses established for upper Weiser River. There is no indication that nutrients are impairing the designated uses of the upper Weiser River. Through water quality monitoring and biological assessment, it was also determined that *E. coli* bacteria are impairing designated uses. Table 47 provides information on the final assessment and status of the designated beneficial uses.

**Table 47. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Weiser River, West Fork Weiser River to Little Weiser River.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Fully Supported | | Biological Assessment Indicated Full Support | No Action to be Taken for Sediment or Nutrients |
| Salmonid Spawning | Fully Supported | | Biological Assessment Indicated Full Support | No Action to be Taken for Sediment or Nutrients |
| Primary Contact Recreation | Fully Supported | | Numeric Criteria Not Exceeded | No Action to be Taken |
| Secondary Contact Recreational | Fully Supported | | Numeric Criteria Not Exceeded | No Action to be Taken |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

Nutrient targets have been established through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus in the lower Weiser River have shown that a reduction must occur in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These reductions will also be allocated to address nutrient loading from tributaries and upstream sources. Further discussion on allocations for this segment is found in Section 3.3.

## Mann Creek, Mann Creek Reservoir to Weiser River




| **Water Body** | **Mann Creek, Mann Creek Reservoir to Weiser River** |
|---|---|
| Miles of impaired water body | 13.0 |
| Listed pollutants | Sediment |
| Potential impaired designated uses | Cold water aquatic life and salmonid spawning |
| Potential sources | Overland flow, irrigation induced erosion, rangeland |

### Discharge (Flow) Characteristics

Mann Creek is one of the few water bodies in the Weiser River Watershed that could be classified as regulated. The Mann Creek Reservoir is located approximately 13 miles upstream of the creek's confluence with the lower Weiser River, which makes up the entire §303(d) listed segment. Mann Creek Reservoir stores much of the late winter/early spring snowmelt for later releases during the irrigation season. Numerous diversions are located throughout the lower watershed, with diversions actually beginning at the dam itself. Other diversions are instream and are either permanent structures or temporally (year-to-year) constructed for water diversion from the stream.

Figure 47 shows the pre-dam average daily discharge recorded at USGS Gage No. 13267000 near the confluence with the Weiser River and discharge from the reservoir at USGS Gage No. 13267500. Figure 48 shows a detailed view of Mann Creek and the diversions.

As with many water bodies in the Weiser River Watershed, discharge is dependent on higher/mid elevation snow accumulation and climatic events. It is expected that ground water and irrigation return water play a large role in the final discharge into the Weiser River during irrigation season. It should be noted that some irrigation water released from Mann Creek Reservoir is actually diverted to the Monroe Creek Watershed to the south.

There have been three intensive studies that monitored flows in the Mann Creek Watershed: Tangarone and Bogue (1975), Clark (1985), and Idaho Department of Agriculture (2003). The USGS has two historic discharge recording sites in the watershed. The two gage stations provide some historic discharge information. Appendix C contains data source descriptions for Mann Creek recorded discharge.

Table 48 shows the results from the monitoring that has been conducted during past and on-going studies on Mann Creek at the confluence with the Weiser River. The data presented in Table 48 show highly variable discharges for the different years that discharge measurements were taken. To offset some of the variability, the table also shows the data with the outliers replaced with mean discharge data recorded for that month.

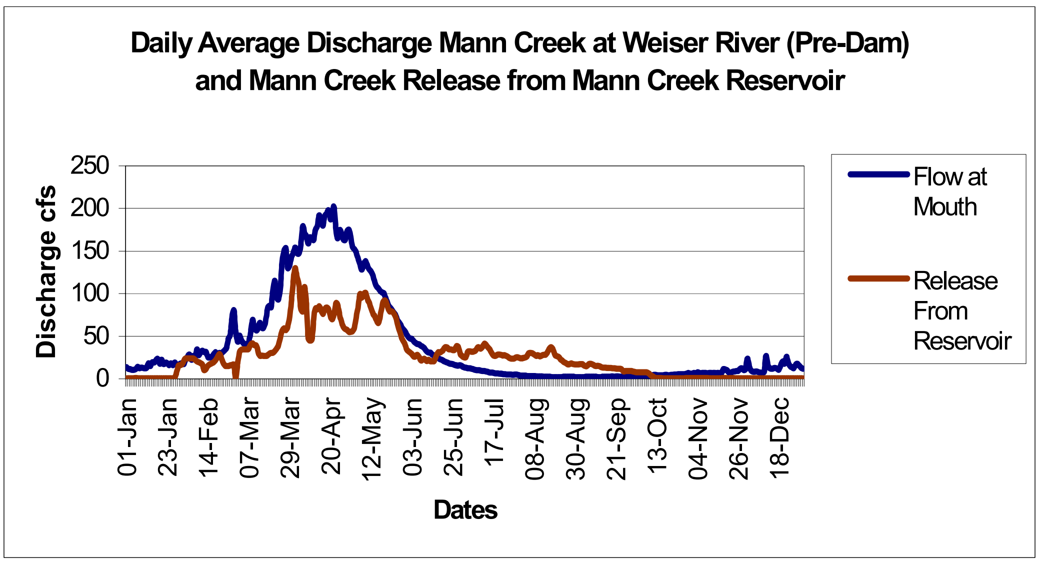



**Figure 47. Average Daily Discharge From Mann Creek (Pre Dam Construction), USGS Gage No. 13267000 (Period of Record 1911-1913, 1920, 1937-1961) and Mann Creek Release from Mann Creek Reservoir, USGS Gage No. 13267050 (Period of Record 1967-1971).**

**Table 48. Monthly Average Measured Discharge for 1975, 1983-1984, and 2001-2003, Outliers Remaining and Outliers Smoothed for Mann Creek at the Mouth.**

| | DEQ 1983-1984 Discharge (cfs)[a] | IDA[b] 2001-2003 Discharge (cfs) | Combined Outliers Remain Discharge (cfs) | Combined Outliers Smoothed[c] Discharge (cfs) |
|---|---|---|---|---|
| Jan | no data | 6.5 | 6.5 | 6.5 |
| Feb | no data | 7.4 | 7.4 | 7.4 |
| Mar | 361.5 | 17.8 | 246.9 | 143.9 |
| Apr | 370.0 | 45.3 | 110.2 | 58.3 |
| May | 339.0 | 27.2 | 131.2 | 61.9 |
| June | 39.0 | 10.5 | 18.6 | 18.6 |
| July | 13.3 | 12.6 | 12.8 | 12.8 |
| Aug | 24.0 | 6.6 | 13.1 | 13.1 |
| Sep | 24.0 | 5.5 | 9.2 | 9.2 |
| Oct | 10.0 | 9.6 | 9.7 | 9.7 |
| Nov | no data | 5.8 | 5.8 | 5.8 |
| Dec | 41.0 | 6.3 | 17.9 | 17.9 |

*a Cubic feet per second*
*b Idaho Department of Agriculture*
*c High discharge measured in 1983 was subsitituted with average discharge measurements for the month.*

As shown in Table 48, discharge rates in Mann Creek are highly variable from year to year. Without current discharge data over a period of time, the development of normalized rates is difficult. Any loading analysis should use the smoothed monthly averages established in Table 48 and use caution in extrapolating a reliable load analysis.

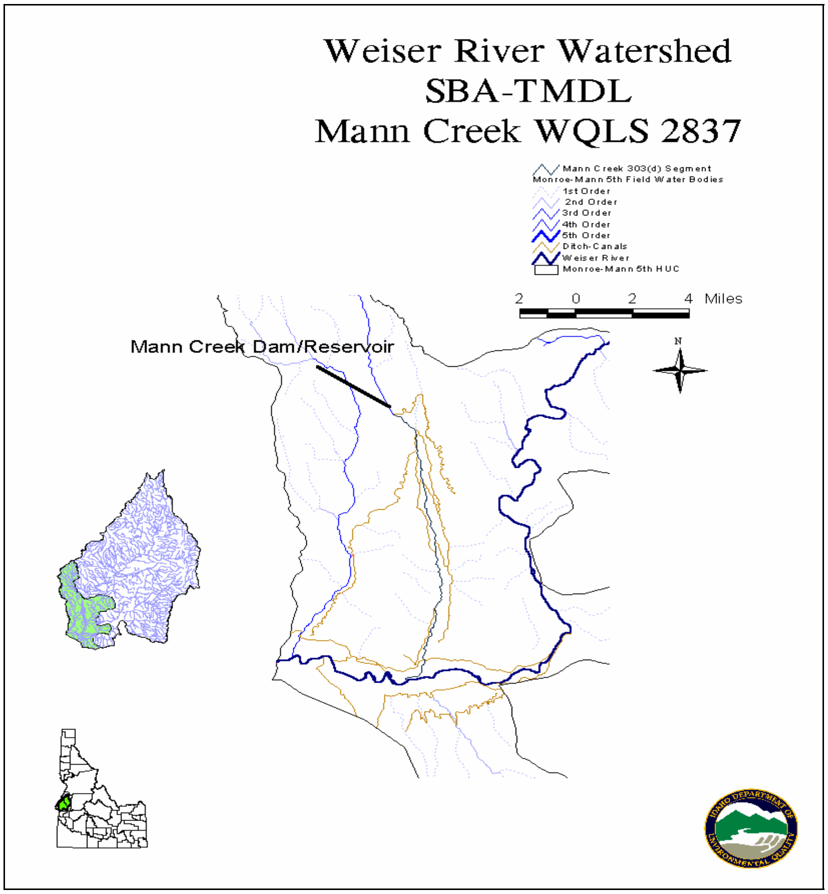



**Figure 48. Mann Creek Diversions.**

### Biological and Other Data

DEQ BURP monitoring was performed on two sites on the §303(d) listed segment downstream of Mann Creek Reservoir. A site approximately 8 miles upstream of the confluence with the Weiser River was monitored in 1998 and again in 2002. The other site, located at the Galloway Canal crossing approximately 1 mile upstream of the confluence, was monitored in 1998. The 2002 BURP data are not available for analysis. Appendix C contains data source descriptions. Table 49 presents the results of the BURP monitoring and the related index scores that will assist in determining the support status of the designated uses (Grafe et al. 2002).

**Table 49. Beneficial Use Reconnaissance Program Results. Mann Creek**

| BURP[a] ID No. | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | Final Condition Score |
|---|---|---|---|---|---|
| 1998SBOIB027 | 58.64 | 3 | 79 | 3 | 3 |
| 1998SBOIB028 | 63.59 | 3 | 60 | 3 | 3 |
| 2002SBOIA027 | 70.9 | 3 | 60 | 3 | 3 |
| 2002SBOIA028 | 76.2 | 3 | 76.2 | 3 | 3 |
| 2002SBOIA029 | 66.9 | 3 | 63 | 3 | 3 |

*a Beneficial Use Recommaissance Program*
*b Stream Macroinvertebrate Index*
*c Stream Habitat Index*

In accordance with the *Water Body Assessment Guidance* (Grafe et al. 2002), when an average of two index condition rating scores is equal to or exceeds 2, the water body is considered fully supporting its beneficial uses. Both the SMI and SHI scores for Mann Creek are 3, indicating full support.

Although no impairment of the designated beneficial uses in Mann Creek is apparent, further analysis of nutrient and sediment data is warranted since load allocations for both parameters may be set for the Weiser River and the Snake River. The assessment of total phosphorus and sediment loads is discussed in Section 3.2.

**Status of Beneficial Uses**

There is no indication from available data that the designated uses in Mann Creek are impaired by sediment. Table 50 shows the status of beneficial uses and recommended actions.

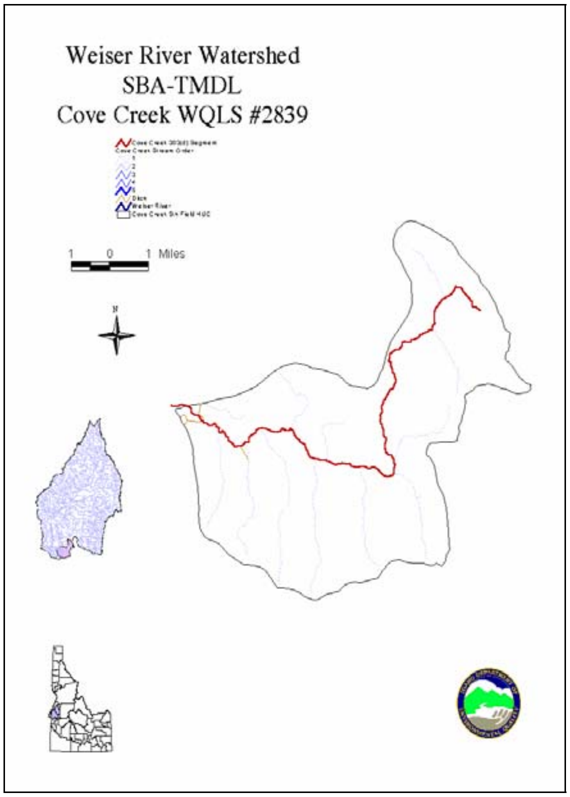
**Table 50. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Mann Creek, Mann Creek Reservoir to Weiser River.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendations |
|---|---|---|---|---|
| Cold Water Aquatic Life | Fully Supported | | As per *Water Body Assessment Guidance* (Grafe et al. 2002) | Remove from §303(d) list. Develop Total Phosphorus Allocations.[a] |
| Salmonid Spawning | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Primary Contact Recreation | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Secondary Contact Recreational | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Drinking Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

Although determined to be fully supporting it beneficial uses, nutrient and sediment reductions must occur to achieve targets established in the lower Weiser River or through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus and TSS in the lower Weiser River have shown that reductions must occur in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) and TSS targets determined for the Weiser River. Load analyses for both TSS and total phosphorus have been completed and are discussed in Section 3.2.

## Cove Creek, Headwaters to Weiser River




| Water Body | Cove Creek<br>Headwaters to Weiser River |
|---|---|
| Miles of impaired water body | 14.0 |
| Listed pollutants | Sediment and Nutrients |
| Potential impaired designated uses | No designated uses for water body |
| Potential Sources | Overland flow, irrigation induced erosion, rangeland |

### Discharge (Flow) Characteristics

As with many water bodies in the Weiser River Watershed, Cove Creek discharge is dependent on mid-elevation snow accumulation and climatic events. The headwaters of Cove Creek originate in the low–elevation, sagebrush-covered hills in the southern portion of the watershed. Some irrigated lands can be found in the area near the confluence with the Weiser River and below the Sunnyside Canal. Dryland agriculture use can also be found in the area (see Figure 21).

Clark (1985) and Idaho Department of Agriculture (2003) monitored discharge in the Cove Creek Watershed. The study completed in 1984 for Cove Creek is very limited in data, with only two monitoring dates and only one with discharge data. There are no USGS discharge recording sites in the watershed. Since the 1984 study had such limited data, the most recent study by Idaho Department of Agriculture will be used. Figure 49 shows the discharge data collected during the years 2001-2002.

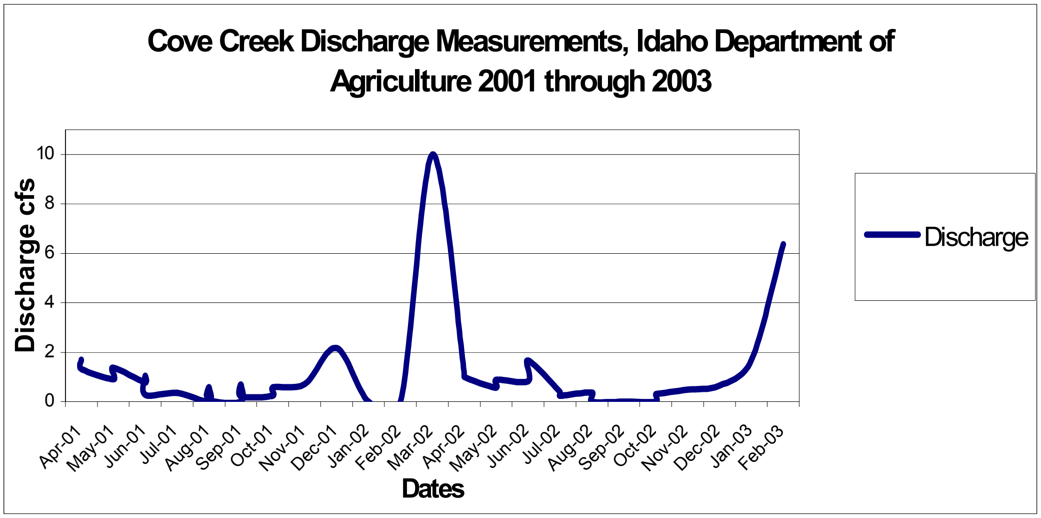



**Figure 49. Discharge Measurements for Cove Creek, 2001-2003.**

Cove Creek is best described as intermittent and/or ephemeral. With the available discharge data indicating zero flow, IDAPA 58.01.02.03.58 applies. A discussion of the applicable WQS for intermittent water bodies is located in Section 2.3.

The peak discharges are short in duration and are dependent on snowmelt and storm events. These periods are not optimal for the support of cold water aquatic life and will not provide adequate habitat for long-term biological communities. Recreational use is not usually associated with short duration peak discharges.

**Biological and Other Data**

DEQ BURP monitoring was performed on two sites in 1998. Table 51 shows the results of the BURP monitoring and the related index scores that will assist in determining the support status of the designated uses (Grafe et al. 2002).

**Table 51. Beneficial Use Reconnaissance Program Results. Cove Creek**

| BURP[a] ID No. | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | Final Condition Score |
|---|---|---|---|---|---|
| 1998SBOIB022 | Dry | NA[d] | Dry | NA | NA |
| 1998SBOIB023 | 20.39 | Below Threshold | 34 | 1 | Not Fully Supporting |

*a Beneficial Use Reconnaissance Program*
*b Stream Macroinvertebrate Index*
*c Stream Habitat Index*
*d Not Applicable*

In accordance with the *Water Body Assessment Guidance* (Grafe et al. 2002), when an average of two index condition rating scores is equal to or exceeds 2, the water body is considered fully supporting its beneficial uses. Or, if one of the index scores is below the threshold value, the water body is not fully supporting cold water aquatic life.

Although impairment to beneficial uses in Cove Creek due to its intermittent nature is not apparent, further analysis of nutrient and sediment data is warranted since load allocations for both parameters may be set for the Weiser River and the Snake River.

**Status of Beneficial Uses**

Cove Creek is an intermittent water body. As such, the WQS for intermittent water bodies will be applied. Table 52 provides information on the final assessment and status of the designated beneficial uses.

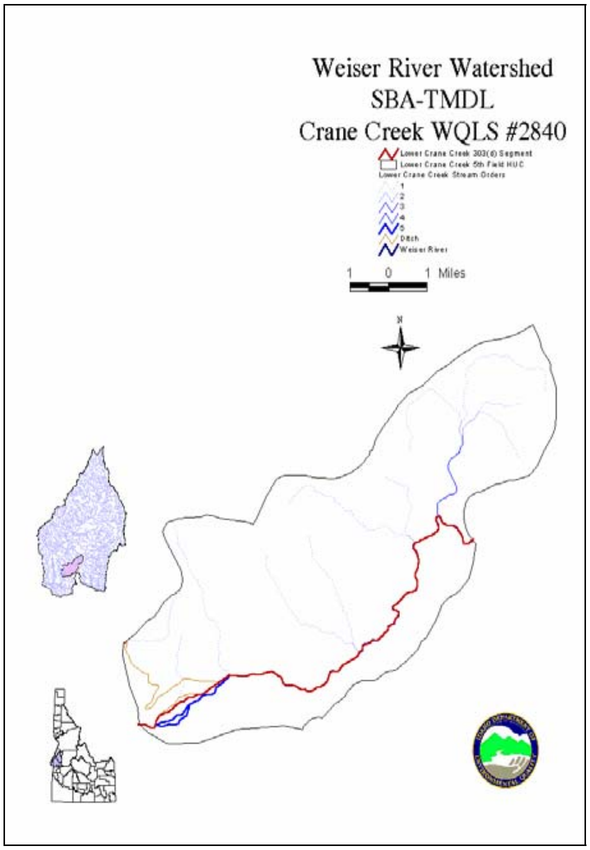
**Table 52. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Cove Creek, Headwaters to Weiser River.**

| Existing Uses | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS[a] | Develop Total Phosphorus Allocations |
| Primary Contact Recreation | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS | No Action to be Taken |
| Secondary Contact Recreational | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS | No Action to be Taken |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a water quality standards*

Although Cove Creek has been determined to be fully supporting it beneficial uses, nutrient and sediment reductions will be required to achieve targets established in the lower Weiser River or through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus and TSS in the lower Weiser River have shown that reductions must occur in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) and TSS targets determined for the Weiser River. For Cove Creek, load analyses have been completed for both TSS and total phosphorus. These analyses are located in Section 3.2.

## Crane Creek, Crane Creek Reservoir to Weiser River




| Water Body | Crane Creek, Crane Creek Reservoir to Weiser River |
|---|---|
| Miles of impaired water body | 12.6 |
| Listed pollutants | Sediment, Bacteria, and Nutrients |
| Potential impaired designated uses | Cold water aquatic life and primary contact recreation |
| Potential Sources | Overland flow, irrigation induced erosion, rangeland, stream bank erosion, Crane Creek Reservoir |

### Discharge (Flow) Characteristics

A USGS discharge gage (13265500) is located near the mouth of Crane Creek at the confluence with the Weiser River. The USGS gage is located approximately 12 miles downstream from Crane Creek Reservoir. Crane Creek discharges are regulated due to irrigation water demand downstream in the Weiser Cove area near Weiser, Idaho. Irrigation water is released from the reservoir, with a majority of the release to the Weiser River occurring from early July through September. The discharge from Crane Creek Reservoir augments Weiser River flows used for irrigation water rights. The water is diverted from the Weiser River into the two canals, Galloway and Sunnyside.

Figure 50 shows the normalized discharge recorded at USGS Gage No. 13265500, located near the mouth of Crane Creek. Data sources and descriptions of Crane Creek discharge are presented in Appendix C.

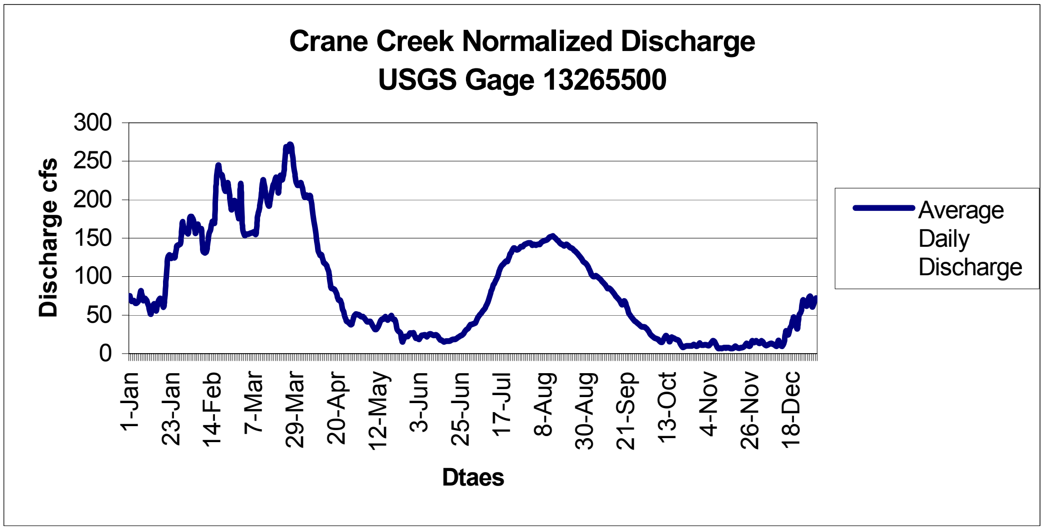



**Figure 50. Normalized Average Daily Discharge at USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.**

**Biological and Other Data**

Biological data are available for only one site on the lower Crane Creek segment from the reservoir to the mouth. Some BURP monitoring was conducted in the Crane Creek area in 1996. Unfortunately, one site was dry. During the period the BURP crew visited that site (mid-August), the discharge averages were approximately 175 cfs. The other site on lower Crane Creek is directly below Crane Creek Reservoir (1996BOIB022). This site was visited in June 1996. Appendix C contains specific information about the two BURP sites.

*Periphyton*

Periphyton samples were collected at the one site that had adequate water in 1996. This site is directly below the Crane Creek Reservoir release. Samples results were entered into the RDI and applicable metrics are discussed below.

The RDI scores in Table 53 show high percentages of pollution tolerant and very motile species. The overall pollution tolerance rating was 2.45. The overall RDI score indicates a rating of 2. When combined with other indices (RMI, RFI, or RPI) an average rating of less than 2 would indicate not fully supporting beneficial use for cold water aquatic life (Grafe et al. 2002).

The overall high percentage of very motile species would also indicate sediment affects the community structure and composition. The high percentage of pollution tolerant species may also indicate organic loading (Bahls 2000 and 2001).

**Table 53. River Diatom Index Scores. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Metric | Crane Creek below Crane Creek Reservoir RDI[a] Metric Score | Crane Creek below Crane Creek Reservoir RDI Score |
|---|---|---|
| % Pollutant Intolerant | 4.9% | 1 |
| % Pollutant Tolerant | 71.5% | 1 |
| Eutrophic Taxa Richness | 13 | 2 |
| % Nitrogen Heterotrophs | 15.9% | 3 |
| % Polysaprobic | 7.2% | 3 |
| Alkaliphilic Taxa Richness | 24 | 3 |
| % Requiring High Oxygen | 67.6% | 5 |
| % Very Motile | 15.7% | 3 |
| % Deformed | 0.0% | 5 |
| | | |
| Final River Diatom Index (RDI) Score | | 26 |
| Final Condition Category Rating | | 2 |

*a River Diatom Index, RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

### *Fisheries*

No fishery information is available for Crane Creek below Crane Creek Reservoir.

### *Macroinvertebrates*

Macroinvertebrate data were evaluated using DEQ's Stream Macroinvertebrate Index (SMI) and RMI to obtain index scores and determine support status. Both the SMI and the RMI results were below the threshold values, indicating the non-support of cold water aquatic life. Since Crane Creek is classified as a fifth order water body, the RMI is an appropriate index to apply to this water body. Table 54 shows the RMI metrics, metric scores, and final index score.

**Table 54. River Macroinvertebrate Index Scores. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Metric | Crane Creek below Crane Creek Reservoir RMI[a] Metric Score | Crane Creek below Crane Creek Reservoir RMI Score |
|---|---|---|
| Number of Taxa | 12 | 1 |
| Number EPT[b] Taxa | 6 | 1 |
| Percent Elmidae | 0% | 1 |
| Percent Dominate Taxa | 47.57% | 3 |
| Percent Predators | 0% | 1 |
| Total RMI Index Score | | 7 |
| Condition Rating | | Below minimum threshold |

*a River Macroinvertebrate Index, RMI Score <11="below minimal threshold" RMI Score 11-13=condition rating "1", RMI Score 14-16=condition rating "2", RMI Score >16=condition rating "3"*
*b Ephemeroptera-Plecoptera-Trichoptera*

Additional analysis of the presence or absence of certain indicator species would assist in determining if a pollutant of concern is impairing the designated uses for Crane Creek. The complete absence of Plecoptera order strongly indicates that sediment is a pollutant impairing the cold water aquatic life designated use. Numerous species in the Plecoptera order are intolerant of sediment and usually are a good indicator of cold water aquatic life support status (Hafele and Hinton 1996).

**Water Column Data**

Appendix C contains information on data that will be used in this assessment. The available data will assist in determining the support status of the designated uses and the loading capacity required for the lower Weiser River and the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

The USGS conducted intensive suspended sediment monitoring on Crane Creek for several years in the 1970s and 1980s. Discharge was the only other parameter that received intensive monitoring. DEQ conducted one year of intensive monitoring from 1983 to 1984 and examined numerous parameters. EPA monitoring conducted in the year 1975 was a portion of an overall watershed monitoring effort conducted by Tangarone and Bogue (1976). The Tangarone and Bogue (1976) study provides limited information with few data points. However, it is one of the few published reports concerning this segment.

Crane Creek was not included in the 2000-2001 Weiser River monitoring effort conducted by DEQ. However, in July 2003, DEQ initiated an intensive *E. coli* monitoring effort to gather additional information and to determine support status for primary contact recreation.

Each of the listed pollutants of concern will be discussed separately. Recommendations will then be made on actions to address those pollutants related to Crane Creek and the Weiser River and to address the targets established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

*Bacteria*

Crane Creek is designated for primary contact recreation (IDAPA 58.01.02.140.18.SW-3). A discussion of the criteria for contact recreation is found in Section 2.3.

The results of water quality monitoring for fecal coliform conducted on this segment triggered additional monitoring (Note: past studies focused on the fecal coliform indicator for the support of primary and secondary contact recreation; in the year 2000, Idaho changed the criteria to the use of *E. coli*). With the change in the criteria to *E. coli* in the year 2000, it was decided that additional monitoring for *E. coli* would be required to determine if Crane Creek is supporting the primary contact recreation designation under the new criteria.

The Idaho Department of Agriculture collected *E. coli* data between the years 2000 and 2003. These results are presented in Appendix C, as are results from DEQ monitoring of fecal coliform conducted in the years 1983 and 1984. The results from the Idaho Department of Agriculture do show numerous exceedances of the single sample WQS criterion for *E. coli*. These single sample exceedances are not in themselves a violation of WQS, but they do trigger a requirement for additional monitoring to determine a 30-day geometric mean.

Data collected in the year 2003 focused on the *E. coli* criteria and on obtaining a geometric mean to determine compliance with IDAPA 58.01.02.251.01.c. The geometric mean results from the year 2003 are shown in Table 55. Table 56 shows the results from duplicate samples taken at the same time.

The data indicate that the primary and secondary contact recreation geometric mean criterion is exceeded near the confluence with the Weiser River. The data demonstrate the segment is not supporting the primary contact recreation designated use.

**Table 55. *E. coli* Individual and Geometric Mean Results, June-July 2003. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Station Location | Date of Monitoring | Flow (cfs)[a] | E. coli (cfu/100 ml)[b] |
|---|---|---|---|
| Crane Creek near USGS Gage 13265500 | 06/30/2003 | 72.8 | 1,700 |
| Crane Creek near USGS Gage 13265500 | 07/08/2003 | 105 | 520 |
| Crane Creek near USGS Gage 13265500 | 07/21/2003 | 164 | 390 |
| Crane Creek near USGS Gage 13265500 | 07/22/2003 | 229 | 300 |
| Crane Creek near USGS Gage 13265500 | 07/28/2003 | 221 | 260 |
| | | | |
| | | Geometric Mean | 411 |

*a cubic feet per second*
*b colony forming units per 100 milliliters*

**Table 56. Duplicate *E. coli* Individual and Geometric Mean Results, June-July 2003. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Station Location | Date of Monitoring | Flow (cfs)[a] | E. coli (cfu/100 ml)[b] |
|---|---|---|---|
| Crane Creek near USGS Gage 13265500 | 06/30/2003 | 72.8 | 2,100 |
| Crane Creek near USGS Gage 13265500 | 07/08/2003 | 105 | 500 |
| Crane Creek near USGS Gage 13265500 | 07/15/2003 | 164 | 340 |
| Crane Creek near USGS Gage 13265500 | 07/21/2003 | 229 | 220 |
| Crane Creek near USGS Gage 13265500 | 07/28/2003 | 221 | 280 |
| | | | |
| | | Geometric Mean | 466 |

*a cubic feet per second*
*b colony forming units per 100 milliliters*

*Nutrients*

Unlike the constituents discussed above, there are no numeric WQS for nutrients. A further discussion of WQS criteria and beneficial use support is located in Section 2.4.

Instantaneous dissolved oxygen levels measured by DEQ in the years 1983 and 1984 showed no violations of the Idaho WQS for water column dissolved oxygen (See Figure 51). Twenty-four-hour monitoring was not conducted. Periphyton results may indicate an organic load based on the pollution tolerance metrics. Dissolved oxygen data collected by the Idaho Department of Agriculture in the year 2000 and did not indicate violations of WQS (Figure 52).

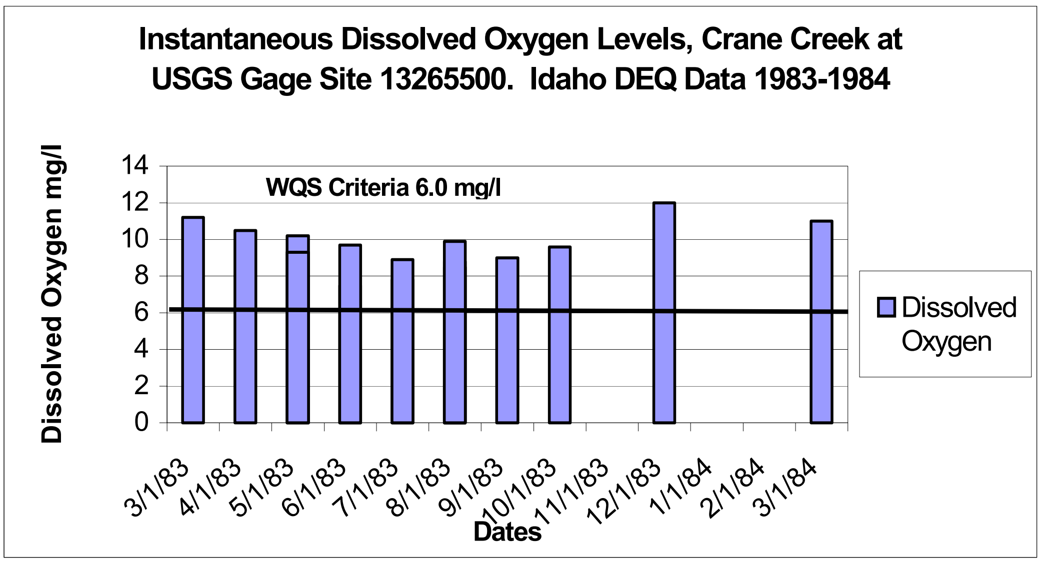



**Figure 51. Instantaneous Dissolved Oxygen Levels, Crane Creek at USGS Gage No. 13265500. DEQ Data 1983-1984. Crane Creek, Crane Creek Reservoir to Weiser River.**

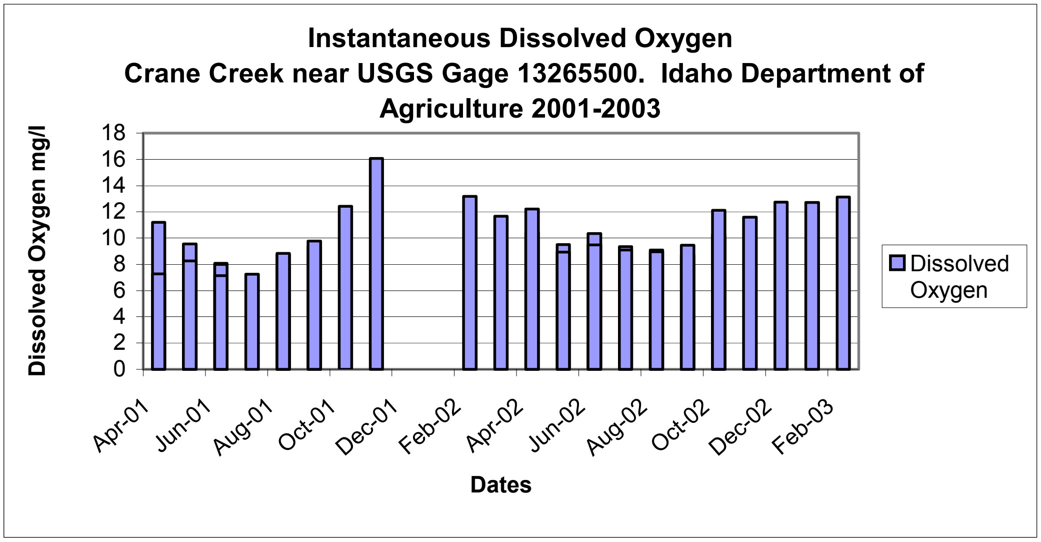



**Figure 52. Instantaneous Dissolved Oxygen Levels, Crane Creek at USGS Gage No. 13265500. Idaho Department of Agriculture Data 2000-2003. Crane Creek, Crane Creek Reservoir to Weiser River.**

It is unclear whether or not nutrients are impairing the water quality in Crane Creek. Water column data for dissolved oxygen do not appear to indicate a problem that may be associated with excessive nutrients. Periphyton information shows an organic load that may or may not indicate that nutrients are impairing the designated uses in Crane Creek.

However, it has been determined that nutrients entering the Snake River from the Weiser River Watershed are impairing the Snake River's beneficial uses. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has identified phosphorus as the nutrient of concern originating from the Weiser River Watershed and other watersheds discharging to the Snake River. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has set a total phosphorus target of 0.07 mg/L to prevent eutrophic conditions. This target has also been assigned to the major tributaries of the Snake River in southwestern Idaho and eastern Oregon (e.g., Payette River, Boise River, Malheur River, Owyhee River, and Weiser River). Current total phosphorus levels in the Weiser River exceed the total phosphorus target of 0.07 mg/L. This target must be met during the period from May through September. This period has been identified as the critical period to prevent nuisance aquatic growth in the Snake River and Brownlee Reservoir.

*Sediment*

Sediment is a pollutant of concern listed for Crane Creek. Macroinvertebrate and periphyton analyses indicate that sediment is impairing the designated uses within the creek. Additionally, the loading analysis for sediment for the lower and middle Weiser River indicate that reduction in sediment loading might be required from tributaries to achieve targets on the lower segments below the Little Weiser River confluence.

Data from the Idaho Department of Agriculture intensive study conducted during the years 20012003 were used to calculate TSS loading from Crane Creek. The results are shown in Table 57. Additional suspended sediment data are available in Appendix C. The studies shown in Appendix C were completed by USGS in various years and DEQ in 1983-84 and looked at suspended sediment and not TSS.

**Table 57. Measured Total Suspended Solid Concentrations, Discharge, and Total Suspended Solids Load, near USGS Gage No. 13265500. Idaho Department of Agriculture 2000-2002. Crane Creek, Crane Creek Reservoir to Weiser River.**

| | TSS[a] Concentration (mg/L)[b] | Discharge (cfs)[c] | TSS Load (kg/day)[d] |
|---|---|---|---|
| Average | 15.3 | 60.8 | 3,711 |
| Standard Deviation | 15.9 | 68.8 | 5,349 |
| Maximum | 64.0 | 202 | 21,291 |
| Minimum | 2.0 | 1.0 | 8 |
| Count | 38 | 38 | 38 |

*a total suspended solids*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

As with total phosphorus loads calculated for the lower Weiser River and middle Weiser River, normalized discharge should also be calculated for the USGS gage site on Crane Creek for suspended sediment. The normalization of the discharge will assist in establishing suspended sediment loads and concentrations based on average daily discharges. Figure 53 shows the results of the regression analysis based on normalized discharge. Table 58 presents the normalized suspended sediment concentrations, discharge, and suspended sediment load based on the regression analysis.

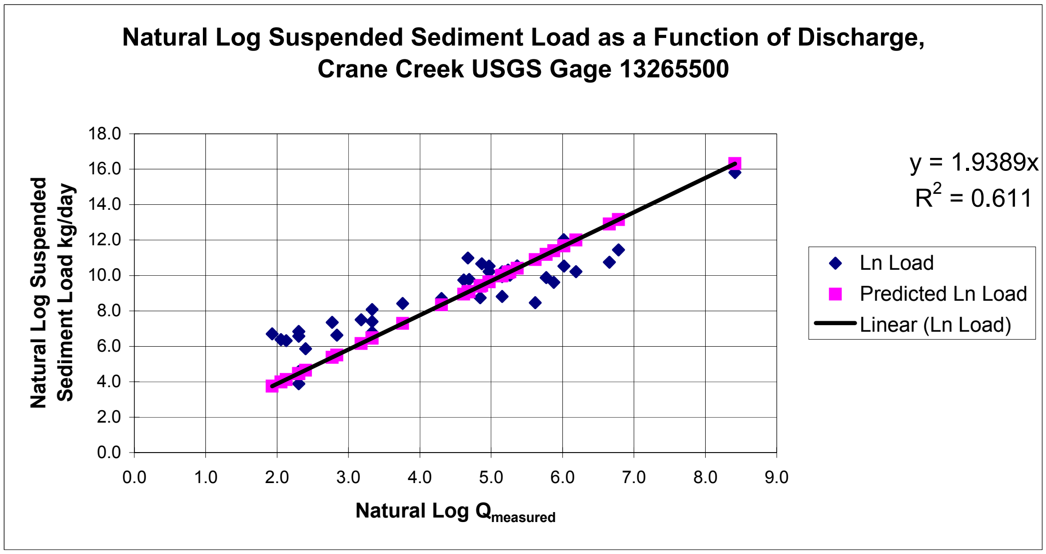



**Figure 53. Regression Analysis for Suspended Sediment Load as a Function of Discharge. Crane Creek at USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.**

Further statistical analysis and comparison of measured and estimated suspended sediment concentrations and loads are presented in Table 58. Measured suspended sediment load and estimated suspended sediment load were analyzed to determine error or bias in calculations. Overall the measured TSS loads provided a lower percent difference than the estimated load.

**Table 58. Measured and Estimated Total Suspended Solid Concentrations, Discharge, and Total Suspended Solids Load, USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.**

| | Measured Discharge (cfs)[a] | Measured TSS[b] Concentration (mg/L)[c] | Measured TSS Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated TSS Concentration (mg/L) | Estimated TSS Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 60.8 | 15.3 | 3,711 | 82.1 | 19.3 | 6,162 |
| Standard Deviation | 68.8 | 15.9 | 5,349 | 67.5 | 14.2 | 8,512 |
| Maximum | 202 | 64.0 | 21,291 | 269 | 56.8 | 37,372 |
| Minimum | 1.0 | 2.0 | 8 | 7.4 | 2.4 | 43 |
| Count | 38 | 38 | 38 | 38 | 38 | 38 |
| | | | | | Square Root Error | 63,376 |
| | | | | | % Difference Measure | 5.9% |
| | | | | | % Difference Estimated | 9.7% |

*a cubic feet per second*
*b total suspended solids*
*c milligrams per liter*
*d kilograms per day*

Table 59 shows the estimated monthly flows, TSS loads, and TSS concentration for Crane Creek at USGS Gage No. 13265500.

The results from the TSS regression analysis provide a detailed daily and monthly sediment load and concentration analysis. However, the results from the modeling effort may underestimate high yield slugs of suspended sediment associated with the rising hydrograph, reservoir releases, and/or storm events. The sediment curve rating may equally overestimate long- and short-term suspended sediment averages. These over/under estimations will be examined in more detail in the development of a TMDL for this parameter.

**Table 59. Estimated Monthly Total Suspended Solids Concentrations, Discharge, and Total Suspended Solids Loads at USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Month | Estimated Discharge (cfs)[a] | TSS[b] Estimated Load (kg/day)[c] | TSS Estimated Concentration (mg/L)[d] |
|---|---|---|---|
| October | 17.1 | 235 | 5.0 |
| November | 10.3 | 87 | 3.2 |
| December | 34.4 | 1,072 | 9.0 |
| January | 93.3 | 5,741 | 22.2 |
| February | 184 | 18,797 | 40.6 |
| March | 207 | 23,468 | 45.0 |
| April | 115 | 9,289 | 26.4 |
| May | 37.3 | 961 | 9.9 |
| June | 22.3 | 359 | 6.3 |
| July | 99.0 | 6,356 | 23.3 |
| August | 140 | 10,908 | 31.8 |
| September | 72.9 | 3,483 | 17.9 |

*a cubic feet per second*
*b total suspended solids*
*c kilograms per day*
*d milligrams per liter*

The TSS concentrations listed in Table 59 do not indicate that the water column component of the sediment load is at a level that would impair beneficial uses. Additional substrate and water column evaluations should be completed to determine impairment. In addition, a comparison of TSS and suspended sediment concentrations should be completed. Past water quality monitoring conducted by USGS has shown suspended sediment concentrations do exceed the recommended level.

**Status of Beneficial Uses**

Both the narrative and numeric criteria were examined for the listed pollutants of concern to determine beneficial use support status in Crane Creek. A biological assessment was conducted, and the resulting data were compared to indices developed and published in the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). Analysis of the biological communities revealed that sediment, a pollutant of concern listed on the 1998 Idaho §303(d) list, is impairing the designated uses established for Crane Creek. Impairment was noted by the lack of sediment intolerant species. However, water column concentrations did not exceed recommended concentrations. Additional substrate and water column assessments should be completed. *E. coli* bacteria exceeded concentrations needed to support contact recreation in Crane Creek. Table 60 provides information of the final assessment and status of the designated beneficial uses.

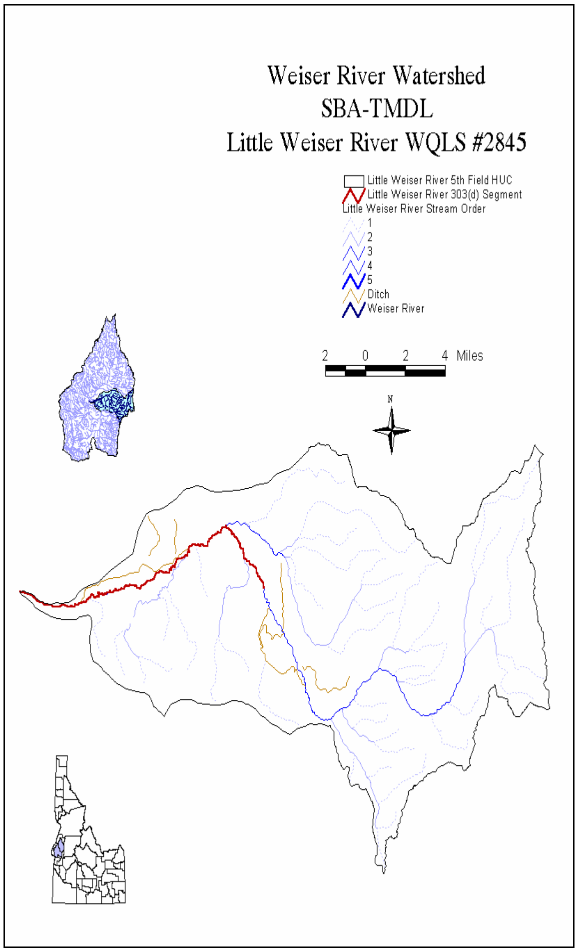
**Table 60. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Crane Creek, Crane Creek Reservoir to Weiser River.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendations |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not Supported | Sediment | Biological Assessment Indicated Impairment | Additional Monitoring Required for Sediment Impairment. Develop Total Phosphorus Allocations.[a] |
| Primary Contact Recreation | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Secondary Contact Recreational | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

Nutrient targets have also been established through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus in the lower Weiser River have shown that reduced levels must be reached in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These reductions will also be allocated to address nutrient loading from tributaries and upstream sources. Possible load allocations for total phosphorus for the Crane Creek Watershed are discussed in Section 3.2.

## Little Weiser River, Indian Valley to Weiser River




| Water Body | Little Weiser River, Indian Valley to Weiser River |
|---|---|
| Miles of impaired water body | 17.3 |
| Listed pollutants | Sediment and Nutrients (Bacteria monitoring in 2002 showed exceedances of criteria) |
| Potential impaired designated uses | Cold water aquatic life and primary contact recreation |
| Potential Sources | Overland flow, irrigation induced erosion, rangeland, streambank erosion |

### Discharge (Flow) Characteristics

An historic USGS (1920-1926) discharge gage (13261500) is located near the mouth of the Little Weiser River, approximately 3 miles upstream from the confluence with the Weiser River. The Little Weiser River discharges are regulated somewhat by irrigation water demand from upstream diversions. Water is diverted from the Little Weiser River to Ben Ross Reservoir. The diversion to the reservoir occurs near river mile 27, upstream of Indian Valley. Irrigation water is released from the reservoir for irrigation water use in the Indian Valley area. Other in-river diversions can also be found in the watershed, but most are used for gravity-fed delivery systems.

Figure 54 shows the normalized discharge recorded at USGS Gage No. 13261500, located near the mouth of the Little Weiser River. The available discharge data sources are listed in Appendix C.

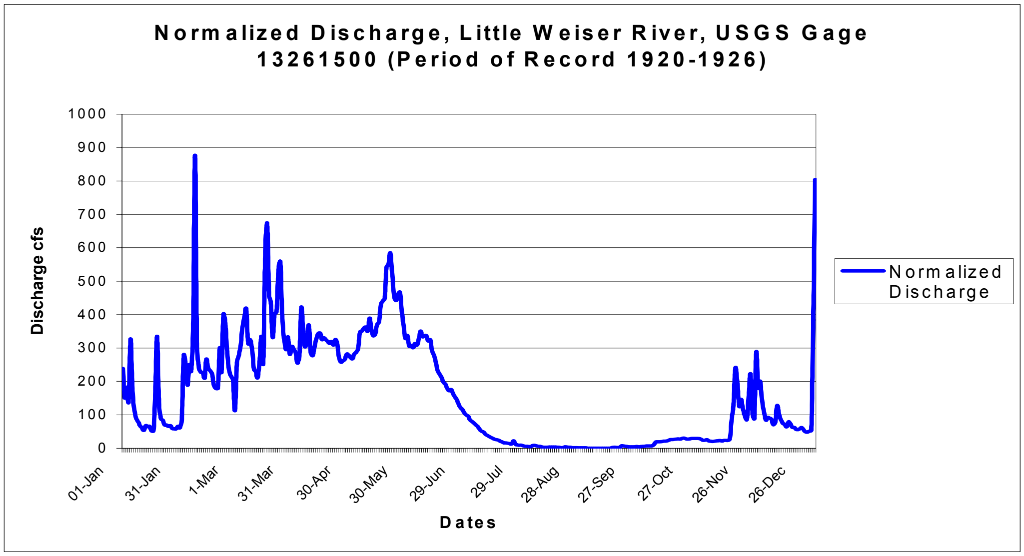



**Figure 54. Normalized Average Daily Discharge at USGS Gage No. 13261500. Little Weiser River, Indian Valley to Weiser River.**

The discharge data presented in Figure 54 were collected from the years 1920 to 1926. By contrast, USGS Gage No. 13261000, located above the Ben Ross Reservoir Diversion, has data on record dating from 1920 to 1972. This 52 years of data provides a better picture of daily discharge in the watershed. However, the total drainage area doubles between the two sites.

Discharge data from the upper site is usually associated with late spring snowmelt from higher elevations, while data from the lower site is usually associated with late winter and early spring snowmelt in the lower elevations. Figure 55 compares the two USGS sites.

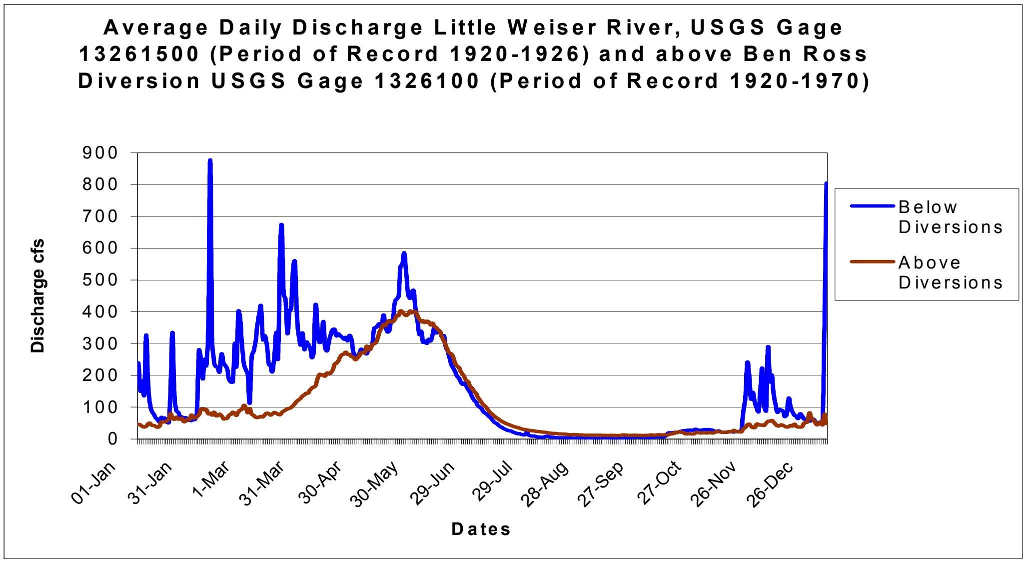



**Figure 55. Normalized Average Daily Discharge at USGS Gage No. 13261500 below Ben Ross Reservoir Diversion and at USGS Gage No. 13261000 above Ben Ross Reservoir Diversion. Little Weiser River, Indian Valley to Weiser River.**

During DEQ's intensive monitoring in the Weiser River Watershed during the years 2000-2001, one of the sites monitored was the Little Weiser River near the confluence with the Weiser River below Cambridge (Ingham 2000). Figure 56 shows the discharge results from DEQ monitoring conducted in during the years 2000-2001.

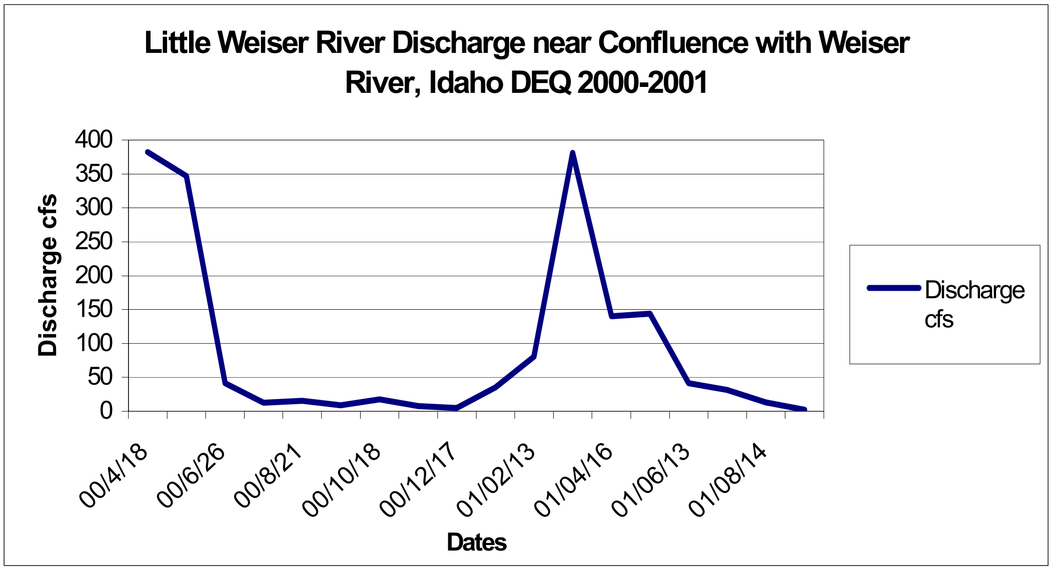



**Figure 56. Discharge Results Little Weiser River near Confluence with Weiser River, near Cambridge, Idaho. DEQ 2000-2001. Little Weiser River, Indian Valley to Weiser River.**

## Biological and Other Data

Biological information is limited to three sites on the lower Little Weiser River. These data were collected as a part of Idaho BURP monitoring in the years 1996 and 2002. These three sites are all within the §303(d) listed segment. However, due to laboratory error, the macroinvertebrate samples collected in 1996 were destroyed. The 2002 macroinvertebrate data is provided in Table 62b. Periphyton samples were collected during the year 1996 and will also be evaluated in this biological assessment. The IDFG provided no fisheries information for the lower Little Weiser, and DEQ has never conducted fisheries evaluations in the lower part of this watershed. Appendix C contains information on the lower Little Weiser River BURP sites.

*Periphyton*

Periphyton samples were collected at one site in the year 1996 (1996BOIA072). This site is located approximately 6 miles east of Cambridge, Idaho, and approximately 9 miles upstream of the confluence with the Weiser River. Sample results were entered into the RDI developed by DEQ. The applicable metrics are discussed below.

The RDI scores in Table 61 show a high percentage of pollution tolerant and very motile species. The overall RDI score indicates a rating of a category 1. When this rating is averaged together with other indices (RMI, RFI, or RPI) and the average category rating is less than 2, cold water aquatic life is not fully supported (Grafe et al. 2002). However, when determining whether or not a certain pollutant is impairing designated uses, the high percentage of very motile species would indicate that sediment is affecting the community structure and composition. The high pollution tolerant percentage of alga species may also indicate organic loading (Bahls 2000 and 2001).

### Table 61. River Diatom Index Scores. Little Weiser River, Indian Valley to Weiser River.

| Metric | Little Weiser River near Confluence with Weiser River Metric Score | Little Weiser River near Confluence with Weiser River RDI[a] Score |
|---|---|---|
| % Pollutant Intolerant | 50.5% | 1 |
| % Pollutant Tolerant | 10.5% | 1 |
| Eutrophic Taxa Richness | 18 | 3 |
| % Nitrogen Heterotrophs | 36.1% | 1 |
| % Polysaprobic | 15.7% | 1 |
| Alkaliphilic Taxa Richness | 24 | 3 |
| % Requiring High Oxygen | 21.3% | 1 |
| % Very Motile | 13.4% | 3 |
| % Deformed | 0% | 5 |
| | | |
| Final River Diatom Index (RDI) Score | | 19 |
| Final Condition Category Rating | | 1 |

*a River Diatom Index, RDI Score<22=condition rating "1" RDI Score 22-33=condition rating "2" RDI Score >34=condition rating "3"*

*Fisheries*

Fish were collected at BURP site 2002SBOIA015. The results are included in Table 62a.

### Table 62a. Species Count and Stream Fish Index Scores, Little Weiser River BURP site 2002SBOIA015, near Cambridge

| Species Found | Weiser River, Lower Canyon | |
|---|---|---|
| | Count | Percent of Total |
| Bridgelip sucker | 8 | 15.0% |
| Speckled dace | 14 | 27.0% |
| Frog | 1 | 2.0% |
| Redside shiner | 28 | 56% |
| Total Number | 51 | 100% |
| SFI Score[a] | 49 | |
| Condition Rating | 1 | |

*Macroinvertebrates*

Table 62b shows the RMI metrics, metric scores, and final index scores for two sites below Indian Valley.

**Table 62b. Stream Macroinvertebrate Index Scores, Little Weiser River, Indian Valley to Weiser River.**

| Metric | 2002SBOIA012 | 2002SBOIA015 |
|---|---|---|
| Number of Taxa | 34 | 29 |
| Number EPT[a] Taxa | 17 | 11 |
| Percent Elmidae | 5.74 | 14.59 |
| Percent Dominate Taxa | 38 | 21.9 |
| Percent Predators | 3.36 | 9.27 |
| Total SMI Index Score | 57.9 | 44.8 |
| Condition Rating | 2 | 2 |

*a Ephemeroptera-Plecoptera-Trichoptera*

*Habitat*

Habitat conditions were inventoried during the BURP monitoring in 2002. Table 62c includes the Stream Habitat Index scores and condition ratings at these two sites.

| Site | 2002SBOIA012 | 2002SBOIA015 |
|---|---|---|
| Total SHI Index Score | 54 | 34 |
| Condition Rating | 1 | 1 |

**Table 62c. Stream Habitat Index Scores, Little Weiser River, Indian Valley to Weiser River**

**Water Column Data**

Unlike the lower or middle Weiser River, the Little Weiser River has limited water quality data. Appendix C contains data source descriptions of available data that will assist in determining the support status of the designated uses and the loading capacity required for the lower and middle Weiser River and for the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

The USGS conducted some limited monitoring immediately below the confluence with the Weiser River for suspended sediment in during the years 1981 and 1982. DEQ conducted an intensive 18-month study in the Weiser River Watershed from the year 2000 through 2001. One monitoring site was located on the Little Weiser River near the confluence with the Weiser River, west of Cambridge, Idaho. Appendix C contains information on the data sources.

Each of the listed pollutants of concern will be discussed separately. Recommendations will then be made to address those pollutants related to the Little Weiser River and the

Weiser River and to address the targets established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

*Bacteria*

The Little Weiser River is designated for primary contact recreation (IDAPA 58.01.02.140.18.SW-3). The WQS definition and criteria for primary contact recreation can be found in Section 2.4. Bacteria are not currently listed on the 1998 Idaho §303(d) list as a pollutant of concern in the Little Weiser River (Idaho DEQ 1998*a*).

During the 2002 BURP monitoring, one bacteria sample exceeded the single sample criterion for *E. coli*. This exceedence of the criterion triggered additional monitoring to determine further compliance or non-compliance of the *E. coli* geometric mean criterion in accordance with IDAPA 58.01.02.251.01.c. The results for the geometric mean for Little Weiser River are shown in Table 63, and the individual sample results are located in Appendix C.

The data indicate that *E. coli* bacteria exceeded concentrations needed to support contact recreation in the Little Weiser River.

**Table 63. *E. coli* Geometric Mean Results, Year 2002. Little Weiser River, Indian Valley to Weiser River.**

| Station Location | Month and Year of Data | Number of Samples | *E. coli* Geometric Mean (cfu/100 ml)[a] |
|---|---|---|---|
| Little Weiser River at BURPID 2002SBOIA015[b] | August 2002 | 5 | 661 |

*a Colony forming units per 100 milliliters*
*b BURPID2002BOIA015 is located 50 meters upstream of the confluence with the Weiser River*

*Nutrients*

Unlike the constituents discussed above, there is no numeric WQS criterion for nutrients. The WQS is a narrative criterion as described in IDAPA 52.01.02.200.06. A discussion of the nutrient criterion is located in Section 2.3.

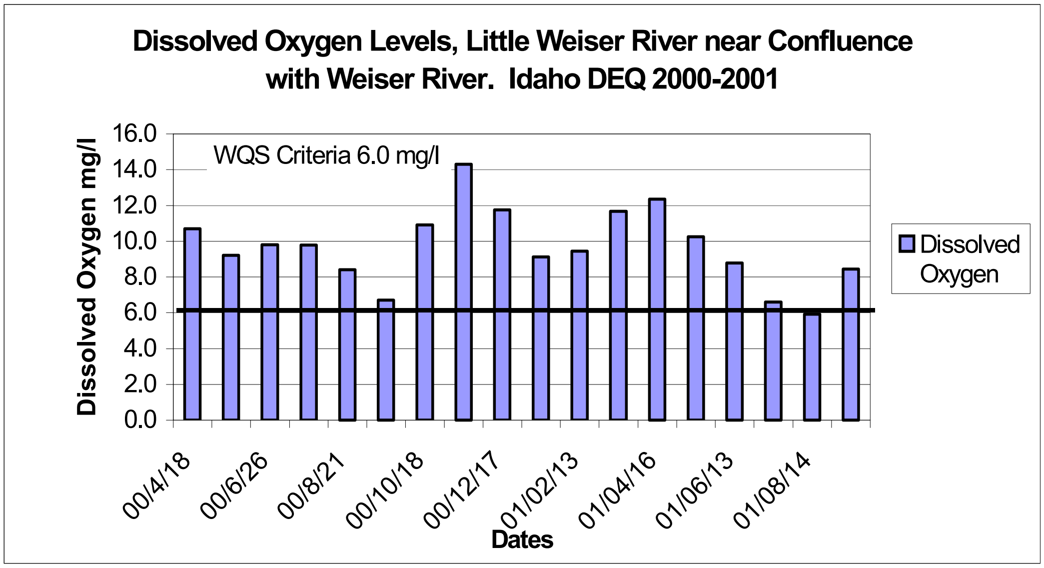



**Figure 57. Instantaneous Dissolved Oxygen Levels, Little Weiser River near Confluence with Weiser River. DEQ Data 2000-2001. Little Weiser River, Indian Valley to Weiser River.**

Instantaneous measurement of dissolved oxygen taken from the year 2000 –to 2002 by DEQ showed no exceedances of the Idaho WQS for water column dissolved oxygen levels. Twenty-four-hour monitoring was not conducted.

It is not clear whether or not nutrients are impairing the water quality in the Little Weiser River. Water column data for dissolved oxygen indicated only 5.6% of samples collected were less that the WQS criterion of 6.0 mg/L. With this in mind, it is unlikely that excessive nutrients are contributing to impairment with regards to dissolved oxygen. Current EPA guidance states that a violation occurs when 10% or more of the samples for a parameter do not meet the WQS. However, available periphyton data may be indicative of an organic load that may or may not mean that nutrients are impairing the designated uses in the Little Weiser River. The low percentage (21.3%) of high oxygen-requiring periphyton species may mean that low dissolved oxygen concentrations may be impairing cold water aquatic life. The increased percentage (15.7%) of polysaprobic species may indicate an organic load that impairs cold water aquatic life.

However, as seen in the Weiser River downstream of the Little Weiser River, nutrients entering the Snake River from the Weiser River Watershed are contributing to the impairment of the Snake River's beneficial uses. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has identified phosphorus as the nutrient of concern originating from the Weiser River Watershed and other watersheds discharging to the Snake River. The *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004) has set a total phosphorus target of 0.07 mg/L to prevent eutrophic conditions. This target must be met from May through September and has been identified as critical to prevent nuisance aquatic growth in the Snake River and Brownlee Reservoir. Possible allocations for the Little Weiser River are discussed in Section 3.2.

*Sediment*

It is not known if sediment is causing an impairment of beneficial uses in the Little Weiser River. Biological indicators show a high presence of sediment tolerant species. Further analysis of macroinvertebrate data will assist in determining if sediment is impairing the beneficial uses.

As discussed in Section 2.4, substrate composition will affect biological communities and structure. In August 2003, DEQ evaluated the substrate at three locations on the Little Weiser River. Table 64 shows the percentage of the substrate that is less than 6.0 mm in size.

**Table 64. Percent Substrate Less Than 6 Millimeters in Size. Little Weiser River, Indian Valley to Weiser River.**

| | Little Weiser River |
|---|---|
| Percent of Substrate Less than 6 mm in Size | 13.0% |

**Status of Beneficial Uses**

Both the narrative and numeric criteria were examined for the listed pollutants of concern to determine beneficial use support status in the Little Weiser River. A biological assessment was conducted, and the data were compared to indices developed and published in the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). Analysis of the biological communities revealed that sediment, a pollutant of concern listed on the 1998 Idaho §303(d) list, is in all likelihood impairing the designated uses established for Little Weiser River. Analyses of the BURP data from the two sites below Indian Valley indicate that the river is not fully supporting beneficial uses. This is based on the average of the condition ratings of the stream macroinvertebrate, fish and habitat monitoring. To be considered full support a stream must have a final average score of at least “2”. BURP site 2002SBOIA012 scored “1.5”, and site 2002SBOIA015 scored “1.33”. Although not totally clear from the available data, nutrients are at levels that could impair designated uses. This conclusion is based on high levels of total phosphorus and the periphyton indicator species. Through water quality monitoring and biological assessment, it was also determined that *E. coli* bacteria are impairing designated uses on the Little Weiser River. Two BURP monitoring sites in the upper Little Weiser River watershed on the Payette National Forest (2002SBOIA013 and 2002SBOIA014) were full support. Table 65 provides information of the final assessment and status of the designated beneficial uses.

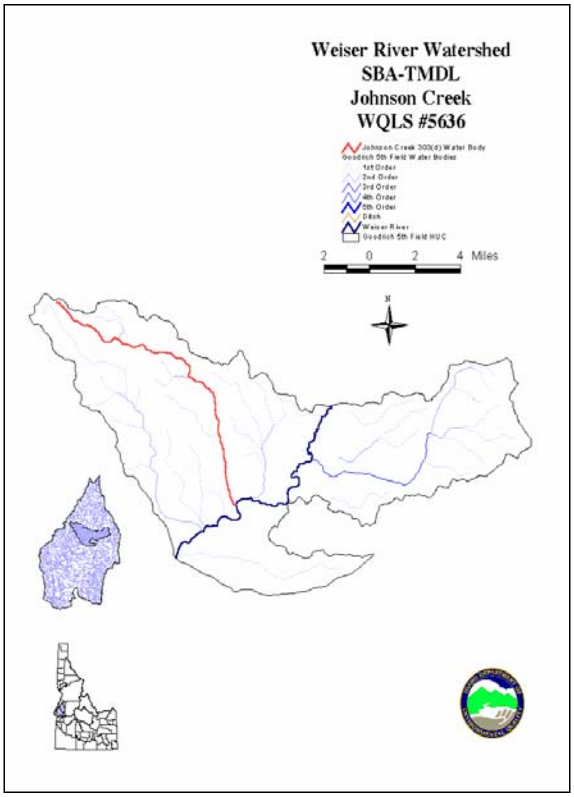
**Table 65. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Little Weiser River, Indian Valley to Weiser River.**

| Designated Use | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not Supported | Sediment | Biological Assessment Indicated Impairment | Develop Sediment TMDL. Develop Total Phosphorus Allocations.[a] |
| Primary Contact Recreation | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Secondary Contact Recreational | Not Supported | Bacteria | Numeric Criteria Exceeded | Develop TMDL to Address Bacteria |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

In addition to protecting the designated uses for the Little Weiser River, nutrient targets have been established through the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Evaluation and modeling for total phosphorus in the lower Weiser River have shown that reduced levels must occur in this segment to achieve the targets outlined in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These reductions will be allocated to address nutrient loading from tributaries and upstream sources also. The Little Weiser River is a major tributary to the lower and middle Weiser River. Possible load allocations are discussed in Section 3.2.

## Johnson Creek, Headwaters to Weiser River




| Water Body | Johnson Creek, Headwaters to Weiser River |
|---|---|
| Miles of Impaired Water Body | 13.7 |
| Listed Pollutants | Unknown |
| Potential Impaired Designated Uses | Cold water aquatic life and salmonid spawning |
| Potential Sources | Forest practices and overland flow |

### Biological Data

Based on a biological assessment using BURP data from the years 1994 and 1995, Johnson Creek is classified as fully supporting its designated uses. Table 66 shows the final assessment scores and the condition rating based on the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). Based on the index scores shown below, Johnson Creek is fully supporting its designated uses.

**Table 66. Beneficial Use Reconnaissance Program Index Scores for Johnson Creek. Johnson Creek, Headwaters to Weiser River.**

| BURP[a] Site ID No. | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | SFI[d] Score | Condition Rating | Final Condition Rating | Support Status |
|---|---|---|---|---|---|---|---|---|
| 1994SBOI A063 | 65.59 | 3 | 28 | 1 | NA | NA | 2 | Full Support |
| 1995SBOI B036 | 59.56 | 3 | 63 | 3 | 38.33 | 1 | 2.3 | Full Support |
| 2002SBOI A016 | 58.7 | 2 | 66 | 3 | 92.00 | 3 | 2.3 | Full Support |
| 2002SBOI A017 | 73.5 | 3 | 82 | 3 | NA | NA | 3 | Full Support |

*a Beneficial Use Reconnaissance Program*
*b Stream Macroinvertebrate Index*
*c Stream Habitat Index*
*d Stream Fish Index*

Based on the scores presented in Table 66, no further assessment is required on Johnson Creek. Johnson Creek, should be removed as an impaired water body on future Idaho §303(d) lists.

### Status of Beneficial Uses

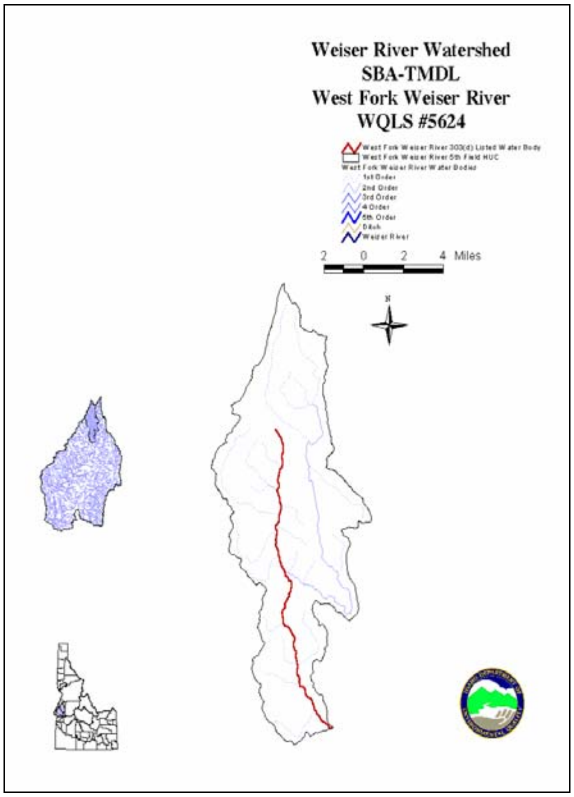
Table 67 shows the status for all designated uses in Johnson Creek, the pollutants impairing those uses, justifications, and recommendations.

**Table 67. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. Johnson Creek, Headwaters to Weiser River.**

| Designated Uses | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Fully Supported | | Assessment Shows Full Support | No Action to be Taken/ Remove from 303(d) list |
| Salmonid Spawning | Fully Supported | | Assessment Shows Full Support | No Action to be Taken/ Remove from 303(d) list |
| Primary Contact Recreation | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Secondary Contact Recreational | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Drinking Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

It is unlikely that a nutrient or sediment load reduction will be placed on Johnson Creek. Therefore, allocations from tributaries will not be required based on the analysis completed on downstream segments.

## West Fork Weiser River, Headwaters to Weiser River




| Water Body | West Fork Weiser River, Headwaters to Weiser River |
|---|---|
| Miles of impaired water body | 15.9 |
| Listed pollutants | Unknown |
| Potential Impaired designated uses | Cold water aquatic life and salmonid spawning |
| Potential sources | Forest practices, irrigated induced erosion, roads, overland flow |

### Biological Data

A biological assessment was completed on the West Fork Weiser River pursuant to the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). In the year 2002, BURP monitoring was conducted. The results from that monitoring indicate that this stream segment is fully supporting its beneficial uses.

**Table 68. Beneficial Use Reconnaissance Program Index Scores for the West Fork Weiser River. West Fork Weiser River, Headwaters to Weiser River.**

| BURP[a] Site ID No. | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | SFI[d] Score | Condition Rating | Final Condition Rating | Support Status |
|---|---|---|---|---|---|---|---|---|
| 1993SBOI025 | 63.76 | 3 | 19 | 1 | NA[e] | NA | 2 | Full Support |
| 1993SBOI026 | 55.76 | 2 | 20 | 1 | NA | NA | 1.5 | Not Full Support |
| 2002SBOIA018 | 56.6 | 2 | 63 | 2 | 84 | 3 | 2.33 | Full Support |
| 2002SBOIA019 | 87.5 | 3 | 80 | 3 | NA | NA | 3 | Full Support |

*a Beneficial Use Reconnaissance Program*
*b Stream Macroinvertebrate Index*
*d Stream Habitat Index*
*d Stream Fish Index*
*e Results unavailable for 1993*

### Status of Beneficial Uses

Table 69 shows the status for all designated uses in the West Fork Weiser River, the pollutants impairing those uses, justifications, and recommendations.

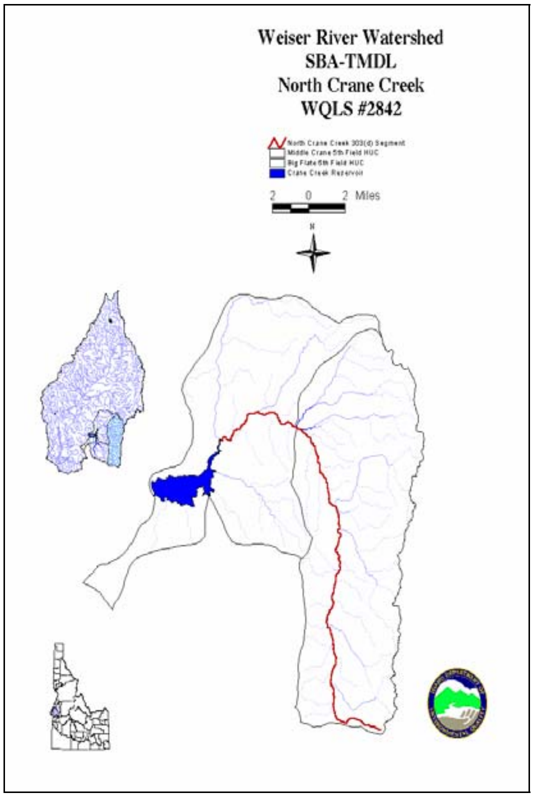
**Table 69. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. West Fork Weiser River, Headwaters to Weiser River.**

| Designated Uses | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Fully Supported | | Assessment Shows Full Support[a] | No Action to be Taken/ Remove from 303(d) list. |
| Salmonid Spawning | Fully Supported | | Assessment Shows Full Support[a] | No Action to be taken/ Remove from 303(d) list. |
| Primary Contact Recreation | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Secondary Contact Recreational | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Drinking Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Support status determined by Idaho DEQ* Water Body Assessment Guidance *(Grafe et al. 2002). Additional data required to make full assessment*

It is unlikely that a nutrient or sediment load reduction will be placed on the West Fork Weiser River. Therefore, allocations from tributaries will not be required based on the analysis completed on downstream segments.

## North Crane Creek, Headwaters to Crane Creek Reservoir




| Water Body | North Crane Creek Headwaters to Crane Creek Reservoir |
|---|---|
| Miles of impaired water body | 24.7 |
| Listed pollutants | Sediment, Temperature, Bacteria, Nutrients, and Flow |
| Potential impaired designated uses | No designated uses |
| Potential sources | Overland flow, irrigation induced erosion, rangeland, stream bank erosion |

### Flow Characteristics

North Crane Creek originates in the rolling, sagebrush-covered hills northeast of Weiser, Idaho. As with most water bodies in the southern portion of the watershed, discharge from the watershed is usually associated with snowmelt, rain-on-snow events, and summertime thunderstorms. There are no major impoundments on North Crane Creek. Numerous small stock ponds can be found throughout the watershed on smaller first and second order water bodies. In the lower elevations, the water body meanders through a wide valley with irrigated pastures and hayfields as the dominant land uses along the stream corridor. Rangeland makes up the dominant upland land use.

No information could be found concerning discharge from the North Crane Creek Watershed in USGS discharge records. In the year 2000, the Idaho Department of Agriculture began intensive monitoring in the lower Weiser River Watershed. The discharge data from this monitoring were the only data found that cover a substantial period. The Idaho Department of Agriculture data are presented in Figures 58 and 59. Since discharge data showed substantial periods of no discharge, bar graphs are provided rather than line graphs. Appendix C contains information on data sources.

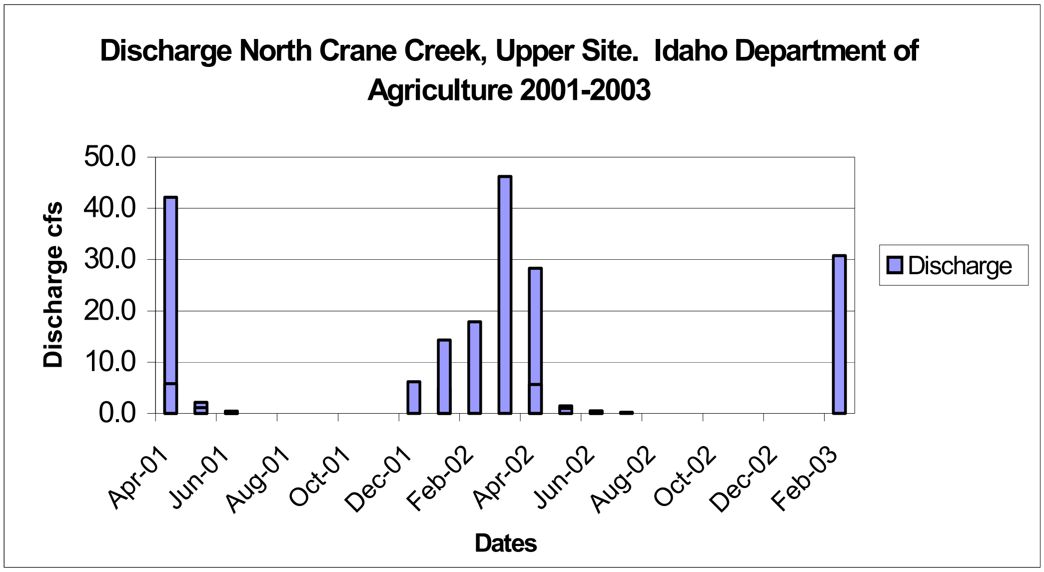



**Figure 58. Discharge 2001-2002, Idaho Department of Agriculture, Upper North Crane Creek Site. North Crane Creek, Headwaters to Crane Creek Reservoir.**

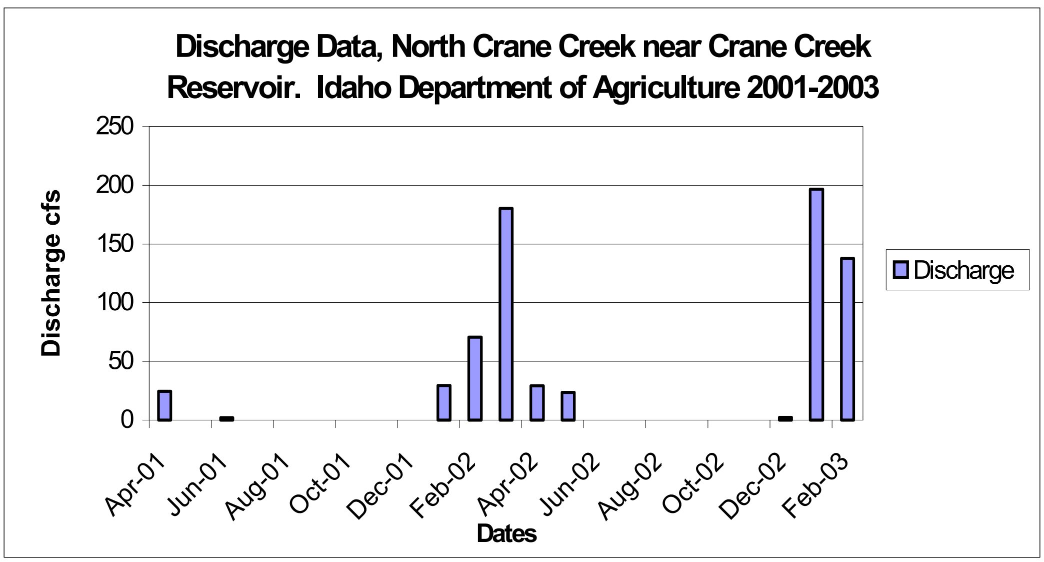



**Figure 59. Discharge 2001-2003, Idaho Department of Agriculture, Lower North Crane Creek Site. North Crane Creek, Headwaters to Crane Creek Reservoir.**

As shown in Figures 58 and 59, North Crane Creek is best described as intermittent. As recorded in the two years of discharge data from the Idaho Department of Agriculture, the period from July through December had zero discharge for both years, at both stations. A discussion of applicable WQS and intermittent waters can be found in Section 2.3.

The peak discharges are short in duration and are dependent on snowmelt and storm events. These periods are not optimal for the support of cold water aquatic life and will not provide adequate habitat for long term biological communities. Recreational use is not usually associated with short duration peak discharges.

**Biological and Other Data**

DEQ BURP monitoring occurred on two sites on the §303(d) listed segment. Both sites were evaluated in the year 1998. Table 70 shows the results of the BURP monitoring effort and the related index scores that will assist in determining the support status of the designated uses (Grafe et al. 2002).

### Table 70. Available Biological Data for North Crane Creek, Headwaters to Crane Creek Reservoir.

| BURP[a] ID No. | Date | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | Final Condition Score |
|---|---|---|---|---|---|---|
| 1995SBOIA001 | 5/24/95 | 15.73 | Below Threshold | | | Not Fully Supporting |
| 1996SBOIB022 | 6/20/96 | 22.51 | Below Threshold | | | Not Fully Supporting |
| 1997SBOIB010 | 6/17/97 | 14.40 | Below Threshold | | | Not Fully Supporting |
| 1997SBOIB011 | 6/18/97 | 32.03 | Below Threshold | | | Not Fully Supporting |
| 1997SBOIB012 | 6/18/97 | 22.01 | Below Threshold | | | Not Fully Supporting |

*a Beneficial Use Reconnaissance Program*
*b Stream Macroinvertebrate Index*
*c Stream Habitat Index*
*d No Data*
*e Not Applicable*

In accordance with the *Water Body Assessment Guidance* (Grafe et al. 2002), when the average of two index condition rating scores is equal to or greater than 2, the water body is considered fully supporting beneficial uses. Or, if one of the index scores is below the threshold value, the water body is not fully supporting cold water aquatic life. However, the intermittent water body criteria will apply. That is, if a water body has zero flow, the aquatic community indices cannot be used (Grafe et al. 2002). Numeric criteria still apply during periods of optimal flow. Therefore, further analysis of the impairment to beneficial uses and possible load allocations would be applied as described in IDAPA 58.01.02.003.53 and in IDAPA 58.01.02.70.06 and .70.07.

**Water Column Data**

Although there is no apparent impairment to beneficial uses after examining biological indicators in North Crane Creek, due to the stream's intermittent nature, further analysis of nutrient and sediment data may be warranted since load allocations for both parameters may be set for the lower Weiser River. Appendix C contains data source information.

*Bacteria*

Bacteria are a listed pollutant for North Crane Creek. A discussion of applicable criteria and contact recreation WQS is presented in Section 2.3.

Appendix C contains the results from Idaho Department of Agriculture bacteria monitoring that was conducted at two locations on North Crane Creek. Data collected in the years 2001 through 2003 show an exceedence of the single sample criterion for *E. coli* bacteria for primary contact recreation (IDAPA 58.01.02.251.01.b.). This exceedence does not necessarily mean that a violation of WQS is occurring, but it does trigger a requirement for additional bacteria monitoring to be conducted on the water body (IDAPA 58.01.02.80.03). That is, additional monitoring is needed to determine compliance with a more stringent geometric mean criterion.

In June 2003, DEQ conducted the additional monitoring required under IDAPA 58.01.02.80.03. The site selected is located approximately 5 miles upstream of the backwaters of Crane Creek Reservoir. These monitoring data are presented in Table 71.

**Table 71. Geometric Mean and Individual *E. coli* Results, DEQ June- July 2003. North Crane Creek, Headwaters to Crane Creek Reservoir.**

| Station Location | Location | Date | E. coli (cfu/100 ml)[a] |
|---|---|---|---|
| North Crane Creek | 5 miles upstream of reservoir | 06/26/2003 | 15 |
| North Crane Creek | 5 miles upstream of reservoir | 06/30/2003 | 31 |
| North Crane Creek | 5 miles upstream of reservoir | 07/08/2003 | 110 |
| North Crane Creek | 5 miles upstream of reservoir | 07/15/2003 | 23 |
| North Crane Creek | 5 miles upstream of reservoir | 07/21/2003 | 120 |
| | | | |
| | | Geometric Mean | 43 |

*a colony forming units per 100 milliliters*

The results presented in Table 71 indicate that the WQS criterion for primary contact recreation is fully supported.

*Temperature*

See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

*Nutrients*

Nutrients are listed as a pollutant of concern for North Crane Creek. Since North Crane Creek is an intermittent water body, it is not possible to determine whether nutrients are impairing the designated beneficial uses. However, there may be a required reduction in nutrients to achieve potential targets set for the lower Weiser River and/or the lower Snake River. A discussion of possible allocations for North Crane Creek is located in Section 3.2.

### Status of Beneficial Uses

North Crane Creek is an intermittent water body. As such, application of the WQS addressing intermittent water bodies will be applied. Table 72 provides information on the final assessment and status of the designated beneficial uses.

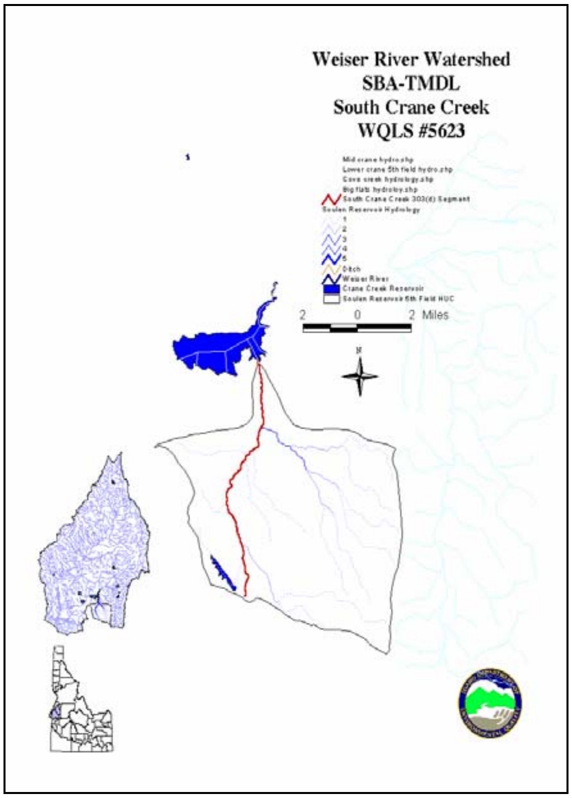
**Table 72. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. North Crane Creek, Headwaters to Crane Creek Reservoir.**

| Existing Uses | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not an Existing Use | | Application of Intermittent Water Body WQS[a] | Remove from 303(d) list – Intermittent Water Body. Develop Total Phosphorus Allocations[b]. |
| Primary Contact Recreation | Not an Existing Use | | Application of Intermittent Water Body WQS | Remove from 303(d) list – Intermittent Water Body |
| Secondary Contact Recreational | Existing Use | | Bacteria Data Indicate Full Support | Remove from 303(d) list – Intermittent Water Body |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Water quality standards*
*b Total phosphorus allocations are necessary to address nutrient targets established in the* Snake River-Hells Canyon SBA-TMDL *(Idaho DEQ and Oregon DEQ 2004).*

Although North Crane Creek has been determined to be intermittent, nutrient and sediment targets may be established for the lower Weiser River and the lower Snake River. North Crane Creek may be required to meet these targets. These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Along with total phosphorus, sediment targets may need to be established for the tributaries of the lower Weiser River and North Crane Creek. Also see the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## South Crane Creek, Headwaters to Crane Creek Reservoir




| Water Body | South Crane Creek Headwaters to Crane Creek Reservoir |
|---|---|
| Miles of impaired water body | 9.2 |
| Listed pollutants | Unknown |
| Potential impaired designated uses | No designated uses |
| Potential sources | Overland flow, irrigation induced erosion, rangeland, stream bank erosion |

### Discharge (Flow) Characteristics

South Crane Creek originates in the rolling, sagebrush covered hills northeast of Weiser, Idaho. As with most water bodies in the southern portion of the watershed, discharge from the watershed is usually associated with snowmelt, rain-on-snow events, and brief, sometimes heavy, summertime thunderstorms. Water diversion and storage occur in Soulen Reservoir, a 100- to 150-acre reservoir located in the headwaters. It is assumed that Soulen Reservoir provides livestock water and irrigation water storage for agricultural land further downstream.

In the lower elevations, South Crane Creek meanders through a wide valley, with irrigated pasture and hayfields as the dominant land uses along the stream corridor. Small impoundments can be found throughout the watershed. Two larger impoundments, approximately 10 to 20 acres each, can be found in the Tennison Creek Watershed, the only large water body that contributes discharge to South Crane Creek.

No historic USGS discharge records could be found concerning discharge from the South Crane Creek Watershed. In the year 2000, the Idaho Department of Agriculture began intensive monitoring in the lower Weiser River Watershed. Data from this monitoring effort were the only data found that cover a substantial period. The Idaho Department of

Agriculture data are presented in Figure 60. Appendix C contains a description of the data sources for South Crane Creek.

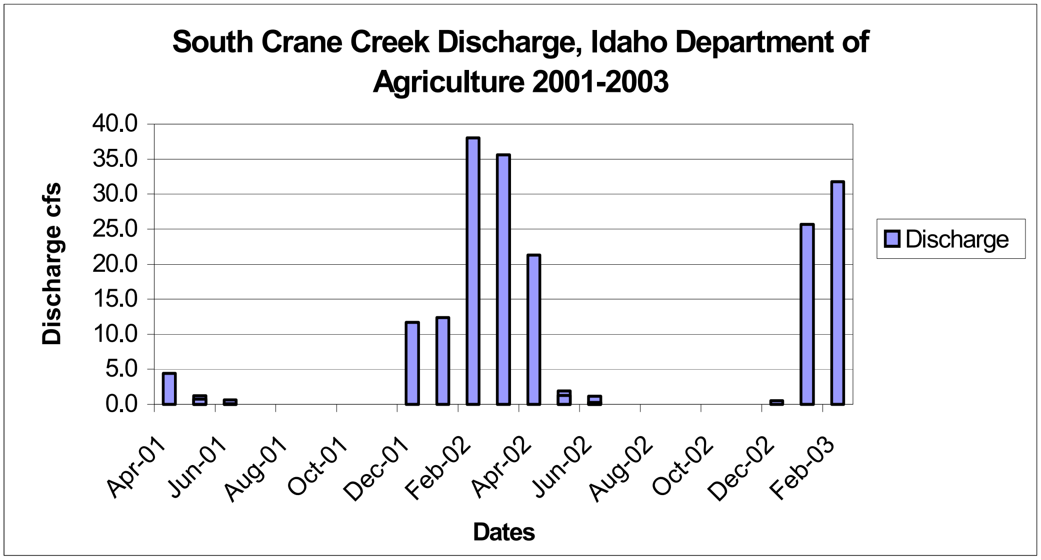



**Figure 60. Discharge 2000-2003, Idaho Department of Agriculture. South Crane Creek, Headwaters to Crane Creek Reservoir.**

South Crane Creek can best be described as intermittent. In the two years of discharge data from the Idaho Department of Agriculture, the period from July through December had zero discharge during both years. Additional discussion concerning applicable WQS and criteria is located in Section 2.3.

The peak discharges in South Crane Creek are short in duration and are dependent on snowmelt and storm events. These periods are not optimal for the support of cold water aquatic life and will not provide adequate habitat for long-term biological communities. Recreational use is not usually associated with short–duration, peak discharges.

**Biological and Other Data**

BURP monitoring occurred on two sites on the §303(d) listed segment. Both sites were evaluated in the year 1998. Table 73 shows the results of the BURP monitoring and the related index scores that will assist in determining the support status of the designated uses (Grafe et al. 2002).

**Table 73. Biological Assessment of South Crane Creek, Headwaters to Crane Creek Reservoir.**

| BURP[a] ID No. | Date | SMI[b] Score | Condition Rating | SHI[c] Score | Condition Rating | Final Condition Score |
|---|---|---|---|---|---|---|
| 1995SBOIB001 | 5/25/95 | 12.07 | Below Threshold | | | Not Fully Supporting |
| 1998SBOIB024 | 6/30/98 | 26.70 | Below Threshold | | | Not Fully Supporting |
| 1998SBOIB025 | 6/30/98 | Dry | NA[d] | Dry | NA | NA |

*a Beneficial Use Reconnaissance Program*
*b Stream Macroinvertebrate Index*
*c Stream Habitat Index*
*d Not Applicable*

In accordance with the *Water Body Assessment Guidance* (Grafe et al. 2002), when an average of two index condition rating scores is equal to or greater than 2, the water body is considered fully supporting its beneficial uses. Or, if one of the index scores is below the threshold value, the water body is not fully supporting cold water aquatic life. However, as an intermittent water body, intermittent water body criteria apply.

**Water Column Data**

Biological indicators do not show impairment to beneficial uses in South Crane Creek. Further analysis of nutrient and sediment data may be warranted since load allocations for both parameters may be set for the lower Weiser River. A discussion of possible allocations can be found in Section 3.2.

*Nutrients*

Nutrients are not listed as a pollutant of concern for South Crane Creek. Since South Crane Creek is an intermittent water body, there are no biological indications that nutrients are impairing the designated beneficial uses. However, there may be a required reduction in nutrients to achieve potential targets set for the lower Weiser River and the lower Snake River. A discussion of possible allocations is located in Section 3.2.

**Status of Beneficial Uses**

South Crane Creek is an intermittent water body. As such, application of the WQS addressing intermittent water bodies will be applied. Table 74 provides information on the final assessment and status of the designated beneficial uses.

**Table 74. Support Status of Designated Beneficial Uses, Pollutants Impairing Those Uses, Justifications, and Recommendations. South Crane Creek, Headwaters to Crane Creek Reservoir.**

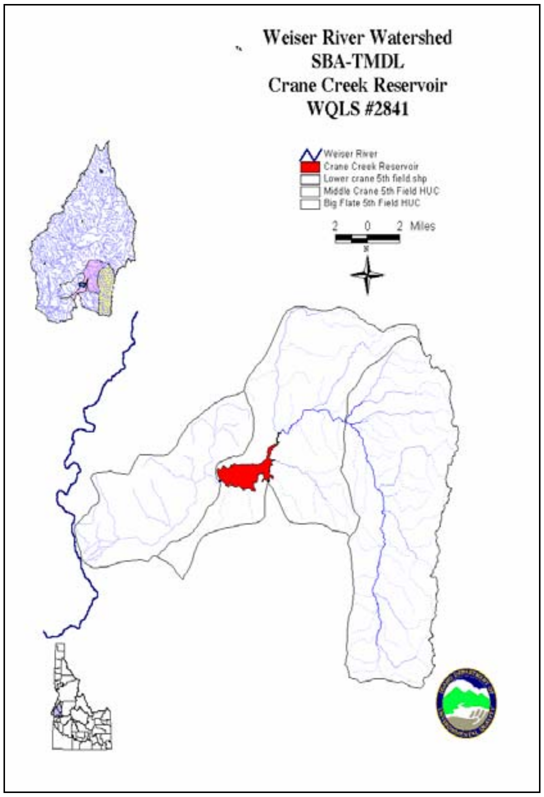
| Existing Uses | Support Status | Pollutants Impairing Use | Justification | Recommendation |
|---|---|---|---|---|
| Cold Water Aquatic Life | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS[a] | Develop Total Phosphorus Allocations[b] |
| Primary Contact Recreation | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS | No Action to be Taken |
| Secondary Contact Recreational | Not an Existing Use | Not Evaluated | Application of Intermittent Water Body WQS | No Action to be Taken |
| Drinking Water Supply | Not an Existing Use | Not Evaluated | | No Action to be Taken |
| Agricultural Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Industrial Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Wildlife Water Supply | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |
| Aesthetics | Presumed to be Fully Supported | Not Evaluated | | No Action to be Taken |

*a Water quality standards*

*b* Total phosphorus allocations are necessary to address nutrient targets established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004).

Although South Crane Creek has been determined to be intermittent, nutrient and sediment targets may be established for the lower Weiser River and the lower Snake River. South Crane Creek may be required to meet these targets. These targets have been established for total phosphorus to prevent eutrophic conditions in the Snake River and downstream reservoirs. Along with total phosphorus, sediment targets may need to be established for the tributaries of the lower Weiser River. A discussion of possible allocations can be found in Section 3.2.

## Crane Creek Reservoir




| Water Body | Crane Creek Reservoir |
|---|---|
| Miles of impaired water body | Reservoir, 1,507 acres |
| Listed pollutants | Sediment and nutrients |
| Potential impaired designated uses | Cold water aquatic life |
| Potential sources | Overland flow, irrigation induced erosion, rangeland stream bank erosion, in-reservoir conditions |

### Discharge (Flow) Characteristics

Crane Creek Reservoir, located northeast of Weiser, Idaho, is a 1,507-acre, manmade reservoir with a maximum water storage capacity of 56,800 acre feet. The dam height is 55 feet. The dam and reservoir are owned and operated by the Crane Creek Irrigation District (Idaho Department of Water Resources 1971).

Some USGS discharge records are available for Crane Creek Reservoir releases from the years 1911 through 1969 (USGS Gage No. 13264500). Dam construction was completed in 1929, with water storage beginning that year. A comparison of pre-dam and post-dam construction discharge data indicates that Crane Creek was an intermittent water body before the dam was built. Reservoir storage is mainly spring snow melt occurring from February through April. Figure 61 shows the discharge at the USGS gage site below the reservoir for both pre-dam and post-dam construction. Appendix C contains information on discharge data sources.

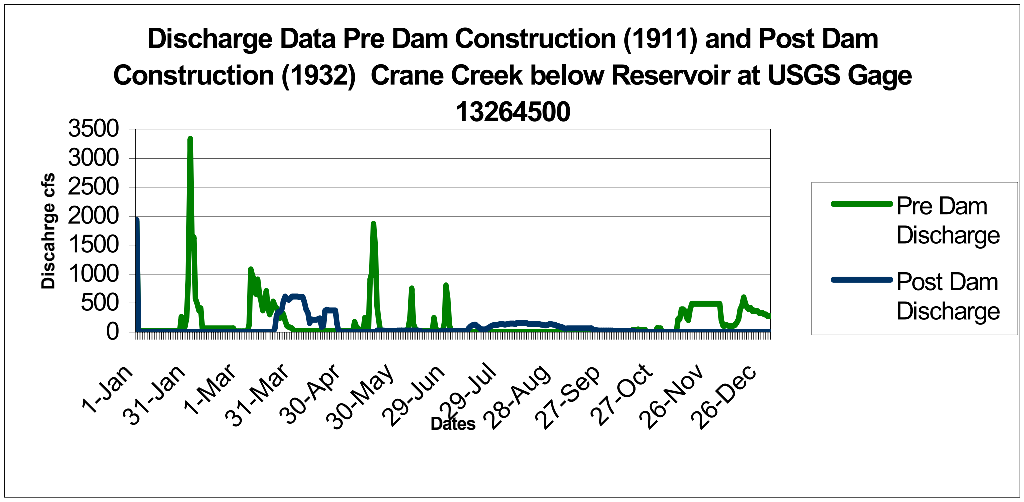



**Figure 61. Crane Creek below Crane Creek Reservoir Outlet, Pre-Dam Construction (1911) and Post Dam Construction (1932), USGS Gage No. 13264500. Crane Creek Reservoir.**

Action on Crane Creek Reservoir will be delayed until 2007 to allow further study and assess the status and appropriateness of designated uses.

## 2.6 Conclusions

Since the publication of Idaho's 1998 §303(d) list, additional information has been collected to verify the support status of the water quality limited segments. As presented in Section 2.5, an extensive evaluation has occurred to determine the status of beneficial uses and the impact of pollutants on those uses. As a result, some modifications to the 1998 §303(d) list are warranted, and in other situations, the preparation of a TMDL is justified. Table 75 recommends actions to be taken on the 1998 §303(d) listed water bodies.

## Table 75. Final Conclusions on Assessment, Impaired Uses, and Recommendations for 1998 §303(d) Listed Water Bodies. Weiser River Watershed.

| Water Body | Segment Boundaries | Beneficial Uses Impaired | Recommended Actions |
|---|---|---|---|
| Lower Weiser River | Galloway Dam to Snake River | Cold Water Aquatic Life, Primary and Secondary Contact Recreation | Develop TMDLs to Address: Sediment, Bacteria, and Temperature.<br>Remove Dissolved Oxygen as Pollutant of Concern.<br>Develop Load Allocations for Total Phosphorus |
| Middle Weiser River | Little Weiser River to Galloway Dam | Cold Water Aquatic Life | Develop TMDL to Address: Sediment<br>Add Temperature as a Pollutant of Concern<br>Remove Bacteria as Pollutant of Concern.<br>Develop Load Allocations for Total Phosphorus. |
| Upper Weiser River | West Fork Weiser River to Little Weiser River | No Impairment Found | Remove Segment from §303(d) list |
| Mann Creek | Mann Creek Reservoir to Weiser River | No Impairment Found | Remove Segment from §303(d) list |
| Cove Creek | Headwaters to Weiser River | No Impairment Found | Remove Segment from §303(d) list; Intermittent Water Body |
| Crane Creek | Crane Creek Reservoir to Weiser River | Cold Water Aquatic Life, Primary and Secondary Contact Recreation | Develop TMDLs to Address: Sediment and Bacteria. Develop Load Allocations for Total Phosphorus. |
| Little Weiser River | Indian Valley to Weiser River | Cold Water Aquatic Life, Primary Contact Recreation | Develop TMDLs to Address: Bacteria and Sediment.<br>Add Bacteria as a Pollutant of Concern.<br>Develop Load Allocations for Total Phosphorus. |
| Johnson Creek | Headwaters to Weiser River | No Impairment Found | Remove Segment from §303(d) list |
| West Fork Weiser River | Headwaters to Weiser River | No Impairment Found | Remove Segment from §303(d) list |
| North Crane Creek | Headwaters to Crane Creek Reservoir | No Impairment Found | Remove Segment from §303(d) list; Intermittent Water Body |
| South Crane Creek | Headwaters to Crane Creek Reservoir | No Impairment Found | Remove Segment from §303(d) list; Intermittent Water Body |
| Crane Creek Reservoir | Reservoir | Cold Water Aquatic Life (current standards) | Further study and assessment and appropriateness of designated uses |

*See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDLs.*

The appropriate segments will require load allocations for total phosphorus, based on the need to address nutrient loading to the Lower Snake River. Total phosphorus allocations will be established to address the critical period of May through September, the critical time period as described in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). This time period has been determined to be the most critical for controlling nuisance aquatic growth.

For the upper Weiser River upstream of the Little Weiser River, the data indicate that total phosphorus concentrations are well below the target set for the lower Weiser River segments. The upstream segment of the upper Weiser River and its tributaries should not receive allocations for total phosphorus.

Impairment of designated or existing uses was determined through assessment of biological indicators. For larger water bodies (greater than fourth order water bodies), the *Idaho River Ecological Assessment Framework: An Integrated Approach* (Grafe, C.S. (ed.) 2000) and the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002) were used to determine support status. The assessment is based on either impairment to biological indicators or comparison of water column measurements to WQS numeric criteria.

Numeric criteria were applied to segments where applicable data existed. Numeric criteria for dissolved oxygen, and bacteria were utilized. Data were collected or historic data were analyzed and compared to numeric criteria.

It is recommended that the following pollutants be removed from the §303(d) list:

- dissolved oxygen and nutrients on the lower Weiser River
- nutrients on Crane Creek
- nutrients and bacteria on the middle Weiser River.

It is also recommended that bacteria be added on the Little Weiser River.

A TMDL will be written for bacteria in the Little Weiser River.

In some instances, impairment was determined by the presence or absence of certain biological indicators, based on literature research of sensitivity to certain pollutants. For sediment, this was especially important. In the lower segments of the Weiser River, Little Weiser River, and Crane Creek, macroinvertebrate and periphyton analyses indicated that sediment is impairing cold water aquatic life. However, for Crane Creek, water column sediment data do not indicate sediment is at concentrations that would impair uses. For the Weiser River, macroinvertebrate community’s structure and composition indicated substrate sediment deposition was the limiting factor. In this case, a percent fines substrate target was utilized.

## 2.7 Data Gaps

Most of the data gaps identified prior to developing the SBA were filled through monitoring conducted in the years 2000 through 2003 (Ingham 2000).

However, the data gaps that remain have hindered the ability to assess a water body and determine the support status of beneficial uses in the Little Weiser River. The lack of macroinvertebrate data from the monitoring season in the year 2000 has prevented the use of two metrics needed to assess the beneficial uses in accordance with the Idaho *Water Body Assessment Guidance* (Grafe et al. 2002). As the data become available, the SBA should be amended, and the TMDL should be modified if needed.

A sediment TMDL based on a substrate target was developed and will be presented in Section 5.0.

Another data gap is the comparison of TSS and suspended sediment concentration (SSC). It is recognized that the use of TSS may underestimate the true amount of sediment in the water column (Gray et al. 2000). In June, July, and August 2003, split samples were collected on the Weiser River at four sites on seven different dates. A regression analysis on the TSS and SSC data and the results are presented in Figure 62.

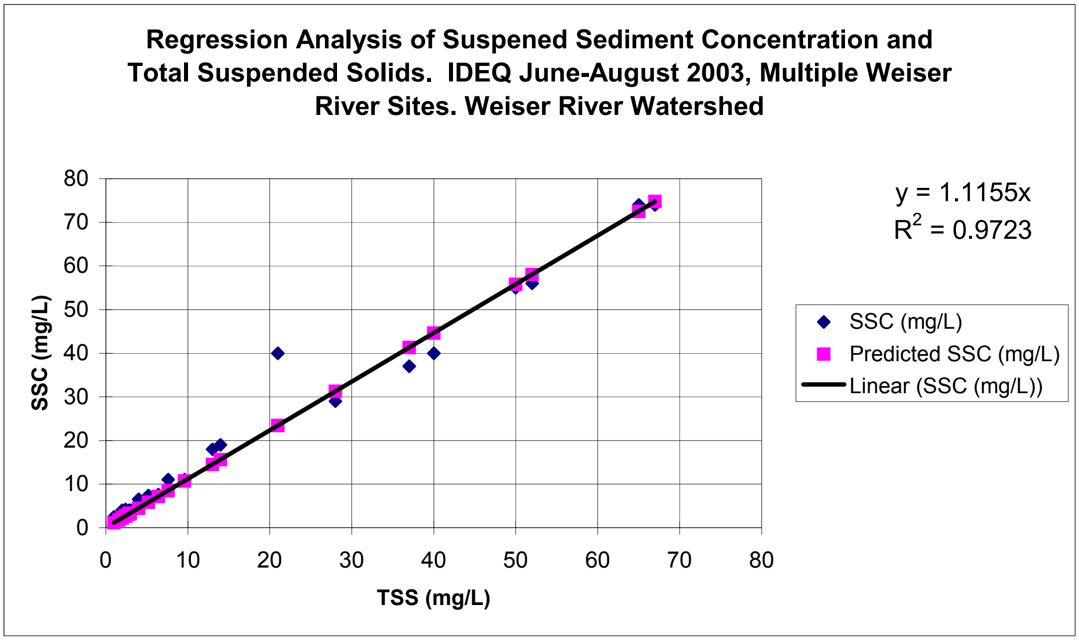



**Figure 62. Regression Analysis of Suspended Sediment Concentration and Total Suspended Solids. Multiple Weiser River Sites. Weiser River Watershed.**

As presented in Figure 62, there appears to be little difference in the SSC and TSS when all sites on the river are combined. As shown in Figure 63, this also appears to be true for the data collected at the lower Weiser River site located at the Highway 95 Bridge at Weiser, Idaho. The data show a strong correlation between the two parameters during the period samples were collected.

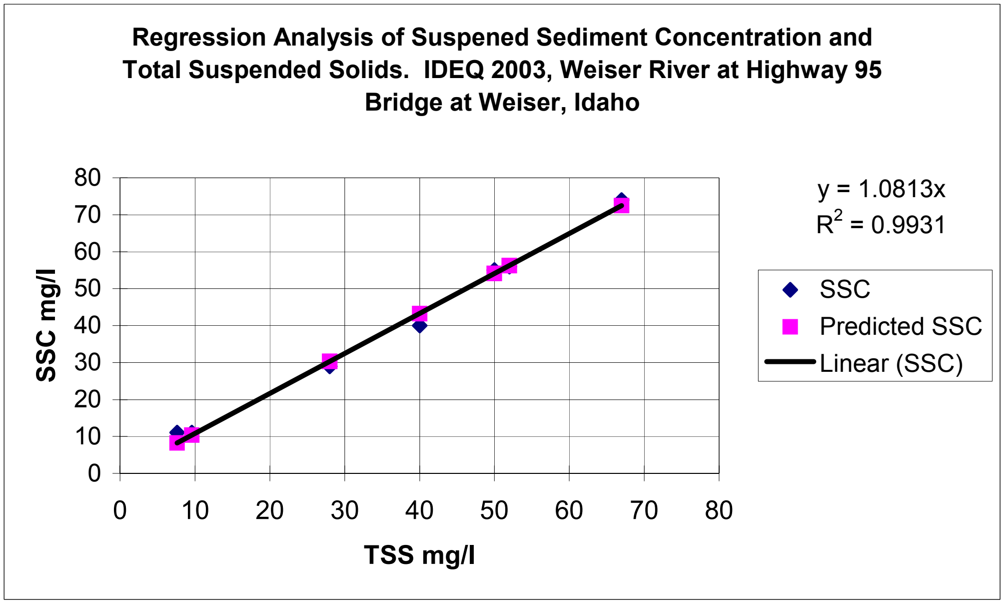



**Figure 63. Regression Analysis of Suspended Sediment Concentration and Total Suspended Solids. Weiser River at Highway 95 Bridge at Weiser, Idaho. Weiser River Watershed.**

However, none of the data presented in the regression analysis represent high discharge periods or periods when TSS reductions must be achieved. TSS data indicate that concentrations increase during high discharge periods. However, the relationship between TSS and SSC during this period is not understood. It is anticipated that SSC levels will increase due to the increased energy needed to transport and suspend larger particles.

Additional monitoring should be conducted with split samples at various sites on the Weiser River during high discharge periods. These data will enhance the ability to predict SSC during high discharge periods.

Bedload sediment is difficult to measure or quantify on large rivers like the Weiser River. Numerous models exist that could assist in determining the bedload movement in the Weiser River. However, bedload sediment data would be required to calibrate and verify a model. It is recommended that bedload sediment models be examined in the near future to determine appropriate data collection periods and procedures. Additionally, stream substrate should be evaluated in Crane Creek below the Crane Creek Reservoir dam.

More information is required to assess the status of beneficial uses in Crane Creek Reservoir. Pollutants in Crane Creek Reservoir are possibly caused by internal recycling, with minimal input from the tributaries.

High turbidity levels found in the reservoir during the year 2003 also appear to be caused by internal recycling and wave action. With little to no inflow during the period from July through August, the turbidity levels remained high.

A complete limnology study should be conducted on Crane Creek Reservoir. This study should accomplish two things:

1. Determine internal sources and causes of the high turbidity levels and concentrations of total phosphorus

2. Determine if the current designated use of cold water aquatic life is appropriate and attainable

There is no information on the pollutant or pollutants of concern upstream of the impaired segment of the Little Weiser River. Additional information on sediment and bacteria loads upstream of Indian Valley would assist in identifying sources and loads outside the impaired segment.

Analysis of Weiser River tributaries upstream from the Crane Creek confluence is needed to identify contributions from different land uses in that area. Water quality analysis is needed to determine the areas to target and the critical time period or periods for pollutant loading.

# 3. Subbasin Assessment – Pollutant Source Inventory and Allocations Analysis

Nonpoint sources of pollution including agriculture, forestry, natural and urban stormwater account for the majority of the pollutants in the Weiser River Watershed. Point sources of pollution that may require additional analyses are the animal feeding operations in the watershed that are located in proximity to water bodies requiring TMDLs for bacteria and, possibly, total phosphorus allocations.

## 3.1 Sources of Pollutants of Concern

The pollutants of concern discussed in previous sections can be associated with a variety of nonpoint and point pollution sources. Wastewater treatment plants, animal feeding operations, and other facilities that discharge waste streams to receiving waters can contribute total phosphorus, bacteria, thermal loads, and, to a certain extent, suspended solids. Most identified point sources are regulated and have limitations on the amount of pollutants they are allowed to discharge. Unidentified point sources may contribute pollutants in quantities that contribute to loading that impairs beneficial uses.

Nonpoint source contributions to the pollutants of concern can vary depending on the type of activity affecting the water body. Tail water runoff from surface irrigated agriculture can contribute nutrients, sediment, bacteria, pesticides, and increased water temperature. Storm water runoff in urban settings may contribute similar pollutants. Runoff from rangelands may accelerate contributions of sediment, bacteria, and nutrients. Natural nonpoint sources, such as landslides and erosion caused by catastrophic weather-related events, could also be significant pollutant contributors.

### Point Sources

The two NPDES permitted facilities in the Weiser River Watershed appear to be minor contributors to the overall loads. The high capitol cost of reducing the pollutants of concern originating from these NPDES facilities would not be cost effective at this time.

Animal feeding operations could also be regulated under a general NPDES permit. These permits specify no discharge except under extreme climatic conditions. Under the current administration by the Idaho Department of Agriculture and EPA, these facilities may or may not be required by federal or state regulations to obtain a general NPDES permit.

### Nonpoint Sources

Nonpoint sources are discharges to water bodies from diffuse sources; as opposed to point sources that discharge from a discrete conveyance. Nonpoint sources are usually associated with land use and climatic events.

## Temperature

A variety of natural factors can affect water temperature. These natural factors include topographic shading, upland vegetation, precipitation, air temperature, wind speed, solar angle, cloud cover, relative humidity, phreatic ground water temperature and discharge, and tributary temperature and flow (Poole and Berman 2000). When the influence of anthropogenic sources alters the ecological factors and other physical characteristics of a water body, an out-of-balance heat exchange can occur.

Thermal loading can be associated with many sources: solar radiation, ambient air temperature, inflows from tributaries and upstream sources, background radiation, convection, conduction, evaporation, wind, and the physical attributes of the water body such as width-depth ratio, pool depth and frequency, substrate meandering patterns, aspect, gradient, and discharge. Warm water from above Galloway Dam is having an impact on water temperatures downstream. During the critical period (summer months), water temperatures upstream of Galloway Dam exceed the WQS criteria for the protection of cold water aquatic life.

The physical factors affecting the Weiser River may include removal of adequate stream cover (riparian vegetation), upland vegetation changes (ground water infiltration), and stream morphology changes such as increased width-depth ratio or lack of floodplain access. In addition to physical factors, climatic factors, such as snowmelt, ambient air temperature, and precipitation, should also be considered. During the years 2000 and 2001, precipitation in the Weiser River Watershed was below normal, both in yearly snow pack and summer precipitation. These climatic conditions can alter the amount of flow, which will affect water temperature (Poole and Berman 2000).

Solar radiation is the direct impact of solar energy on water. Riparian vegetation, stream morphology, and surrounding topography affect the amount of solar radiation that reaches the water surface. Reducing shading or stream cover has been shown to increase the water temperature (Teti 1998). Brown (1970) showed solar radiation on water surfaces was the greatest factor in high water temperature during critical summer periods. The surface area and depth of a water body are also variables that affect the impact of solar radiation on water temperature. A wide, shallow stream allows for more surface area to be affected by solar radiation (width-depth ratio).

Lack of adequate stream cover (canopy) can affect the heat transfer from water to air. Stream cover provides a buffering capability for the interaction between the water surface and the ambient air by reducing wind speed over the water surface. It can also affect the relative humidity near the water surface, which also affects the rate of heat transfer. Water evaporation rates increase when there is greater wind speed and solar radiation, which, in turn, reduces the amount of water within the stream channel.

Since most of the lower Weiser River channel has been modified for flood control, another factor to be considered is the effect on the hyporheic flow condition (below streambed flow). The hyporheic flow relies on the ability of streams to form pools and riffles as well as the near benthic area of the stream to cool water for surface flow. As water enters a pool or a meander, gravity forces water into the ground and ground water continues to flow downstream until it re-enters the stream at a lower elevation. As the ground water passes through alluvial soils, it is cooled to the ambient soil temperature, thereby lowering the water temperature (Wroblicky et al. 1996; Stanford, Ward, and Ellis 1994). The lack of an adequate floodplain, side channels, and backwaters are also critical influences for hyporheic flows and water temperature (Poole and Berman 2000).

The Corps of Engineers constructed levees to prevent flooding in the lower Weiser River. In addition to preventing the river from accessing its historic floodplain, the Corps of Engineers prohibits the growth of trees greater than 6 inches in diameter on or in the immediate vicinity of the levees. This policy essentially removes any potential shading of the river in these areas. See Appendix D for further information.

**Sediment**

Sediment sources in the Weiser River and Crane Creek Watersheds can include stream bank erosion, overland flow, wind blown deposition, and instream channel transport. There is little information on any of the potential sediment sources that can provide a quantitative estimate of the delivery rate to streams and show that sediment is impairing the existing uses. However, studies have shown a direct impairment of aquatic biota communities from excessive sediment (Strand and Merritt 1999).

Overland flow usually consists of gully erosion, mass wasting, and general surface erosion. Since a certain amount of overland flow sediment is retained in hillside storage, the exact delivery rate of sediment from this source is difficult to determine.

One factor in determining erosion is the K factor, the measure of soil erodability as affected by intrinsic soil properties (National Sedimentation Laboratory 2002). Along with other factors such as slope, slope length, cover, and erosivity of the climate, a determination of average annual soil loss can be made in terms of tons/acre/year. Table 3 describes the geology, soil types, and K factors found in the Weiser River Watershed.

Slope of the land and other variables, such as precipitation, wind erosion, the erosion potential of soils, and other natural factors, can also affect overland erosion. In the case of the Weiser River, slope may be a critical factor in overland erosion in rangeland areas where natural vegetation has been altered.

Smaller subwatersheds (first and second order streams) provide some sediment load to larger streams that are listed for sediment as a pollutant of concern. However, since many of these smaller watersheds only provide sediment input during snowmelt and storm events, it is very difficult to determine sediment loads from these subwatersheds.

Smaller watersheds with irrigated agriculture could be contributing sediment during the irrigation season through irrigation induced erosion. Runoff from similar practices in urban settings may have the same effects.

Since high sediment loads occur during the high discharge period, the land uses most susceptible to overland runoff should be considered significant contributors. These areas include barren croplands, dryland agriculture areas, winter feeding areas, river/stream banks, roads, mining areas, and rangelands. River/stream bank erosion is a source of sediment, especially during periods of high discharge. Clark (1985) identified a segment of the Weiser River, below Galloway Dam, as a contributor of approximately 29,000 tons of sediment per year to the Snake River.

A critical part of the implementation plan will be to determine sediment yield from all sources and address the high priority areas of concern. Development of export coefficients will assist in addressing high priority areas.

**Bacteria**

Bacteria can originate from a variety of sources. These sources can include direct contribution by warm-blooded animals, irrigation induced runoff from pastures, irrigation induced runoff from land application sites, gray water from unapproved residential disposal systems, faulty septic systems, and recreational activities. It will be a critical part of the implementation plan to identify bacteria sources and address the high priority areas of concern. In the Crane Creek subwatershed, the source for bacteria appears to be below the reservoir since the bacteria counts from the reservoir itself are low. Irrigated pastureland is one of the largest land uses in the Little Weiser River corridor; however, the source of excessive bacteria is not known at this time.

**Nutrients (Total Phosphorus)**

Phosphorus can be found in most soils and in a variety of chemical states. Some phosphorus is readily available for plant uptake, while other forms may require a chemical or biological interface to become available. The fertilizers applied on cultivated fields (ortho-phosphate) are in a form readily available for plant uptake. Animal waste also contains high amounts of biologically available phosphorus. Phosphorus that is chemically bound to sediments is not necessarily readily available for plant uptake, but through a biological, chemical, or physical reaction, it can become available.

Data are presented in Section 3.2 that show some areas of concern for the total phosphorus load in the Weiser River. Areas, or sources, of concern vary during different discharge conditions. During high discharge periods from May through mid-June, a majority of the total phosphorus load is associated with upstream sources, above the Crane Creek and Mann Creek Watersheds. During low discharge periods, Crane Creek appears to be a significant source of total phosphorus to the Weiser River, while the river upstream acts as a sink for phosphorus originating from upstream. Below Galloway Dam, the Lower Payette Ditch, Monroe Creek, and irrigation return drains appear to be significant sources of total phosphorus.

Land uses for the fifth field HUCs identified as tributaries contributing pollutant loads or areas adjacent to impaired water bodies are presented in Table 76. Figure 64 shows land uses in the fifth field HUCs for the critical reaches not supporting beneficial uses or providing significant contributions to downstream loads.

### Table 76. Nonpoint Source Assessment, Land Use. Weiser River Watershed.

| Fifth Field HUCa | Dryland (acres) | Gravity Irrigated (acres) | Sprinkler Irrigated (acres) | Rangeland (acres) | Forest (acres) | Urban (acres) | Open Water (acres) |
|---|---|---|---|---|---|---|---|
| Monroe-Mann | | 5,789 | 1,741 | 20,587 | | 580 | 41 |
| Weiser Cove | 174 | 5,873 | 2,826 | 58,034 | | | |
| Sage | | 483 | | 20,537 | 500 | | |
| Lower Crane | | 1,000 | 903 | 30,263 | | | 1 |
| Keithly | 248 | 6,744 | 2,702 | 34,629 | | 1 | |
| Pine | | 5,262 | 257 | 25,488 | 3,005 | | |
| Crane Creek Reservoir | 47 | 222 | 2,996 | 49,246 | | | 1,507 |
| Big Flats | | 1,676 | 71 | 42,010 | | | |
| Soulen | 198 | 697 | 752 | 29,403 | | | |
| Cove Creek | 1,600 | 130 | 285 | | | | |
| Little Weiser | | 7,368 | 365 | 39,868 | | | 221 |
| Total | 2,267 | 35,244 | 12,898 | 350,065 | 3,505 | 581 | 1,770 |

*a Acres calculated for fifth field hydrologic units (HUCs) having direct impact on receiving waters; areas above dams omitted except for Crane Creek.*

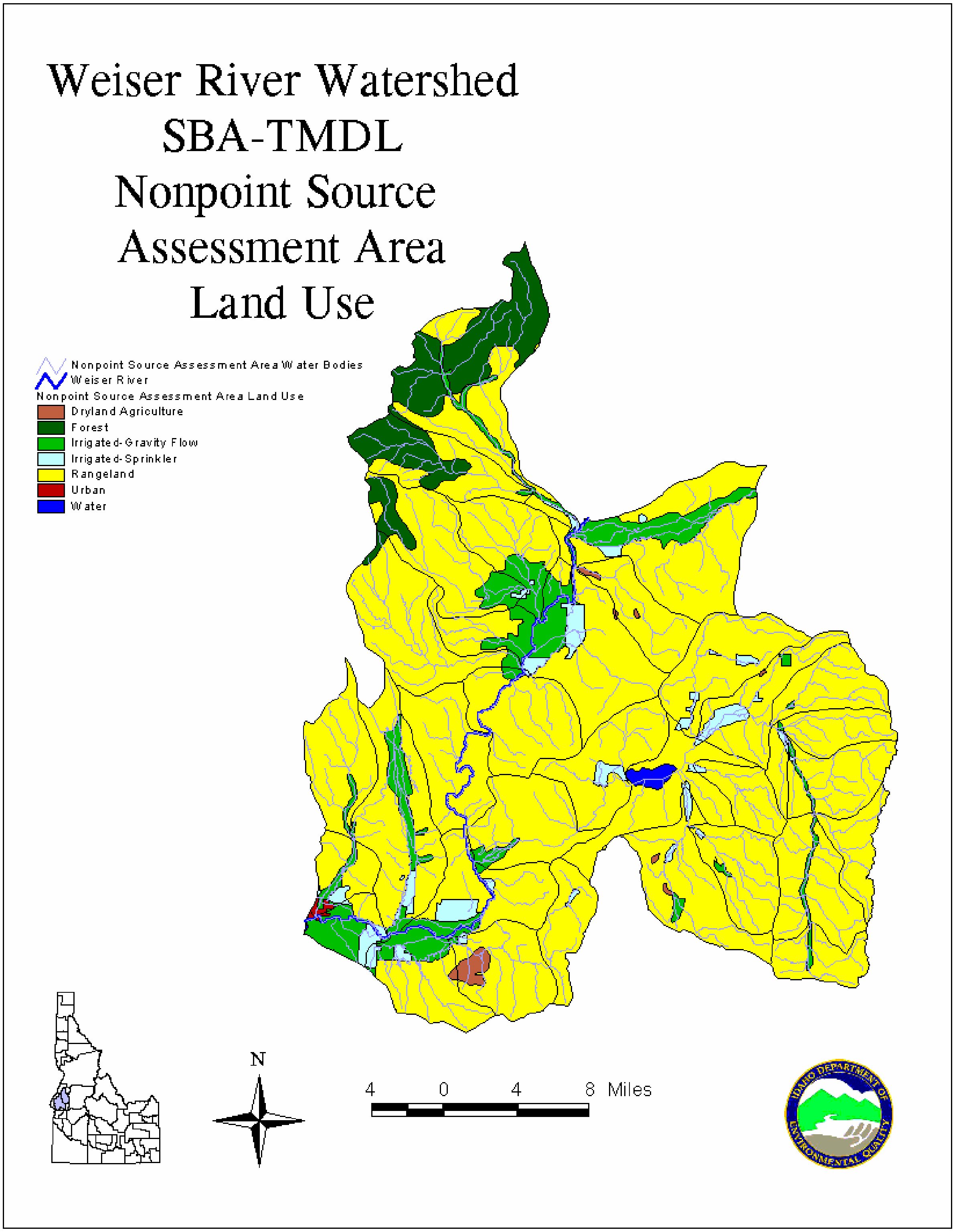



**Figure 64. Nonpoint Source Assessment Area Land Use. Weiser River Watershed.**

### Pollutant Transport

Currently, information is unavailable to determine pollutant export (mainly nutrients and sediment) from the different land uses. Literature values could be applied to determine appropriate export coefficient values. Verification of these values would be a time-consuming and expensive undertaking.

Bacteria loads originate from animal and human waste. The monitoring conducted in the years 2000 through 2002 showed the majority of the bacteria contribution originates below Galloway Dam. Idaho Department of Agriculture data that was collected from 2000 through 2003 showed Mann Creek as a significant source of bacteria. Since the critical time period for bacteria levels is during low flow, it would appear that inflows below Galloway Dam are providing a majority of the bacteria loads. It does not appear that any other pollutants, such as sediment, can be associated with bacteria loads.

High total phosphorus load transport usually occurs during high flows and is usually associated with sediment. This assumption is not necessarily true in the Weiser River Watershed. For example, the total phosphorus and TSS concentration data collected during the years 2000 through 2003 for Mann Creek showed no correlation between TSS and total phosphorus. Approximately 82% of the total phosphorus is in the form of ortho-phosphate, which is usually dissolved within the water column. An average of 43% of the total phosphorus is dissolved ortho-phosphate in the Weiser River at Highway 95 (2000-2001). A regression analysis on total phosphorus and TSS concentrations resulted in an $r^2$ of -0.57. In Crane Creek, one of the larger contributors of total phosphorus during the low discharge period, 83% of the total phosphorus is in the form of ortho-phosphate. Regression analysis showed an $r^2$ value of 0.13. Additional seasonal analysis is required to gain a better understanding of total phosphorus transport in the water column.

Warm water from above Galloway Dam is having an impact on water temperature downstream. During the critical period (summer months), water temperatures upstream of Galloway Dam exceed the WQS criteria for the protection of cold water aquatic life. At the USGS gage station located 5 miles upstream of Galloway Dam, the average daily temperature was 21.5 $^oC$ and the maximum daily average temperature was 24.3 $^oC$ during July and August 2001. The daily average temperature increased to 23.5 $^oC$, and the maximum daily average temperature was 26.6 $^oC$ downstream in the Weiser River at Highway 95.

## 3.2 Total Phosphorus Allocations

### Point Sources

The only point sources in the Weiser River Watershed are the Cambridge and Council WWTPs. Neither facility requires a waste load allocation at this time. Further discussion of point sources will follow.

## Lower Weiser River

*Water Quality Data Analysis*

Figures 65 and 66 show the total phosphorus concentration results for the Weiser River at the Highway 95 Bridge at Weiser, Idaho. This site is approximately 0.5 mile upstream from the confluence with the Snake River. Monitoring conducted by the Bureau of Reclamation from the years 1987 through 1989 and DEQ from the years 2000 through 2001 (Ingham 2000) are the only data available from this location. The data presented in Figures 65 and 66 and Appendix C may not reflect the final concentration as the Weiser River discharges into the Snake River since the monitoring location is upstream of Monroe Creek. The estimated loading and discharge to the Snake River from the Weiser River is presented in Tables 77 and 78. The estimated discharge takes into account Monroe Creek, which enters the Weiser River below the historic river monitoring site at the Highway 95 Bridge. Table 79 presents data collected from May through September, the critical period of the year for total phosphorus levels.

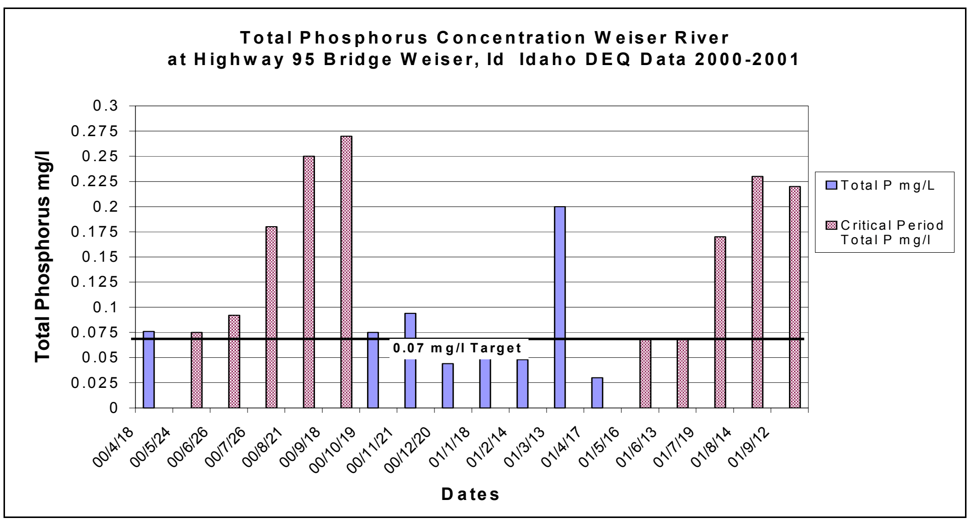



**Figure 65. Total Phosphorus Concentrations, Weiser River at Highway 95 Bridge at Weiser, Idaho. DEQ Data 2000-2001. Weiser River, Galloway Dam to the Snake River.**

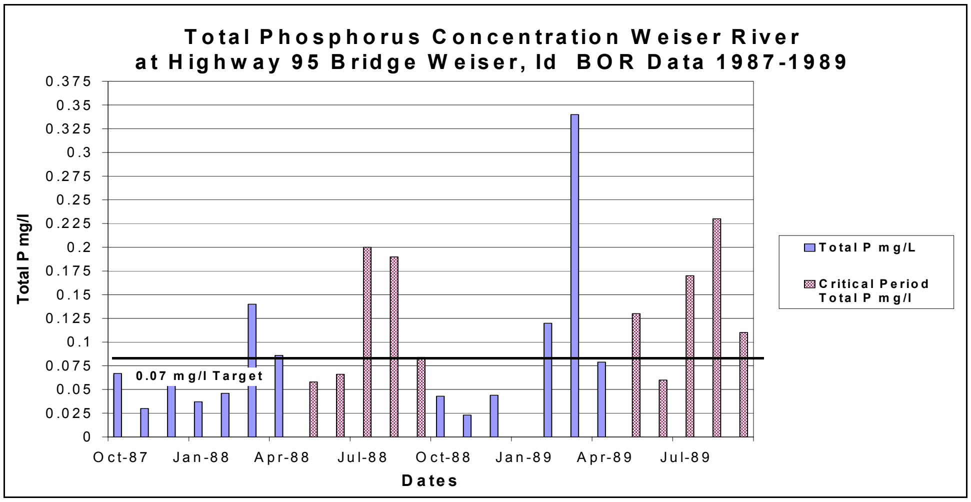



**Figure 66. Total Phosphorus Concentrations, Weiser River at Highway 95 Bridge at Weiser, Idaho. BOR Data 1987-1989. Weiser River, Galloway Dam to the Snake River.**

**Table 77. Measured and Estimated Flows to the Snake River from the Weiser River Watershed and Measured Total Phosphorus Concentrations. Bureau of Reclamation 1987-1989. Weiser River, Galloway Dam to the Snake River.**

| Months | Actual Measured Flows BOR[a] 1987-1988 (cfs)[b] | Estimated Flow Discharge to Snake River BOR 1987-1988 (cfs) | Total Phosphorus Concentration BOR 1987-1988 (mg/L)[c] | Actual Measured Flows BOR 1988-1989 (cfs) | Estimated Flows Discharge to Snake River BOR 1988-1989 (cfs) | Total Phosphorus Concentration BOR 1988-1989 (mg/L) |
|---|---|---|---|---|---|---|
| Oct[d] | 162 | 163 | 0.066 | 50 | 51 | 0.043 |
| Nov | 80 | 81 | 0.030 | 97 | 98 | 0.023 |
| Dec | 188 | 189 | 0.055 | 48 | 49 | 0.044 |
| Jan | 549 | 552 | 0.037 | ND[e] | ND | ND |
| Feb | 997 | 1,004 | 0.046 | 3,222 | 3,229 | 0.120 |
| Mar | 1,121 | 1,149 | 0.140 | 6,577 | 6,604 | 0.340 |
| Apr | 801 | 839 | 0.086 | 2,245 | 2,243 | 0.079 |
| May[f] | 556 | 599 | 0.058 | 3,525 | 3,568 | 0.130 |
| Jun[f] | 645 | 670 | 0.066 | 955 | 980 | 0.060 |
| Jul[f] | 128 | 154 | 0.200 | 227 | 253 | 0.170 |
| Aug[f] | 132 | 140 | 0.190 | 224 | 232 | 0.230 |
| Sep[f] | 56 | 65 | 0.043 | 98 | 107 | 0.110 |

*a Bureau of Reclamation*
*b cubic feet per second*
*c milligrams per liter*
*d average of two samples collected as duplicates*
*e no data*
*f shaded represents critical period*

## Table 78. Measured and Estimated Flows to the Snake River from the Weiser River Watershed, Idaho DEQ 2000-2001. Weiser River, Galloway Dam to the Snake River.

| Months | Actual Measured Flows DEQ 1999-2000 (cfs)[a] | Estimated Flow Discharge to Snake River DEQ 1999-2000 (cfs) | Total Phosphorus Concentration DEQ 1999-2000 (mg/L)[b] | Actual Measured Flows 2000-2001 (cfs) | Estimated Flows Discharge to Snake River DEQ 2000-2001 (cfs) | Total Phosphorus Concentration DEQ 2000-2001 (mg/L) |
|---|---|---|---|---|---|---|
| Oct[c] | ND[d] | ND | ND | 50 | 51 | 0.075 |
| Nov | ND | ND | ND | 97 | 98 | 0.094 |
| Dec | ND | ND | ND | 170 | 171 | 0.044 |
| Jan | ND | ND | ND | 140 | 142 | 0.051 |
| Feb | ND | ND | ND | 220 | 227 | 0.048 |
| Mar | ND | ND | ND | 1,760 | 1,788 | 0.200 |
| Apr | 2,601 | 2,639 | 0.076 | 718 | 756 | 0.030 |
| May[e] | 2,470 | 2,513 | 0.075 | 1,370 | 1,413 | 0.068 |
| Jun[e] | 1,382 | 1,407 | 0.092 | 377 | 402 | 0.069 |
| Jul[e] | 205 | 231 | 0.180 | 256 | 282 | 0.170 |
| Aug[e] | 55 | 63 | 0.250 | 237 | 245 | 0.230 |
| Sep[e] | 57 | 66 | 0.270 | 141 | 150 | 0.220 |

*a cubic feet per second*
*b milligrams per liter*
*c average of two samples collected as duplicate*
*d no data*
*e shaded represents critical period*

## Table 79. Critical Period (May-September) Statistical Results for Total Phosphorus Concentrations. Weiser River at Highway 95 Bridge, Weiser ID. Weiser River, Galloway Dam to the Snake River.

| Weiser River at Highway 95 Bridge 1987-1989 BOR Data (May-September) | Total Phosphorus Concentrations (mg/L)[a] |
|---|---|
| Average | 0.130 |
| Standard Deviation | 0.064 |
| Maximum | 0.230 |
| Minimum | 0.058 |
| **Weiser River at Highway 95 Bridge 1999-2001 DEQ Data (May-September)** | **Total Phosphorus Concentrations (mg/L)** |
| Average | 0.162 |
| Standard Deviation | 0.080 |
| Maximum | 0.270 |
| Minimum | 0.068 |

*a milligrams per liter*

*Normalized Discharge Data Analysis*

An attempt was made to normalize river discharge data. However, to normalize discharge data, a reliable historic discharge recording station was needed. The nearest continuous recording station for the Weiser River is located approximately 12 miles upstream of the confluence with the Snake River (USGS Gage No.1326600). Unfortunately, this site is upstream of two major irrigation water diversions (outflows) and numerous tributaries and irrigation return drains (inflows). Therefore, historic discharge data recorded at this site would not be representative of discharges to the Snake River, especially during periods when irrigation water withdrawals and irrigation water returns are occurring. To compensate for the expected difference in discharge levels from the USGS site 12 miles upstream, a water budget including withdrawals and inflow from the USGS gage to the Snake River was developed.

With the use of USGS historic data for irrigation water withdrawals for the Sunnyside Canal (USGS Gage No. 16265000) and the Galloway Canal (USGS Gage No. 16266500), an estimate of a total phosphorus budget can be calculated for the Weiser River at Galloway Dam. From Galloway Dam to the confluence with the Snake River, three major tributaries—Mann Creek, Cove Creek, and Monroe Creek—discharge to the Weiser River. In addition to these tributaries, five irrigation water return drains—Smith Drain, Frazier Drain, Unity Drain, Sunnyside Canal Drain, and Payette Ditch—discharge to the Weiser River. None of the tributaries or irrigation water return drains are current discharge monitoring sites. Data from past water quality evaluations and historic USGS discharge information was utilized to determine a mass balance for inflow and outflow. This approach offers a means to determine discharge and total phosphorus loading analysis from the Weiser River Watershed to the Snake River, even with the unpredictable discharges in the Weiser River Watershed.

Many variables will affect real-time discharges and the associated total phosphorus loads in the watershed. Irrigation water diversions are numerous, and in most years, the available water in the river is insufficient to supply existing water rights from the middle and lower Weiser River. Supplemental water is provided by Crane Creek Reservoir during the months of July, August, and September to fulfill those water rights.

Irrigation tail water return and tributary inflows have the greatest influence on the lower Weiser River discharges and total phosphorus loads and concentrations during the critical, low-discharge period from July through September. This discharge period also represents a part of the critical period of May through September established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These sources, located below the Galloway Dam, can contribute up to 80% of the total discharge to the Snake River. Cropping patterns from year to year affect irrigation water return and diversions. Small grains do not usually require water past July, while other crops, such as sugar beets, may require irrigation water late into the season. The use of a normalized discharge and mass balance analysis should be representative of discharge and total phosphorus loads to the Snake River.

The current USGS gage site (13266000), located 12 miles upstream of the confluence with the Snake River, provides over 60 years of data, with continuous discharge data from 1952 through the present. The USGS has also conducted water quality monitoring at this site, which provides total phosphorus load information. This site also includes data when releases from Crane Creek Reservoir have the greatest effect on discharge and total phosphorus loads to the Weiser River. Historic USGS data for the two major diversions, Sunnyside Canal (13265000) and Galloway Canal (13266500), provide an overall withdrawal rate from the river during the critical period. Studies conducted by DEQ, BOR, the Idaho Department of Agriculture, and EPA provide short-term studies of discharges and total phosphorus loading back to the river. Data sources used to determine the mass balance and the normalized discharge are located in Appendix C. Sources of water quality data are also shown in Appendix C.

*Current Total Phosphorus Load Analysis*

The first step taken to conduct the load analysis was to calculate the nutrient load based on the flows and nutrient concentrations recorded for the date that samples were collected. There was a high standard deviation compared to the mean, so the data were transformed to establish a natural log set of data. The natural log data were then analyzed, and a regression analysis was performed. The final results of the regression analysis are discussed in Appendix C.

Table 80 shows the results of the regression analysis on a monthly basis. This approach is taken to help identify critical sources and monthly variability of total phosphorus loads. As an example, source analysis showed the total phosphorus load above Galloway Dam accounted for 88.5% of the load in the month of May and 51.2% of the load in the month of September.

**Table 80. Mass Balance for Discharge and Total Phosphorus Loads and Concentrations to the Snake River from the Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 2,537 | 609 | 0.098 |
| June | 1,412 | 372 | 0.110 |
| July | 241 | 86.4 | 0.155 |
| August | 66.1 | 30.6 | 0.191 |
| September | 53.2 | 25.7 | 0.199 |
| Analysis[d] | | | |
| Average | 863 | 225 | 0.150 |
| Standard Deviation | 1,010 | 236 | 0.042 |
| Maximum | 2,667 | 631 | 0.211 |
| Minimum | 37.0 | 19.1 | 0.097 |
| Count[e] | 153 | 153 | 153 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*
*e estimated discharge, load, and concentration based on regression analysis of dates of instream monitoring (BOR 1987-89 and DEQ 1999-2001)*

*Total Phosphorus Load Allocations*

The target of 0.07 mg/L is applied using the normalized discharge data and load analysis. A total phosphorus load allocation is calculated when the target value and normalized discharge data are applied. Table 81 presents the load allocations on a monthly basis. Load allocations are assigned to upstream sources to achieve the allocation in the Snake River. Table 82 presents current total phosphorus loading, allocation, load reduction, and percent reduction required to meet the allocation target.

**Table 81. Discharge and Total Phosphorus Load Allocation and Concentrations to the Snake River from the Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Allocation (kg/day)[b] | Total Phosphorus Concentration Target (mg/L)[c] |
|---|---|---|---|
| **May** | | | |
| *Total Allocation* | 2,537 | 435 | 0.07 |
| *Above Galloway Dam* | | 401 | 0.07 |
| *Below Galloway Dam* | | 33.7 | 0.07 |
| **June** | | | |
| *Total Allocation* | 1,441 | 242 | 0.07 |
| *Above Galloway Dam* | | 227 | 0.07 |
| *Below Galloway Dam* | | 14.1 | 0.07 |
| **July** | | | |
| *Total Allocation* | 241 | 41.2 | 0.07 |
| *Above Galloway Dam* | | 29.6 | 0.07 |
| *Below Galloway Dam* | | 11.9 | 0.07 |
| **August** | | | |
| *Total Allocation* | 66.1 | 11.3 | 0.07 |
| *Above Galloway Dam* | | 4.8 | 0.07 |
| *Below Galloway Dam* | | 6.5 | 0.07 |
| **September** | | | |
| *Total Allocation* | 53.7 | 9.1 | 0.07 |
| *Above Galloway Dam* | | 4.8 | 0.07 |
| *Below Galloway Dam* | | 4.3 | 0.07 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

**Table 82. Discharge and Total Phosphorus Load Allocation, Concentrations, Load Reductions, and Load Reduction Percentage to the Snake River from the Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Current (kg/day)[b] | Total Phosphorus Load Allocation (kg/day) | Total Phosphorus Load Reduction (kg/day) | Percent Reduction Required (%) |
|---|---|---|---|---|---|
| **May** | | | | | |
| *Total Allocation* | 2,537 | 587 | 435 | 152 | 25.9% |
| *Above Galloway Dam* | | 520 | 401 | 119 | 22.9% |
| *Below Galloway Dam* | | 67.2 | 33.7 | 33.5 | 49.9% |
| **June** | | | | | |
| *Total Allocation* | 1,441 | 361 | 242 | 119 | 33.0% |
| *Above Galloway Dam* | | 326 | 227 | 98.2 | 30.2% |
| *Below Galloway Dam* | | 35.4 | 14.1 | 21.3 | 60.2% |
| **July** | | | | | |
| *Total Allocation* | 241 | 84.5 | 41.2 | 43.3 | 51.2% |
| *Above Galloway Dam* | | 60.0 | 29.6 | 30.4 | 50.6% |
| *Below Galloway Dam* | | 24.5 | 11.9 | 12.6 | 51.4% |
| **August** | | | | | |
| *Total Allocation* | 66.1 | 30.8 | 11.3 | 19.5 | 63.3% |
| *Above Galloway Dam* | | 14.4 | 4.8 | 9.6 | 66.7% |
| *Below Galloway Dam* | | 16.4 | 6.5 | 9.9 | 60.4% |
| **September** | | | | | |
| *Total Allocation* | 53.7 | 29.7 | 9.1 | 20.6 | 69.4% |
| *Above Galloway Dam* | | 15.2 | 4.8 | 10.4 | 68.4% |
| *Below Galloway Dam* | | 14.5 | 4.3 | 10.2 | 70.3% |

*a cubic feet per second*
*b kilograms per day*

## Middle Weiser River

### *Water Quality Data Analysis*

Data collected from routine USGS monitoring during the years 1996, 1997, 1999 and 2000 and DEQ monitoring during the years 2000 and 2001 (Ingham 2000) are presented in Table 83 for the critical period. The data presented in Table 83 represent total phosphorus conditions and loads at the USGS gage site. Loading to the lower Weiser River may vary due to irrigation water withdrawals from the Sunnyside and Galloway Canals.

**Table 83. Total Phosphorus Concentrations, Discharge, and Total Phosphorus Load, USGS Gage No. 13266000. USGS Data 1996-1998 and 2000, DEQ Data 2000-2001. Weiser River, Little Weiser River to Galloway Dam.**

| | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| Average | 1,010 | 392 | 0.142 |
| Standard Deviation | 1,529 | 946 | 0.072 |
| Maximum | 7,340 | 4,848 | 0.270 |
| Minimum | 141 | 36.9 | 0.024 |
| Count | 28 | 28 | 28 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

As with total phosphorus loads calculated for the lower Weiser River, normalized discharge should also be calculated from the USGS gage site. The normalization of the discharge will assist in establishing total phosphorus loads and concentrations based on average daily discharges. Appendix C provides additional discussion of statistical analysis of discharge and total phosphorus loading analysis. Table 84 presents the normalized discharge, total phosphorus load, and concentrations at the USGS gage site 13266000. Table 85 presents estimated discharge, total phosphorus load, and concentrations at Galloway Dam.

**Table 84. Mass Balance for Discharge and Total Phosphorus Loads and Concentrations at USGS Gage Site (13266000). Weiser River, Little Weiser River to Galloway Dam.**

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 2,547 | 556 | 0.089 |
| June | 1,550 | 370 | 0.099 |
| July | 387 | 121 | 0.130 |
| August | 227 | 79.2 | 0.143 |
| September | 180 | 65.9 | 0.149 |
| Analysis[d] | | | |
| Average | 980 | 238 | 0.122 |
| Standard Deviation | 963 | 199 | 0.024 |
| Maximum | 2,677 | 579 | 0.152 |
| Minimum | 164 | 61 | 0.088 |
| Count[e] | 153 | 153 | 153 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*
*e estimated discharge, load, and concentration based on regression analysis of dates of instream monitoring (USGS 1997-99 and 2000 and DEQ 1999-2001)*

**Table 85. Mass Balance for Discharge and Total Phosphorus Loads and Concentrations at Galloway Dam. Weiser River, Little Weiser River to Galloway Dam.**

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 2,340 | 520 | 0.091 |
| June | 1,328 | 326 | 0.103 |
| July | 171 | 60.0 | 0.163 |
| August | 28.0 | 14.4 | 0.226 |
| September | 29.0 | 14.8 | 0.217 |
| Analysis[d] | | | |
| Average | 864 | 218 | 0.147 |
| Standard Deviation | 1,009 | 229 | 0.042 |
| Maximum | 2,667 | 611 | 0.208 |
| Minimum | 37.0 | 18.8 | 0.094 |
| Count[e] | 153 | 153 | 153 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*
*e estimated discharge, load, and concentration based on regression analysis of dates of instream monitoring (USGS 1997-99 and 2000 and DEQ 1999-2001)*

*Total Phosphorus Load Allocations*

The target of 0.07 mg/L is applied using the normalized discharge data and load analysis. A total phosphorus load allocation is calculated when the target value and normalized discharge data are applied. Table 86 presents the load allocations on a monthly basis. Load allocations are assigned to upstream sources and Crane Creek to achieve the allocation in the middle Weiser River at Galloway Dam. Table 87 shows the reductions required to meet the allocations.

**Table 86. Discharge and Total Phosphorus Load Allocation and Concentrations at Galloway Dam. Middle Weiser River. Weiser River, Little Weiser River to Galloway Dam.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Allocation (kg/day)[b] | Total Phosphorus Concentration Target (mg/L)[c] |
|---|---|---|---|
| **May** | | | |
| *Total Allocation* | 2,340 | 401 | 0.07 |
| *Crane Creek* | | 6.4 | 0.07 |
| *Removed by Diversions* | | 35.4 | 0.07 |
| *Upstream Sources* | | 430 | 0.07 |
| **June** | | | |
| *Total Allocation* | 1,328 | 227 | 0.07 |
| *Crane Creek* | | 3.8 | 0.07 |
| *Removed by Diversions* | | 38.0 | |
| *Upstream Sources* | | 262 | |
| **July** | | | |
| *Total Allocation* | 171 | 29.3 | 0.07 |
| *Crane Creek* | | 17.0 | 0.07 |
| *Removed by Diversions* | | 37.2 | |
| *Upstream Sources* | | 49.5 | |
| **August** | | | |
| *Total Allocation* | 28.0 | 4.8 | 0.07 |
| *Crane Creek* | | 23.9 | 0.07 |
| *Removed by Diversions* | | 34.1 | |
| *Upstream Sources* | | 15.0 | 0.07 |
| **September** | | | |
| *Total Allocation* | 29.0 | 4.9 | 0.07 |
| *Crane Creek* | | 12.5 | 0.07 |
| *Removed by Diversions* | | 27.1 | |
| *Upstream Sources* | | 18.5 | 0.07 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

**Table 87. Discharge and Total Phosphorus Load Allocation, Concentrations, and Percent Reduction for the Lower Weiser River. Weiser River, Galloway Dam to the Snake River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Current (kg/day)[b] | Total Phosphorus Load Allocation (kg/day) | Total Phosphorus Load Reduction (kg/day) | Percent Reduction Required (%) |
|---|---|---|---|---|---|
| **May** | | | | | |
| *Total Allocation* | 2,340 | 541 | 401 | 140 | 26% |
| *Crane Creek*[c] | | 21.6 | 6.4 | 15.2 | 70% |
| *Removed by Diversions*[d] | | 47.8 | 35.4 | 12.4 | 26% |
| *Upstream Sources* | | 570 | 430 | 137 | 24% |
| **June** | | | | | |
| *Total Allocation* | 1,328 | 333 | 228 | 106 | 32% |
| *Crane Creek* | | 14.0 | 3.8 | 10.2 | 73% |
| *Removed by Diversions* | | 57.0 | 38.0 | 19.0 | 33% |
| *Upstream Sources* | | 376 | 262 | 115 | 30% |
| **July** | | | | | |
| *Total Allocation* | 171 | 54.1 | 29.3 | 24.8 | 46% |
| *Crane Creek* | | 49.3 | 17.0 | 32.3 | 66% |
| *Removed by Diversions* | | 72.1 | 37.2 | 34.9 | 48% |
| *Upstream Sources* | | 76.9 | 49.5 | 27.4 | 36% |
| **August** | | | | | |
| *Total Allocation* | 28.0 | 10.2 | 4.8 | 5.4 | 53% |
| *Crane Creek* | | 66.6 | 23.9 | 42.7 | 64% |
| *Removed by Diversions* | | 72.2 | 34.1 | 38.1 | 53% |
| *Upstream Sources* | | 15.8 | 15.0 | 0.8 | 5% |
| **September** | | | | | |
| *Total Allocation* | 29.0 | 10.9 | 3.8 | 7.1 | 65% |
| *Crane Creek* | | 38.1 | 12.5 | 25.6 | 67% |
| *Removed by Diversions* | | 57.5 | 27.1 | 30.4 | 53% |
| *Upstream Sources* | | 30.3 | 18.5 | 11.8 | 39% |

*a cubic feet per second*
*b kilograms per day*
*c Crane Creek allocation based on 0.07 mg/L target*
*d diversion allocation will be met with reductions upstream*

## Upper Weiser River

### *Water Quality Data Analysis*

Data collected from routine USGS monitoring during the years 1974, 1975, 1981 and 1982 and DEQ monitoring during the years 2000 and 2001 (Ingham 2000) are presented in Table 88. The data represent the critical period established in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). The data presented in Table 88 represent total phosphorus concentrations and loads at the USGS gage site (13258500).

**Table 88. Total Phosphorus Concentration, Discharge, and Total Phosphorus Load. USGS (1974-1975 and 1981-1982) and DEQ Data (2000-2001). West Fork Weiser River to Little Weiser River.**

| | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| Average | 656 | 186 | 0.054 |
| Standard Deviation | 1,186 | 691 | 0.044 |
| Maximum | 7,480 | 5,123 | 0.280 |
| Minimum | 12.0 | 1.2 | 0.010 |
| Count | 60 | 60 | 60 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

As with total phosphorus loads calculated for the lower Weiser River, normalized discharge should also be calculated for the upper Weiser River. The normalization of the discharge will assist in establishing total phosphorus loads and concentrations based on average daily discharges. Appendix C contains the results of the regression analysis based on normalized discharge. Table 89 presents the normalized concentrations, discharge, and total phosphorus load for upper Weiser River.

Further statistical analysis and comparison of measured and estimated total phosphorus concentrations and loads are presented in Appendix C. To determine total phosphorus loads during the critical period from May through September, results from the regression analysis were applied to normalized discharge for that period. The estimated total phosphorus load and estimated concentration for the critical period are presented in Table 89.

**Table 89. Estimated Total Phosphorus Concentrations, Discharge, and Total Phosphorus Loads, Weiser River near Cambridge, May through September. Weiser River, West Fork Weiser River to Little Weiser River.**

| Month | Estimated Discharge (cfs)[a] | Estimated Total Phosphorus Load (kg/day)[b] | Estimated Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 1704 | 101.0 | 0.024 |
| June | 892 | 66.9 | 0.032 |
| July | 193 | 25.6 | 0.059 |
| August | 83.8 | 15.6 | 0.076 |
| September | 84.8 | 15.7 | 0.076 |
| Analysis[d] | | | |
| Average | 593 | 45.1 | 0.053 |
| Standard Deviation | 653 | 34.8 | 0.022 |
| Maximum | 1,832 | 106.0 | 0.078 |
| Minimum | 78.1 | 14.9 | 0.024 |
| Count[e] | 153 | 153 | 153 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*
*e estimated discharge, load, and concentration based on regression analysis of dates of instream monitoring (USGS 1974-1975 1981-1982and DEQ 1999-2001)*

The analysis of total phosphorus data does not indicate that concentrations are at impairment levels or that the total phosphorus loads are a significant source for total phosphorus loads in lower segments. Additionally, a review of the complaint files at DEQ's Boise Regional Office did not locate any complaints concerning nuisance aquatic growth, slime growth, fish kills, or odor. It is recommended that no total phosphorus load allocations be developed for this segment.

*Total Phosphorus Point Source*

The City of Cambridge WWTP is located in the upper Weiser River Watershed. The facility is a three-cell lagoon with chlorination. The effluent limitations for the City of Cambridge are shown in Table 90.

**Table 90. Monthly Monitoring Requirement for the City of Cambridge Wastewater Treatment Plant and Effluent Limitations. Weiser River, West Fork Weiser River to Little Weiser River.**

| Facility | pH Max (su)[a] | BOD[b] (mg/L)[c] | Suspended Solids (mg/L) | Fecal Coliform (No./100 ml)[d] (May-Sept) | Fecal Coliform (No./100 ml) (Oct-Apr) |
|---|---|---|---|---|---|
| Cambridge, Idaho Wastewater Treatment Plant | 9.0 | 45 | 70 | 50 | 100 |

*a standard units*
*b biochemical oxygen demand*
*c milligrams per liter*
*d number per 100 milliliters*

The City of Cambridge collected additional data for nutrients during the years 2001 and 2002. Although this increased monitoring was requested by DEQ, it was not a requirement of the NPDES permit. Table 91 shows the results of the monitoring conducted by the City of Cambridge on the effluent from the city's WWTP.

**Table 91. Water Quality Monitoring Results for the City of Cambridge Wastewater Treatment Plant Effluent. Weiser River, West Fork Weiser River to Little Weiser River.**

| Date | Ortho Phosphorus Concentration (mg/L)[a] | Total Phosphorus Concentration (mg/L) | Discharge (mgd)[b] | Ortho Phosphorus Load (kg/day)[c] | Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|
| Mar 2001 | 1.60 | 1.78 | 0.1170 | 0.69 | 0.77 |
| Apr 2001 | 0.95 | 1.17 | 0.0810 | 0.29 | 0.36 |
| May 2001 | 0.41 | 0.84 | 0.0463 | 0.07 | 0.15 |
| Jul 2001 | 0.55 | 0.78 | 0.0410 | 0.08 | 0.14 |
| Aug 2001 | 0.42 | 0.70 | 0.0255 | 0.05 | 0.07 |
| Sep 2001 | 0.47 | 1.28 | 0.0266 | 0.04 | 0.07 |
| Oct 2001 | 0.47 | 1.63 | 0.0382 | 0.07 | 0.19 |
| Nov 2001 | 0.75 | 1.99 | 0.0743 | 0.21 | 0.46 |
| Dec 2001 | 0.97 | 1.52 | 0.0857 | 0.31 | 0.65 |
| Jan 2002 | 1.42 | 2.01 | 0.0880 | 0.47 | 0.50 |
| Feb 2002 | 1.77 | 0.11 | 0.1130 | 0.75 | 0.86 |
| Mar 2002 | 1.64 | 1.81 | 0.2480 | 1.54 | 1.70 |
| Apr 2002 | 0.50 | 0.73 | 0.1332 | 0.25 | 0.37 |

*a milligrams per liter*
*b million gallons per day*
*c kilograms per day*

The data from the City of Cambridge effluent monitoring were incorporated into the Weiser River water quality data at the USGS gage site located approximately 2 miles upstream of the monitoring location (Ingham 2003). An overall load was calculated for the Weiser River below the City of Cambridge discharge. Table 92 shows the critical months' (May-September) load and expected concentrations of total phosphorus. As demonstrated in Table 92, the discharge from the Cambridge WWTP has negligible effect on the total phosphorus load or concentration in the river.

**Table 92. Estimated Total Phosphorus Concentrations, Discharge, and Total Phosphorus Loads, Weiser River near Cambridge, May through September. Weiser River, West Fork Weiser River to Little Weiser River.**

| Month | Discharge (cfs)[a] | Above WWTP[b] River Total Phosphorus Load (kg/day)[c] | Above WWTP River Total Phosphorus Concentration (mg/L)[d] | Below WWTP River Total Phosphorus Load (kg/day) | Below WWTP River Total Phosphorus Concentration (mg/L) |
|---|---|---|---|---|---|
| May | 1,725 | 101.1 | 0.024 | 101.5 | 0.024 |
| Jun | 827 | 64.3 | 0.032 | 64.4 | 0.032 |
| Jul | 155 | 21.7 | 0.063 | 21.8 | 0.063 |
| Aug | 84 | 15.6 | 0.076 | 15.7 | 0.077 |
| Sep | 131 | 19.7 | 0.069 | 19.8 | 0.070 |
| | | | | | |
| Average | 584 | 44.6 | 0.053 | 45.0 | 0.053 |

*a cubic feet per second*
*b wastewater treatment plant*
*ckilograms per day*
*d milligrams per liter*

The City of Council's WWTP is located upstream of the City of Cambridge. The data indicate that neither facility increases total phosphorus concentrations above the recommended criteria and do not affect the downstream target. It is recommended that Segment 2835, Weiser River (West Fork Weiser River to Little Weiser River) which receives both effluents, be removed from the 303 (d) list for sediment and nutrients.

**Mann Creek**

*Water Quality Data Analysis*

Mann Creek is not listed for nutrients, and there is no indication that nutrients are impairing the designated beneficial uses. However, it is apparent that a reduction in total phosphorus will be required in the Weiser River to achieve the targets set in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). Therefore, the reduction targets for the Weiser River must also to apply to its tributaries.

Most data for Mann Creek are from DEQ (Clark 1985) and the Idaho Department of Agriculture (2003). In both cases, monitoring sites were selected near the confluence with the Weiser River and the release from Mann Creek Reservoir. Data from Mann Creek at the confluence with the Weiser River provide total phosphorus concentrations and discharge measurements. The critical period for nutrient loading to the Snake River, from the months of May through September, will be used for Mann Creek. The monitoring results are presented in Table 93. Additional total phosphorus concentrations loads are located in Appendix C.

**Table 93. Measured Total Phosphorus Concentrations and Loads, Mann Creek at Weiser River. DEQ 1983 and Idaho Department of Agriculture 2001-2003.**

| | Smoothed Discharge Data DEQ 1983 and IDA[a] 2001-2003 (cfs)[b] | Average Total Phosphorus Concentration DEQ 1983 and IDA 2001-2003 (mg/L)[c] | Average Total Phosphorus Load DEQ 1983 and IDA 2001-2003 (kg/day)[d] |
|---|---|---|---|
| May | 61.9 | 0.193 | 26.9 |
| June | 18.6 | 0.217 | 9.5 |
| July | 12.8 | 0.354 | 10.7 |
| Aug | 13.1 | 0.211 | 6.6 |
| Sep | 5.5 | 0.180 | 2.7 |
| Analysis[e] | | | |
| Average | 23.1 | 0.229 | 11.5 |
| Standard Deviation | 33.3 | 0.119 | 15.6 |
| Maximum | 131 | 0.770 | 80.2 |
| Minimum | 1.4 | 0.110 | 0.5 |
| Count | 30 | 30 | 30 |

*a Idaho Department of Agriculture*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*
*e analysis on all critical period data (May-September), not on data presented in table*

Additional data are available upstream at the Mann Creek Reservoir Dam, including discharge data from a historic USGS gage site (13267050). These data were analyzed in the same manner as the data from the confluence with the Weiser River. The results indicate an overall increase in total phosphorus concentration by 320% and a total phosphorus load increase of 187% from the reservoir to the confluence with the Weiser River. Appendix C contains the results from monitoring conducted in the years 1975 (Tangarone and Bogue 1976), 1983 (Clark 1985), 2001 and 2002 (Idaho Department of Agriculture 2003). The values presented in Table 93 should be used to determine a load allocation for Mann Creek's contribution to the lower Weiser River.

*Total Phosphorus Load Allocations*

The target of 0.07 mg/L is applied using the normalized discharge data and load analysis. A total phosphorus load allocation is calculated when the target value and normalized discharge data are applied. Table 94 presents the load allocations on a monthly basis. Load allocations are assigned to Mann Creek at the mouth to achieve the allocation at the lower Weiser River. Table 95 shows the reductions required to meet the allocations.

**Table 94. Discharge and Total Phosphorus Load Allocation and Concentrations Mann Creek at Confluence with Weiser River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Allocation (kg/day)[b] | Total Phosphorus Concentration Target (mg/L)[c] |
|---|---|---|---|
| **May** | | | |
| *Total Allocation* | 61.9 | 10.6 | 0.070 |
| **June** | | | |
| *Total Allocation* | 18.6 | 3.2 | 0.070 |
| **July** | | | |
| *Total Allocation* | 12.8 | 2.2 | 0.070 |
| **August** | | | |
| *Total Allocation* | 13.1 | 2.2 | 0.070 |
| **September** | | | |
| *Total Allocation* | 5.5 | 0.8 | 0.070 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

**Table 95. Discharge and Total Phosphorus Load Allocation, Concentrations, and Percent Reduction for Mann Creek. Weiser River, Galloway Dam to the Snake River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Current (kg/day)[b] | Total Phosphorus Load Allocation (kg/day) | Total Phosphorus Load Reduction (kg/day) | Percent Reduction Required (%) |
|---|---|---|---|---|---|
| **May** | | | | | |
| *Total Allocation* | 61.9 | 26.9 | 10.6 | 16.3 | 60.6% |
| **June** | | | | | |
| *Total Allocation* | 18.6 | 9.5 | 3.2 | 6.3 | 66.3% |
| **July** | | | | | |
| *Total Allocation* | 12.8 | 10.7 | 2.2 | 8.5 | 79.4% |
| **August** | | | | | |
| *Total Allocation* | 13.1 | 6.6 | 2.2 | 4.4 | 66.7% |
| **September** | | | | | |
| *Total Allocation* | 5.5 | 2.7 | 0.8 | 1.9 | 70.4% |

*a cubic feet per second*
*b kilograms per day*

## Other Tributaries to the Lower Weiser River

*Water Quality Data Analysis*

Cove Creek is listed for nutrients. Since Cove Creek is an intermittent stream, WQSs specific to this condition apply. However, since a reduction in total phosphorus is required in the Weiser River to achieve the targets set in the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004); this reduction will also apply to its tributaries.

Most data for the lower Weiser River tributaries are from DEQ (Clark 1985) and the Idaho Department of Agriculture (2003). In both cases, monitoring sites were selected near the tributaries' confluence with the Weiser River. The critical period for nutrient loading to the Snake River, from the months of May through September, will be used for the tributaries. Current total phosphorus loads and concentrations are presented in Table 96.

**Table 96. Measured Discharge and Total Phosphorus Concentrations and Loads, Tributaries to the Lower Weiser River. DEQ 1983 and Idaho Department of Agriculture 2001-2003. Weiser River, Galloway Dam to Snake River.**

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| *Monroe Creek* | | | |
| MAY | 43.0 | 21.6 | 0.205 |
| JUN | 25.0 | 8.0 | 0.130 |
| JUL | 26.0 | 12.1 | 0.190 |
| AUG | 8.3 | 3.6 | 0.176 |
| SEP | 9.0 | 4.2 | 0.190 |
| *Lower Payette Drain* | | | |
| MAY | 25.0 | 6.1 | 0.100 |
| JUN | 22.5 | 5.5 | 0.100 |
| JUL | 10.0 | 2.4 | 0.100 |
| AUG | 6.7 | 1.6 | 0.100 |
| SEP | 6.0 | 1.5 | 0.100 |
| *Smith Drain* | | | |
| MAY | 6.0 | 1.6 | 0.104 |
| JUN | 7.6 | 6.9 | 0.326 |
| JUL | 2.7 | 0.9 | 0.127 |
| AUG | 6.1 | 2.8 | 0.143 |
| SEP | 3.0 | 0.7 | 0.108 |
| *Unity Drain* | | | |
| MAY | 4.8 | 3.2 | 0.276 |
| JUN | 6.4 | 3.4 | 0.206 |
| JUL | 6.7 | 3.5 | 0.213 |
| AUG | 4.2 | 2.1 | 0.191 |
| SEP | 3.7 | 1.4 | 0.158 |
| *Frazier Drain* | | | |
| MAY | 1.6 | 2.5 | 0.627 |
| JUN | 1.0 | 0.9 | 0.386 |
| JUL | 1.7 | 1.2 | 0.291 |
| AUG | 1.4 | 2.2 | 0.630 |
| SEP | 1.1 | 1.5 | 0.529 |
| *Sunnyside Ditch* | | | |
| MAY | 3.0 | 1.6 | 0.193 |
| JUN | 1.6 | 0.8 | 0.224 |
| JUL | 3.5 | 1.2 | 0.132 |
| AUG | 3.4 | 2.2 | 0.263 |
| SEP | 1.7 | 1.1 | 0.257 |
| *Cove Creek* | | | |
| MAY | 0.8 | 0.6 | 0.327 |
| JUN | 0.5 | 0.4 | 0.314 |
| JUL | 0.4 | 0.3 | 0.304 |
| AUG | 0.6 | 0.4 | 0.281 |
| SEP | 0.9 | 0.7 | 0.310 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

*Total Phosphorus Load Allocations*

The target of 0.07 mg/L is applied using the normalized discharge data and load analysis. A total phosphorus load allocation is calculated when the target value and normalized discharge data are applied. Table 97 presents the load allocations on a monthly basis. Load allocations are assigned to tributaries at the mouth to achieve the allocation in the lower Weiser River. Table 98 shows current the total phosphorus load, the load reduction required to meet the allocations, and the percent load reduction required.

## Table 97. Discharge and Total Phosphorus Load Allocation and Concentrations, Tributaries to Lower Weiser River. Weiser River, Galloway Dam to Snake River.

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| *Monroe Creek* | | | |
| MAY | 43.0 | 7.4 | 0.07 |
| JUN | 25.0 | 4.3 | 0.07 |
| JUL | 26.0 | 4.5 | 0.07 |
| AUG | 8.3 | 1.4 | 0.07 |
| SEP | 9.0 | 1.5 | 0.07 |
| *Lower Payette Drain* | | | |
| MAY | 25.0 | 4.3 | 0.07 |
| JUN | 22.5 | 3.9 | 0.07 |
| JUL | 10.0 | 1.7 | 0.07 |
| AUG | 6.7 | 1.1 | 0.07 |
| SEP | 6.0 | 1.0 | 0.07 |
| *Smith Drain* | | | |
| MAY | 6.0 | 1.0 | 0.07 |
| JUN | 7.6 | 1.3 | 0.07 |
| JUL | 2.7 | 0.5 | 0.07 |
| AUG | 6.1 | 1.0 | 0.07 |
| SEP | 3.0 | 0.5 | 0.07 |
| *Unity Drain* | | | |
| MAY | 4.8 | 0.8 | 0.07 |
| JUN | 6.4 | 1.1 | 0.07 |
| JUL | 6.7 | 1.2 | 0.07 |
| AUG | 4.2 | 0.7 | 0.07 |
| SEP | 3.7 | 0.6 | 0.07 |
| *Frazier Drain* | | | |
| MAY | 1.6 | 0.3 | 0.07 |
| JUN | 1.0 | 0.2 | 0.07 |
| JUL | 1.7 | 0.3 | 0.07 |
| AUG | 1.4 | 0.2 | 0.07 |
| SEP | 1.1 | 0.2 | 0.07 |
| *Sunnyside Ditch* | | | |
| MAY | 3.0 | 0.5 | 0.07 |
| JUN | 1.6 | 0.3 | 0.07 |
| JUL | 3.5 | 0.6 | 0.07 |
| AUG | 3.4 | 0.6 | 0.07 |
| SEP | 1.7 | 0.3 | 0.07 |
| *Cove Creek* | | | |
| MAY | 0.8 | 0.1 | 0.07 |
| JUN | 0.5 | 0.1 | 0.07 |
| JUL | 0.4 | 0.1 | 0.07 |
| AUG | 0.6 | 0.1 | 0.07 |
| SEP | 0.9 | 0.2 | 0.07 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

**Table 98. Discharge, Current Total Phosphorus Load, Load Allocation, Reduction Required, and Percent Reduction Required, Tributaries to Lower Weiser River. Weiser River, Galloway Dam to Snake River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Current (kg/day)[b] | Total Phosphorus Load Allocation (kg/day) | Total Phosphorus Load Reduction (kg/day) | Percent Reduction Required (%) |
|---|---|---|---|---|---|
| *Monroe Creek* | | | | | |
| MAY | 43.0 | 21.6 | 7.4 | 14.2 | 65.9% |
| JUN | 25.0 | 8.0 | 4.3 | 3.7 | 46.2% |
| JUL | 26.0 | 12.1 | 4.5 | 7.6 | 63.2% |
| AUG | 8.3 | 3.6 | 1.4 | 2.2 | 60.2% |
| SEP | 9.0 | 4.2 | 1.5 | 2.6 | 63.2% |
| *Lower Payette Drain* | | | | 0.0 | |
| MAY | 25.0 | 6.1 | 4.3 | 1.8 | 30.0% |
| JUN | 22.5 | 5.5 | 3.9 | 1.7 | 30.0% |
| JUL | 10.0 | 2.4 | 1.7 | 0.7 | 30.0% |
| AUG | 6.7 | 1.6 | 1.1 | 0.5 | 30.0% |
| SEP | 6.0 | 1.5 | 1.0 | 0.4 | 30.0% |
| *Smith Drain* | | | | | |
| MAY | 6.0 | 1.6 | 1.0 | 0.6 | 37.0% |
| JUN | 7.6 | 6.9 | 1.3 | 5.6 | 81.2% |
| JUL | 2.7 | 0.9 | 0.5 | 0.5 | 49.2% |
| AUG | 6.1 | 2.8 | 1.0 | 1.8 | 62.7% |
| SEP | 3.0 | 0.7 | 0.5 | 0.2 | 28.0% |
| *Unity Drain* | | | | | |
| MAY | 4.8 | 3.2 | 0.8 | 2.4 | 74.3% |
| JUN | 6.4 | 3.4 | 1.1 | 2.3 | 67.9% |
| JUL | 6.7 | 3.5 | 1.2 | 2.4 | 67.4% |
| AUG | 4.2 | 2.1 | 0.7 | 1.4 | 65.8% |
| SEP | 3.7 | 1.4 | 0.6 | 0.8 | 56.3% |
| *Frazier Drain* | | | | | |
| MAY | 1.6 | 2.5 | 0.3 | 2.2 | 88.7% |
| JUN | 1.0 | 0.9 | 0.2 | 0.8 | 81.9% |
| JUL | 1.7 | 1.2 | 0.3 | 0.9 | 76.1% |
| AUG | 1.4 | 2.2 | 0.2 | 2.0 | 89.3% |
| SEP | 1.1 | 1.5 | 0.2 | 1.3 | 87.3% |
| *Sunnyside Ditch* | | | | | |
| MAY | 3.0 | 1.6 | 0.5 | 1.1 | 68.2% |
| JUN | 1.6 | 0.8 | 0.3 | 0.6 | 68.3% |
| JUL | 3.5 | 1.2 | 0.6 | 0.6 | 48.2% |
| AUG | 3.4 | 2.2 | 0.6 | 1.6 | 74.1% |
| SEP | 1.7 | 1.1 | 0.3 | 0.8 | 73.7% |
| *Cove Creek* | | | | | |
| MAY | 0.8 | 0.6 | 0.1 | 0.4 | 77.7% |
| JUN | 0.5 | 0.4 | 0.1 | 0.3 | 77.7% |
| JUL | 0.4 | 0.3 | 0.1 | 0.2 | 76.6% |
| AUG | 0.6 | 0.4 | 0.1 | 0.3 | 75.6% |
| SEP | 0.9 | 0.7 | 0.2 | 0.5 | 77.4% |

*a cubic feet per second*
*b kilograms per day*

## Crane Creek

The total phosphorus load from Crane Creek is shown in Table 86. Load allocations, reductions required, and percent reductions required are shown in Table 87.

## Little Weiser River

*Water Quality Data Analysis*

The Little Weiser River is listed for nutrients. While nutrients do not appear to be impairing beneficial uses, it is apparent a reduction in total phosphorus will be required in the Little Weiser River to achieve the targets set in the middle Weiser River and lower Weiser River.

Most data for the Little Weiser River are from DEQ monitoring between the years 2000 and 2001 (Ingham 2000). Monitoring sites were selected near the confluence with the Weiser River. Data from the Little Weiser River at the confluence with the Weiser River provide total phosphorus concentrations and discharge measurements. The critical period for nutrient loading to the Snake River, from May through September, will be used for the Little Weiser River. The monitoring results are presented in Table 99. Additional total phosphorus concentrations and loads are located in Appendix C.

**Table 99. Measured Total Phosphorus Concentrations and Loads, Little Weiser at Weiser River. DEQ 2000-2001. Little Weiser River near Confluence with Weiser River. Little Weiser River, Indian Valley to Weiser River.**

| | Discharge (cfs)[a] | Average Total Phosphorus Load DEQ 2000-2001 (kg/day)[b] | Average Total Phosphorus Concentration DEQ 2000-2001 (mg/L)[c] |
|---|---|---|---|
| Average[d] | 65.7 | 13.7 | 0.102 |
| Standard Deviation | 107.0 | 21.0 | 0.026 |
| Maximum | 347.0 | 71.3 | 0.129 |
| Minimum | 2.3 | 0.4 | 0.049 |
| Count | 10 | 10 | 10 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*

As with total phosphorus loads calculated for the middle and lower Weiser River, normalized discharge should also be calculated from the USGS gage site (13261500) on the Little Weiser River. The normalization of the discharge will assist in establishing total phosphorus loads and concentrations based on average daily discharges. Appendix C provides additional discussion of statistical analysis of discharge and total phosphorus loading. Table 100 presents the normalized discharge, total phosphorus loads, and concentrations at the USGS gage site.

**Table 100. Estimated Total Phosphorus Concentrations and Loads, Little Weiser at Weiser River. Little Weiser River, Indian Valley to Weiser River.**

| Month | Discharge (cfs)[a] | Total Phosphorus Load (kg/day)[b] | Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 392.8 | 40.3 | 0.043 |
| June | 234.0 | 28.9 | 0.053 |
| July | 34.9 | 8.5 | 0.123 |
| August | 3.7 | 2.2 | 0.268 |
| September | 2.8 | 1.7 | 0.339 |
| Analysis[d] | | | |
| Average | 133.8 | 16.4 | 0.165 |
| Standard Deviation | 165.2 | 16.2 | 0.132 |
| Maximum | 585.0 | 51.9 | 0.473 |
| Minimum | 0.7 | 0.8 | 0.036 |
| Count[e] | 153 | 153 | 153 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*
*d analysis on all critical period data (May-September), not on data presented in table*
*e estimated discharge, load, and concentration based on regression analysis of dates of instream monitoring (DEQ 2000-2001)*

*Total Phosphorus Load Allocations*

The target of 0.07 mg/L is applied using the normalized discharge data and load analysis. A total phosphorus load allocation is calculated when the target value and normalized discharge data are applied. Table 101 presents the load allocations on a monthly basis. Load allocations are assigned to the Little Weiser River at the mouth to achieve the allocation in the middle Weiser River. Table 102 shows the reductions required to meet the allocations.

**Table 101. Discharge, and Total Phosphorus Load Allocations and Concentrations, Little Weiser River at Confluence with Weiser River. Little Weiser River, Indian Valley to Weiser River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Allocation (kg/day)[b] | Total Phosphorus Concentration Target (mg/L)[c] |
|---|---|---|---|
| **May** | | | |
| *Total Allocation* | 392.8 | 67.3 | 0.070 |
| **June** | | | |
| *Total Allocation* | 234.0 | 40.1 | 0.070 |
| **July** | | | |
| *Total Allocation* | 34.9 | 6.0 | 0.070 |
| **August** | | | |
| *Total Allocation* | 3.7 | 0.6 | 0.070 |
| **September** | | | |
| *Total Allocation* | 2.8 | 0.5 | 0.070 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

**Table 102. Discharge, Current Total Phosphorus Load, Total Phosphorus Load Allocation, Load Reduction, and Percent Reductions. Little Weiser River at Confluence with Weiser River. Little Weiser River, Indian Valley to Weiser River.**

| Month/Source Allocation | Discharge (cfs)[a] | Total Phosphorus Load Current (kg/day)[b] | Total Phosphorus Load Allocation (kg/day) | Total Phosphorus Load Reduction (kg/day) | Percent Reduction Required (%) |
|---|---|---|---|---|---|
| **May** | | | | | |
| *Total Allocation* | 394.5 | 40.3 | 67.3 | NRR[c] | NRR |
| **June** | | | | | |
| *Total Allocation* | 234.0 | 28.9 | 40.1 | NRR | NRR |
| **July** | | | | | |
| *Total Allocation* | 34.9 | 8.5 | 6 | 2.5 | 29.4% |
| **August** | | | | | |
| *Total Allocation* | 3.7 | 2.2 | 0.6 | 1.6 | 72.7% |
| **September** | | | | | |
| *Total Allocation* | 2.8 | 1.7 | 0.5 | 1.2 | 70.6% |

*a cubic feet per second*
*b kilograms per day*
*c no reduction required*

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

The Weiser River Soil Conservation District provided information on ongoing efforts to address nonpoint sources from agriculture areas. No other information was provided on the types of activities occurring and which pollutants are being addressed through these pollutant controls efforts. The following contracts are mainly federally funded projects with the local soil conservation district sponsoring the project and the NRCS providing technical assistance.

- Little Weiser River Drainage-5 contracts, total acres 2,473
- Mainstem Weiser River-19 contracts, total acres 6,449
- Crane Creek Drainage-1 contract, total acres 266

Because elevated levels of nitrates have been found in local ground water, the lower Weiser River area, including the Sunnyside area, has been designated a State Nitrate Priority Area. A ground water management plan has been developed to address nitrates in the area. With this designation as a high priority area, Idaho provides resources to local governments to address land use practices and develop pollution control measures.

# 5. Total Maximum Daily Loads

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

Practically, the MOS is a reduction in the load capacity that is available for allocation to pollutant sources. NB load is also effectively a reduction in the load capacity available for allocation to anthropogenic pollutant sources. This can be summarized symbolically as the equation:

LC = MOS + NB + LA + WLA = TMDL

The equation is written in this order because it represents the logical order in which a loading analysis is conducted. First, the LC is determined. Then, the LC is broken down into its components: the necessary MOS is determined and set aside; then NB, if relevant, is quantified and set aside; and then the remainder (LA and WLA) is allocated among pollutant sources. When the breakdown and allocation are completed, a TMDL, which must equal the LC, is established.

Another step in a loading analysis is the quantification of current pollutant loads by source. This allows the specification of load reductions as percentages from current conditions, considers equities in load reduction responsibility, and is necessary in order for pollutant trading to occur. Also, a required part of the loading analysis is that the LC must be based on critical conditions, the conditions that exist when water quality standards are most likely to be violated. If a TMDL is protective under critical conditions, it must be more than protective under less extreme conditions. Because both LC and pollutant source loads vary independently, determination of critical conditions can be complicated.

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

## 5.1 Instream Water Quality Targets

The overall goal of the TMDL is to achieve the full support of designated or existing beneficial uses. These goals will be achieved by meeting certain pollutant target loads, surrogate measures determined through literature values, and/or established numeric and narrative criteria described in Idaho Water Quality Standards and Wastewater Treatment Requirements (IDAPA 58.01.02).

### Design Conditions

The TMDL targets are designed to achieve the full support of the designated or existing beneficial uses in the Weiser River Watershed. Some of these targets are based on water column pollutants, such as total phosphorus, TSS, chlorophyll a, and bacteria. Other targets are based on research values, such as the water body substrate composition of percent fines or Potential Natural Vegetation related to temperature.

### Target Selection

In order to restore "full support of designated beneficial uses" (Idaho Code 39.3611, et.seq.), the targets listed in Table 103 for nutrients, bacteria, temperature, and sediment are based on either numeric criteria or literature values determined through the use of biological indicators (e.g., substrate targets and macroinvertebrates). A more in-depth discussion of how these targets were derived is included in Section 2 of this document. Table 104 provides citations for the rationale for the target selections.

**Table 103. Water Quality Targets for Specific Water Bodies. Weiser River Watershed.**

| Parameter | Weiser River (Lower) Selected Targets |
|---|---|
| Bacteria | Less than 126 *E. coli* cfu[a] or mpn/100 ml[b] as a 30 day log mean with a minimum of 5 samples and no sample greater than 406 *E. coli* cfu or mpn/100 ml |
| Sediment | Less than or equal to 50 mg/L TSS for no more than 30 days, less than or equal to 80 mg/L TSS for no more than 14 days, both calculated as a geometric mean over the exposure duration, and a substrate target of percent fines (<6.0 mm[e]) not to exceed 30% |
| Temperature | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. |
| **Parameter** | **Weiser River (Middle) Selected Targets** |
| Sediment | Less than or equal to 50 mg/L TSS for no more than 30 days, less than or equal to 80 mg/L TSS for no more than 14 days, both calculated as a geometric mean over the exposure duration and a substrate target of percent fines (<6.0 mm) not to exceed 30% |
| Temperature | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. |
| **Parameter** | **Little Weiser River Selected Target** |
| Bacteria | Less than 126 *E. coli* cfu or mpn/100 ml as a 30 day log mean with a minimum of 5 samples and no single sample greater than 406 *E. coli* cfu or mpn/100 ml |
| Sediment | Less than or equal to 50 mg/L TSS for no more than 30 days, less than or equal to 80 mg/L TSS for no more than 14 days, both calculated as a geometric mean over the exposure duration, and a substrate target of percent fines (<6.0 mm) not to exceed 30% |
| Temperature | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. |
| **Parameter** | **Crane Creek (Crane Creek Reservoir to Weiser River) Selected Target** |
| Sediment | Less than or equal to 50 mg/L TSS for no more than 30 days, less than or equal to 80 mg/L TSS for no more than 14 days, both calculated as a geometric mean over the exposure duration and a substrate target of percent fines (<6.0 mm) not to exceed 30% |
| Bacteria | Less than 126 *E. coli* cfu or mpn/100 ml as a 30 day log mean with a minimum of 5 samples and no single sample greater than 406 *E. coli* cfu or mpn/100 ml |
| Temperature | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. |

*a colony forming units*
*b most probable number per 100 milliliters*
*c milligrams per liter*
*d total suspended solids*
*e millimeters*
*f micrograms per liter*

### Table 104. Water Quality Target Rationale. Weiser River Watershed.

| Parameter | Selected Target Rationale |
|---|---|
| Bacteria | IDAPA 58.01.02.251.01, numeric criteria for full support of primary contact recreation |
| Nutrients | Recommended criteria for eutrophic water bodies (EPA 1972)<br>Established TMDLs for similar water bodies in region (e.g., Cascade Reservoir) |
| Sediment (TSS) | Established TMDLs for similar water bodies in region (e.g., Boise River) |
| Temperature | IDAPA 58.01.02.053. BENEFICIAL USE SUPPORT STATUS - Natural Conditions.<br>IDAPA 58.01.02.200.09 Natural Background Conditions. |
| Percent Fines | Biological indicators' tolerance of percent fines (Clark 2003; and Relyea, Minshall, and Danehy 2000) |

## Monitoring Points

Biological assessments should be conducted on a routine basis to determine the response of biological indicators to the targets set in the TMDL. Since much of the original assessment process is based on these indicators, continuous monitoring will be essential to determine response. The biological assessment completed in the years 2000 and 2001 (Ingham 2000) will act as guidance to determine if the goals and targets described in the TMDL are adequate for the full support of the designated or existing beneficial uses or if modifications are required to re-address the targets or the attainability of the beneficial uses. Additional biological assessments should be conducted on the Little Weiser River at the established BURP monitoring site, along with an additional site directly upstream of the §303(d) listed segment (above Indian Valley).

Water column assessments should focus on compliance areas described in the TMDL. These compliance areas include the following locations:

- Weiser River confluence with the Snake River
- Weiser River at the USGS gage 13266000
- Crane Creek near the confluence with the Weiser River
- Weiser River at Midvale
- Little Weiser River near Cambridge

Bacteria assessments should be conducted at least once every two years on the three segments determined not fully supporting primary contact recreation.

Additional assessments and determinations of the difference between TSS and SSC should be an ongoing program. Monitoring for these two parameters should focus on high discharge periods when high discharge velocities will cause the movement of large sediment particles.

## 5.2 Load Capacity

Loading capacity is the maximum load that each water body can accommodate and still meet the water quality standards “with season variations and a margin of safety which takes into account any lack of knowledge...” (CWA § 303(d) (C)). Likely sources of uncertainty include lack of knowledge of assimilative capacity, uncertain relations of a selected target or targets to a beneficial use or uses, and variability in target measurement. Load capacity for these stream segments was determined by using the target criteria to identify loads per day.

Most load capacities are based on water column concentrations, which can vary depending on the amount of water. That is, since concentrations are based on an amount of a substance per a known volume of water (e.g., mg/L), that concentration would change if additional water (but not additional substance) was added. However, the overall load would not increase. By determining loads as a function of discharge, it is hoped that this variation will be reduced. For most of the load capacities determined in the Weiser River Watershed, the load was determined as a function of discharge. Normalized discharge was used as a mechanism to offset the extreme high and low discharges associated with the Weiser River. Data analysis showed that, in most cases, the normalized load data correlated well with the limited data for the actual load measured.

All loads were calculated based on target concentrations and normalized discharge for the critical period or for the period when an exceedence of criteria was occurring (e.g., total suspended sediment exceedence). All loads presented in Table 105 through Table 108 are estimated load capacities under normalized discharge conditions and at concentrations that will achieve water quality targets.

In some situations, a pollutant load (mass/unit/time) is not an appropriate means of describing a target. In these situations, surrogate measures are more appropriate. For the Weiser River Watershed, some of these targets consist of water column concentrations (without a discharge measurement), substrate composition, or a shade component to reduce thermal input. None of these offer the traditional load components of a mass/unit/time calculation, but they provide a target for achieving the full support of designated or existing beneficial uses.

Tables 105 through 108 shows the load capacity for the pollutants impairing beneficial uses. Table 130 provides a synopsis of load capacity, existing loads, load allocations, reductions required and percent reduction required.

## Table 105. Load Capacity, Lower Weiser River.

| Pollutant | Critical Period | Load Capacity |
|---|---|---|
| | | |
| *E. coli* Bacteria | July | (cfu or mpn)[a] |
| | | 280,000 |
| | | |
| Sediment (TSS)[b] | | (kg/day)[c] |
| | March | 301,000 |
| | April | 309,000 |
| | May | 301,000 |
| | | |
| Sediment (% Fines) | Year Round | % |
| | | 30.0 |
| | | |
| Thermal | June-September | d |

*a colony forming units and most probable number b total suspended solids c kilograms per day*
*d See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.*

## Table 106. Load Capacity, Middle Weiser River.

| Pollutant | Critical Period | Load Capacity |
|---|---|---|
| | | |
| Sediment (TSS)[a] | | kg/day[b] |
| | February | 188,000 |
| | March | 295,000 |
| | April | 304,000 |
| | May | 306,969 |
| | June | 190,000 |
| | | |
| Sediment (% Fines) | | % |
| | Year Round | 30.0 |

*a total suspended solids*
*b kilograms per day*

## Table 107. Load Capacity, Crane Creek, Crane Creek Reservoir to Weiser River.

| Pollutant | Critical Period | Load Capacity |
|---|---|---|
| *E. coli* Bacteria | | (cfu or mpn/day)[a] |
| | July | 3,530,000 |
| | | |
| | | |
| Sediment (% Fines) | | % |
| | Year Round | 30 |

*a colony forming units and most probable number*

## Table 108. Load Capacity, Little Weiser River.

| Pollutant | Critical Period | Load Capacity |
|---|---|---|
| *E. coli* Bacteria | July | (cfu or mpn/day)[a] |
| | | 1,240,000 |
| | | |
| Sediment (% Fines) | Year Round | % |
| | | 30.0 |

*a colony forming units and most probable number*

## 5.3 Estimates of Existing Pollutant Loads

Loading analyses were performed where adequate water quality data for tributaries were available (See Tables 116 through 120). Regulations allow that loadings "...may range from reasonably accurate estimates to gross allotments, depending on the availability of data and appropriate techniques for predicting the loading." (40 CFR § 130.2(g)). Table 120 provides a synopsis of load capacity, existing loads, load allocations, reductions required, and percent reduction required.

### Table 109. Existing Loads, Lower Weiser River.

| Pollutant | Existing Load |
|---|---|
| | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] |
| | 6,760,000 |
| | |
| Sediment (TSS)[b] | (kg/day)[c] |
| March | 326,000 |
| April | 338,000 |
| May | 340,000 |
| | |
| Sediment (% Fines) | % |
| | 41.7 |
| | |
| Thermal | d |

*a colony forming units and most probable number, b total suspended solids second, c Joules per square meter per sec, d See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.*

### Table 110. Existing Loads, Middle Weiser River.

| Pollutant | Existing Load |
|---|---|
| | |
| Sediment (TSS)[a] | (kg/day)[b] |
| February | 211,900 |
| March | 516,500 |
| April | 532,000 |
| May | 562,000 |
| June | 256,000 |
| | |
| Sediment (% Fines) | % |
| | 21.1 |
| | |
| Sediment (Turbidity) | NTUs[c] |
| July-September | 35 |

*a total suspended solids*
*b kilograms per day*
*c nephelometric turbidity units*

### Table 111. Existing Loads, Crane Creek.

| Pollutant | Existing Load |
|---|---|
| | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] |
| July | 20,900,000 |
| | |
| Sediment (% Fines) | % |
| | NA |
| | |
| Sediment (Turbidity) | NTUs[b] |
| July-September | 38 |

*a colony forming units and most probable number*
*b nephelometric turbidity units*

### Table 112. Existing Loads, Little Weiser River.

| Pollutant | Existing Load |
|---|---|
| | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] |
| | 6,534,000 |
| | |
| Sediment (% Fines) | % |
| | 13.0[b] |

*a colony forming units and most probable number, b Although the existing load identified is below the target,a considerable amount of unstable streambanks exist in the Little Weiser River watershed.*

## 5.4 Load Allocation

Using the existing data in concert with target concentrations, load allocations were determined for each watershed. The total allocation includes a margin of safety to account for seasonal variability and uncertainty.

Although the best available techniques and information are applied, uncertainty arises in the selection of water quality targets, load capacity, and estimates of existing loads. This can be attributed to the variability and number of nonpoint sources. The margin of safety is a reduction in loading capacity that is identified prior to allocation to any sources that introduce uncertainty.

### Margin of Safety

Several areas of uncertainty are addressed by applying a margin of safety. In this TMDL, storm events may not be captured in the existing data set since the data consist of biweekly and monthly measurements. Pollutant loads vary from year to year, and this variability may not be adequately assessed with only two years of monitoring data.

The margin of safety varies by pollutant. Some margin of safety parameters are based on the statistical analysis of existing data and are compared to water quality modeling results. Table 113 provides the margin of safety to be used on the different segments and the different pollutants.

**Table 113. Margin of Safety and Rationale, Selected Water Bodies. Weiser River Watershed.**

| Water Body/Pollutant | Margin of Safety | Rationale |
|---|---|---|
| **Lower Weiser River** | | |
| Bacteria | 12.6% of Load Capacity | Based on Relative Range of Duplicate Samples |
| Sediment (Water Column) | 10.8% of Load Capacity | Square Root Error of Modeling Results |
| Sediment (% Fines Substrate) | 14.0% of Load Capacity | 10% Allowance for Sampling Error<br>4% Allowance for Analytical Error |
| **Middle Weiser River** | | |
| Sediment (Water Column) | 9.3% of Load Capacity | Square Root Error of Modeling Results |
| Sediment (% Fines Substrate) | 14.0% of Load Capacity | 10% Allowance for Sampling Error<br>4% Allowance for Analytical Error |
| **Crane Creek** | | |
| Bacteria | 15.4% of Load Capacity | Based on Relative Range of Duplicate Samples |
| Sediment | 10.4% of Load Capacity | Square Root Error of Modeling Results |
| Sediment (% Fines Substrate) | 14.0% of Load Capacity | 10% Allowance for Sampling Error<br>4% Allowance for Analytical Error |
| **Little Weiser River** | | |
| Bacteria | 14.0% of Load Capacity | 10% Allowance for Sampling Error<br>4% Allowance for Analytical Error |
| Sediment | 12.2% of Load Capacity | Square Root Error of Modeling Results |

## Background

In addition to the margin of safety, the natural and background loads represent further reductions in loading capacity available for allocation. Natural sources are those that originate from non-anthropogenic sources and, as such, require no reductions. Background sources are those that originate upstream from a segment of a water body and may or may not require reductions. Table 114 describes the background levels and provides a rationale for application of a background level on selected water bodies.

## Waste Load Allocations

Water quality data collected in the year 2003 showed the point sources within the Weiser River Watershed. The wastewater treatment plants in the cities of Cambridge and Council are having negligible influence on water quality. The data indicated that discharges to the river had little to no affect on total phosphorus loads. These facility’s waste load allocations should be established at the current NPDES permitted levels.

Point sources discharging directly to the Weiser River within the TMDL reach are allocated heat loads corresponding to discharge loads, and the discharge loads are applied to design flows to ensure that measurable increase requirements are not exceeded. These waste loads are not included in the following tables or discussion of load allocations.

## Load Allocations

Load allocations are assigned to nonpoint sources. Any reductions required to meet allocations should be directed at those sources.

### Modifications to Load Allocations

In coordination with the WAG, DEQ intends to review and modify, if necessary, the load allocations to the water quality segments provided in this TMDL as additional data and information become available during implementation. Successful implementation depends upon the cooperation of and resources available to the stakeholders in the watershed. It is recognized that the load allocations may require modification as stakeholders and designated agencies determine the best pollution control strategies to reach water quality targets. For example, during implementation, it may be discovered that water quality targets can best be attained by reducing sources in one area rather than another. The load allocations should be modified to reflect these implementation considerations.

**Table 114. Background Allocations and Rationale, Selected Water Bodies. Weiser River Watershed.**

| Water Body/Pollutant | Background | Rationale |
|---|---|---|
| **Lower Weiser River** | | |
| Bacteria | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment (Water Column) | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment (% Fines Substrate) | 16.6 % of Load Capacity | Allowance for Natural Occurrence Deposition |
| Temperature (Thermal) | c | c |
| **Middle Weiser River** | | |
| Sediment (Water Column) | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment (% Fines Substrate) | 16.6 % of Load Capacity | Allowance for Natural Occurrence Deposition |
| **Crane Creek** | | |
| Bacteria | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment (Water Column) | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment (% Fines Substrate) | 20% of Load Capacity | Allowance for Natural Occurrence Deposition |
| **Little Weiser River** | | |
| Bacteria | 20% of Load Capacity | Allowance for Natural Occurrence |
| Sediment | 20% of Load Capacity | Allowance for Natural Occurrence |

*a milligrams per liter, b micrograms per liter, c See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.*

Further refinement of natural and background sources will be ongoing as more data is collected. Since TMDLs are a dynamic process, the document will be updated as appropriate.

## Reserve

The identified sources and land uses are predominantly agricultural, with some minor influence from roadways. With the identified trend of conversion from agricultural land uses to urban/suburban and rural development land uses, agricultural sources of pollutants are likely to remain stable or decrease within the implementation lifetime of this TMDL. For this reason, no future pollutant source load allocations (reserve capacity) were calculated.

## Seasonal Variation

Bacteria loads are based on the critical period when a high probability exists for primary contact recreational use, such as swimming. However, load reductions should be based on reducing bacteria levels throughout the year and should also provide for full support of secondary contact recreation, which includes activities such as fishing where the possibility of ingesting river water is still a concern.

Targets selected for sediments are based on the use of biological indicator species. Water column targets for TSS are designed to reduce the slugs of sediment associated with high discharge periods. However, all sediment sources must be addressed to meet the substrate targets.

See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

## Reasonable Assurance

The state has responsibility under Sections 401, 402, and 404 of the CWA to provide water quality certification. Under this authority, the state reviews dredge and fill, stream channel alteration, and NPDES permits to ensure the proposed actions will meet Idaho WQS.

Under Section 319 of the CWA, each state is required to develop and submit a nonpoint source management plan (NSMP). Idaho's NSMP has been submitted to EPA and has been approved (Idaho DEQ 1999*d*). The NSMP identifies programs for implementation of best management practices (BMPs), identifies available funding sources, and includes a schedule for program milestones. It is certified by Idaho Attorney General to ensure that adequate authorities exist to implement the NSMP.

Idaho's NSMP describes many of the voluntary and regulatory approaches the state will take to abate nonpoint source pollution. Section 39-3601, et seq., of the CWA includes provisions for public involvement, such as the formation of Basin Advisory Groups and Watershed Advisory Groups (WAGs) (IDAPA 58.01.02.052). The WAGs are established in high priority watersheds to assist DEQ and other state agencies in formulating specific actions needed to control point and nonpoint sources of pollution affecting water quality limited segments. A WAG was formed to assist with this report and its implementation plan. This WAG will continue to be the main stakeholder contact for the Weiser River Watershed TMDL and its implementation plan. The implementation plan must be completed within 18 months after approval of the TMDL.

Idaho uses a voluntary approach to control agricultural nonpoint sources. However, regulatory authority can be found in the WQS (IDAPA 58.01.02.350.01 through 58.01.02.350.03). IDAPA 58.01.02.054.07 refers to the Idaho Agricultural Pollution Abatement Plan (Ag Plan), which provides direction to the agricultural community for approved BMPs (IDA-SCC 1993). A portion of the Ag Plan outlines elected groups or responsible agencies (e.g., Soil Conservation Districts [SCDs]) who will take the lead if nonpoint source pollution problems need to be addressed. For agriculture, the Ag Plan assigns the local SCDs to assist the land owner/operator with developing and implementing BMPs to abate nonpoint source pollution associated with the land use. If a voluntary approach does not succeed in abating the pollutant problem, the state may seek injunctive relief for those situations that are determined to be an imminent and substantial danger to public health or environment (IDAPA 58.01.02.350.02(a)).

If water quality monitoring indicates WQSs are not being met, even with the use of BMPs or knowledgeable and reasonable practices, the state may request the designated agency to evaluate and/or modify the BMPs to protect beneficial uses.

## Construction Storm Water and TMDL Waste Load Allocations

### Construction Storm Water

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

### The Construction General Permit (CGP)

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

### Storm Water Pollution Prevention Plan (SWPPP)

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

### Requirements

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

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

## Remaining Available Load

After the natural background and the margin of safety loads are subtracted from the load capacity, the remaining available load represents that amount that can be allocated to nonpoint sources within the subwatersheds in the form of load allocations. At this time, no changes to waste load allocations will be assigned to point sources in the watershed. Current discharge limitations for each point source will be the waste load allocation.

Tables 115 through 117 show the allocations for selected segments in the Weiser River Watershed. Table 120 provides a synopsis of load capacity, existing loads, load allocations, reductions required and percent reduction required.

## Table 115. Load Allocations, Lower Weiser River.

| Pollutant | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Galloway Dam to Snake River Nonpoint Source Allocation | Total Load Allocation |
|---|---|---|---|---|---|---|
| | | | | | | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) |
| July | 189,000 | 30,996 | 37,800 | 460,000 | 120,204 | 649,000 |
| | | | | | | |
| Sediment (TSS)[b] | (kg/day)[c] | (kg/day) | (kg/day) | (kg/day) | (kg/day) | (kg/day) |
| March | 11,000 | 42,140 | 60,200 | 290,000 | -91,340 | 301,000 |
| April | 19,000 | 43,260 | 61,800 | 290,000 | -86,060 | 309,000 |
| May | 11,000 | 42,140 | 60,200 | 290,000 | -91,340 | 301,000 |
| | | | | | | |
| Sediment (% Fines) | (%) | (%) | (%) | (%) | (%) | (%) |
| Year Round | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 |
| | | | | | | |
| Thermal June-September | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. | | | | | |

*a colony forming units and most probable number*
*b total suspended solids*
*c kilograms per day*

## Table 116. Load Allocation, Middle Weiser River.

| Pollutant/ Critical Period | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Little Weiser to Galloway Dam Nonpoint Source Allocation | Total Load Allocation |
|---|---|---|---|---|---|---|
| | | | | | | |
| Sediment (TSS)[a] | (kg/day)[b] | (kg/day) | (kg/day) | (kg/day) | (kg/day) | (kg/day) |
| February | 144,700 | 13,457 | 28,940 | 43,300 | 102,303 | 188,000 |
| March | 196,600 | 18,284 | 39,320 | 98,400 | 138,996 | 295,000 |
| April | 127,000 | 11,811 | 25,400 | 177,000 | 89,789 | 304,000 |
| May | 131,969 | 12,273 | 26,394 | 175,000 | 93,302 | 306,969 |
| June | 125,500 | 11,672 | 25,100 | 64,500 | 88,729 | 190,000 |
| | | | | | | |
| Sediment (% Fines) | % | % | % | % | % | % |
| Year Round | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 |

*a total suspended solids*
*b kilograms per day*

### Table 117. Load Allocations, Crane Creek, Crane Creek Reservoir to Weiser River.

| Pollutant/ Critical Period | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Crane Creek Nonpoint Source Allocation | Total Load Allocation |
|---|---|---|---|---|---|---|
| | | | | | | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) |
| July | 2,075,380 | 543,620 | 706,000 | 205,000 | 2,075,380 | 3,530,000 |
| | | | | | | |
| Sediment (% Fines) | % | % | % | % | % | % |
| Year Round | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 |

*a colony forming units and most probable number*

### Table 118. Load Capacity, Little Weiser River.

| Pollutant | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Indian Valley to Weiser River Nonpoint Source Allocation | Total Load Allocation |
|---|---|---|---|---|---|---|
| | | | | | | |
| *E. coli* Bacteria | (cfu or mpn/day)[a] | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) | (cfu or mpn/day) |
| July | 613,400 | 173,600 | 248,000 | 205,000 | 613,400 | 1,240,000 |
| | | | | | | |
| Sediment (% Fines) | % | % | % | % | % | % |
| Year Round | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 |

*a colony forming units and most probable number*

## 5.5 Implementation Strategies

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

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

The geographic scope of this TMDL encompasses the entire Weiser River Watershed, fourth field HUC 17050124. The water bodies to be addressed include two segments of the Weiser River, the Little Weiser River and Crane Creek (excluding Crane Creek Reservoir). Descriptions of these water bodies and the pollutants to be addressed in the implementation plan are located in Section 2.5.

### Time Frame

The implementation plan must include a long-term strategy for implementation and maintenance of the plan. The plan's timeline should be as specific as possible and should include a BMP implementation and/or evaluation schedule, monitoring schedules, reporting dates, and milestones for evaluating progress. There may be disparity in timelines for different subwatersheds. This is acceptable only if reasonable assurance is provided that milestones will be achieved.

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

A definitive timeline for implementing the TMDLs and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the WAG, the designated agencies, and other interested publics.

## Approach

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

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

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

For nonpoint sources, DEQ also expects that implementation plans be implemented as soon as practicable. However, DEQ recognizes that it may take some period of time, from several years to several decades, to fully implement the appropriate management practices. DEQ also recognizes that it may take additional time after implementation has been accomplished before the management practices identified in the implementation plans become fully effective in reducing and controlling pollution. It is possible that after application of all reasonable BMPs, some TMDLs or their associated targets and surrogates cannot be achieved as originally established. Nevertheless, it is DEQ's expectation that land managers make a good faith effort to achieving their load allocations in the shortest practicable time.

DEQ recognizes that expedited implementation of TMDLs will be socially and economically challenging. Further, there is a desire to minimize economic impacts as much as possible when consistent with protecting water quality and beneficial uses. DEQ further recognizes that, despite the best and most sincere efforts, natural events beyond the control of humans may interfere with or delay attainment of the TMDL and/or its associated targets and surrogates. Such events could be, but are not limited to, floods, fire, insect infestations, and drought.

For some pollutants, pollutant surrogates have been defined as targets for meeting the TMDLs. The purpose of the surrogates is not to bar or eliminate human access or activity in the basin or its riparian areas. It is the expectation, however, that the specific implementation plan will address how human activities will be managed to achieve the water quality targets and surrogates. It is also recognized that full attainment of pollutant surrogates (system potential vegetation, for example) at all locations may not be feasible due to physical, legal, or other regulatory constraints. To the extent possible, the implementation plan should identify potential constraints, but should also provide the ability to mitigate those constraints should the opportunity arise. If a nonpoint source that is covered by the TMDL complies with its finalized implementation plan, it will be considered in compliance with the TMDL.

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

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

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

- DEQ intends to review the progress of the TMDLs and the implementation plans on a 5-year basis, subject to available resources.
- DEQ expects that designated agencies will also monitor and document their progress in implementing the provisions of the implementation plans for those pollutant sources for which they are responsible. This information will be provided to DEQ for use in reviewing the TMDLs.
- DEQ expects that designated agencies will identify benchmarks for the attainment of TMDL targets and surrogates as part of the specific implementation plans being developed. These benchmarks will be used to measure progress toward the goals outlined in the TMDLs.
- DEQ expects designated agencies to revise the components of their implementation plans to address deficiencies where implementation of the specific management techniques are found to be inadequate.
- If DEQ, in consultation with the designated agencies, concludes that all feasible steps have been taken to meet a TMDL and its associated targets and surrogates, and that the TMDL or the associated targets and surrogates are not practicable, the TMDL may be reopened and revised as appropriate. DEQ would also consider reopening the

TMDL should new information become available indicating that the TMDL or its associated targets and/or surrogates should be modified.

## Responsible Parties

Development of the final implementation plan for the Weiser River TMDL will proceed under the existing practice established for Idaho. The plan will be cooperatively developed by DEQ, the Weiser River WAG, and other designated agencies with input from the public through an established process. Of the three entities, the WAG will act as the integral part of the implementation planning process to identify appropriate implementation measures. Other individuals may also be identified to assist in the development of the site-specific implementation plans as their areas of expertise are identified as beneficial to the process. Together, these entities will recommend specific control actions and will then, with the Basin Advisory Group, review the specific implementation plan before submitting it to DEQ. DEQ will act as a repository for approved implementation plans.

Designated state agencies are responsible for assisting with preparation of specific implementation plans, particularly for those sources for which they have regulatory authority or programmatic responsibilities. Idaho's designated state management agencies are listed on Table 119.

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

**Table 119. Regulatory Authority for Nonpoint Pollution Sources. Weiser River Watershed.**

| Nonpoint Source Best Management Practices | Primary Responsible Agency or Agencies | Code/Regulation or Authority Involved |
|---|---|---|
| Idaho Forest Practice Rules | Idaho Department of Lands, Board of Land Commissioners | Idaho Code § 39-3602, IDAPA 58.01.02.003.62, IDAPA 58.01.02.350.03 |
| Rules Governing Solid Waste Management | Department of Environmental Quality and the Health Districts | IDAPA 58.01.02.350.03(b) |
| Rules Governing Subsurface and Individual Sewage Disposal Systems | Department of Environmental Quality and the Health Districts | Idaho Code § 39-3602, IDAPA 58.01.02.350.03(c), IDAPA 58.01.15 |
| Rules and Standards for Stream-Channel Alteration | Board of Water Resources | IDAPA 58.01.02.350.03(d) |
| Rules Governing Exploration and Surface Mining Operations in Idaho | Idaho Department of Lands, Board of Land Commissioners | Idaho Code § 39-3602, IDAPA 58.01.02.350.03(e), IDAPA 58.01.02.003.62 |
| Rules Governing Placer and Dredge Mining in Idaho | Idaho Department of Lands, Board of Land Commissioners | IDAPA 58.01.02.350.03(f) |
| Rules Governing Dairy Waste | Idaho Department of Agriculture | IDAPA 58.01.02.350.03.(g) and IDAPA 58.01.02.04.14 |

All stakeholders in the Weiser River Watershed Subbasin have a responsibility for implementing the TMDLs. DEQ and the designated agencies in Idaho have primary responsibility for overseeing implementation in cooperation with landowners and managers. Their general responsibilities are outlined below.

- **DEQ** will oversee and track overall progress on the specific implementation plans and monitor the watershed response. DEQ will also work with local governments on urban/suburban issues.
- **Idaho Department of Lands** will maintain and update approved BMPs for forest practices and mining. The Idaho Department of Lands is responsible for ensuring use of appropriate BMPs on state and private lands.
- **Idaho Soil Conservation Commission**, working in cooperation with local Soil and Water Conservation Districts, the Idaho Department of Agriculture, and NRCS, will provide technical assistance to agricultural landowners. These agencies will help landowners design BMP systems appropriate for their property and identify and seek appropriate cost-share funds. They also will provide periodic project reviews to ensure BMPs are working effectively.

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

- Develop BMPs to achieve load allocations.
- Give reasonable assurance that management measures will meet load allocations through both quantitative and qualitative analyses of management measures.

- Adhere to measurable milestones for progress.
- Develop a timeline for implementation, with reference to costs and funding.
- Develop a monitoring plan to determine if BMPs are being implemented, individual BMPs are effective, load allocations are being met, and water quality standards are being met.

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

## Monitoring Strategy

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

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

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

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

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

Implementation plan monitoring has two major components:

- Watershed monitoring and
- BMP monitoring

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

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

**Watershed Monitoring**

In the Weiser River Watershed TMDL, watershed monitoring has the following objectives:

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

*MONITORING TO FILL DATA GAPS*

Constituents:
- Chlorophyll *a* and turbidity in Crane Creek Reservoir including an assessment of attainable water quality conditions.
- Analysis of bioassessment protocols on the Little Weiser River
- Additional substrate analysis on Crane Creek below Crane Creek Reservoir
- Additional monitoring of sediment and bacteria in the Little Weiser River above Indian Valley

Schedule:
- Final evaluations completed within the first phase of implementation

*ROUTINE PROGRESS MONITORING*

Constituents:
- Bacteria, phosphorus, sediment, temperature (potential natural vegetation) and river bioassessment protocols

Locations:
- Monitoring points located upstream and downstream in the defined TMDL segments, namely the middle and lower Weiser River and the Little Weiser River
- Monitoring of major tributaries at their inflow to the middle and lower Weiser River TMDL reach

Schedule:

- Routine monitoring frequency is projected to occur monthly or (at minimum) seasonally as water quality needs require
- Monitoring of major tributaries at their inflow to the middle and lower Weiser River TMDL reach on a monthly or (at minimum) a seasonal basis to determine loading trends

These projected goals of the Weiser River monitoring plan will be a joint effort on the part of many government and private participants. Specific responsibility will be identified as the implementation planning process proceeds.

**BMP/Project Effectiveness Monitoring**

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

**Evaluation of Efforts Over Time**

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

A definitive timeline for implementing the TMDL and the associated allocations will be developed as part of the implementation plan. This timeline will be developed in consultation with the WAG, the designated agencies, and other interested publics.

## 5.6 Conclusions

There were no water quality or biological data presented that showed nutrients were impairing beneficial uses in the Weiser River. However, total phosphorus load allocations have been developed to address goals and targets for the *Snake River-Hells Canyon SBA-TMDL* (Idaho DEQ and Oregon DEQ 2004). These targets for the Snake River have shown that a significant reduction in total phosphorus from the Weiser River Watershed must occur during the months of May through September.

Biological assessment determined that sediment is impairing designated beneficial uses in the lower Weiser River and middle Weiser River.

Bacteria levels in the lower Weiser River, Little Weiser River, and Crane Creek exceed Idaho's WQS for the support of primary and secondary contact recreation. Total maximum daily loads have been developed on these segments to protect these uses. The target for all water bodies is based on the state WQS criteria of a geometric mean of 126 colony forming units/100 milliliters. Significant reductions will be required in all water bodies to meet this target.

Water temperature in the lower Weiser River exceeds the state WQS for the protection of cold water aquatic life. Both daily average (19 $^{o}$C) and maximum daily (22 $^{o}$C) temperatures exceeded the criteria. See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

Four 1998 §303(d) listed water bodies have been determined to be in full support of designated or existing uses. It is recommended that the upper Weiser River (West Fork Weiser River to Little Weiser River), Mann Creek, Johnson Creek, and West Fork Weiser River all be removed from the list. Dissolved oxygen is a listed pollutant in the lower Weiser River. Monitoring showed that dissolved oxygen is meeting water quality standards.

Three water bodies have been determined to be intermittent, and thus intermittent WQS and criteria should be applied to these water quality limited segments. These segments are Cove Creek, South Crane Creek, and North Crane Creek. Water temperature for the middle Weiser River (Little Weiser River to Galloway Dam) exceeded the WQS criteria for the protection of cold water aquatic life. See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL.

There are no indications of impairment of drinking water, industrial, or agricultural water supply beneficial uses, nor is there any indication that wildlife habitat and aesthetics are impaired.

The pollutant reductions in this document, if implemented, will ensure that the water bodies listed as water quality limited will achieve full support of their designated or existing beneficial uses. Continued monitoring of water column parameters and biological indicators will be a critical component to ensure that the BMPs implemented are appropriate and to determine which BMPs are most effective. The TMDL monitoring process also ensures that refinements and adjustment to targets can be made as needed. DEQ recognizes that implementation strategies may be modified if monitoring indicates the goals and targets determined in this document are not being met. DEQ also recognizes that, as additional information is collected, the attainability of some uses may be challenged in the future.

## Table 120. Water Quality TMDLs and Targets for Selected Water Quality Limited Segments. Weiser River Watershed.

| Lower Weiser River | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **Pollutant** | | **Load Capacity** | **Allocation for Segment** | **Margin of Safety** | **Natural Background** | **Upstream Source Allocation** | **Galloway Dam to Snake River Nonpoint Source Allocation** | **Total Load Allocation** | **Existing Load** | **Reduction Required** | **% Reduction Required** |
| | | | | | | | | | | | |
| *E. coli* Bacteria | July | cfu or mpn[a] | cfu or mpn | cfu or mpn | cfu or mpn | cfu or mpn | cfu or mpn | cfu or mpn | cfu or mpn | cfu or mpn | % |
| | | 280,000 | 189,000 | 30,996 | 37,800 | 460,000 | 120,204 | 649,000 | 6,760,000 | 6,111,000 | 90% |
| | | | | | | | | | | | |
| Sediment (TSS)[b] | | kg/day[c] | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | % |
| | March | 301,000 | 11,000 | 42,140 | 60,200 | 290,000 | -91,340 | 301,000 | 326,000 | 25,000 | 8% |
| | April | 309,000 | 19,000 | 43,260 | 61,800 | 290,000 | -86,060 | 309,000 | 338,000 | 29,000 | 9% |
| | May | 301,000 | 11,000 | 42,140 | 60,200 | 290,000 | -91,340 | 301,000 | 340,000 | 39,000 | 11% |
| | | | | | | | | | | | |
| Sediment (% Fines) | Year Round | % | % | % | % | % | % | % | % | % | % |
| | | 30.0 | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 | 41.7 | 12 | 28% |
| | | | | | | | | | | | |
| Thermal | June-September | See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. | | | | | | | | | |

**Table 120. (Continued). Water Quality TMDLs and Targets for Selected Water Quality Limited Segments. Weiser River Watershed.**

| Middle Weiser River | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pollutant | Critical Period | Load Capacity | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Little Weiser to Galloway Dam and Crane Creek Nonpoint Source Allocation | Total Load Allocation | Existing Load | Reduction Required | % Reduction Required |
| | | | | | | | | | | | |
| Sediment (TSS) | | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | kg/day | % |
| | February | 188,000 | 144,700 | 13,457 | 28,940 | 43,300 | 102,303 | 188,000 | 211,900 | 23,900 | 11% |
| | March | 295,000 | 196,600 | 18,284 | 39,320 | 98,400 | 138,996 | 295,000 | 516,500 | 221,500 | 43% |
| | April | 304,000 | 127,000 | 11,811 | 25,400 | 177,000 | 89,789 | 304,000 | 532,000 | 228,000 | 43% |
| | May | 306,969 | 131,969 | 12,273 | 26,394 | 175,000 | 93,302 | 306,969 | 562,000 | 255,031 | 45% |
| | June | 190,000 | 125,500 | 11,672 | 25,100 | 64,500 | 88,729 | 190,000 | 256,000 | 66,000 | 26% |
| | | | | | | | | | | | |
| Sediment (% Fines) | Year Round | % | % | % | % | % | % | % | % | % | % |
| | | 30.0 | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 | 21.1 | NA | NA |

**Table 120. (Continued). Water Quality TMDLs and Targets for Selected Water Quality Limited Segments. Weiser River Watershed.**

| Crane Creek (Crane Creek Reservoir to Weiser River) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pollutant | Critical Period | Load Capacity | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Crane Creek Nonpoint Source Allocation | Total Load Allocation | Existing Load | Reduction Required | % Reduction Required |
| | | | | | | | | | | | |
| *E. coli* Bacteria | July | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | % |
| | | 3,530,000 | 2,075,380 | 543,620 | 706,000 | 205,000 | 2,075,380 | 3,530,000 | 20,900,000 | 17,370,000 | 83% |
| | | | | | | | | | | | |
| Sediment (% Fines) | Year Round | % | % | % | % | % | % | % | % | % | % |
| | | NA | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 | NA | NA | NA |

**Table 120. (Continued). Water Quality TMDLs and Targets for Selected Water Quality Limited Segments. Weiser River Watershed.**

| Little Weiser River | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Pollutant | | Load Capacity | Allocation for Segment | Margin of Safety | Natural Background | Upstream Source Allocation | Indian Valley to Weiser River Nonpoint Source Allocation | Total Load Allocation | Existing Load | Reduction Required | % Reduction Required |
| *E. coli* Bacteria | July | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | cfu or mpn/day | % |
| | | 1,240,000 | 613,400 | 173,600 | 248,000 | 205,000 | 613,400 | 1,240,000 | 6,534,000 | 5,294,000 | 81% |
| | | | | | | | | | | | |
| Sediment (% Fines) | Year Round | % | % | % | % | % | % | % | % | % | % |
| | | 30.0 | 30 | 4.9 | 8.6 | 0.0 | 16.5 | 30.0 | 13.0 | NA | NA |

*a colony forming units and most probable number*
*b total suspended solids*
*c kilograms per day*
*d Joules per square meter per second*
*e milligrams per liter*
*g micrograms per liter*

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# Glossary

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

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

**Acre-Foot** A volume of water that would cover an acre to a depth of one foot. Often used to quantify reservoir storage and the annual discharge of large rivers.

**Adsorption** The adhesion of one substance to the surface of another. Clays, for example, can adsorb phosphorus and organic molecules

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

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

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

**Adfluvial** Describes fish whose life history involves seasonal migration from lakes to streams for spawning.

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| **Adjunct** | In the context of water quality, adjunct refers to areas directly adjacent to focal or refuge habitats that have been degraded by human or natural disturbances and do not presently support high diversity or abundance of native species. |
| **Alevin** | A newly hatched, incompletely developed fish (usually a salmonid) still in nest or inactive on the bottom of a water body, living off stored yolk. |
| **Algae** | Non-vascular (without water-conducting tissue) aquatic plants that occur as single cells, colonies, or filaments. |
| **Alluvium** | Unconsolidated recent stream deposition. |
| **Ambient** | General conditions in the environment. In the context of water quality, ambient waters are those representative of general conditions, not associated with episodic perturbations, or specific disturbances such as a wastewater outfall (Armantrout 1998, EPA 1996). |
| **Anadromous** | Fish, such as salmon and sea-run trout, that live part or the majority of their lives in the salt water but return to fresh water to spawn. |
| **Anaerobic** | Describes the processes that occur in the absence of molecular oxygen and describes the condition of water that is devoid of molecular oxygen. |
| **Anoxia** | The condition of oxygen absence or deficiency. |
| **Anthropogenic** | Relating to, or resulting from, the influence of human beings on nature. |
| **Anti-Degradation** | Refers to the U.S. Environmental Protection Agency's interpretation of the Clean Water Act goal that states and tribes maintain, as well as restore, water quality. This applies to waters that meet or are of higher water quality than required by state standards. State rules provide that the quality of those high quality waters may be lowered only to allow important social or economic development and only after adequate public participation (IDAPA 58.01.02.051). In all cases, the existing beneficial uses must be maintained. State rules further define lowered water quality to be 1) a measurable change, 2) a change adverse to a use, and 3) a change in a pollutant relevant to the water's uses (IDAPA 58.01.02.003.56). |
| **Aquatic** | Occurring, growing, or living in water. |

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| **Aquifer** | An underground, water-bearing layer or stratum of permeable rock, sand, or gravel capable of yielding of water to wells or springs. |
| **Assemblage (aquatic)** | An association of interacting populations of organisms in a given water body; for example, a fish assemblage, or a benthic macroinvertebrate assemblage (also see Community) (EPA 1996). |
| **Assimilative Capacity** | The ability to process or dissipate pollutants without ill effect to beneficial uses. |
| **Autotrophic** | An organism is considered autotrophic if it uses carbon dioxide as its main source of carbon. This most commonly happens through photosynthesis. |
| **Batholith** | A large body of intrusive igneous rock that has more than 40 square miles of surface exposure and no known floor. A batholith usually consists of coarse-grained rocks such as granite. |
| **Bedload** | Material (generally sand-sized or larger sediment) that is carried along the streambed by rolling or bouncing. |
| **Beneficial Use** | Any of the various uses of water, including, but not limited to, aquatic biota, recreation, water supply, wildlife habitat, and aesthetics, which are recognized in water quality standards. |
| **Beneficial Use Reconnaissance Program (BURP)** | A program for conducting systematic biological and physical habitat surveys of water bodies in Idaho. BURP protocols address lakes, reservoirs, and wadeable streams and rivers |
| **Benthic** | Pertaining to or living on or in the bottom sediments of a water body |
| **Benthic Organic Matter.** | The organic matter on the bottom of a water body. |
| **Benthos** | Organisms living in and on the bottom sediments of lakes and streams. Originally, the term meant the lake bottom, but it is now applied almost uniformly to the animals associated with the lake and stream bottoms. |
| **Best Management Practices (BMPs)** | Structural, nonstructural, and managerial techniques that are effective and practical means to control nonpoint source pollutants. |
| **Best Professional Judgment** | A conclusion and/or interpretation derived by a trained and/or technically competent individual by applying interpretation and synthesizing information. |

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| **Biochemical Oxygen Demand (BOD)** | The amount of dissolved oxygen used by organisms during the decomposition (respiration) of organic matter, expressed as mass of oxygen per volume of water, over some specified period of time. |
| **Biological Integrity** | 1) The condition of an aquatic community inhabiting unimpaired water bodies of a specified habitat as measured by an evaluation of multiple attributes of the aquatic biota (EPA 1996). 2) The ability of an aquatic ecosystem to support and maintain a balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to the natural habitats of a region (Karr 1991). |
| **Biomass** | The weight of biological matter. Standing crop is the amount of biomass (e.g., fish or algae) in a body of water at a given time. Often expressed as grams per square meter. |
| **Biota** | The animal and plant life of a given region. |
| **Biotic** | A term applied to the living components of an area. |
| **Clean Water Act (CWA)** | The Federal Water Pollution Control Act (commonly known as the Clean Water Act), as last reauthorized by the Water Quality Act of 1987, establishes a process for states to use to develop information on, and control the quality of, the nation's water resources. |
| **Coliform Bacteria** | A group of bacteria predominantly inhabiting the intestines of humans and animals but also found in soil. Coliform bacteria are commonly used as indicators of the possible presence of pathogenic organisms (also see Fecal Coliform Bacteria). |
| **Colluvium** | Material transported to a site by gravity. |
| **Community** | A group of interacting organisms living together in a given place. |
| **Conductivity** | The ability of an aqueous solution to carry electric current, expressed in micro (μ) mhos/cm at 25 °C. Conductivity is affected by dissolved solids and is used as an indirect measure of total dissolved solids in a water sample. |
| **Cretaceous** | The final period of the Mesozoic era (after the Jurassic and before the Tertiary period of the Cenozoic era), thought to have covered the span of time between 135 and 65 million years ago. |

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| **Criteria** | In the context of water quality, numeric or descriptive factors taken into account in setting standards for various pollutants. These factors are used to determine limits on allowable concentration levels, and to limit the number of violations per year. EPA develops criteria guidance; states establish criteria. |
| **Cubic Feet per Second** | A unit of measure for the rate of flow or discharge of water. One cubic foot per second is the rate of flow of a stream with a cross-section of one square foot flowing at a mean velocity of one foot per second. At a steady rate, once cubic foot per second is equal to 448.8 gallons per minute and 10,984 acre-feet per day. |
| **Cultural Eutrophication** | The process of eutrophication that has been accelerated by human-caused influences. Usually seen as an increase in nutrient loading (also see Eutrophication). |
| **Culturally Induced Erosion** | Erosion caused by increased runoff or wind action due to the work of humans in deforestation, cultivation of the land, overgrazing, and disturbance of natural drainages; the excess of erosion over the normal for an area (also see Erosion). |
| **Debris Torrent** | The sudden down slope movement of soil, rock, and vegetation on steep slopes, often caused by saturation from heavy rains. |
| **Decomposition** | The breakdown of organic molecules (e.g., sugar) to inorganic molecules (e.g., carbon dioxide and water) through biological and nonbiological processes. |
| **Depth Fines** | Percent by weight of particles of small size within a vertical core of volume of a streambed or lake bottom sediment. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 6.5 mm depending on the observer and methodology used. The depth sampled varies but is typically about one foot (30 cm). |
| **Designated Uses** | Those water uses identified in state water quality standards that must be achieved and maintained as required under the Clean Water Act. |
| **Discharge** | The amount of water flowing in the stream channel at the time of measurement. Usually expressed as cubic feet per second (cfs). |
| **Dissolved Oxygen (DO)** | The oxygen dissolved in water. Adequate DO is vital to fish and other aquatic life. |

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| **Disturbance** | Any event or series of events that disrupts ecosystem, community, or population structure and alters the physical environment. |
| ***E. coli*** | Short for *Escherichia Coli*, *E. coli* are a group of bacteria that are a subspecies of coliform bacteria. Most *E. coli* are essential to the healthy life of all warm-blooded animals, including humans. Their presence is often indicative of fecal contamination. |
| **Ecology** | The scientific study of relationships between organisms and their environment; also defined as the study of the structure and function of nature. |
| **Ecological Indicator** | A characteristic of an ecosystem that is related to, or derived from, a measure of a biotic or abiotic variable that can provide quantitative information on ecological structure and function. An indicator can contribute to a measure of integrity and sustainability. Ecological indicators are often used within the multimetric index framework. |
| **Ecological Integrity** | The condition of an unimpaired ecosystem as measured by combined chemical, physical (including habitat), and biological attributes (EPA 1996). |
| **Ecosystem** | The interacting system of a biological community and its non-living (abiotic) environmental surroundings. |
| **Effluent** | A discharge of untreated, partially treated, or treated wastewater into a receiving water body. |
| **Endangered Species** | Animals, birds, fish, plants, or other living organisms threatened with imminent extinction. Requirements for declaring a species as endangered are contained in the Endangered Species Act. |
| **Environment** | The complete range of external conditions, physical and biological, that effect a particular organism or community. |
| **Eocene** | An epoch of the early Tertiary period, after the Paleocene and before the Oligocene. |
| **Eolian** | Windblown, referring to the process of erosion, transport, and deposition of material by the wind. |

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| **Ephemeral Stream** | A stream or portion of a stream that flows only in direct response to precipitation. It receives little or no water from springs and no long continued supply from melting snow or other sources. Its channel is at all times above the water Appendix C-Table. (American Geologic Institute 1962). |
| **Erosion** | The wearing away of areas of the earth's surface by water, wind, ice, and other forces. |
| **Eutrophic** | From Greek for "well nourished," this describes a highly productive body of water in which nutrients do not limit algal growth. It is typified by high algal densities and low clarity. |
| **Eutrophication** | 1) Natural process of maturing (aging) in a body of water. 2) The natural and human-influenced process of enrichment with nutrients, especially nitrogen and phosphorus, leading to an increased production of organic matter. |
| **Exceedence** | A violation (according to DEQ policy) of the pollutant levels permitted by water quality criteria. |
| **Existing Beneficial Use or Existing Use** | A beneficial use actually attained in waters on or after November 28, 1975, whether or not the use is designated for the waters in Idaho's *Water Quality Standards and Wastewater Treatment Requirements* (IDAPA 58.01.02). |
| **Exotic Species** | A species that is not native (indigenous) to a region. |
| **Extrapolation** | Estimation of unknown values by extending or projecting from known values. |
| **Fauna** | Animal life, especially the animal's characteristic of a region, period, or special environment. |
| **Fecal Coliform Bacteria** | Bacteria found in the intestinal tracts of all warm-blooded animals or mammals. Their presence in water is an indicator of pollution and possible contamination by pathogens (also see Coliform Bacteria). |
| **Fecal Streptococci** | A species of spherical bacteria including pathogenic strains found in the intestines of warm-blooded animals. |
| **Feedback Loop** | In the context of watershed management planning, a feedback loop is a process that provides for tracking progress toward goals and revising actions according to that progress. |
| **Fixed-Location Monitoring** | Sampling or measuring environmental conditions continuously or repeatedly at the same location. |

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| **Flow** | See Discharge. |
| **Fluvial** | In fisheries, this describes fish whose life history takes place entirely in streams but migrate to smaller streams for spawning. |
| **Focal** | Critical areas supporting a mosaic of high quality habitats that sustain a diverse or unusually productive complement of native species. |
| **Fully Supporting** | In compliance with water quality standards and within the range of biological reference conditions for all designated and exiting beneficial uses as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002). |
| **Fully Supporting Cold Water** | Reliable data indicate functioning, sustainable cold water biological assemblages (e.g., fish, macroinvertebrates, or algae), none of which have been modified significantly beyond the natural range of reference conditions (EPA 1997). |
| **Fully Supporting but Threatened** | An intermediate assessment category describing water bodies that fully support beneficial uses, but have a declining trend in water quality conditions, which if not addressed, will lead to a "not fully supporting" status. |
| **Geographical Information Systems (GIS)** | A georeferenced database. |
| **Geometric Mean** | A back-transformed mean of the logarithmically transformed numbers often used to describe highly variable, right-skewed data (a few large values), such as bacterial data. |
| **Grab Sample** | A single sample collected at a particular time and place. It may represent the composition of the water in that water column. |
| **Gradient** | The slope of the land, water, or streambed surface. |
| **Ground Water** | Water found beneath the soil surface saturating the layer in which it is located. Most ground water originates as rainfall, is free to move under the influence of gravity, and usually emerges again as stream flow. |
| **Growth Rate** | A measure of how quickly something living will develop and grow, such as the amount of new plant or animal tissue produced per a given unit of time, or number of individuals added to a population. |
| **Habitat** | The living place of an organism or community. |
| **Headwater** | The origin or beginning of a stream. |

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| **Hydrologic Basin** | The area of land drained by a river system, a reach of a river and its tributaries in that reach, a closed basin, or a group of streams forming a drainage area (also see Watershed). |
| **Hydrologic Cycle** | The cycling of water from the atmosphere to the earth (precipitation) and back to the atmosphere (evaporation and plant transpiration). Atmospheric moisture, clouds, rainfall, runoff, surface water, ground water, and water infiltrated in soils are all part of the hydrologic cycle. |
| **Hydrologic Unit** | One of a nested series of numbered and named watersheds arising from a national standardization of watershed delineation. The initial 1974 effort (USGS 1987) described four levels (region, subregion, accounting unit, cataloging unit) of watersheds throughout the United States. The fourth level is uniquely identified by an eight-digit code built of two-digit fields for each level in the classification. Originally termed a cataloging unit, fourth field hydrologic units have been more commonly called subbasins. Fifth and sixth field hydrologic units have since been delineated for much of the country and are known as watershed and subwatersheds, respectively. |
| **Hydrologic Unit Code (HUC)** | The number assigned to a hydrologic unit. Often used to refer to fourth field hydrologic units. |
| **Hydrology** | The science dealing with the properties, distribution, and circulation of water. |
| **Impervious** | Describes a surface, such as pavement, that water cannot penetrate. |
| **Influent** | A tributary stream. |
| **Inorganic** | Materials not derived from biological sources. |
| **Instantaneous** | A condition or measurement at a moment (instant) in time. |
| **Intergravel Dissolved Oxygen** | The concentration of dissolved oxygen within spawning gravel. Consideration for determining spawning gravel includes species, water depth, velocity, and substrate. |

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| **Intermittent Stream** | 1) A stream that flows only part of the year, such as when the ground water Appendix C-Table is high or when the stream receives water from springs or from surface sources such as melting snow in mountainous areas. The stream ceases to flow above the streambed when losses from evaporation or seepage exceed the available stream flow. 2) A stream that has a period of zero flow for at least one week during most years. |
| **Interstate Waters** | Waters that flow across or form part of state or international boundaries, including boundaries with Indian nations. |
| **Irrigation Return Flow** | Surface (and subsurface) water that leaves a field following the application of irrigation water and eventually flows into streams. |
| **Key Watershed** | A watershed that has been designated in Idaho Governor Batt's *State of Idaho Bull Trout Conservation Plan* (1996) as critical to the long-term persistence of regionally important trout populations. |
| **Knickpoint** | Any interruption or break of slope. |
| **Land Application** | A process or activity involving application of wastewater, surface water, or semi-liquid material to the land surface for the purpose of treatment, pollutant removal, or ground water recharge. |
| **Limiting Factor** | A chemical or physical condition that determines the growth potential of an organism. This can result in a complete inhibition of growth, but typically results in less than maximum growth rates. |
| **Limnology** | The scientific study of fresh water, especially the history, geology, biology, physics, and chemistry of lakes. |
| **Load Allocation (LA)** | A portion of a water body's load capacity for a given pollutant that is given to a particular nonpoint source (by class, type, or geographic area). |
| **Load(ing)** | The quantity of a substance entering a receiving stream, usually expressed in pounds or kilograms per day or tons per year. Loading is the product of flow (discharge) and concentration. |
| **Loading Capacity (LC)** | A determination of how much pollutant a water body can receive over a given period without causing violations of state water quality standards. Upon allocation to various sources, and a margin of safety, it becomes a total maximum daily load. |

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| **Loam** | Refers to a soil with a texture resulting from a relative balance of sand, silt, and clay. This balance imparts many desirable characteristics for agricultural use. |
| **Loess** | A uniform wind-blown deposit of silty material. Silty soils are among the most highly erodable. |
| **Lotic** | An aquatic system with flowing water such as a brook, stream, or river where the net flow of water is from the headwaters to the mouth. |
| **Luxury Consumption** | A phenomenon in which sufficient nutrients are available in either the sediments or the water column of a water body, such that aquatic plants take up and store an abundance in excess of the plants' current needs. |
| **Macroinvertebrate** | An invertebrate animal (without a backbone) large enough to be seen without magnification and retained by a 500µm mesh (U.S. No.30) screen. |
| **Macrophytes** | Rooted and floating vascular aquatic plants, commonly referred to as water weeds. These plants usually flower and bear seeds. Some forms, such as duckweed and coontail (*Ceratophyllum sp.*), are free-floating forms not rooted in sediment. |
| **Margin of Safety (MOS)** | An implicit or explicit portion of a water body's loading capacity set aside to allow the uncertainly about the relationship between the pollutant loads and the quality of the receiving water body. This is a required component of a total maximum daily load (TMDL) and is often incorporated into conservative assumptions used to develop the TMDL (generally within the calculations and/or models). The MOS is not allocated to any sources of pollution. |
| **Mass Wasting** | A general term for the down slope movement of soil and rock material under the direct influence of gravity. |
| **Mean** | Describes the central tendency of a set of numbers. The arithmetic mean (calculated by adding all items in a list, then dividing by the number of items) is the statistic most familiar to most people. |
| **Median** | The middle number in a sequence of numbers. If there are an even number of numbers, the median is the average of the two middle numbers. For example, 4 is the median of 1, 2, 4, 14, 16; and 6 is the median of 1, 2, 5, 7, 9, 11. |
| **Metric** | 1) A discrete measure of something, such as an ecological indicator (e.g., number of distinct taxon). 2) The metric system of measurement. |

**Milligrams per liter (mg/L)** A unit of measure for concentration in water, essentially equivalent to parts per million (ppm).

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

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

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

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

**National Pollution Discharge Elimination System (NPDES)** A national program established by the Clean Water Act for permitting point sources of pollution. Discharge of pollution from point sources is not allowed without a permit.

**Natural Condition** A condition indistinguishable from that without human-caused disruptions.

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

**Nodal** Areas that are separated from focal and adjunct habitats, but serve critical life history functions for individual native fish.

**Nonpoint Source** A dispersed source of pollutants, generated from a geographical area when pollutants are dissolved or suspended in runoff and then delivered into waters of the state. Nonpoint sources are without a discernable point or origin. They include, but are not limited to, irrigated and non-irrigated lands used for grazing, crop production, and silviculture; rural roads; construction and mining sites; log storage or rafting; and recreation sites.

**Not Assessed (NA)** A concept and an assessment category describing water bodies that have been studied, but are missing critical information needed to complete an assessment.

**Not Attainable** A concept and an assessment category describing water bodies that demonstrate characteristics that make it unlikely that a beneficial use can be attained (e.g., a stream that is dry but designated for salmonid spawning).

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| **Not Fully Supporting** | Not in compliance with water quality standards or not within the range of biological reference conditions for any beneficial use as determined through the *Water Body Assessment Guidance* (Grafe et al. 2002). |
| **Not Fully Supporting Cold Water** | At least one biological assemblage has been significantly modified beyond the natural range of its reference condition (EPA 1997). |
| **Nuisance** | Anything which is injurious to the public health or an obstruction to the free use, in the customary manner, of any waters of the state. |
| **Nutrient** | Any substance required by living things to grow. An element or its chemical forms essential to life, such as carbon, oxygen, nitrogen, and phosphorus. Commonly refers to those elements in short supply, such as nitrogen and phosphorus, which usually limit growth. |
| **Nutrient Cycling** | The flow of nutrients from one component of an ecosystem to another, as when macrophytes die and release nutrients that become available to algae (organic to inorganic phase and return). |
| **Oligotrophic** | The Greek term for “poorly nourished.” This describes a body of water in which productivity is low and nutrients are limiting to algal growth, as typified by low algal density and high clarity. |
| **Organic Matter** | Compounds manufactured by plants and animals that contain principally carbon. |
| **Orthophosphate** | A form of soluble inorganic phosphorus most readily used for algal growth. |
| **Oxygen-Demanding Materials** | Those materials, mainly organic matter, in a water body that consume oxygen during decomposition. |
| **Parameter** | A variable, measurable property whose value is a determinant of the characteristics of a system, such as temperature, dissolved oxygen, and fish populations are parameters of a stream or lake. |
| **Partitioning** | The sharing of limited resources by different races or species; use of different parts of the habitat, or the same habitat at different times. Also the separation of a chemical into two or more phases, such as partitioning of phosphorus between the water column and sediment. |
| **Pathogens** | Disease-producing organisms (e.g., bacteria, viruses, parasites). |
| **Perennial Stream** | A stream that flows year-around in most years. |

**Periphyton** Attached microflora (algae and diatoms) growing on the bottom of a water body or on submerged substrates, including larger plants.

**Pesticide** Substances or mixtures of substances intended for preventing, destroying, repelling, or mitigating any pest. Also, any substance or mixture intended for use as a plant regulator, defoliant, or desiccant.

**pH** The negative $\log_{10}$ of the concentration of hydrogen ions, a measure which in water ranges from very acid (pH=1) to very alkaline (pH=14). A pH of 7 is neutral. Surface waters usually measure between pH 6 and 9.

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

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

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

**Plankton** Microscopic algae (phytoplankton) and animals (zooplankton) that float freely in open water of lakes and oceans.

**Point Source** A source of pollutants characterized by having a discrete conveyance, such as a pipe, ditch, or other identifiable "point" of discharge into a receiving water. Common point sources of pollution are industrial and municipal wastewater.

**Pollutant** Generally, any substance introduced into the environment that adversely affects the usefulness of a resource or the health of humans, animals, or ecosystems.

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| **Pollution** | A very broad concept that encompasses human-caused changes in the environment which alter the functioning of natural processes and produce undesirable environmental and health effects. This includes human-induced alteration of the physical, biological, chemical, and radiological integrity of water and other media. |
| **Population** | A group of interbreeding organisms occupying a particular space; the number of humans or other living creatures in a designated area. |
| **Pretreatment** | The reduction in the amount of pollutants, elimination of certain pollutants, or alteration of the nature of pollutant properties in wastewater prior to, or in lieu of, discharging or otherwise introducing such wastewater into a publicly owned wastewater treatment plant. |
| **Primary Productivity** | The rate at which algae and macrophytes fix carbon dioxide using light energy. Commonly measured as milligrams of carbon per square meter per hour. |
| **Protocol** | A series of formal steps for conducting a test or survey. |
| **Qualitative** | Descriptive of kind, type, or direction. |
| **Quality Assurance (QA)** | A program organized and designed to provide accurate and precise results. Included are the selection of proper technical methods, tests, or laboratory procedures; sample collection and preservation; the selection of limits; data evaluation; quality control; and personnel qualifications and training. The goal of QA is to assure the data provided are of the quality needed and claimed (Rand 1995, EPA 1996). |
| **Quality Control (QC)** | Routine application of specific actions required to provide information for the quality assurance program. Included are standardization, calibration, and replicate samples. QC is implemented at the field or bench level (Rand 1995, EPA 1996). |
| **Quantitative** | Descriptive of size, magnitude, or degree. |
| **Reach** | A stream section with fairly homogenous physical characteristics. |
| **Reconnaissance** | An exploratory or preliminary survey of an area. |
| **Reference** | A physical or chemical quantity whose value is known, and thus is used to calibrate or standardize instruments. |

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| **Reference Condition** | 1) A condition that fully supports applicable beneficial uses with little affect from human activity and represents the highest level of support attainable. 2) A benchmark for populations of aquatic ecosystems used to describe desired conditions in a biological assessment and departures from them. The reference condition can be determined through examining regional reference sites, historical conditions, quantitative models, and expert judgment (Hughes 1995). |
| **Reference Site** | A specific locality on a water body that is minimally impaired and is representative of reference conditions for similar water bodies. |
| **Representative Sample** | A portion of material or water that is as similar in content and consistency as possible to that in the larger body of material or water being sampled. |
| **Resident** | A term that describes fish that do not migrate. |
| **Respiration** | A process by which organic matter is oxidized by organisms, including plants, animals, and bacteria. The process converts organic matter to energy, carbon dioxide, water, and lesser constituents. |
| **Riffle** | A relatively shallow, gravelly area of a streambed with a locally fast current, recognized by surface choppiness. Also an area of higher streambed gradient and roughness. |
| **Riparian** | Associated with aquatic (stream, river, lake) habitats. Living or located on the bank of a water body. |
| **Riparian Habitat Conservation Area (RHCA)** | A U.S. Forest Service description of land within the following number of feet up-slope of each of the banks of streams:<br>- 300 feet from perennial fish-bearing streams<br>150 feet from perennial non-fish-bearing streams<br>100 feet from intermittent streams, wetlands, and ponds in priority watersheds. |
| **River** | A large, natural, or human-modified stream that flows in a defined course or channel, or a series of diverging and converging channels. |
| **Runoff** | The portion of rainfall, melted snow, or irrigation water that flows across the surface, through shallow underground zones (interflow), and through ground water to creates streams. |

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| **Sediments** | Deposits of fragmented materials from weathered rocks and organic material that were suspended in, transported by, and eventually deposited by water or air. |
| **Settleable Solids** | The volume of material that settles out of one liter of water in one hour. |
| **Species** | 1) A reproductively isolated aggregate of interbreeding organisms having common attributes and usually designated by a common name. 2) An organism belonging to such a category. |
| **Spring** | Ground water seeping out of the earth where the water Appendix C-Table intersects the ground surface. |
| **Stagnation** | The absence of mixing in a water body. |
| **Stenothermal** | Unable to tolerate a wide temperature range. |
| **Stratification** | A Department of Environmental Quality classification method used to characterize comparable units (also called classes or strata). |
| **Stream** | A natural water course containing flowing water, at least part of the year. Together with dissolved and suspended materials, a stream normally supports communities of plants and animals within the channel and the riparian vegetation zone. |
| **Stream Order** | Hierarchical ordering of streams based on the degree of branching. A first-order stream is an unforked or unbranched stream. Under Strahler's (1957) system, higher order streams result from the joining of two streams of the same order. |
| **Storm Water Runoff** | Rainfall that quickly runs off the land after a storm. In developed watersheds the water flows off roofs and pavement into storm drains that may feed quickly and directly into the stream. The water often carries pollutants picked up from these surfaces. |
| **Stressors** | Physical, chemical, or biological entities that can induce adverse effects on ecosystems or human health. |
| **Subbasin** | A large watershed of several hundred thousand acres. This is the name commonly given to 4$^{th}$ field hydrologic units (also see Hydrologic Unit). |
| **Subbasin Assessment (SBA)** | A watershed-based problem assessment that is the first step in developing a total maximum daily load in Idaho. |

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| **Subwatershed** | A smaller watershed area delineated within a larger watershed, often for purposes of describing and managing localized conditions. Also proposed for adoption as the formal name for 6th field hydrologic units. |
| **Surface Fines** | Sediments of small size deposited on the surface of a streambed or lake bottom. The upper size threshold for fine sediment for fisheries purposes varies from 0.8 to 605 mm depending on the observer and methodology used. Results are typically expressed as a percentage of observation points with fine sediment. |
| **Surface Runoff** | Precipitation, snow melt, or irrigation water in excess of what can infiltrate the soil surface and be stored in small surface depressions; a major transporter of nonpoint source pollutants in rivers, streams, and lakes. Surface runoff is also called overland flow. |
| **Surface Water** | All water naturally open to the atmosphere (rivers, lakes, reservoirs, streams, impoundments, seas, estuaries, etc.) and all springs, wells, or other collectors that are directly influenced by surface water. |
| **Suspended Sediments** | Fine material (usually sand size or smaller) that remains suspended by turbulence in the water column until deposited in areas of weaker current. These sediments cause turbidity and, when deposited, reduce living space within streambed gravels and can cover fish eggs or alevins. |
| **Taxon** | Any formal taxonomic unit or category of organisms (e.g., species, genus, family, order). The plural of taxon is taxa (Armantrout 1998). |
| **Tertiary** | An interval of geologic time lasting from 66.4 to 1.6 million years ago. It constitutes the first of two periods of the Cenozoic Era, the second being the Quaternary. The Tertiary has five subdivisions, which from oldest to youngest are the Paleocene, Eocene, Oligocene, Miocene, and Pliocene epochs. |
| **Thalweg** | The center of a stream's current, where most of the water flows. |
| **Threatened Species** | Species, determined by the U.S. Fish and Wildlife Service, which are likely to become endangered within the foreseeable future throughout all or a significant portion of their range. |

**Total Maximum Daily Load (TMDL)** A TMDL is a water body's loading capacity after it has been allocated among pollutant sources. It can be expressed on a time basis other than daily if appropriate. Sediment loads, for example, are often calculated on an annual bases. TMDL = Loading Capacity = Load Allocation + Wasteload Allocation + Margin of Safety. In common usage, a TMDL also refers to the written document that contains the statement of loads and supporting analyses, often incorporating TMDLs for several water bodies and/or pollutants within a given watershed.

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

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

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

**Tributary** A stream feeding into a larger stream or lake.

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

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| **Tributary** | A stream feeding into a larger stream or lake. |
| **Trophic State** | The level of growth or productivity of a lake as measured by phosphorus content, chlorophyll *a* concentrations, amount (biomass) of aquatic vegetation, algal abundance, and water clarity. |
| **Turbidity** | A measure of the extent to which light passing through water is scattered by fine suspended materials. The effect of turbidity depends on the size of the particles (the finer the particles, the greater the effect per unit weight) and the color of the particles. |
| **Vadose Zone** | The unsaturated region from the soil surface to the ground water Appendix C-Table. |
| **Wasteload Allocation (WLA)** | The portion of receiving water's loading capacity that is allocated to one of its existing or future point sources of pollution. Wasteload allocations specify how much pollutant each point source may release to a water body. |
| **Water body** | A stream, river, lake, estuary, coastline, or other water feature, or portion thereof. |
| **Water Column** | Water between the interface with the air at the surface and the interface with the sediment layer at the bottom. The idea derives from a vertical series of measurements (oxygen, temperature, phosphorus) used to characterize water. |
| **Water Pollution** | Any alteration of the physical, thermal, chemical, biological, or radioactive properties of any waters of the state, or the discharge of any pollutant into the waters of the state, which will or is likely to create a nuisance or to render such waters harmful, detrimental, or injurious to public health, safety, or welfare; to fish and wildlife; or to domestic, commercial, industrial, recreational, aesthetic, or other beneficial uses. |
| **Water Quality** | A term used to describe the biological, chemical, and physical characteristics of water with respect to its suitability for a beneficial use. |
| **Water Quality Criteria** | Levels of water quality expected to render a body of water its designated uses. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, or industrial processes. |

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| **Water Quality Limited** | A label that describes water bodies for which one or more water quality criterion is not met or beneficial uses are not fully supported. Water quality limited segments may or may not be on a §303(d) list. |
| **Water Quality Limited Segment** | Any segment placed on a state's §303(d) list for failure to meet applicable water quality standards, and/or is not expected to meet applicable water quality standards in the period prior to the next list. These segments are also referred to as "§303(d) listed." |
| **Water Quality Management Plan** | A state or area-wide waste treatment management plan developed and updated in accordance with the provisions of the Clean Water Act. |
| **Water Quality Modeling** | The prediction of the response of some characteristics of lake or stream water based on mathematical relations of input variables such as climate, stream flow, and inflow water quality. |
| **Water Quality Standards** | State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of the water body and establish the water quality criteria that must be met to protect designated uses. |
| **Water Appendix C-Table** | The upper surface of ground water; below this point, the soil is saturated with water. |
| **Watershed** | 1) All the land which contributes runoff to a common point in a drainage network, or to a lake outlet. Watersheds are infinitely nested, and any large watershed is composed of smaller "subwatersheds." 2) The whole geographic region which contributes water to a point of interest in a water body. |
| **Water body Identification Number (WBID)** | A number that uniquely identifies a water body in Idaho ties in to the Idaho Water Quality Standards and GIS information. |
| **Wetland** | An area that is at least some of the time saturated by surface or ground water so as to support with vegetation adapted to saturated soil conditions. Examples include swamps, bogs, fens, and marshes. |
| **Young of the Year** | Young fish born the year captured, evidence of spawning activity. |

# Technical Appendices

# Appendix A. Unit Conversion Chart

| | English Units | Metric Units | To Convert | Example |
|---|---|---|---|---|
| Distance | Miles (mi) | Kilometers (km) | 1 mi = 1.61 km<br>1 km = 0.62 mi | 3 mi = 4.83 km<br>3 km = 1.86 mi |
| Length | Inches (in)<br>Feet (ft) | Centimeters (cm)<br>Meters (m) | 1 in = 2.54 cm<br>1 cm = 0.39 in<br>1 ft = 0.30 m<br>1 m = 3.28 ft | 3 in = 7.62 cm<br>3 cm = 1.18 in<br>3 ft = 0.91 m<br>3 m = 9.84 ft |
| Area | Acres (ac)<br>Square Feet ($ft^2$)<br>Square Miles ($mi^2$) | Hectares (ha)<br>Square Meters ($m^2$)<br>Square Kilometers ($km^2$) | 1 ac = 0.40 ha<br>1 ha = 2.47 ac<br>1 $ft^2$ = 0.09 $m^2$<br>1 $m^2$ = 10.76 $ft^2$<br>1 $mi^2$ = 2.59 $km^2$<br>1 $km^2$ = 0.39 $mi^2$ | 3 ac = 1.20 ha<br>3 ha = 7.41 ac<br>3 $ft^2$ = 0.28 $m^2$<br>3 $m^2$ = 32.29 $ft^2$<br>3 $mi^2$ = 7.77 $km^2$<br>3 $km^2$ = 1.16 $mi^2$ |
| Volume | Gallons (g)<br>Cubic Feet ($ft^3$) | Liters (L)<br>Cubic Meters ($m^3$) | 1 g = 3.78 l<br>1 l = 0.26 g<br>1 $ft^3$ = 0.03 $m^3$<br>1 $m^3$ = 35.32 $ft^3$ | 3 g = 11.35 l<br>3 l = 0.79 g<br>3 $ft^3$ = 0.09 $m^3$<br>3 $m^3$ = 105.94 $ft^3$ |
| Flow Rate | Cubic Feet per Second ($ft^3$/sec)[1] | Cubic Meters per Second ($m^3$/sec) | 1 $ft^3$/sec = 0.03 $m^3$/sec<br>1 $m^3$/sec = $ft^3$/sec | 3 $ft^3$/sec = 0.09 $m^3$/sec<br>3 $m^3$/sec = 105.94 $ft^3$/sec |
| Concentration | Parts per Million (ppm) | Milligrams per Liter (mg/L) | 1 ppm = 1 (mg/L)[2] | 3 ppm = 3 (mg/L) |
| Weight | Pounds (lbs) | Kilograms (kg) | 1 lb = 0.45 kg<br>1 kg = 2.20 lbs | 3 lb = 1.36 kg<br>3 kg = 6.61 kg |
| Temperature | Fahrenheit (°F) | Celsius (°C) | °C = 0.55 (F - 32)<br>°F = (C x 1.8) + 32 | 3 °F = -15.95 °C<br>3 ° C = 37.4 °F |

*1 1 ft3/sec = 0.65 million gallons per day; 1 million gallons per day is equal to 1.55 ft3/sec.*
*2The ratio of 1 ppm = 1 (mg/L) is approximate and is only accurate for water.*

Add Page No.

# Appendix B. Methods for Bioassessment (Rivers)

## River Macroinvertebrate Index (RMI)

The RMI is composed of metrics developed through the Idaho River Ecological Assessment Framework: An Integrated Approach (Grafe 2000)[1]. The RMI uses metrics that are composed of five individual metrics as described in Table B-1. These differing metrics categories, using biological community structure (richness), composition, feeding groups and diversity, are developed and tested to reference conditions observed in areas with minimal human disturbance (e.g. wilderness water bodies). Table B-1 shows these metric categories and how they are utilized. Table B-2 shows the metric scoring for each index.

Table B-1. River Macroinvertebrate Index Description

| Metric Category | Metric | Definition | Predicted Response to Increasing Disturbance |
|---|---|---|---|
| Richness | Number of Taxa | Number of distinct taxa in assemblage | Decrease |
| | Number of EPTa | Number of distinct mayflies, stoneflies and caddisflies in assemblage | Decrease |
| Composition | Percent Elmidae | Percent of sample that is riffle beetle | Decrease |
| Feeding Group | Percent Predators | Percent of sample that is taxa that preys on other macroinvertebrates | Decrease |
| Diversity | Percent Dominant Taxon | Percent of sample in the most abundant taxa | Increase |

*a Ephemeroptera, Plecoptera and Trichoptera*

Table B-2. River Macroinvertebrate Index Descriptive Statistics and Scoring Range

| Metric | Minimum | Maximum | Scoring 5 | Scoring 3 | Scoring 1 |
|---|---|---|---|---|---|
| Number of Taxa | 19 | 33 | >23 | 19-22 | <19 |
| Number of EPT[a] Taxon | 9 | 22 | >17 | 9-16 | ,17 |
| Percent Elmidae | 0.2 | 6.3 | >1.7 | 0.2-1.6 | <1.6 |
| Percent Predators | 19.0 | 37.0 | <37 | 38-59 | >59 |
| Percent Dominant Taxon[b] | 3.4 | 15.0 | | >3.4 | <3.4 |

*a Ephemeroptera, Plecoptera and Trichoptera*
*b the weak discriminatory power of this metric allowed for only two scores*

Based on the scoring mechanism shown in Table B-2, the highest possible score obtainable would be 23, while the lowest would be 5. These values are then evaluated in an overall category rating when combined with at least one other bioassessment tool (e.g. river fish index, river diatom index) an overall category rating is established. Further discussion on the overall category rating will follow. Table B-3 shows the final scoring used to determine the category rating.

Table B-3. River Macroinvertebrate Index Rating and Category Rating Score

| Metric | Below Minimal Threshold | Category Rating "1" | Category Rating "2" | Category Rating "3" |
|---|---|---|---|---|
| RMI[a] Score | <11 | 11-13 | 14-16 | >16 |

*a River Macroinvertebrate Index*

Table B-4 through B- 8 show the final results for the RMI scores and category rating obtained on the Weiser River monitoring sites during the period from August 2001 through October 2001.

Table B-4. River Macroinvertebrate Index Scores. Weiser River at Highway 95 Bridge at Weiser, Idaho. Lower Weiser River, Galloway Dam to Snake River.

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 29 | 5 | 36 | 5 |
| Number EPT[b] Taxa | 11 | 3 | 6 | 1 |
| Percent Elmidae | 0.38% | 3 | 2.17% | 5 |
| Percent Dominate Taxa | 1.52% | 5 | 15.87% | 5 |
| Percent Predators | 0.76% | 1 | 2.17% | 1 |
| Total RMI Index Score | | 17 | | 17 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score*
*b Ephemeroptera-Plecoptera-Trichoptera*

Table B-5. River Macroinvertebrate Index Scores. Weiser River at Unity Bridge near Weiser, Idaho. Weiser River, Galloway Dam to Snake River.

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 27 | 5 | 29 | 5 |
| Number EPT[b] Taxa | 13 | 3 | 11 | 3 |
| Percent Elmidae | 4.87% | 5 | 4.12% | 5 |
| Percent Dominate Taxa | 1.69% | 5 | 1.37% | 5 |
| Percent Predators | 1.69% | 1 | 2.55% | 1 |
| Total RMI Index Score | | 19 | | 19 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score*
*b Ephemeroptera-Plecoptera-Trichoptera*

Table B-6. River Macroinvertebrate Index Scores. Weiser River at Galloway Dam.

| Metric | August 2001 Metric Result | August 2001 RMI[a] Metric Score | October 2001 Metric Result | October 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 36 | 5 | 32 | 5 |
| Number EPT[b] Taxa | 20 | 5 | 17 | 3 |
| Percent Elmidae | 12.36% | 5 | 15.21% | 5 |
| Percent Dominate Taxa | 18.44% | 5 | 13.91% | 5 |
| Percent Predators | 7.22% | 3 | 5.01% | 3 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index RMI Score*
*b Ephemeroptera-Plecoptera-Trichoptera*

Table B-7. River Macroinvertebrate Index Scores, Weiser River above Crane Creek near Weiser, Idaho, and above Midvale, Idaho.

| Metric | Above Crane Creek August 2001 Metric Result | Above Crane Creek August 2001 RMI[a] Metric Score | Above Midvale August 2001 Metric Result | Above Midvale August 2001 RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 35 | 5 | 32 | 5 |
| Number EPT[b] Taxa | 20 | 5 | 16 | 3 |
| Percent Elmidae | 6.66% | 5 | 4.94% | 5 |
| Percent Dominate Taxa | 1.33% | 5 | 14.99% | 5 |
| Percent Predators | 4.66% | 3 | 6.92% | 3 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index, RMI Score*
*b Ephemeroptera-Plecoptera-Trichoptera*

Table B-8. River Macroinvertebrate Index Scores. Weiser River, West Fork Weiser River to Little Weiser River.

| Metric | Weiser River at Council Metric Result | Weiser River at Council RMI[a] Metric Score | Weiser River at Goodrich Metric Result | Weiser River at Goodrich RMI Metric Score |
|---|---|---|---|---|
| Number of Taxa | 42 | 5 | 27 | 5 |
| Number EPT[b] Taxa | 32 | 5 | 17 | 5 |
| Percent Elmidae | 3.08% | 5 | 8.22% | 5 |
| Percent Dominate Taxa | 19.08% | 5 | 1.76% | 5 |
| Percent Predators | 4.62% | 3 | 1.96% | 1 |
| Total RMI Index Score | | 23 | | 21 |
| Condition Rating | | 3 | | 3 |

*a River Macroinvertebrate Index, RMI Score*
*b Ephemeroptera-Plecoptera-Trichoptera*

## River Diatom Index (RDI)

The RDI is composed of metrics developed through the Idaho River Ecological Assessment Framework: An Integrated Approach (Grafe 2000)[1]. The RDI uses metrics that are composed of nine individual metrics as described in Table B-9. These differing metrics categories, using biological community pollution tolerance groups (sensitivity), species eutrophic composition, mobility and abnormalities are developed and tested to reference conditions observed in areas with minimal human disturbance (e.g. wilderness water bodies). Table B-9 shows these metric categories and how they are utilized. Table B-10 shows the metric scoring for each index.

Table B-9. River Diatom Index Description

| Metric Category | Metric | Definition | Predicted Response to Increasing Disturbance |
|---|---|---|---|
| Tolerance and Intolerance | Percent Sensitive | Percent of species identified as sensitive to pollutants (organic, salts, temperature, sediment, toxics, high nutrients and unstable substrate) | Decrease |
| | Percent Very Tolerant | Percent of species identified as highly tolerant to pollutants (organic, salts, temperature, sediment, toxics, high nutrients and unstable substrate) | Increase |
| Autoecological Guild | Eutrophic Species Richness | Number of species identified as high inorganic or organic tolerant | Increase |
| | Percent Nitrogen Heterotrophs | Percent of species identified as non-nitrogen fixers | Increase |
| | Percent Polysaprobic | Percent of species identified as tolerant of high organic load | Increase |
| | Alkaliphilic Species Richness | Number of species identified as tolerant of salts | Increase |
| | Percent High Oxygen | Percent of species identified as requiring high dissolved oxygen levels | Decrease |
| Morphometric Guild | Percent Very Motile | Percent of species identified as tolerant of sediments | Increase |
| Individual Condition | Percent Deformed Cells | Percent of deformed cells in samples (usually associated with metals) | Increase |

Table B-10. River Diatom Index Descriptive Statistics and Scoring Range

| Metric | Scoring | | |
|---|---|---|---|
| | 1 | 3 | 5 |
| Percent Sensitive | <60 | 60-80 | >80 |
| Percent Very Tolerant | >15 | 3-15 | <3 |
| Eutrophic Species Richness | >20 | 12-20 | <12 |
| Percent Nitrogen Heterotrophs | >20 | 7-20 | <7 |
| Percent Polysaprobic | >10 | 5-10 | <5 |
| Alkaliphilic Species Richness | >30 | 18-30 | <18 |
| Percent High Oxygen | <25 | 25-55 | >55 |
| Percent Very Motile | >25 | 7-25 | <7 |
| Percent Deformed Cells | >1 | 0-1 | 0 |

Based on the scoring mechanism shown in Table B-10, the highest possible score obtainable would be 45, while the lowest would be 9. These values are then evaluated in an overall category rating when combined with at least one other bioassessment tool (e.g. river fish index, river diatom index) an overall category rating is established. Further discussion on the overall category rating will follow. Table B-11 shows the final scoring used to determine the category rating.

Table B-11. River Diatom Index Rating and Category Rating Score

| Metric | Below Minimal Threshold | Category Rating "1" | Category Rating "2" | Category Rating "3" |
|---|---|---|---|---|
| RDI[a] Score | NA[b] | <22 | 22-33 | >34 |

*a River Diatom Index*
*b No minmimal thershold identified*

Table B-12 through B-16 show the final results for the RDI scores and category rating obtained on the Weiser River monitoring sites during the period from August 2001 through October 2001.

Table B12. River Diatom Index Scores. Weiser River, Galloway Dam to the Snake River.

| Metric | Weiser River at Highway 95 Bridge at Weiser, Idaho (Metric Score) | Weiser River at Highway 95 Bridge at Weiser, Idaho (RDI[a] Score) | Weiser River at Unity Bridge (Metric Score) | Weiser River at Unity Bridge (RDI Score) | Weiser River below Galloway Dam (Metric Score) | Weiser River below Galloway Dam (RDI Score) |
|---|---|---|---|---|---|---|
| % Pollutant Intolerant | 32.3% | 1 | 22.9% | 1 | 28.9% | 1 |
| % Pollutant Tolerant | 15.9% | 1 | 27.2% | 1 | 16.5% | 1 |
| Eutrophic Taxa Richness | 26 | 1 | 25 | 1 | 24 | 1 |
| % Nitrogen Heterotrophs | 36.1% | 1 | 52.1% | 1 | 38.2% | 1 |
| % Polysaprobic | 18.3% | 1 | 28.4% | 1 | 22.7% | 1 |
| Alkaliphilic Taxa Richness | 33 | 1 | 28 | 3 | 29 | 3 |
| % Requiring High Oxygen | 5.2% | 1 | 7.4% | 1 | 10.3% | 1 |
| % Very Motile | 27.8% | 1 | 21.4% | 3 | 35.5% | 1 |
| % Deformed | 0% | 5 | 0% | 5 | 0% | 5 |
| | | | | | | |
| Final River Diatom Index (RDI) Score | | 13 | | 17 | | 15 |
| River Diatom Index (RDI) Condition Rating | | 1 | | 1 | | 1 |

*a River Diatom Index RDI Score*

Table B-13. River Diatom Index Scores. Weiser River, Little Weiser River to Galloway Dam.

| Metric | Weiser River below Galloway Dam Metric Score | Weiser River below Galloway Dam RDI[a] Score | Weiser River above Crane Creek Metric Score | Weiser River above Crane Creek RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 28.9% | 1 | 46.9% | 1 |
| % Pollutant Tolerant | 16.5% | 1 | 5.7% | 3 |
| Eutrophic Taxa Richness | 24 | 1 | 24 | 1 |
| % Nitrogen Heterotrophs | 38.2% | 1 | 28.2% | 1 |
| % Polysaprobic | 22.7% | 1 | 19.2% | 1 |
| Alkaliphilic Taxa Richness | 29 | 3 | 28 | 3 |
| % Requiring High Oxygen | 10.3% | 1 | 6.4% | 1 |
| % Very Motile | 35.5% | 1 | 25.7% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index (RDI) Score | | 15 | | 17 |
| Final Condition Category Rating | | 1 | | 1 |

*a River Diatom Index,*

**Table B-14. River Diatom Index Scores. Weiser River, Little Weiser River to Galloway Dam.**

| Metric | Weiser River above Midvale Metric Score | Weiser River above Midvale RDI Score | Weiser River below Little Weiser River Metric Score | Weiser River below Little Weiser River RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 60.3% | 3 | 53.4% | 1 |
| % Pollutant Tolerant | 9.7% | 3 | 11.1% | 3 |
| Eutrophic Taxa Richness | 16 | 3 | 21 | 1 |
| % Nitrogen Heterotrophs | 19.5% | 3 | 21.7% | 1 |
| % Polysaprobic | 10.0% | 1 | 17% | 1 |
| Alkaliphilic Taxa Richness | 21 | 3 | 23 | 3 |
| % Requiring High Oxygen | 8.2% | 1 | 11.3% | 1 |
| % Very Motile | 28% | 1 | 25.1% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index (RDI) Score | | 23 | | 17 |
| Final Condition Category Rating | | 2 | | 1 |

*a River Diatom Index,*

Table B-15. River Diatom Index Scores. Weiser River, West Fork Weiser River to Little Weiser River.

| Metric | Weiser River at Council Metric Score | Weiser River at Council RDI[a] Score | Weiser River at Goodrich Metric Score | Weiser River at Goodrich RDI Score |
|---|---|---|---|---|
| % Pollutant Intolerant | 51.7% | 1 | 51.3% | 1 |
| % Pollutant Tolerant | 2.8% | 1 | 13.2% | 3 |
| Eutrophic Taxa Richness | 18 | 5 | 24 | 1 |
| % Nitrogen Heterotrophs | 5.3% | 3 | 12.9% | 3 |
| % Polysaprobic | 27.5% | 5 | 15.8% | 1 |
| Alkaliphilic Taxa Richness | 24 | 1 | 30 | 3 |
| % Requiring High Oxygen | 5.6% | 3 | 13.0% | 1 |
| % Very Motile | 15.4% | 3 | 27.5% | 1 |
| % Deformed | 0% | 5 | 0% | 5 |
| | | | | |
| Final River Diatom Index Score | | 27 | | 19 |
| Final Condition Category Rating | | 2 | | 1 |

*a River Diatom Index,*

Table B-16. River Diatom Index Scores. Crane Creek, Crane Creek Reservoir to Weiser River.

| Metric | Crane Creek below Crane Creek Reservoir RDI[a] Metric Score | Crane Creek below Crane Creek Reservoir RDI Score |
|---|---|---|
| % Pollutant Intolerant | 4.9% | 1 |
| % Pollutant Tolerant | 71.5% | 1 |
| Eutrophic Taxa Richness | 13 | 2 |
| % Nitrogen Heterotrophs | 15.9% | 3 |
| % Polysaprobic | 7.2% | 3 |
| Alkaliphilic Taxa Richness | 24 | 3 |
| % Requiring High Oxygen | 67.6% | 5 |
| % Very Motile | 15.7% | 3 |
| % Deformed | 0.0% | 5 |
| | | |
| Final River Diatom Index (RDI) Score | | 26 |
| Final Condition Category Rating | | 2 |

*a River Diatom Index*

## River Fish Index (RFI)

The RFI is composed of metrics developed through the Idaho River Ecological Assessment Framework: An Integrated Approach (Grafe 2000)[1]. The RDI uses metrics that is composed of nine individual metrics as described in Table B-17. These differing metrics categories, using biological community pollution tolerance groups (sensitivity), species eutrophic composition, mobility and abnormalities are developed and tested to reference conditions observed in areas with minimal human disturbance (e.g. wilderness water bodies). Table B-18 shows how these metric categories, and how they are utilized. Table B-19 shows the metric scoring calculations for each index.

| Metric Category | Metric | Definition | Predicted Response to Increasing Disturbance |
|---|---|---|---|
| **Assemblage Richness and Composition** | **Cold water native species** | Direct evaluation of native cold water species | Decrease |
| | **Percent cold water** | Percent of total native and introduced cold water species found in sample set | Decrease |
| **Indicator Species** | **Percent tolerant individuals** | Percent of sample determined to be pollutant tolerant (Zaroban 1999) | Increase |
| | **# Non-indigenous species** | Total number of non-native species found | Increase |
| | **Percent carp** | Percent of sample with highly pollutant tolerant specie | Increase |
| | **Percent sculpin** | Percent of sample requiring high dissolved oxygen levels and clean silt free substrate | Decrease |
| **Reproduction Function** | **# Trout age classes** | Evaluates the age class of trout and spawning success | Decrease |
| | **# Sculpin age classes** | Evaluates the age class of sculpin and habitat conditions | Decrease |
| **# Cold water fish captured per minute of electrofishing** | **# Cold water fish captured per minute of electrofishing** | Evaluates the abundance of trout species per sampling event | Decrease |
| **Anomalies** | **Anomalies** | Evaluates associated toxic pollutants | Increase |

Table B-17. River Fish Index Description

Table B-18. River Fish Index Scoring Description.

| Metric (x) | f(x) Metric score | | | | | | |
|---|---|---|---|---|---|---|---|
| Cold water native species | f(x) = 3.333333E-1*x | | | | | | |
| Percent sculpin | f(x) = 6.666667E-2*x | | | | | | |
| # Sculpin age classes | # Ages | 0 | 1 | 2 | 3 | 4 | >4 |
| | Score | 0 | 0.05 | 0.3 | 0.75 | 0.925 | 1 |
| Percent cold water | f(x) = 1.428571E-2*x□ | | | | | | |
| Percent sensitive native individuals | f(x) = 2.475072E-6*x^3 + -5.387238E-4*x^2 + 3.911333E-2*x + 1.423585E-2 | | | | | | |
| Percent tolerant individuals | f(x) =(9.877495E-1-6.500219E-3)/(1+(x/4.026224E+1)^7.230386E+0)+ 6.5E-3 | | | | | | |
| # Non-indigenous species | # Species | 0 | 1 | 2 | 3 | 4 | >4 |
| | Score | 1 | 0.5 | 0.25 | 0.0625 | 0.004 | 0 |
| # Cold water fish captured per minute of electrofishing | f(x) = 1.476804E-2*x^3 + -1.551539E-1*x^2 + 6.421866E-1*x + -2.253135E-2 | | | | | | |
| Anomalies | f(x) = 1 * exp( -6.907755E-1*x ) | | | | | | |
| # Trout age classes | # Ages | 0 | 1 | 2 | 3 | 4 | >4 |
| | Score | 0 | 0.1 | 0.5 | 0.875 | 1 | 1 |
| Presence of carp | f(x) = exp( -6.907755E-1*x ) | | | | | | |

Based on the scoring mechanism shown in Table B-18, the highest and lowest possible scores are dependent on input from the sampling effort. These values are then evaluated in an overall category rating when combined with at least one other bioassessment tool (e.g. river fish index, river diatom index) an over all category rating is established. Further discussion on the overall category rating will follow. Table B-19 shows the final scoring used to determine the category rating.

Table B-19. River Fish Index Rating and Category Rating Score

| Metric | Below Minimal Threshold | Category Rating "1" | Category Rating "2" | Category Rating "3" |
|---|---|---|---|---|
| RFI[a] Score | <54 | 54-69 | 70-75 | >75 |

*a River Fish Index*

Table B-20 through B-22 show the results from the 1999 Idaho Department of Fish and Game sampling effort. Raw data provided by the Department is available in Appendix C. Tables B-23 through B-27 shows the final fish data scoring.

Table B-20. Number and Percentage of Fish Species in the Weiser River at Weiser, Idaho. July 1999. Weiser River, Galloway Dam to the Snake River.

| Species Found | Weiser River near Weiser, Idaho | | Weiser River below Galloway Dam | |
|---|---|---|---|---|
| | Count | Percent of Total | Count | Percent of Total |
| Bridgelip sucker | 17 | 26.2% | 24 | 8.5% |
| Channel catfish | 1 | 1.5% | 0 | 0.0% |
| Chiselmouth mouth | 16 | 24.6% | 55 | 19.4% |
| Largescale sucker | 1 | 1.5% | 41 | 14.5% |
| Mountain whitefish | 9 | 13.8% | 26 | 9.2% |
| Northern pike minnow | 2 | 3.1% | 46 | 16.3% |
| Smallmouth bass | 18 | 27.7% | 55 | 19.4% |
| Speckled dace | 1 | 1.5% | 2 | 0.7% |
| Common carp | 0 | 0.0% | 13 | 4.6% |
| Longnose dace | 0 | 0.0% | 5 | 1.8% |
| Redside shiner | 0 | 0.0% | 14 | 4.9% |
| Redband trout | 0 | 0.0% | 2 | 0.7% |
| Sculpin | 0 | 0.0% | 0 | 0.0% |
| Rainbow trout | 0 | 0.0% | 0 | 0.0% |
| Mountain sucker | 0 | 0.0% | 0 | 0.0% |
| Total Number | 65 | 100% | 283 | 100% |

Table B-21. Species Count and River Fish Index Scores, Weiser River Lower Canyon Section, Upper Canyon Section, and Near Midvale, Idaho.

| Species Found | Weiser River, Lower Canyon | | Weiser River, Upper Canyon | | Weiser River near Midvale, Idaho | |
|---|---|---|---|---|---|---|
| | Count | Percent of Total | Count | Percent of Total | Count | Percent of Total |
| Bridgelip sucker | 9 | 6.0% | 22 | 8.7% | 5 | 3.8% |
| Channel catfish | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Chiselmouth mouth | 7 | 4.7% | 31 | 12.3% | 17 | 12.9% |
| Largescale sucker | 7 | 4.7% | 50 | 19.8% | 29 | 22.0% |
| Mountain whitefish | 3 | 2.0% | 9 | 3.6% | 7 | 5.3% |
| Northern pike minnow | 20 | 13.4% | 47 | 18.6% | 22 | 16.7% |
| Smallmouth bass | 65 | 43.6% | 54 | 21.3% | 7 | 5.3% |
| Speckled dace | 0 | 0.0% | 7 | 2.8% | 2 | 1.5% |
| Common carp | 9 | 6.0% | 1 | 0.4% | 0 | 0.0% |
| Longnose dace | 0 | 0.0% | 4 | 1.6% | 1 | 0.8% |
| Redside shiner | 22 | 14.8% | 10 | 4.0% | 38 | 28.8% |
| Redband trout | 5 | 3.4% | 10 | 4.0% | 4 | 3.0% |
| Sculpin | 2 | 1.3% | 8 | 3.2% | 0 | 0.0% |
| Rainbow trout | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| Mountain sucker | 0 | 0.0% | 0 | 0.0% | 0 | 0.0% |
| | | | | | | |
| Total Number | 149 | 100% | 253 | 100% | 132 | 100% |

Table B-22. Presence/Absence of Fish Species. Weiser River, West Fork Weiser River to Little Weiser River.

| Weiser River at Cambridge June 1999 | | |
|---|---|---|
| **Species Found** | **Count** | **Percent of Total** |
| Bridgelip sucker | 15 | 3.5% |
| Channel catfish | 0 | 0.0% |
| Chiselmouth mouth | 31 | 7.3% |
| Largescale Sucker | 114 | 26.9% |
| Mountain whitefish | 74 | 17.5% |
| Northern pike minnow | 51 | 12.0% |
| Smallmouth bass | 4 | 0.9% |
| Speckled dace | 0 | 0.0% |
| Common carp | 0 | 0.0% |
| Longnose dace | 0 | 0.0% |
| Redside shiner | 93 | 21.9% |
| Redband trout | 40 | 9.4% |
| Sculpin | 0 | 0.0% |
| Rainbow trout | 1 | 0.2% |
| Mountain succor | 1 | 0.2% |
| | | |
| Total Number | 424 | 100% |

Table B-23. River Fish Index Input Values

| Stream | Site | #trout | # scul | Total fish | Total species | Native species (USNK) | Native species (LSNK) | #Sens N Ind(1) | #Sens N Ind(2) | #Cold Nat. Ind(1) |
|---|---|---|---|---|---|---|---|---|---|---|
| Weiser River at Weiser | WR-001 | 0 | 0 | 64 | 7 | 5 | 5 | 0 | 0 | 9 |
| Weiser River below Galloway Dam | WR-002 | 2 | 0 | 285 | 11 | 8 | 9 | 0 | 2 | 26 |
| Weiser River Canyon | WR-004 | 0 | 2 | 149 | 10 | 6 | 7 | 0 | 0 | 8 |
| Weiser River Upper Canyon | WR-005 | 10 | 8 | 253 | 12 | 8 | 9 | 0 | 10 | 9 |
| Weiser River @ Midvale | WR-005U | 4 | 0 | 133 | 10 | 8 | 9 | 0 | 4 | 7 |
| Weiser River Cambridge | WR-005C | 41 | 1 | 424 | 10 | 7 | 8 | 0 | 41 | 75 |
| | | | | | | | | | | |

Table B-23 (Continued). River Fish Index Input Values

| Stream | Site | #Cold Nat. Ind(2) | # Cold Indiv | #Tot Ind | #Alien Ind | #Cold Nat. Ind(1) | #Cold Nat. Ind(2) | # Cold Indiv | #Tot Ind | #Alien Ind |
|---|---|---|---|---|---|---|---|---|---|---|
| Weiser River at Weiser | WR-001 | 9 | 9 | 21 | 19 | 9 | 9 | 9 | 21 | 19 |
| Weiser River below Galloway Dam | WR-002 | 28 | 28 | 125 | 72 | 26 | 28 | 28 | 125 | 72 |
| Weiser River Canyon | WR-004 | 8 | 8 | 45 | 74 | 8 | 8 | 8 | 45 | 74 |
| Weiser River Upper Canyon | WR-005 | 19 | 19 | 120 | 65 | 9 | 19 | 19 | 120 | 65 |
| Weiser River @ Midvale | WR-005U | 11 | 11 | 57 | 11 | 7 | 11 | 11 | 57 | 11 |
| Weiser River Cambridge | WR-005C | 116 | 115 | 180 | 45 | 75 | 116 | 115 | 180 | 45 |

Table B-23 (Continued). River Fish Index Input Values

| Stream | Site | #Alien Ind(2) | # Alien Sp (1) | # Alien Sp (2) | #Cold Nat Spec | #Cold Nat Sp (2) | % Trout | % Salm. | % Cato. |
|---|---|---|---|---|---|---|---|---|---|
| Weiser River at Weiser | WR-001 | 19 | 2 | 2 | 1 | 1 | 0 | 14 | 28 |
| Weiser River below Galloway Dam | WR-002 | 70 | 3 | 2 | 1 | 2 | 1 | 10 | 23 |
| Weiser River Canyon | WR-004 | 74 | 2 | 2 | 2 | 2 | 0 | 5 | 11 |
| Weiser River Upper Canyon | WR-005 | 55 | 3 | 2 | 1 | 2 | 4 | 8 | 28 |
| Weiser River @ Midvale | WR-005U | 7 | 2 | 1 | 1 | 2 | 3 | 8 | 26 |
| Weiser River Cambridge | WR-005C | 4 | 3 | 1 | 2 | 4 | 10 | 27 | 30 |

Table B-24. Final RFI Scoring Data and Results

| | | | | | | Metric Raw Values | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Water Body | Site | River Basin | # Cold native sp | #Sculpin age classes | Sculpin (%) | % Sen Nat Ind | % Cold Ind | % Tol Ind | # Non indig sp. | Carp (%) | # Salmonid age classes | CPUE (Cold ind/min) |
| Weiser River at Weiser | WR-001 | LSNK | 1 | 0 | 0.00 | 0.00 | 14.06 | 32.81 | 2.00 | 0.00 | 0 | 1.00 |
| Weiser River below Galloway Dam | WR-002 | LSNK | 2 | 0 | 0.00 | 0.70 | 9.82 | 43.86 | 2.00 | 4.91 | 2 | 3.11 |
| Weiser River Canyon | WR-004 | LSNK | 2 | 1 | 1.34 | 0.00 | 5.37 | 30.20 | 2.00 | 6.04 | 1 | 0.89 |
| Weiser River Upper Canyon | WR-005 | LSNK | 2 | 1 | 3.16 | 3.95 | 7.51 | 47.43 | 2.00 | 0.40 | 1 | 2.11 |
| Weiser River @ Midvale | WR-005U | LSNK | 2 | 0 | 0.00 | 3.01 | 8.27 | 42.86 | 1.00 | 0.00 | 1 | 1.22 |
| Weiser River Cambridge | WR-005C | LSNK | 4 | 1 | 0.24 | 9.67 | 27.12 | 42.45 | 1.00 | 0.00 | 1 | 12.78 |

Table B-24 (Continued). Final RFI Scoring Data and Results

| | | | | | Calculated Metric Scores | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | % DELT anom | #Coldwater Native Species | # Sculpin age classes (if missing, % sculpin) | % Sensitive native individuals | % Cold Individuals | % Tolerant individuals | # Non-indigenous species | % Carp | # Salmonid age classes | CPUE (#cold indiv/min electrofish) |
| Weiser River at Weiser | 0 | 0.33 | 0 | 0.00 | 0.20 | 0.81 | 0.25 | 1.00 | 0 | 0.5 |
| Weiser River below Galloway Dam | 0 | 0.67 | 0 | 0.04 | 0.14 | 0.35 | 0.25 | 0.03 | 0.5 | 0.9 |
| Weiser River Canyon | 0 | 0.67 | 0.05 | 0.00 | 0.08 | 0.88 | 0.25 | 0.02 | 0.1 | 0.4 |
| Weiser River Upper Canyon | 0 | 0.67 | 0.05 | 0.16 | 0.11 | 0.24 | 0.25 | 0.76 | 0.1 | 0.8 |
| Weiser River @ Midvale | 0 | 0.67 | 0 | 0.13 | 0.12 | 0.39 | 0.5 | 1.00 | 0.1 | 0.6 |
| Weiser River Cambridge | 0 | 1.00 | 0.05 | 0.34 | 0.39 | 0.40 | 0.5 | 1.00 | 0.1 | 1.0 |

Table B-24 (Continued). Final RFI Scoring Data and Results

| | % Anomalies | River Fish Index RFI Score | River Fish Index RFI Condition Rating |
|---|---|---|---|
| Weiser River at Weiser | 1 | 40.7 | Below Minimum Threshold |
| Weiser River below Galloway Dam | 1 | 39.0 | Below Minimum Threshold |
| Weiser River Canyon | 1 | 34.7 | Below Minimum Threshold |
| Weiser River Upper Canyon | 1 | 41.1 | Below Minimum Threshold |
| Weiser River @ Midvale | 1 | 44.6 | Below Minimum Threshold |
| Weiser River Cambridge | 1 | 57.9 | 1 |

# Appendix C. Data Sources and Data

## Weiser River, Galloway Dam to the Snake River and Tributaries

Appendix C-Table 1. Available Discharge Data, Weiser River, Galloway Dam to the Snake River.

| Discharge Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Weiser River below Crane Creek[a] | 1895-1914 and 1952-2003 | USGS | 13266000 |
| Sunnyside Canal (Crane Creek Irrigation Dist. Canal) [a] | 1920-1926 | USGS | 13265000 |
| Galloway Canal[a] | 1920-1969 | USGS | 13266500 |
| First Creek | 1983-1984 | Idaho DEQ | STORET 2040350 |
| Bear Creek | 1983-1984 | Idaho DEQ | STORET 2040351 |
| Cove Creek | 1983-1984<br>2001-2003 | Idaho DEQ<br>Idaho Dept. of Ag | STORET 2040357<br>NA |
| Mann Creek | 1911-1913, 1920, 1937-1961<br>1983-1984<br>2001-2003 | USGS<br><br>Idaho DEQ<br>Idaho Dept. of Ag | 13267000<br><br>STORET 2040347<br>NA |
| Lower Payette Ditch | 1975<br>1883-1984 | USEPA<br>Idaho DEQ | STORET 153715<br>STORET 2040358 |
| Sunnyside Return | 1983-1984 | Idaho DEQ | STORET 2040352 |
| Frazier Gulch | 1983-1984 | Idaho DEQ | STORET 2040353 |
| Smith Drain | 1983-1984 | Idaho DEQ | STORET 2040354 |
| Unity Bridge Drain | 1983-1984 | Idaho DEQ | STORET 2040355 |
| Weiser River at Highway 95 Bridge | 1975<br>1983-1984<br>1987-1989<br>2000-2001 | USEPA<br>Idaho DEQ<br>USBOR<br>Idaho DEQ | STORET 153714<br>STORET 2040342<br>CSP120<br>NA |
| Monroe Creek | 1911-1913<br>1975<br>1983-1984 | USGS<br>USEPA<br>Idaho DEQ | 13268000<br>STORET 153716<br>STORET 2040349 |

*a location upstream of WQLS, data used in analysis*

Appendix C-Table 2. Available Discharge and Water Quality Data, Weiser River, Galloway Dam to the Snake River and Tributaries.

| Monitoring Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Weiser River below Crane Creek[a] | 1996-2003 | USGS | 13266000 |
| First Creek | 1983-1984 | Idaho DEQ | STORET 2040350 |
| Bear Creek | 1983-1984 | Idaho DEQ | STORET 2040351 |
| Cove Creek | 1983-1984<br>2001-2003 | Idaho DEQ<br>Idaho Dept. of Ag | STORET 2040357<br>NA[b] |
| Mann Creek | 1983-1984<br>2001-2003 | Idaho DEQ<br>Idaho Dept. of Ag | STORET 2040347<br>NA |
| Lower Payette Ditch | 1975<br>1883-1984 | USEPA<br>Idaho DEQ | STORET 153715<br>STORET 2040358 |
| Sunnyside Return | 1983-1984 | Idaho DEQ | STORET 2040352 |
| Frazier Gulch | 1983-1984 | Idaho DEQ | STORET 2040353 |
| Smith Drain | 1983-1984 | Idaho DEQ | STORET 2040354 |
| Unity Bridge Drain | 1983-1984 | Idaho DEQ | STORET 2040355 |
| Weiser River at Highway 95 Bridge | 1975<br>1983-1984<br>1987-1989<br>2000-2001 | USEPA<br>Idaho DEQ<br>USBOR<br>Idaho DEQ | STORET 153714<br>STORET 2040342<br>CSP120<br>NA |
| Monroe Creek | 1975<br>1983-1984<br>2002-2003 | USEPA<br>Idaho DEQ<br>Idaho Dept. of Ag | STORET 153716<br>STORET 2040349<br>NA |

*a location upstream of WQLS, data used in analysis*
*b not available*

Appendix C-Table 3. Available Biological Data. Weiser River, Galloway Dam to the Snake River and Tributaries.

| Assessment ID No. | Type of Data | Location | Date(s) of Visit |
|---|---|---|---|
| WR-001[b] | Periphyton and Macroinvertebrate | Weiser River at Highway 95 Bridge, Weiser, Idaho | August 2000 and July 2001[a] |
| WR-002 [b] | Periphyton and Macroinvertebrate | Weiser River at Unity Bridge near Weiser, Idaho | August 2000 and July 2001[a] |
| WR-003 [b] | Periphyton and Macroinvertebrate | Weiser River below Galloway dam | August 2000 and July 2001[a] |
| BURP ID No. 1998SBOI027 BURP ID No. 1998SBOI028 | Habitat, Macroinvertebrates | Mann Creek below Mann Creek Reservoir | July 1998 |
| BURP ID No. 1998SBOI022 BURP ID No. 1998SBOI023 | Habitat, Macroinvertebrates | Cove Creek near Mouth Cove Creek near Headwaters | July 1998 |
| EPAREACH 17050124003 | Fish | Weiser River at Weiser, Idaho | June 1999 |
| EPAREACH 17050124003 | Fish | Weiser River below Galloway dam | June 1999 |

*a Macroinvertebrate Data not Available for Analysis b Due to Clerical Error, the Stations were Assigned Station ID No.'s as WR-006, WR-007 and W8-002 in Bahls' (2001 and 2002)*

## Weiser River, Little Weiser River to Galloway Dam

Appendix C-Table 4. Available Discharge Data, Weiser River, Little Weiser River to Galloway Dam

| Discharge Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Weiser River below Crane Creek | 1895-1914 and 1952-2003 | USGS | 13266000 |
| Crane Creek | 1920-1982, 2001<br>1983 | USGS<br>Idaho DEQ | 13265500<br>20400340 |
| Weiser River above Crane Creek | 1921-1952 | USGS | 13263500 |
| Little Weiser River | 1920-1927, 1938-1971 | USGS | 13261000 |
| Sunnyside Canal (Crane Creek Irrigation Dist. Canal) | 1920-1926 | USGS | 13265000 |
| Galloway Canal | 1920-1969 | USGS | 13266500 |
| First Creek | 1983-1984 | Idaho DEQ | STORET 2040350 |
| Bear Creek | 1983-1984 | Idaho DEQ | STORET 2040351 |

Appendix C-Table 5. Available Water Quality Data, Weiser River, Little Weiser River to Galloway Dam

| Monitoring Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| First Creek | 1983-1984 | Idaho DEQ | STORET 2040350 |
| Bear Creek | 1983-1984 | Idaho DEQ | STORET 2040351 |
| Weiser River below Crane Creek | 1895-1914<br>and 1952-2003<br>1975<br>2000-2001 | USGS<br><br>USEPA<br>Idaho DEQ | 13266000<br><br>153711<br>NA |
| Crane Creek | 1920-1982, 2001<br>1975<br>1983 | USGS<br>USEPA<br>Idaho DEQ | 13265500<br>153710<br>STORET 20400340 |
| Weiser River above Crane Creek | 1921-1952 | USGS | 13263500 |
| Little Weiser River | 1920-1927, 1938-1971<br>2000-2001 | USGS<br>Idaho DEQ | 13261000<br>NA |
| Weiser River at Midvale | 1975<br>2000-2001 | USEPA<br>Idaho DEQ | 153709<br>NA |
| Keithly Creek | 1975 | USEPA | 153708 |
| Weiser River above Midvale | 1975 | USEPA | 153707 |

Appendix C-Table 6. Available Biological Data, Weiser River, Little Weiser River to Galloway Dam

| Assessment ID No. | Type of Data | Location | Date(s) of Visit |
|---|---|---|---|
| WR-004 | Periphyton and Macroinvertebrate | Weiser River above Crane Creek | August 2000 and July 2001[1] |
| WR-005 | Periphyton and Macroinvertebrate | Weiser River at Midvale | August 2000 and July 2001[1] |
| WR-006 | Periphyton and Macroinvertebrate | Weiser River below Little Weiser River | August 2000 and July 2001[1] |
| BURP ID No. 1996BOIB022 | Habitat and Macroinvertebrates | Crane Creek below Reservoir | June 1996 |
| Little Weiser River | | | |
| EPAREACH 17050124014 | Fish | Weiser River lower Canyon | June 1999 |
| EPAREACH 17050124014 | Fish | Weiser River upper Canyon | June 1999 |
| EPAREACH 17050124017 | Fish | Weiser River at Midvale | June 1999 |

*1 Macroinvertebrate Data not Available for Analysis 2 Due to Clerical Error, the Stations were Assigned Station ID No.'s as WR-006, WR-007 and W8-002 in Bahls' (2001 and 2002)*

**Weiser River, West Fork Weiser River to Little Weiser River, Segment 2835**

Appendix C-Table 7. Available Discharge Data, Weiser River Segment 2835, West Fork Weiser River to Little Weiser River.

| Monitoring Site(s) | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Rush Creek | 1938-1942 | USGS | 13259500 |
| Weiser River near Cambridge, ID | 1939-2002<br>2000-2001 | USGS<br>Idaho DEQ | 13258500<br>NA |
| Bacon Creek near Mesa, Id | 1943-1949 | USGS | 13258000 |
| Middle Fork Weiser River near Mesa, ID. | 1911-1987 | USGS | 13257000 |
| Weiser River near Council, ID | 1937-1953 | USGS | 13256000 |
| Weiser River near White School near Fruitvale, ID. | 1981-1982 | USGS | 13255060 |
| Hornet Creek | 1937-1943 | USGS | 13255500 |
| Weiser River near Council, ID. WWTP | 2000-2001 | Idaho DEQ | NA |

Appendix C-Table 8. Available Water Quality Data, Weiser River, West Fork Weiser River to Little Weiser River

| Monitoring Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Weiser River | 1974-1975,1981-1984<br>1975<br>2000-2001<br>2003 | USGS<br>USEPA<br>Idaho DEQ<br>Idaho DEQ<br>Idaho DEQ | 13258500<br>153726<br>NA<br>NA<br>NA |
| Council, Idaho WWTP | 2003 | City of Council | ID-002008-7 |
| Cambridge, Idaho WWTP | 2001-2003 | City of Cambridge | ID-002180-6 |

Appendix C-Table 9. Available Biological Data, Weiser River, West Fork Weiser River to Little Weiser River

| Assessment ID No. | Type of Data | Location | Date(s) of Visit |
|---|---|---|---|
| WR-008 | Periphyton and Macroinvertebrate | Weiser River at Hornet Creek Road Bridge, near Council, Idaho | August 2000 and July 2001[1] |
| WR-007 | Periphyton and Macroinvertebrate | Weiser River at Goodrich Bridge | August 2000 and July 2001[1] |
| EPAREACH 17050124020 | Fish | Weiser River at Cambridge | June 1999 |

*1 Macroinvertebrate Data not Available for Analysis 2 Due to Clerical Error, the Stations were Assigned Station ID No.'s as WR-001 and WR-002 in Bahls' (2001 and 2002)*

## Mann Creek, Mann Creek Reservoir to Weiser River

Appendix C-Table 10. Available Data Sources, Mann Creek, Mann Creek Reservoir to Weiser River

| Station | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Mann Creek at Mouth | 1911-1913, 1920, 1937-1961<br>1975<br>1983-1984<br>2001-2002 | USGS<br><br>USEPA<br>Idaho DEQ<br>Idaho Department of Ag | 13267000<br><br>STORET No. 153713<br>STORET No.2040347<br>NA |
| Mann Creek | 1998 | Idaho DEQ | BURP ID No. 1998SBOI027<br>BURP ID No. 1998SBOI028 |
| Mann Creek at Reservoir Release | 1967-1971<br>1983-1984<br>2001-2002 | USGS<br>Idaho DEQ<br>Idaho Department of Ag | 13267050<br>STORTET No.2040348<br>NA |

## Cove Creek, Headwaters to Weiser River

Appendix C-Table 11. Available Data Sources, Cove Creek

| Station | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Cove Creek near Mouth | 1983-1984<br>2001-2002 | Idaho DEQ<br>Idaho Department of Ag | <br>NA |
| Cove Creek | 1998 | Idaho DEQ | BURP ID No. 1998SBOI027<br>BURP ID No. 1998SBOI028 |

**Little Weiser River, Indian Valley to Weiser River**

Appendix C-Table 12. Available Discharge Data, Little Weiser River, Indian Valley to Weiser River

| Monitoring Site(s) | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Little Weiser River near Mouth | 1920-1926<br>2000-2001 | USGS<br>Idaho DEQ | 13261500<br>NA |
| Little Weiser near Indian Valley1 | 1920-1979 | USGS | 13261000 |
| Little Weiser below Mill Creek1 | 1923-1982 | USGS | 13260500 |
| Ben Ross Feeder Canal[a] | 1981-1982 | USGS | 13261100 |
| Indian Valley Irrigation Canal (Ben Ross Reservoir Release) 1 | 1981-1982 | USGS | 13261200 |

*a USGS Site Upstream of §303(d) listed Segment.*

Appendix C-Table 13. Available Water Quality Data, Little Weiser River, Indian Valley to Weiser River

| Monitoring Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Little Weiser River | 1974-1975,1981-1984<br>1975<br>2000-2001<br>2002 | USGS<br>USEPA<br>Idaho DEQ<br>Idaho DEQ | 13261500<br>153710<br>NA<br>BURPID2002BOIA015 |

Appendix C-Table 14. Available Beneficial Use Reconnaissance Program Stations, Little Weiser River, Indian Valley to Weiser River

| BURP ID No. | Location | Date of Visit |
|---|---|---|
| 1996BOIA072 | 6 Miles East of Cambridge at County Road Bridge | August 5, 1996 |
| 2002BOIA015 | ¼ Mile Upstream of Confluence with Weiser River 1 ½ Miles south-southwest of Cambridge | July 18, 2002 |
| 2002BOIA12 | 11 Miles East of Cambridge, Directly off Highway 95 | July 17, 2002 |

## Johnson Creek, Headwaters to Weiser River

Appendix C-Table 15. Available Data Sources, Johnson Creek

| Assessment ID No. | Type of Data | Location | Date(s) of Visit |
|---|---|---|---|
| BURP ID No. 1993SBOI063 | Habitat and Macroinvertebrate | Township 16 North, Range 2 West Section 23 | June 1993 |
| BURP ID No. 1993SBOI036 | Habitat and Macroinvertebrate | Township 16 North, Range 2 West Section 2 | June 1993 |
| BURP ID No. 2002SBOIA016 | Habitat, Fish and Macroinvertebrate | Township 16 North, Range 2 West Section 2 | July 2002 |
| BURP ID No. 2002SBOIA017 | Habitat, Fish and Macroinvertebrate | Township 16 North, Range 2 West Section 6 | July 2002 |

## West Fork Weiser River, Headwaters to Weiser River

Appendix C-Table 16. Available Data Sources, West Fork Weiser River

| Assessment ID No. | Type of Data | Location | Date(s) of Visit |
|---|---|---|---|
| BURP ID No. 1993SBOI025 | Habitat and Macroinvertebrate | Range 18 North, Township 1 West Section 17 | June 1993 |
| BURP ID No. 1993SBOI026 | Habitat and Macroinvertebrate | | June 1993 |
| BURP ID No. 2002SBOIA019 | Habitat and Macroinvertebrate | Range 18 North, Township 1 West Section 7 | July 2002 |
| BURP ID No. 2002SBOIA018 | Habitat and Macroinvertebrate | Range 18 North, Township 1 West Section 7 | July 2002 |

**South Crane Creek, Headwaters to Crane Creek Reservoir**

Appendix C-Table 17. Available Discharge Data for South Crane Creek, Headwaters to Crane Creek Reservoir.

| Discharge Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Lower South Crane Creek | 2001-2003 | Idaho department of Agriculture | NA[a] |
| Upper South Crane Creek | 2001-2003 | Idaho department of Agriculture | NA |

*a not available*

Appendix C-Table 18. Available Water Quality Data for South Crane Creek

| Water Quality Data | Location | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Nutrients, TSS, bacteria, temperature, dissolved oxygen | Two Locations on South Crane Creek | Idaho Department of Agriculture | NA[a] |

*a not available*

Appendix C-Table 19. Available Beneficial Use Reconnaissance Program Stations, South Crane Creek, Headwaters to Crane Creek Reservoir.

| BURP ID No. | Location | Date of Visit |
|---|---|---|
| BURP ID No. 1995SBOIA001 | | |
| BURP ID No. 1998SBOIB024 | | |
| BURP ID No. 1998SBOIB025 | | |

**North Crane Creek, Headwaters to Crane Creek Reservoir**

Appendix C-Table 20. Available Discharge Data for North Crane Creek, Headwaters to Crane Creek Reservoir

| Discharge Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Lower North Crane Creek | 2001-2003 | Idaho Department of Agriculture | NA[a] |
| Upper North Crane Creek | 2001-2003 | Idaho Department of Agriculture | NA |

*a not available*

Appendix C-Table 21. Available Water Quality Data for North Crane Creek

| Water Quality Data | Location | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Nutrients, TSS, bacteria, temperature, dissolved oxygen | Two Locations on North Crane Creek | Idaho Department of Agriculture | NA[a] |
| Bacteria | 5 miles upstream of reservoir | Idaho DEQ | NA |

Appendix C-Table 22. Available Beneficial Use Reconnaissance Program Stations, South Crane Creek, Headwaters to Crane Creek Reservoir

| BURP ID No. | Location | Date of Visit |
|---|---|---|
| BURP ID No. 1998SBOIB024 (Lower site) | Just north of the bridge where South Crane Road crosses creek | 6/30/98 |
| BURP ID No. 1998SBOIB025 (Upper site) | 1.8 miles south on Soulen Ranch Road from lower site | 6/30/98 |

## Crane Creek Reservoir

Appendix C-Table 23. Available Discharge Data for Crane Creek Reservoir

| Discharge Site | Years of Available Data | Responsible Agency(s) | Identification Number |
|---|---|---|---|
| Crane Creek below Reservoir Outfall | 1911 and 1932 | USGS | 13264500 |

*a not available*

**Weiser River Galloway Dam to the Snake River, Segment 2834 and Tributaries**

Appendix C-Table 24. Individual *E. coli* Results for 2000 and 2001. Weiser River @ Highway 95 Bridge at Weiser, ID. Segment 2834, Weiser River, Galloway Dam to the Snake River.

| Date | E. coli CFU*/100ml | Fecal Coliform CFU/100 ml |
|---|---|---|
| 00/4/18 | 4 | 30 |
| 00/5/24 | 82 | 160 |
| 00/6/27 | 84 | 182 |
| 00/7/26 | 42 | 2000 |
| 00/8/22 | 60 | 460 |
| 00/9/19 | 44 | 180 |
| 00/11/21 | 4 | 4 |
| 00/12/18 | 4 | 20 |
| 01/1/18 | 2 | 2 |
| 01/2/14 | 2 | 2 |
| 01/3/13 | 38 | 62 |
| 01/4/17 | 4 | 12 |
| 01/5/16 | 500 | 720 |
| 01/6/13 | 70 | 150 |
| 01/7/19 | 420 | 34 |
| 01/8/14 | 480 | 860 |
| 01/9/12 | 320 | 550 |

** CFU-Colony Forming Units*

Appendix C-Table 25. Measured and Estimated Flows to the Snake River from the Weiser River Watershed, and Measured Total Phosphorus Concentrations. Bureau of Reclamation 1987-1989, Weiser River, Galloway Dam to the Snake River.

| Months[a] | Actual Measured Flows BOR 1987-1988 (cfs) | Estimated Flow Discharge to Snake River BOR 1987-1988 (cfs) | Total Phosphorus Concentration BOR 1987-1988 (mg/L) | Actual Measured Flows 1988-1989 (cfs) | Estimated Flows Discharge to Snake River BOR 1988-1989 (cfs) | Total Phosphorus Concentration BOR 1988-1989 (mg/L) |
|---|---|---|---|---|---|---|
| Oct[b] | 162 | 163 | 0.066 | 50 | 51 | 0.043 |
| Nov | 80 | 81 | 0.030 | 97 | 98 | 0.023 |
| Dec | 188 | 189 | 0.055 | 48 | 49 | 0.044 |
| Jan | 549 | 552 | 0.037 | na | na | na |
| Feb | 997 | 1004 | 0.046 | 3222 | 3229 | 0.120 |
| Mar | 1121 | 1149 | 0.140 | 6577 | 6604 | 0.340 |
| Apr | 801 | 839 | 0.086 | 2245 | 2243 | 0.079 |
| May | 556 | 599 | 0.058 | 3525 | 3568 | 0.130 |
| Jun | 645 | 670 | 0.066 | 955 | 980 | 0.060 |
| Jul | 128 | 154 | 0.200 | 227 | 253 | 0.170 |
| Aug | 132 | 140 | 0.190 | 224 | 232 | 0.230 |
| Sep | 56 | 65 | 0.043 | 98 | 107 | 0.110 |

*a shaded indicates critical period*
*b average two sample set, duplicated.*

Appendix C-Table 26. Measured and Estimated Flows to the Snake River, Idaho DEQ 2000-2001, Weiser River, Galloway Dam to the Snake River

| Months[a] | Actual Measured Flows DEQ 1999-2000 (cfs) | Estimated Flows Discharge to Snake River DEQ 1999-2000[b] (cfs) | Total Phosphorus Concentration DEQ 1999-2000[3] (mg/L) | Estimated Flow Discharge to Snake River 2000-2001 (cfs) | Estimated Flows Discharge to Snake River DEQ 2000-2001 (cfs) | Total Phosphorus Concentration DEQ 2000-2001[c] (mg/L) |
|---|---|---|---|---|---|---|
| Oct | NA | NA | NA | 50 | 51 | 0.075 |
| Nov | NA | NA | NA | 97 | 98 | 0.094 |
| Dec | NA | NA | NA | 170 | 171 | 0.044 |
| Jan | NA | NA | NA | 140 | 142 | 0.051 |
| Feb | NA | NA | NA | 220 | 227 | 0.048 |
| Mar | NA | NA | NA | 1760 | 1788 | 0.200 |
| Apr | 2601 | 2639 | 0.076 | 718 | 756 | 0.03 |
| May[1] | 2470 | 2513 | 0.075 | 1370 | 1413 | 0.068 |
| Jun[1] | 1382 | 1407 | 0.092 | 377 | 402 | 0.069 |
| Jul[1] | 205 | 231 | 0.180 | 256 | 282 | 0.170 |
| Aug[1] | 55 | 63 | 0.250 | 237 | 245 | 0.230 |
| Sep[1] | 57 | 66 | 0.270 | 141 | 150 | 0.220 |

*a. Shaded Represents Critical Period. b Takes Into Account Monroe Creek Flows c. Monroe Creek Total Phosphorus Load Not Calculated into Concentration Levels.*

Appendix C-Table 27 Statistical Results for Total Phosphorus Concentrations. Weiser River at Highway 95 Bridge, Weiser Id., Weiser River, Galloway Dam to the Snake River.

| Weiser River at Highway 95 Bridge 1987-1989 BOR Data (All data points) | Total Phosphorus Concentrations (mg/L) |
|---|---|
| Average | 0.103 |
| Standard Deviation | 0.076 |
| Maximum | 0.340 |
| Minimum | 0.023 |
| 95th Percentile | 0.226 |
| Weiser River at Highway 95 Bridge 2000-2001 Idaho DEQ Data | |
| Average | 0.125 |
| Standard Deviation | 0.081 |
| Maximum | 0.270 |
| Minimum | 0.030 |
| 95th Percentile | 0.253 |

Appendix C-Table 28. Critical Period (May-September) Statistical Results for Total Phosphorus Concentrations. Weiser River at Highway 95 Bridge, Weiser Id., Weiser River, Galloway Dam to the Snake River.

| Weiser River at Highway 95 Bridge 1987-1989 BOR Data (May-September) | Total Phosphorus Concentrations (mg/L) |
|---|---|
| Average | 0.130 |
| Standard Deviation | 0.064 |
| Maximum | 0.230 |
| Minimum | 0.058 |
| 95th Percentile | 0.217 |
| Weiser River at Highway 95 Bridge 2000-2001 Idaho DEQ Data (May-September) | |
| Average | 0.162 |
| Standard Deviation | 0.080 |
| Maximum | 0.270 |
| Minimum | 0.068 |
| 95th Percentile | 0.261 |

Appendix C-Table 29. Average Measured Discharge, Total Phosphorus Load and Concentration from BOR 1987-1989 and Idaho DEQ 2000-2001, Critical Period to the Snake River[1] from the Weiser River Watershed. Weiser River, Galloway Dam to the Snake River.

| Month | Discharge (cfs) | Total Phosphorus Load (kg/day)[a] | Total Phosphorus Concentration (mg/L) |
|---|---|---|---|
| May | 2023 | 491.8 | 0.087 |
| June | 865 | 162.7 | 0.074 |
| July | 230 | 100.5 | 0.181 |
| August | 170 | 92.2 | 0.221 |
| September | 97 | 42.1 | 0.173 |
| **Analysis**[b] | | | |
| Average | 677 | 177.9 | 0.147 |
| Standard Deviation | 923 | 251.7 | 0.068 |
| Maximum | 3568 | 1142.6 | 0.259 |
| Minimum | 63 | 15.7 | 0.062 |
| Count | 20 | 20 | 20 |

*a Monroe Creek Average Discharge, Total Phosphorus Load and Concentration Calculated into Total Load for Weiser River's Contribution to Snake River.*
*b Analysis on all Critical Period Data (May-September)*

Normalized Discharge-Total Phosphorus Regression Analysis

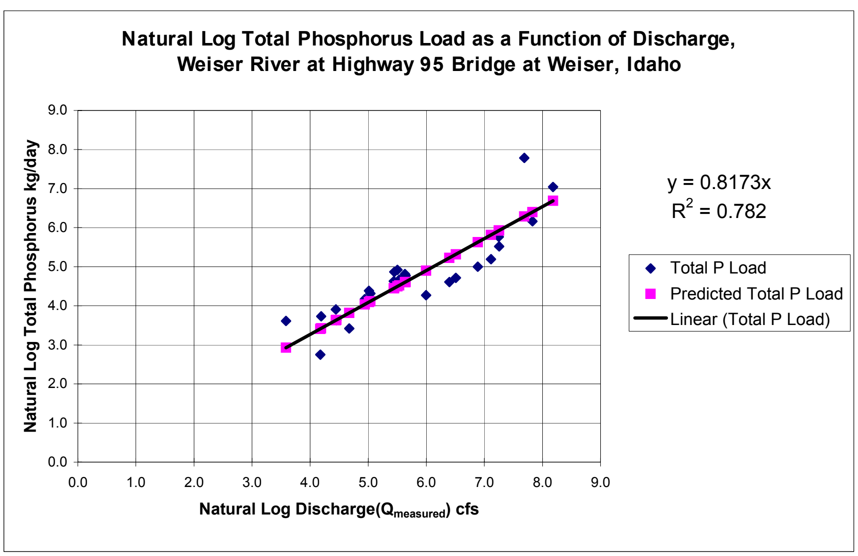


Figure 1. Natural Log Plots for Measured Load (Y axis) as a Function of Measured Flows (X axis). Weiser River, Galloway Dam to the Snake River.

$\ln(y) = 0.8173\ln(x)$
$r^2 = 0.782$

The value obtained as the estimated total phosphorus load for that day's normal (average) flow is y. The variable ln(x) is the natural log value for the average (normal) flow for that date. So, the estimated total phosphorus load would appear as:

Total Phosphorus Load ln(y) = 0.8173ln(x) or

Total Phosphorus Load (y) = exp(0.8173ln(x))

As an example, for the date June 26, 2000, the following natural log values were obtained:

Natural Log Measured Flow = 7.2949 (1,407 (cfs))

Natural Log Measured Total Phosphorus Load = 5.765 (319.0 (kg/day))

Natural Log Average (normal) Flow = 6.703 (815 (cfs))

Total Phosphorus Load = 239.5 (kg/day)

Analysis was conducted on all flow and total phosphorus data collected from the period from 1988-1989 and 2000-2001.

Appendix C-Table 30. Measured and Normalized Discharge, Total Phosphorus Concentrations and Total Phosphorus Load, Critical Period Discharge to the Snake River[a] from the Weiser River Watershed. Weiser River, Galloway Dam to the Snake River.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Load (kg/day)[c] | Measured Total Phosphorus Concentration (mg/L)[d] | Estimated Discharge (cfs)[b] | Estimated Total Phosphorus Load (mg/L)[c] | Estimated Total Phosphorus Concentration (kg/day)[d] |
|---|---|---|---|---|---|---|
| Average | 677 | 177.9 | 0.147 | 910 | 218.1 | 0.133 |
| Standard Deviation | 923 | 251.7 | 0.068 | 1001 | 208.9 | 0.038 |
| Max | 3,568 | 1,142.6 | 0.259 | 2,605 | 561.6 | 0.203 |
| Min | 63 | 15.7 | 0.062 | 40 | 20.0 | 0.088 |
| Count[e] | 20 | 20 | 20 | 20 | 20 | 20 |
| | | | | Square | Root Error | 1,303.0 |
| | | | | % Difference | Measured | 13.7% |
| | | | | % Difference | Estimated | 16.7% |

*a Analysis on all critical period data (May-September)*
*b cubic feet per second*
*c kilograms per day*
*d milligrams per liter*
*e Estimated discharge, load, and concentration based on comparison of dates of instream monitoring*

Appendix C-Table 31. Estimated (Normalized Discharge) Critical Period Discharges, Total Phosphorus Loads and Concentrations, Critical Period Discharge to the Snake River[a] from the Weiser River Watershed. Weiser River, Galloway Dam to the Snake River.

| Month | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] | Total Phosphorus Concentration (mg/L)[d] |
|---|---|---|---|
| May | 2537.1 | 605.8 | 0.098 |
| June | 1412.1 | 371.9 | 0.110 |
| July | 240.8 | 86.4 | 0.155 |
| August | 66.1 | 30.6 | 0.191 |
| September | 53.2 | 25.7 | 0.199 |
| **Analysis** [a] | | | |
| Average | 864 | 224.5 | 0.150 |
| Standard Deviation | 1010 | 236.3 | 0.042 |
| Maximum | 2667 | 631.1 | 0.211 |
| Minimum | 37 | 19.1 | 0.097 |
| Count | 153 | 153 | 153 |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c kilogram per day*
*d milligram per liter*
*Monroe Creek Average Discharge, Total Phosphorus Load and Concentration Calculated into Total Load for Weiser River's Contribution to Snake River.*

Appendix C-Table 32. Measured and Normalized Discharge, Total Phosphorus Concentrations and Total Phosphorus Load, Critical Period Discharge to the Snake River[a] from the Weiser River Watershed. Weiser River, Galloway Dam to the Snake River.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Load (kg/day)[c] | Measured Total Phosphorus Concentration (mg/L)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Load (mg/L) | Estimated Total Phosphorus Concentration (kg/day) |
|---|---|---|---|---|---|---|
| Average | 677 | 177.9 | 0.147 | 910 | 218.1 | 0.133 |
| Standard Deviation | 923 | 251.7 | 0.068 | 1001 | 208.9 | 0.038 |
| Max | 3568 | 1142.6 | 0.259 | 2605 | 561.6 | 0.203 |
| Min | 63 | 15.7 | 0.062 | 40 | 20.0 | 0.088 |
| count[d] | 20 | 20 | 20 | 20 | 20 | 20 |
| | | | | | | |
| | | | | Square Root Error | | 1303.0 |
| | | | | % Difference Measured | | 13.7% |
| | | | | % Difference Estimated | | 16.7% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c kilogram per day*
*d milligram per liter*

Appendix C-Table 33. Mass Balance for Discharge and Total Phosphorus Loads and Concentrations to the Snake River from the Lower Weiser River[a]. Weiser River, Galloway Dam to the Snake River.

| Month | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] | Total Phosphorus Concentration (mg/L)[d] |
|---|---|---|---|
| May | 2537.1 | 580.8 | 0.094 |
| June | 1441.3 | 357.3 | 0.104 |
| July | 240.8 | 86.3 | 0.159 |
| August | 66.1 | 33.7 | 0.220 |
| September | 53.7 | 10.9 | 0.086 |
| **Analysis**[d] | | | |
| Average | 863.7 | 213.0 | 0.133 |
| Standard Deviation | 1009.8 | 227.0 | 0.058 |
| Maximum | 2667.0 | 605.1 | 0.362 |
| Minimum | 37.0 | 10.9 | 0.061 |
| Count | 153 | 153 | 153 |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c kilogram per day*
*d milligram per liter*

Appendix C-Table 34. Measured and Mass Balance Discharge, Total Phosphorus Load and , Critical Period Discharge to the Snake River[a] from the Weiser River Watershed. Weiser River, Galloway Dam to the Snake River.

| | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] | Total Phosphorus Concentration (mg/L)[d] | Discharge (cfs) | Total Phosphorus Load (mg/L) | Total Phosphorus Concentration (kg/day) |
|---|---|---|---|---|---|---|
| Average | 677 | 177.9 | 0.147 | 888 | 232.8 | 0.169 |
| Standard Deviation | 923 | 251.7 | 0.068 | 990 | 220.5 | 0.086 |
| Max | 3568 | 1142.6 | 0.259 | 2562 | 606.6 | 0.373 |
| Min | 63 | 15.7 | 0.062 | 31 | 28.5 | 0.094 |
| count[d] | 20 | 20 | 20 | 20 | 20 | 20 |
| | | | | | | |
| | | | | Square Root Error | | 1383.8 |
| | | | | % Difference Measured | | 12.1% |
| | | | | % Difference Mass Balance | | 16.8% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c kilogram per day*
*d milligram per liter*

Appendix C-Table 35. Measured, Estimated and Mass Balance Total Phosphorus Concentrations at the Snake River from the Lower Weiser River[a]. Weiser River, Galloway Dam to the Snake River.

| Months | Measured Total Phosphorus Concentration 1987-89 and 2000-2001 (mg/L)[b] | Estimated Total Phosphorus Concentration Based on Normalized Discharge (kg/day)[c] | Mass Balance Phosphorus Concentration Based on Inflows and Outflows (kg/day) |
|---|---|---|---|
| May | 0.087 | 0.098 | 0.094 |
| Jun | 0.074 | 0.110 | 0.104 |
| Jul | 0.181 | 0.155 | 0.159 |
| Aug | 0.221 | 0.191 | 0.220 |
| Sep | 0.173 | 0.199 | 0.086 |
| Analysis | | | |
| Average | 0.147 | 0.150 | 0.133 |
| Standard Deviation | 0.068 | 0.042 | 0.058 |
| Maximum | 0.259 | 0.211 | 0.362 |
| Minimum | 0.062 | 0.097 | 0.061 |
| Count | 20 | 153 | 153 |

*a Analysis on all Critical Period Data (May-September) Based on 153 Days in Critical Period and Normalized Discharge Data*
*b milligram per lite*
*c kilogram per day*

## Mann Creek

Appendix C-Table 36. Measured Discharge for 1983-1984, 2001-2003[a]. Mann Creek

| | WY 1983-84 Discharge (cfs)[b] | WY 2001 Discharge (cfs) | WY 2002 Discharge (cfs) | WY 2003 Oct-Feb Discharge (cfs) |
|---|---|---|---|---|
| Average | 134.8 | 5.5 | 25.4 | 10.2 |
| Standard Deviation | 188.0 | 5.8 | 40.7 | 3.6 |
| MAX | 556.0 | 23.2 | 166.0 | 17.1 |
| MIN | 10.0 | 1.4 | 1.7 | 6.2 |
| Count | 15 | 13 | 19 | 7 |

*a Analysis based on all available data*
*b cubic feet per second*

Appendix C-Table 37. Measured Total Phosphorus Concentrations Mann Creek, May through September 1975, 1983-1984 and 2001-2003. Mann Creek

| | USEPA[a] Total Phosphorus (mg/L)[b] | WY 1983-84 Total Phosphorus (mg/L) | WY 2001 Total Phosphorus (mg/L) | WY 2002 Total Phosphorus (mg/L) |
|---|---|---|---|---|
| Average | 0.373 | 0.245 | 0.222 | 0.216 |
| Standard Deviation | 0.110 | 0.190 | 0.080 | 0.047 |
| MAX | 0.500 | 0.770 | 0.430 | 0.300 |
| MIN | 0.300 | 0.110 | 0.150 | 0.130 |
| Count | 3 | 10 | 11 | 10 |

*a USEPA’s 1975 is Five Data Points, Four in August*
*b milligram per liter*

Appendix C-Table 38. Average Measured Discharge, Total Phosphorus Load and Concentrations from Mann Creek at the Confluence with the Weiser River[a], May through September. Mann Creek

| Month | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] | Total Phosphorus Concentration (mg/L)[d] |
|---|---|---|---|
| May | 27.2 | 11.4 | 0.202 |
| June | 11.6 | 8.8 | 0.200 |
| July | 12.6 | 8.7 | 0.246 |
| August | 6.6 | 3.4 | 0.307 |
| September | 5.5 | 2.7 | 0.184 |
| **Analysis** [d] | | | |
| Average | 12.7 | 7.0 | 0.228 |
| Standard Deviation | 8.7 | 3.8 | 0.050 |
| Maximum | 27.2 | 11.4 | 0.307 |
| Minimum | 5.5 | 2.7 | 0.184 |
| Count | 5 | 5 | 5 |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c kilogram per day*
*d milligram per liter*

Appendix C-Table 39. Measured Total Phosphorus Concentrations Mann Creek Reservoir Release, May-September 1983-1984 and 2001-2003. Mann Creek

| | WY 1983-84 Total May-September Phosphorus (mg/L)[a] | WY 2001 Total May-September Phosphorus (mg/L) | WY 2002 Total May-September Phosphorus (mg/L) |
|---|---|---|---|
| Average | 0.098 | 0.059 | 0.068 |
| Standard Deviation | 0.085 | 0.013 | 0.029 |
| MAX | 0.290 | 0.080 | 0.140 |
| MIN | 0.020 | 0.050 | 0.050 |
| count | 10 | 10 | 10 |

*a milligram per liter*

Appendix C-Table 40. Measured Total Phosphorus Concentrations and Loads, Releases from Mann Creek Reservoir, May-September 1983-1984 and 2001-2003. Mann Creek

| | WY 1983 Total P (mg/L)[a] | WY 1983 Total P (kg/day)[b] | WY 2001 Total P Conc. (mg/L) | WY 2001 Total P Load (kg/day) | WY 2002 Total P Conc. (mg/L) | WY 2002 Total P Load (kg/day) | Overall Total P Conc. (mg/L) | Overall Total P Load (kg/day) |
|---|---|---|---|---|---|---|---|---|
| Average | 0.098 | 18.1 | 0.059 | 2.0 | 0.068 | 5.8 | 0.075 | 8.6 |
| Standard Deviation | 0.085 | 24.2 | 0.013 | 1.7 | 0.029 | 3.3 | 0.053 | 15.3 |
| MAX | 0.290 | 78.0 | 0.080 | 5.2 | 0.140 | 11.0 | 0.290 | 78.0 |
| MIN | 0.020 | 1.1 | 0.050 | 0.0 | 0.050 | 0.2 | 0.020 | 0.0 |
| Count | 10 | 10 | 10 | 10 | 10 | 10 | 30 | 30 |

*a milligram per liter*
*b kilogram per day*

Appendix C-Table 41. Measured and Estimated Discharge, Total Phosphorus Concentration and Total Phosphorus Load Release from Mann Creek Reservoir[a], May through September. Mann Creek

| | Measured Discharge (cfs)[b] | Measured Total P ((mg/L))[c] | Measured Total P (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total P (mg/L) | Estimated Total P (kg/day) |
|---|---|---|---|---|---|---|
| Average | 42.9 | 0.075 | 8.6 | 35.6 | 0.086 | 6.4 |
| Standard Deviation | 61.7 | 0.053 | 15.3 | 23.3 | 0.024 | 2.1 |
| Max | 319.0 | 0.290 | 78.0 | 95.3 | 0.146 | 11.3 |
| Min | 0.1 | 0.020 | 0.0 | 9.0 | 0.048 | 3.2 |
| count | 30 | 30 | 30 | 30 | 30 | 30 |
| | | | | | | |
| | | | | Square | Root Error | 36.5 |
| | | | | % Difference | Measured | 23.7% |
| | | | | % Difference | Estimated | 17.5% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligram per liter*
*d kilogram per day*

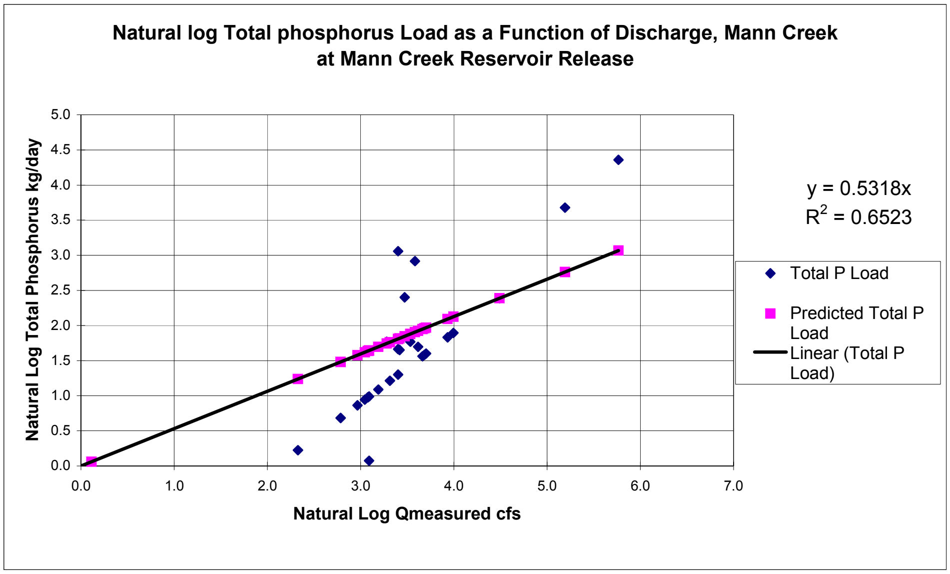


Figure 2. Regression Analysis of Total Phosphorus as a Function of Discharge from Mann Creek at Mann Creek Reservoir.

The final regression analysis was applied to the daily average discharge for the critical period of May 1 through September 30. The final estimated normalized total phosphorus loadings along side actual water quality monitoring results from 1983 and 2001-2003 are displayed in Appendix C-Table 41.

The analysis of the data indicated that the sediment rating curve may be more reliable as an actual prediction of sediment load from the reservoir than the data collected for the studies.

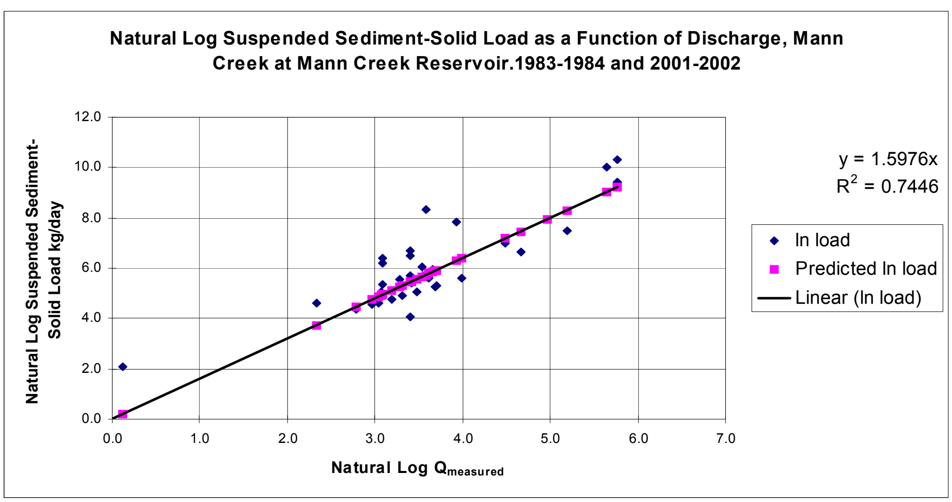


Figure 3. Regression Analysis of Suspended Sediment as a Function of Discharge from Mann Creek Reservoir.

Appendix C-Table 42. Measured Suspended Sediment-Total Suspended Solids for Mann Creek 1975, 1983-1984 and 2001-2003.

| | USEPA[a] Total Residue Non-Filterable (mg/L)[b] | WY 1983-84 Suspended Sediment (mg/L) | WY 2001 Total Suspended Solids (mg/L) | WY 2002 Total Suspended Solids (mg/L) | WY 2003 Oct-Feb Total Suspended Solids (mg/L) |
|---|---|---|---|---|---|
| Average | 26.6 | 58.3 | 16.4 | 24.3 | 7.4 |
| Standard Deviation | 11.3 | 51.9 | 23.3 | 34.8 | 4.1 |
| MAX | 38.0 | 185.0 | 85.0 | 122.0 | 15.0 |
| MIN | 8.0 | 4.0 | 3.0 | 2.0 | 3.0 |
| count | 5 | 15 | 12 | 18 | 7 |

*aUSEPA's 1975 is Five Data Points, Four in August 1975 and One in December 1975 (All other averages are based on all data points in the water year) b milligram per liter*

Appendix C-Table 43. Measured and Estimated Suspended Sediment-Total Suspended Solids for Mann Creek[a]. Mann Creek

| | Measured Discharge (cfs)[b] | Measured SS Conc. (mg/L)[c] | Measured SS Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated SS Conc. (mg/L) | Estimated SS Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 47.6 | 29.0 | 1.11E+04 | 41.6 | 41.6 | 1.26E+04 |
| Standard Deviation | 112.3 | 39.8 | 3.74E+04 | 56.1 | 62.5 | 2.46E+04 |
| Max | 556.0 | 185.0 | 2.11E+05 | 175.0 | 196.8 | 8.43E+04 |
| Min | 1.4 | 2.0 | 8.07E+00 | 1.9 | 0.9 | 4.09E+00 |
| count | 54 | 54 | 54 | 54 | 54 | 54 |
| | | | | | | |
| | | | | Square | Root Error | 2.00E+-5 |
| | | | | % Difference | Measured | 5.6% |
| | | | | % Difference | Estimated | 6.3% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 44. Measured Discharge and Suspended Sediment-Total Suspended Solids for Mann Creek at the Reservoir Release[a]. Mann Creek

| | WY 1983 SS Conc. (mg/L)[b] | WY 1983 SS Load (kg/day)[c] | WY 2002 TSS Conc. (mg/L) | WY 2001 TSS Load (kg/day) | WY 2002 TSS Conc. (mg/L) | WY 2002 TSS Load (kg/day) | Overall SS-TSS Conc. (mg/L) | Overall SS-TSS Load (kg/day) |
|---|---|---|---|---|---|---|---|---|
| Average | 14.6 | 5.27E+03 | 3.0 | 8.64E+01 | 2.8 | 2.93E+02 | 7.5 | 2.20E+03 |
| Standard Deviation | 14.1 | 9.04E+03 | 1.2 | 6.96E+01 | 1.3 | 3.17E+02 | 10.5 | 6.10E+03 |
| MAX | 48.0 | 2.97E+04 | 5.0 | 2.24E+02 | 5.0 | 1.09E+03 | 48.0 | 2.97E+04 |
| MIN | 0.8 | 5.87E+01 | 2.0 | 1.07E+00 | 1.0 | 1.54E-01 | 0.8 | 1.54E-01 |
| Count | 15 | 15 | 10 | 10 | 13 | 13 | 38 | 38 |

*a Analysis based on all available data*
*b milligrams per*
*c liter kilograms per day*

Appendix C-Table 45. Measured and Estimated Discharge, Suspended Sediment-Total Suspended Solids Concentration and Loads for Mann Creek at the Reservoir Release[a]. Mann Creek

| | Measured Discharge (cfs)[a] | Measured SS Conc. (mg/L)[b] | Measured SS Load (kg/day)[c] | Estimated Discharge (cfs) | Estimated SS Conc. (mg/L) | Estimated SS Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 57.6 | 7.5 | 2.20E+03 | 35.1 | 3.2 | 3.67E+02 |
| Standard Deviation | 82.9 | 10.5 | 6.10E+03 | 26.0 | 1.5 | 4.08E+02 |
| Max | 319.0 | 48.0 | 2.97E+04 | 95.3 | 6.2 | 1.45E+03 |
| Min | 0.1 | 0.8 | 1.54E-01 | 0.3 | 0.2 | 1.46E-01 |
| count | 38 | 38 | 38 | 38 | 38 | 38 |
| | | | | | | |
| | | | | Square | Root Error | 3.32E+03 |
| | | | | % Difference | Measured | 66.6% |
| | | | | % Difference | Estimated | 11.1% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

## Cove Creek

Appendix C-Table 46. Measured Total Phosphorus Concentrations for Cove Creek, May through September 2001-2002. Cove Creek

| | IDA 2001 May-September Total Phosphorus (mg/L)[a] | IDA 2002 May-September Total Phosphorus (mg/L) | Overall 2001-2002 May-September Total Phosphorus (mg/L) |
|---|---|---|---|
| Average | 0.291 | 0.343 | 0.312 |
| Standard Deviation | 0.066 | 0.160 | 0.113 |
| MAX | 0.400 | 0.570 | 0.570 |
| MIN | 0.170 | 0.180 | 0.170 |
| Count | 10 | 7 | 17 |

*a milligram per liter*

Appendix C-Table 47. Measured Discharge, Total Phosphorus Concentrations and Loads, Cove Creek, May through September 2001-2002. Cove Creek

| | 2001 Measured Discharge (cfs)[a] | 2001 Total P Measured Concentration (mg/L)[b] | 2001 Total P Measured Load (kg/day)[c] | 2002 Measured Discharge (cfs) | 2002 Total P Measured Concentration (mg/L) | 2002 Total P Measured Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 0.6 | 0.291 | 0.41 | 0.7 | 0.343 | 0.66 |
| Standard Deviation | 0.4 | 0.066 | 0.23 | 0.5 | 0.160 | 0.70 |
| MAX | 1.4 | 0.400 | 0.76 | 1.7 | 0.570 | 2.21 |
| MIN | 0.1 | 0.170 | 0.04 | 0.3 | 0.180 | 0.15 |
| Count | 10 | 10 | 10 | 7 | 7 | 7 |

*a cubic feet per second*
*b milligrams per liter*
*c kilograms per day*

Appendix C-Table 48. Measured Suspended Solids Concentrations for Cove Creek[a], 2001-2003. Cove Creek

| | WY 2001 Total Suspended Solids (mg/L)[b] | WY 2002 Total Suspended Solids (mg/L) | WY 2003 Oct-Feb Total Suspended Solids (mg/L) |
|---|---|---|---|
| Average | 7.5 | 13.9 | 2.8 |
| standard deviation | 5.8 | 30.7 | 1.3 |
| MAX | 23 | 119.0 | 5.0 |
| MIN | 2 | 2 | 2 |
| count | 12 | 14 | 6 |

*a Analysis based on all available data (unless otherwise specified)* *b milligram per liter*

Appendix C-Table 49. Measured Suspended Sediment-Total Suspended Solids for Cove Creek[a]. Cove Creek

| | Measured Discharge (cfs)[a] | Measured Suspended Sediment - TSS Conc. (mg/L)[b] | Measured Suspended Sediment - TSS Load (kg/day)[c] |
|---|---|---|---|
| Average | 1.0 | 9 | 32.6 |
| standard deviation | 1.8 | 21 | 91.2 |
| Max | 10.0 | 119 | 486.1 |
| Min | 0 | 2 | 0 |
| count | 39 | 32 | 35 |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

## Weiser River, Little Weiser River to Galloway Dam

Appendix C-Table 50. Individual *E. coli* Results for Year 2000 and 2001. Weiser River USGS Gage 3266000 Bridge near Weiser, ID and at Midvale. Segment 6834, Weiser River, Little Weiser River to Galloway.

| Date | Idaho DEQ at Midvale E. coli (cfu/100ml)[a] | Idaho DEQ USGS Gage E. coli (cfu/100ml) | Date | USGS at USGS Gage Fecal coli (cfu/100ml) |
|---|---|---|---|---|
| 00/4/18 | 20 | 8 | 96/10/04 | 160 |
| 00/5/24 | 128 | 70 | 97/04/21 | 560 |
| 00/6/26 | 86 | 98 | 97/05/13 | 920 |
| 00/7/25 | 40 | 112 | 97/06/25 | 70 |
| 00/8/21 | 6 | 72 | 97/07/23 | 300 |
| 00/9/19 | 30 | 68 | 97/08/14 | 860 |
| 00/10/18 | 8 | 2 | 97/09/18 | 250 |
| 00/11/21 | 4 | 4 | 00/04/11 | 23 |
| 00/12/17 | 2 | 12 | 00/05/09 | 41 |
| 01/1/18 | 20 | 6 | 00/06/08 | 170 |
| 01/2/14 | 18 | 2 | 00/7/11 | 100 |
| 01/3/12 | 28 | 46 | 00/08/22 | 300 |
| 01/4/17 | 26 | 10 | 00/09/02 | 160 |
| 01/5/14 | 360 | 540 | | |
| 01/6/13 | 1120 | 70 | | |
| 01/7/19 | 160 | 28 | | |
| 01/8/14 | 640 | 270 | | |
| 01/9/11 | 40 | 292 | | |

*a colony forming units per 100 milliliters*

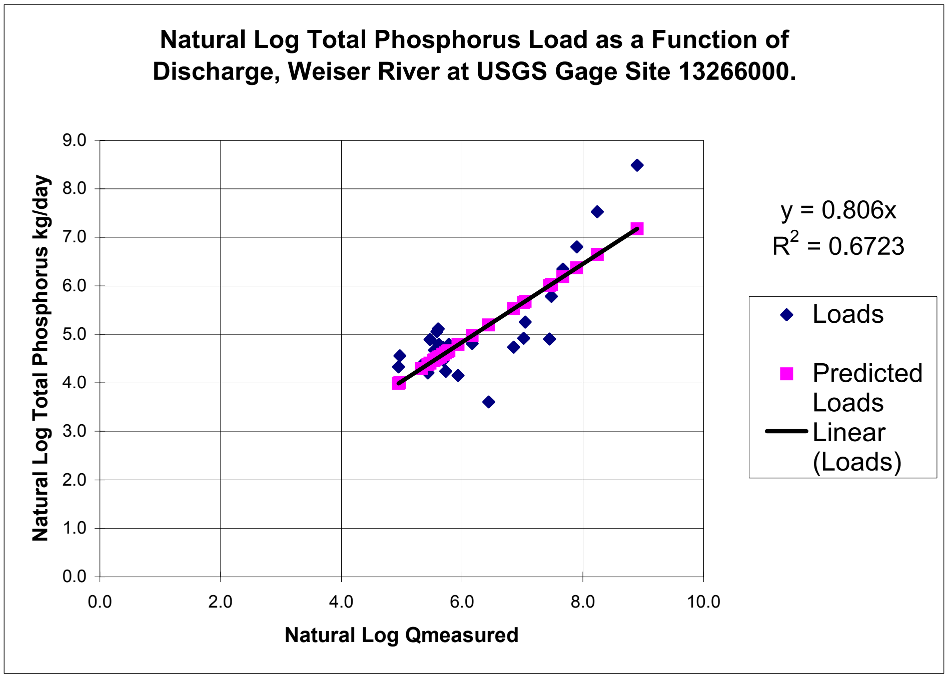


Figure 4. Regression Analysis for Total Phosphorus Load as a Function of Discharge. Weiser River at USGS Gage No. 13266000. Weiser River, Little Weiser River to Galloway Dam.

Further statistical analysis and comparison of measured and estimated total phosphorus concentrations and loads are presented in Appendix C-Table 51. Measured total phosphorus load and estimated total phosphorus load were analyzed to determine error or bias in calculations. Overall the estimated total phosphorus load provided a lower percent difference than the measured load.

Appendix C-Table 51. Measured and Normalized Total Phosphorus Concentrations, Discharge, and Total Phosphorus Load, USGS Gage No. 13266000. USGS Data 1996-1998 and 2000, DEQ Data 2000-2001[a]. Weiser River, Little Weiser River to Galloway Dam.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Concentration (mg/L)[c] | Measured Total Phosphorus Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Concentration (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 1,010 | 0.142 | 392.3 | 979 | 0.122 | 237.8 |
| Standard Deviation | 1,529 | 0.072 | 946.3 | 996 | 0.024 | 206.1 |
| Maximum | 7,340 | 0.270 | 4,847.8 | 2,646 | 0.151 | 573.6 |
| Minimum | 141 | 0.024 | 36.9 | 168 | 0.089 | 62.2 |
| Count | 28 | 28 | 28 | 28 | 28 | 28 |
| | | | | Square Root Error | | 1,625.0 |
| | | | | % Difference Measured | | 24.1% |
| | | | | % Difference Estimated | | 14.6% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 52. Measured Total Phosphorus Concentrations, Discharge, and Total Phosphorus Load, DEQ Data 2000-2001, May through September. Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.

| | Total Phosphorus Concentration (mg/L)[a] | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 0.064 | 456.1 | 80.4 |
| Standard Deviation | 0.016 | 784.5 | 144.4 |
| Maximum | 0.093 | 2183.0 | 416.5 |
| Minimum | 0.038 | 34.0 | 3.2 |
| Count | 10 | 10 | 10 |

*a milligrams per liter*
*b cubic feet per second*
*c kilograms per day*

Appendix C-Table 53. Measured Total Phosphorus Concentrations, Discharge and Total Phosphorus Load, Idaho DEQ Data 2000-2001, May through September. Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.

| | Total Phosphorus Concentration (mg/L)[a] | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 0.064 | 456.1 | 80.4 |
| Standard Deviation | 0.016 | 784.5 | 144.4 |
| Max | 0.093 | 2183.0 | 416.5 |
| Min | 0.038 | 34.0 | 3.2 |
| Count | 10 | 10 | 10 |

*a milligrams per liter*
*b cubic feet per second*
*c kilograms per day*

Appendix C-Table 54. Measured and Normalized Suspended Sediment-Solids Concentrations, Discharge and Suspended Sediment-Solids Loads USGS Gage Site 13266000. USGS Data 1996-1998 and 2000, Idaho DEQ Data 1983-1984 and 2000-2001[a]. Weiser River, Little Weiser River to Galloway Dam.

| | Measured Discharge (cfs)[b] | Measured Suspended Sediment-Solids Concentration (mg/L)[c] | Measured Suspended Sediment-Solids Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Suspended Sediment-Solids Concentration (mg/L) | Estimated Suspended Sediment-Solids Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 1340 | 45.6 | 3.57E+05 | 1251 | 31.1 | 1.43E+05 |
| Standard Deviation | 1702 | 71.5 | 1.19E+06 | 1050 | 19.0 | 1.49E+05 |
| Max | 7340 | 486.0 | 8.04E+06 | 2666 | 55.2 | 3.60E+05 |
| Min | 140 | 2.0 | 7.93E+02 | 164 | 9.8 | 3.91E+03 |
| count | 57 | 57 | 57 | 57 | 57 | 57 |
| | | | | | | |
| | | | | Square | Root Error | 1.54E+06 |
| | | | | % Difference | Measured | 23.3% |
| | | | | % Difference | Estimated | 9.3% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 55. Measured Suspended Solid Concentrations, Discharge and Suspended Solid Load, Idaho DEQ Data 2000-2001, May through September. Weiser River at Midvale, Idaho. Weiser River, Little Weiser River to Galloway Dam.

| | Total Suspended Solid Concentration (mg/L)[a] | Discharge (cfs)[b] | Total Suspended Solid Load (kg/day)[c] |
|---|---|---|---|
| Average | 10.1 | 635.4 | 3.75E+04 |
| STD | 12.0 | 909.1 | 7.19E+04 |
| Max | 40.0 | 3215.0 | 2.44E+05 |
| Min | 2.0 | 34.0 | 2.15E+02 |
| Count | 18 | 18 | 18 |

*a milligrams per liter*
*b cubic feet per second*
*c kilograms per day*

**Upper Weiser River**

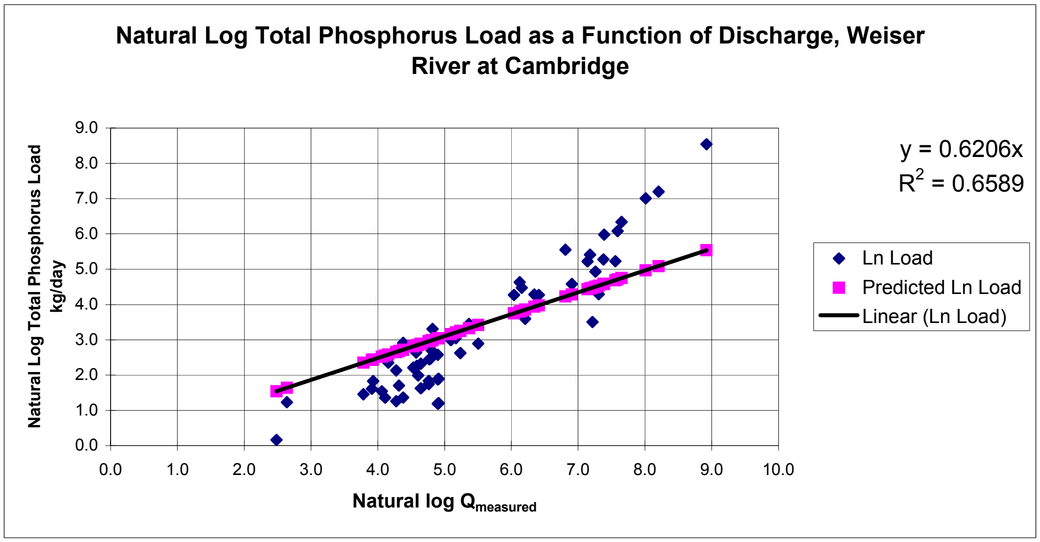


Figure 5. Regression Analysis for Total Phosphorus Load as a Function of Discharge. Weiser River at Cambridge.

Appendix C-Table 56. Measured and Normalized Total Phosphorus Concentrations, Discharges and Total Phosphorus Loads, Square Root Error and Percent Difference. Weiser River at Cambridge[a].

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Concentration (mg/L)[c] | Measured Total Phosphorus Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Concentration (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 656.2 | 0.054 | 186.3 | 631.8 | 0.049 | 48.2 |
| Standard Deviation | 1,185.9 | 0.044 | 690.7 | 638.6 | 0.020 | 33.4 |
| Maximum | 7,480.0 | 0.280 | 5,123.2 | 1,850.0 | 0.077 | 106.6 |
| Minimum | 12.0 | 0.010 | 1.2 | 80.3 | 0.024 | 15.2 |
| Count | 60 | 60 | 60 | 60 | 60 | 60 |
| | | | | | | |
| | | | | Square Root Error | | 449.1 |
| | | | | % Difference Measured | | 81.6% |
| | | | | % Difference Estimated | | 21.1% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 57. Estimated Total Phosphorus Concentrations, Discharge, and Total Phosphorus Loads, Weiser River near Cambridge, May through September.

| Month | Estimated Discharge (cfs)[a] | Estimated Total Phosphorus Load (kg/day)[b] | Estimated Total Phosphorus Concentration (mg/L)[c] |
|---|---|---|---|
| May | 1,725 | 94.0 | 0.026 |
| June | 827 | 64.3 | 0.032 |
| July | 155 | 21.7 | 0.063 |
| August | 84 | 15.6 | 0.076 |
| September | 131 | 24.2 | 0.063 |
| | | | |
| Overall | 523.6 | 40.8 | 0.057 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

## Crane Creek, Crane Creek Reservoir to Weiser River

Appendix C-Table 58. Total Phosphorus Concentrations, Discharge, and Total Phosphorus Load, USGS Gage No. 13265500. DEQ Data 1983-1984 and Idaho Department of Agriculture Data 2000-2002. Critical Period May-September. Crane Creek, Crane Creek Reservoir to Weiser River.

| | Total Phosphorus Concentration (mg/L)[a] | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 0.235 | 83 | 58.1 |
| Standard Deviation | 0.154 | 74 | 80.7 |
| Maximum | 0.960 | 202 | 406.3 |
| Minimum | 0.030 | 4 | 0.7 |

*a milligrams per liter*
*b cubic feet per second*
*c kilograms per day*

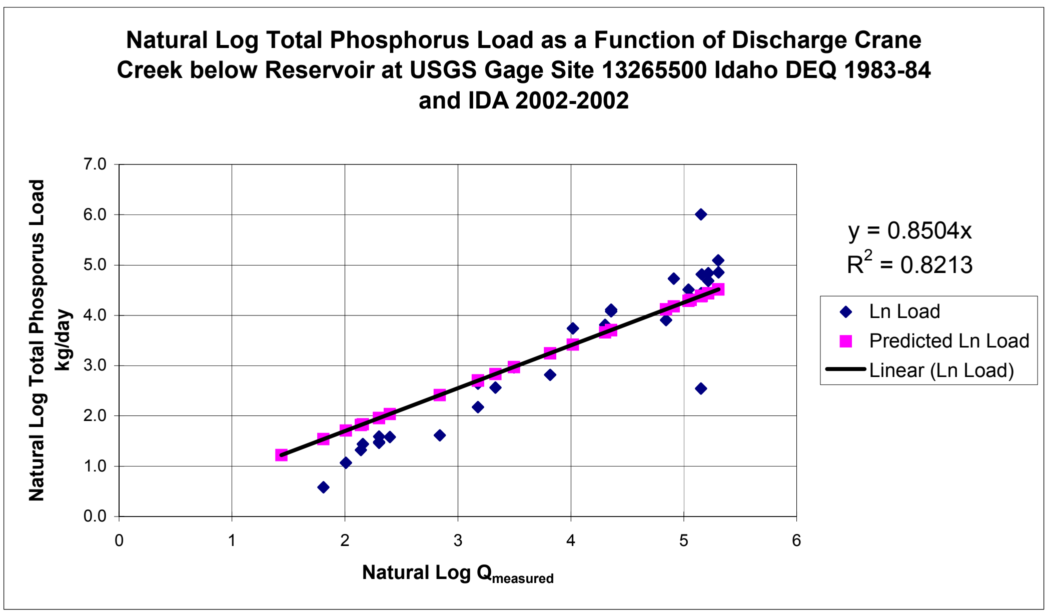


Figure 6. Regression Analysis for Total Phosphorus Load as a Function of Discharge. Crane Creek at USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.

Appendix C-Table 59. Measured and Normalized Total Phosphorus Concentrations, Load, and Discharge[a]. Crane Creek at USGS Gage No. 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Conc. (mg/L)[c] | Measured Total Phosphorus Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Conc. (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 83 | 0.235 | 58.1 | 75 | 0.224 | 38.2 |
| Standard Deviation | 74 | 0.154 | 80.7 | 49 | 0.026 | 21.9 |
| Maximum | 202 | 0.960 | 406.3 | 148 | 0.269 | 70.1 |
| Minimum | 4 | 0.030 | 0.7 | 16 | 0.194 | 10.7 |
| Count | 31 | 31 | 31 | 31 | 31 | 31 |
| | | | | | | |
| | | | | Square Root Error | | 240.4 |
| | | | | % Difference Measured | | 24.2% |
| | | | | % Difference Estimated | | 15.9% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 60. Estimated Total Phosphorus Concentrations, Discharge, and Total Phosphorus Loads USGS Gage No. 13265500, May through September. Crane Creek, Crane Creek Reservoir to Weiser River.

| Month | Total Phosphorus Estimated Discharge (cfs)[a] | Total Phosphorus Estimated Load (kg/day)[b] | Total Phosphorus Estimated Concentration (mg/L)[c] |
|---|---|---|---|
| May | 37 | 21.6 | 0.240 |
| June | 22 | 14.0 | 0.258 |
| July | 99 | 49.3 | 0.209 |
| August | 140 | 66.6 | 0.195 |
| September | 73 | 38.1 | 0.217 |
| | | | |
| Overall Average | 75 | 38.1 | 0.224 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

Appendix C-Table 61. Individual *E. coli* and Fecal coli Results for Year 2003 and 1983-1984. Crane Creek @ USGS Gage 3265500 Segment 2840, Crane Creek Reservoir to Weiser River.

| Date | Idaho DEQ Crane Creek Fecal Coli CFU[a]/100ml | Date | Idaho Department of Agriculture E. Coli CFU/100ml | Date | Idaho Department of Agriculture E. Coli CFU/100ml | Date | Idaho Department of Agriculture E. Coli CFU/100ml |
|---|---|---|---|---|---|---|---|
| 03/23/1983 | 30 | 04/10/2001 | 100 | 11/27/2001 | 100 | 09/05/2002 | 180 |
| 04/25/1983 | 160 | 04/24/2001 | 870 | 12/19/2001 | 20 | 09/19/2002 | 250 |
| 05/10/1983 | 600 | 05/07/2001 | 390 | 01/23/2002 | 20 | 10/03/2002 | 210 |
| 05/24/1983 | 90 | 05/22/2001 | 2400 | 02/19/2002 | 120 | 10/17/2002 | 270 |
| 06/07/1983 | 700 | 06/05/2001 | >6700 | 03/27/2002 | 240 | 10/31/2002 | 80 |
| 06/21/1983 | 2600 | 06/19/2001 | 500 | 04/09/2002 | 80 | 11/20/2002 | 140 |
| 07/06/1983 | 1000 | 06/28/2001 | 150 | 04/24/2002 | 20 | 12/18/2002 | 60 |
| 07/18/1983 | 600 | 07/17/2001 | 270 | 05/15/2002 | >2500 | 01/23/2003 | 20 |
| 08/02/1983 | 1900 | 08/01/2001 | 400 | 05/29/2002 | 350 | 02/20/2003 | 10 |
| 08/16/1983 | 800 | 08/15/2001 | 200 | 06/12/2002 | 360 | | |
| 08/31/1983 | 700 | 08/30/2001 | <100 | 06/26/2002 | >2500 | | |
| 09/15/1983 | 120 | 09/13/2001 | 300 | 07/11/2002 | 240 | | |
| 10/11/1983 | 800 | 09/27/2001 | 1400 | 07/24/2002 | 520 | | |
| 12/21/1983 | 140 | 10/10/2001 | | 08/08/2002 | <10 | | |
| 03/28/1984 | 10 | 10/25/2001 | 100 | 08/21/2002 | 80 | | |

*a CFU-Colony Forming Units*

Appendix C-Table 62. Measured and Normalized Total Phosphorus Concentrations, Discharge[a] Crane Creek at USGS Gage 13265500. Crane Creek, Crane Creek Reservoir to Weiser River.

| | Measured Discharge (cfs)[a] | Measured Total Phosphorus Concentration (mg/L)[b] | Measured Total Phosphorus Load (kg/day)[c] | Estimated Discharge (cfs) | Estimated Total Phosphorus Concentration (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 83 | 0.235 | 58.1 | 75 | 0.224 | 38.2 |
| Standard Deviation | 74 | 0.154 | 80.7 | 49 | 0.026 | 21.9 |
| Max | 202 | 0.960 | 406.3 | 148 | 0.269 | 70.1 |
| Min | 4 | 0.030 | 0.7 | 16 | 0.194 | 10.7 |
| Count | 31 | 31 | 31 | 31 | 31 | 31 |
| | | | | | | |
| | | | | Square | Root Error | 240.4 |
| | | | | % Difference | Measured | 24.2% |
| | | | | % Difference | Estimated | 15.9% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 63. Measured and Normalized Suspended Sediment Concentrations, Discharge, Suspended Sediment Loads and Probable Error at USGS Gage Site 13265500[a]. Crane Creek, Crane Creek Reservoir to Weiser River.

| | Measured Discharge (cfs)[a] | Measured Suspended Sediment-Solids Concentration (mg/L)[b] | Measured Suspended Sediment-Solids Load (kg/day)[c] | Estimated Discharge (cfs) | Estimated Suspended Sediment-Solids Concentration (mg/L) | Estimated Suspended Sediment-Solids Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 280 | 64.8 | 2.11E+05 | 96 | 29.2 | 1.04E+04 |
| Standard Deviation | 724 | 109.4 | 1.19E+06 | 72 | 20.7 | 1.25E+04 |
| Max | 4510 | 673.0 | 7.42E+06 | 249 | 72.6 | 4.43E+04 |
| Min | 7 | 2.0 | 4.89E+01 | 8 | 2.8 | 5.41E+01 |
| count | 39 | 39 | 39 | 39 | 39 | 39 |
| | | | | | | |
| | | | | Square | Root Error | 9.95E+04 |
| | | | | % Difference | Measured | 212.4% |
| | | | | % Difference | Estimated | 10.4% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 64. Individual *E. coli* and Fecal coli Results for Year 2003 and 1983-1984. Crane Creek @ USGS Gage 3265500.

| Date | Idaho DEQ Crane Creek Fecal Coli CFU[a]/100ml | Date | Idaho Department of Agriculture E. Coli CFU/100ml | Date | Idaho Department of Agriculture E. Coli CFU/100ml | Date | Idaho Department of Agriculture E. Coli CFU[a]/100ml |
|---|---|---|---|---|---|---|---|
| 03/23/1983 | 30 | 04/10/2001 | 100 | 11/27/2001 | 100 | 09/05/2002 | 180 |
| 04/25/1983 | 160 | 04/24/2001 | 870 | 12/19/2001 | 20 | 09/19/2002 | 250 |
| 05/10/1983 | 600 | 05/07/2001 | 390 | 01/23/2002 | 20 | 10/03/2002 | 210 |
| 05/24/1983 | 90 | 05/22/2001 | 2400 | 02/19/2002 | 120 | 10/17/2002 | 270 |
| 06/07/1983 | 700 | 06/05/2001 | >6700 | 03/27/2002 | 240 | 10/31/2002 | 80 |
| 06/21/1983 | 2600 | 06/19/2001 | 500 | 04/09/2002 | 80 | 11/20/2002 | 140 |
| 07/06/1983 | 1000 | 06/28/2001 | 150 | 04/24/2002 | 20 | 12/18/2002 | 60 |
| 07/18/1983 | 600 | 07/17/2001 | 270 | 05/15/2002 | >2500 | 01/23/2003 | 20 |
| 08/02/1983 | 1900 | 08/01/2001 | 400 | 05/29/2002 | 350 | 02/20/2003 | 10 |
| 08/16/1983 | 800 | 08/15/2001 | 200 | 06/12/2002 | 360 | | |
| 08/31/1983 | 700 | 08/30/2001 | <100 | 06/26/2002 | >2500 | | |
| 09/15/1983 | 120 | 09/13/2001 | 300 | 07/11/2002 | 240 | | |
| 10/11/1983 | 800 | 09/27/2001 | 1400 | 07/24/2002 | 520 | | |
| 12/21/1983 | 140 | 10/10/2001 | | 08/08/2002 | <10 | | |
| 03/28/1984 | 10 | 10/25/2001 | 100 | 08/21/2002 | 80 | | |

*a CFU-Colony Forming Units*

## Little Weiser River

Appendix C-Table 65. Individual Sampling *E. coli* Results. Little Weiser River, Indian Valley to Weiser River.

| Date | Station Location | *E. coli* Results CFU[a]/100ml |
|---|---|---|
| 7/19/20022[b] | BURPID2002BOIA015[c] | 460 |
| | | |
| 8/01/2002 | BURPID2002BOIA015 | 350 |
| 8/05/2002 | BURPID2002BOIA015 | 700 |
| 8/09/2002 | BURPID2002BOIA015 | 620 |
| 8/14/2002 | BURPID2002BOIA015 | 1600 |
| 8/19/2002 | BURPID2002BOIA015 | 520 |

*a CFU-Colony Forming Units*
*b First Sampling Event*
*c BURPID2002BOIA015 is located 50 meters Upstream of Confluence with Weiser River*

Appendix C-Table 66. Measured and Normalized Total Phosphorus Concentrations, Discharge and Total Phosphorus Load. Square Root Error and Percent Difference[a]. Little Weiser River near Confluence with Weiser River. Little Weiser River, Indian Valley to Weiser River.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Conc. (mg/L)[c] | Measured Total Phosphorus Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Conc. (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 65.7 | 0.102 | 13.7 | 254.1 | 0.116 | 24.9 |
| Standard Deviation | 107.0 | 0.026 | 21.0 | 319.4 | 0.099 | 24.3 |
| Max | 347.0 | 0.129 | 71.3 | 919.0 | 0.342 | 68.7 |
| Min | 2.3 | 0.049 | 0.4 | 1.6 | 0.031 | 1.3 |
| count | 10 | 10 | 10 | 10 | 10 | 10 |
| | | | | | | |
| | | | | Square Root Error | | 102.8 |
| | | | | % Difference Measured | | 13.3% |
| | | | | % Difference Estimated | | 24.2% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 67. Estimated Total Phosphorus Concentrations, Discharge and Total Phosphorus Loads Little Weiser River, May through September. Little Weiser River, Indian Valley to Weiser River.

| Month | Estimated Discharge (cfs)[a] | Estimated Load (kg/day)[b] | Estimated Concentration (mg/L)[c] |
|---|---|---|---|
| May | 392.8 | 40.3 | 0.043 |
| June | 234.0 | 28.9 | 0.053 |
| July | 34.9 | 8.5 | 0.123 |
| August | 3.7 | 2.2 | 0.268 |
| September | 2.8 | 1.7 | 0.339 |
| | | | |
| Overall | 133.8 | 16.4 | 0.165 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

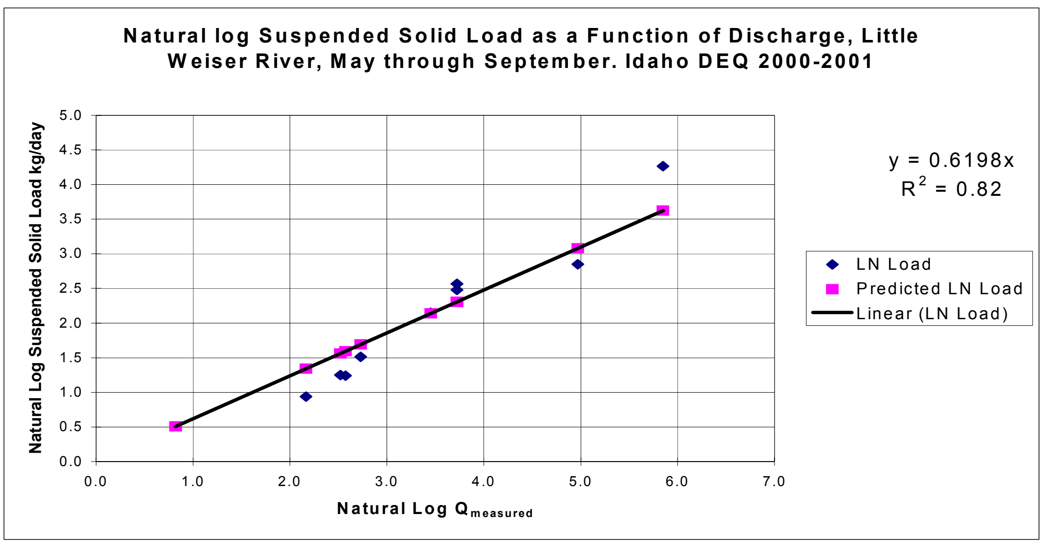


Figure 7. Regression Analysis for Total Phosphorus Load as a Function of Discharge. Little Weiser River near Confluence with Weiser River. Little Weiser River, Indian Valley to Weiser River.

Appendix C-Table 68. Estimated Total Phosphorus Concentrations, Discharge, and Total Phosphorus Loads, Little Weiser River, May through September. Little Weiser River, Indian Valley to Weiser River.

| Month | Estimated Discharge (cfs)[a] | Total Phosphorus Estimated Load (kg/day)[b] | Total Phosphorus Estimated Concentration (mg/L)[c] |
|---|---|---|---|
| May | 392.8 | 40.3 | 0.043 |
| June | 234.0 | 28.9 | 0.053 |
| July | 34.9 | 8.5 | 0.123 |
| August | 3.7 | 2.2 | 0.268 |
| September | 2.8 | 1.7 | 0.339 |
| | | | |
| Overall Average | 133.8 | 16.4 | 0.165 |

*a cubic feet per second*
*b kilograms per day*
*c milligrams per liter*

Appendix C-Table 69. Measured and Normalized Suspended Sediment Concentrations, Discharge, Suspended Sediment Loads and Probable Error[a]. Little Weiser River, Indian Valley to Weiser River.

| | Measured Discharge (cfs)[b] | Measured Suspended Sediment-Solids Concentration (mg/L)[c] | Measured Suspended Sediment-Solids Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Suspended Sediment-Solids Concentration (mg/L) | Estimated Suspended Sediment-Solids Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 94.8 | 14.5 | 8.69E+03 | 221 | 27.1 | 2.92E+04 |
| standard deviation | 133.7 | 18.4 | 1.87E+04 | 247 | 25.6 | 5.17E+04 |
| Max | 382.6 | 63.0 | 5.90E+04 | 919 | 93.0 | 2.09E+05 |
| Min | 2.3 | 2.0 | 1.11E+01 | 2 | 0.6 | 2.33E+00 |
| count | 18 | 18 | 18 | 18 | 18 | 18 |
| | | | | | | |
| | | | | Square | Root Error | 2.40E+05 |
| | | | | % Difference | Measured | 3.6% |
| | | | | % Difference | Estimated | 12.2% |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

## Weiser River
## West Fork Weiser River to Little Weiser River

Appendix C-Table 70. Individual Sampling *E. coli* Results for 2003. Weiser River, West Fork Weiser River to Little Weiser River

| Date | Station Location | *E. coli* Results CFU[a]/100ml |
|---|---|---|
| 06/03/2003 | USGS Gage near Cambridge, Idaho | 110 |
| 06/18/2003 | USGS Gage near Cambridge, Idaho | 55 |
| 06/26/2003 | USGS Gage near Cambridge, Idaho | 36 |
| 06/30/2003 | USGS Gage near Cambridge, Idaho | 20 |
| 07/08/2003 | USGS Gage near Cambridge, Idaho | 58 |
| 07/15/2003 | USGS Gage near Cambridge, Idaho | 56 |
| 07/21/2003 | USGS Gage near Cambridge, Idaho | 36 |

*a CFU-Colony Forming Units2 First Sampling Event 3 BURPID2002BOIA015 is located 50 meters Upstream of Confluence with Weiser River*

Appendix C-Table 71. Measured and Normalized Total Phosphorus Concentrations, Discharge and Total Phosphorus Load. Square Root Error and Percent Difference[a]. Weiser River at Cambridge.

| | Measured Discharge (cfs)[b] | Measured Total Phosphorus Conc. (mg/L)[c] | Measured Total Phosphorus Load (kg/day)[d] | Estimated Discharge (cfs) | Estimated Total Phosphorus Conc. (mg/L) | Estimated Total Phosphorus Load (kg/day) |
|---|---|---|---|---|---|---|
| Average | 656.2 | 0.054 | 186.3 | 631.8 | 0.049 | 48.2 |
| Standard Deviation | 1185.9 | 0.044 | 690.7 | 638.6 | 0.020 | 33.4 |
| Max | 7480.0 | 0.280 | 5123.2 | 1850.0 | 0.077 | 106.6 |
| Min | 12.0 | 0.010 | 1.2 | 80.3 | 0.024 | 15.2 |
| Count | 60 | 60 | 60 | 60 | 60 | 60 |
| | | | | | | |
| | | | | Square | Root Error | 449.1 |
| | | | | % Difference | Measured | 81.6% |
| | | | | % Difference | Estimated | 21.1% |

*a Analysis on all Critical Period Data (May-September)*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 72. Measured Discharge, Total Suspended Solid Concentrations, Discharge and Total Suspended Solid Loads, Weiser River, West Fork Weiser River to Little Weiser River.

| | Suspended Sediment-Solids Concentration (mg/L)[b] | Discharge (cfs)[c] | Suspended Sediment-Solids Load (kg/day)[d] |
|---|---|---|---|
| Average | 48.3 | 1006.7 | 2.58E+05 |
| Standard Deviation | 83.5 | 1307.2 | 6.61E+05 |
| Max | 379.0 | 4680.0 | 3.71E+06 |
| Min | 1.000 | 14.0 | 1.37E+02 |
| Count | 45 | 45 | 45 |

*a Analysis based on all available data*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

Appendix C-Table 73. Normalized Total Suspended Solids Concentrations, Discharge and Total Suspended Solid Loads, Weiser River, West Fork Weiser River to Little Weiser River.

| | Suspended Sediment-Solids Concentration (mg/L)[b] | Discharge (cfs)[c] | Suspended Sediment-Solids Load (kg/day)[d] |
|---|---|---|---|
| Average | 23.4 | 784.6 | 6.69E+04 |
| Standard Deviation | 14.1 | 653.7 | 7.21E+04 |
| Max | 43.6 | 1812.0 | 1.93E+05 |
| Min | 6.3 | 80.5 | 1.24E+03 |
| Count | 45 | 45 | 45 |

*a Analysis based on all available data*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

## South Crane Creek

Appendix C-Table 74. Measured Discharge, Total Phosphorus Concentration and Loads for Lower South Crane Creek, 2001-2003[a]. Idaho Department of Agriculture, South Crane Creek, Headwaters to Crane Creek Reservoir.

| | Total Phosphorus Concentration (mg/L)[a] | Discharge (cfs)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 11.1 | 0.132 | 3.7 |
| Standard Deviation | 13.8 | 0.027 | 4.7 |
| MAX | 38.0 | 0.190 | 14.0 |
| MIN | 0.1 | 0.090 | 0.0 |
| Count | 17 | 17 | 17 |

*a Analysis based on all available data*
*b milligrams per liter*
*c cubic feet per second*
*d kilograms per day*

Appendix C-Table 75. Measured Discharge, Total Phosphorus Concentration and Loads for Upper South Crane Creek, 2001-2003[a]. Idaho Department of Agriculture South Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[b] | Total Phosphorus Concentration (mg/L)[c] | Total Phosphorus Load (kg/day)[d] |
|---|---|---|---|
| Average | 6.7 | 0.119 | 1.9 |
| Standard Deviation | 5.8 | 0.035 | 1.5 |
| MAX | 17.3 | 0.180 | 4.7 |
| MIN | 0.5 | 0.080 | 0.1 |
| Count | 10 | 10 | 10 |

*a Analysis based on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 76. Measured Suspended Solids Concentrations for Lower South Crane Creek, 2001-2003[a]. Idaho Department of Agriculture South Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[b] | Total Suspended Solid Concentration (mg/L)[c] | Total Suspended Solid Load (kg/day)[d] |
|---|---|---|---|
| Average | 11.1 | 4.8 | 1.64E+02 |
| Standard Deviation | 13.8 | 3.6 | 3.23E+02 |
| MAX | 38.0 | 14.0 | 1.30E+03 |
| MIN | 0.1 | 2.0 | 1.22E+00 |
| Count | 17 | 17 | 17 |

*a Analysis baesd on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

Appendix C-Table 77. Measured Suspended Solids Concentrations for Upper South Crane Creek, 2001-2003[a]. Idaho Department of Agriculture South Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[b] | Total Suspended Solid Concentration (mg/L)[c] | Total Suspended Solid Load (kg/day)[d] |
|---|---|---|---|
| Average | 6.7 | 4.2 | 8.84E+01 |
| Standard Deviation | 5.8 | 3.6 | 1.19E+02 |
| MAX | 17.3 | 11.0 | 3.85E+02 |
| MIN | 0.5 | 1.0 | 1.32E+00 |
| Count | 10 | 10 | 10 |

*a Analysis baesd on all available data*
*b cubic feet per second*
*c milligrams per liter*
*d kilograms per day*

## North Crane Creek

Appendix C-Table 78. Measured Suspended Solids Concentrations for Lower North Crane Creek, April 2001 through June 2001, January 2002 through June 2002 and December 2002 through February 2003. Idaho Department of Agriculture North Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[a] | Total Suspended Solid Concentration (mg/L)[b] | Total Suspended Solid Load (kg/day)[c] |
|---|---|---|---|
| Average | 69.6 | 10 | 3.32E+03 |
| Standard Deviation | 74.2 | 13 | 6.58E+03 |
| MAX | 196.5 | 44 | 2.11E+04 |
| MIN | 2.0 | 2 | 1.06E+01 |
| Count | 10 | 10 | 10 |

*a cubic feet per second*
*b milligrams per liter*
*c kilograms per day*

Appendix C-Table 79. Measured Suspended Solids Concentrations for Upper North Crane Creek, April 2001 through June 2001, January 2002 through July 2002 and December 2002 through February 2003. Idaho Department of Agriculture North Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[a] | Total Suspended Solid Concentration (mg/L)[b] | Total Suspended Solid Load (kg/day)[c] |
|---|---|---|---|
| Average | 10.5 | 5 | 2.38E+02 |
| Standard Deviation | 14.7 | 6 | 4.62E+02 |
| MAX | 46.2 | 18 | 1.55E+03 |
| MIN | 0.13 | 2 | 6.12E-01 |
| Count | 20 | 20 | 20 |

*a cubic feet per second*
*b milligrams per liter*
*c kilograms per day*

Appendix C-Table 80. Measured Discharge, Total Phosphorus Concentration and Loads for Lower North Crane Creek, April 2001 through June 2001, January 2002 through June 2002 and December 2002 through February. Idaho Department of Agriculture North Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[a] | Total Phosphorus Concentration (mg/L)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 69.6 | 0.084 | 14.9 |
| Standard Deviation | 74.2 | 0.028 | 19.3 |
| MAX | 196.5 | 0.130 | 62.5 |
| MIN | 2.0 | 0.050 | 0.4 |
| Count | 10 | 10 | 10 |

*a cubic feet per second*
*b milligrams per liter*
*c kilograms per day*

Appendix C-Table 81. Measured Discharge, Total Phosphorus Concentration and Loads for Upper North Crane Creek, April 2001 through June 2001, January 2002 through July 2002 and December 2002 through February 2003. Idaho Department of Agriculture North Crane Creek, Headwaters to Crane Creek Reservoir.

| | Discharge (cfs)[a] | Total Phosphorus Concentration (mg/L)[b] | Total Phosphorus Load (kg/day)[c] |
|---|---|---|---|
| Average | 10.5 | 0.068 | 1.96 |
| Standard Deviation | 14.7 | 0.024 | 2.76 |
| MAX | 46.2 | 0.120 | 9.29 |
| MIN | 0.13 | 0.050 | 0.02 |
| Count | 20 | 20 | 20 |

*a cubic feet per second*
*b milligrams per liter*
*c kilograms per day*

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# Appendix C-Table 82

TSS Model Validation
USGS Gage at Cambridge 2000-2001 Idaho DEQ Data
USGS Discharge Data Period of Record 1952-2002

| | | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|---|
| | 00/4/18 | 25 | 625.0 | 61.8 | 3817.9 | 1544.7 |
| | 00/5/24 | 25 | 625.0 | 55.8 | 3112.3 | 1394.7 |
| | 00/6/26 | 5 | 25.0 | 18.9 | 356.9 | 94.5 |
| | 00/7/25 | 2 | 4.0 | 3.6 | 13.3 | 7.3 |
| | 00/8/22 | 4 | 16.0 | 2.8 | 7.8 | 11.1 |
| | 00/9/19 | 4 | 16.0 | 3.1 | 9.6 | 12.4 |
| | 00/10/18 | 3 | 9.0 | 3.6 | 12.8 | 10.7 |
| | 00/11/20 | 1 | 1.0 | 7.5 | 55.8 | 7.5 |
| | 00/12/17 | 2 | 4.0 | 11.7 | 137.6 | 23.5 |
| | 01/1/17 | 4 | 16.0 | 22.9 | 525.1 | 91.7 |
| | 01/2/13 | 3 | 9.0 | 20.2 | 408.9 | 60.7 |
| | 01/3/12 | 21 | 441.0 | 39.8 | 1580.9 | 835.0 |
| | 01/4/16 | 25 | 625.0 | 58.9 | 3464.1 | 1471.4 |
| | 01/5/14 | 14 | 196.0 | 59.3 | 3516.5 | 830.2 |
| | 01/6/13 | 11 | 121.0 | 32.3 | 1045.0 | 355.6 |
| | 01/7/18 | 4 | 16.0 | 5.0 | 25.1 | 20.1 |
| | 01/8/14 | 8 | 64.0 | 2.7 | 7.5 | 22.0 |
| | 01/9/11 | 3 | 9.0 | 12.0 | 144.9 | 36.1 |
| Sum of | | 164.0 | 2822.0 | 422.0 | 18242.0 | 6829.0 |
| Average | | 9.1 | 156.8 | 23.4 | 1013.4 | 379.4 |
| Count | | 18 | 18 | 18 | 18 | 18 |

| | |
|---|---|
| Percent Difference Measured | 6.9% |
| Percent Difference Predicted | 17.8% |
| Root Mean Sq. | 131 |

| | |
|---|---|
| SumXi2= | 1.64E+02 |
| Sx2= | 2.69E+04 |
| Sx2/n= | 1.49E+03 |
| Sxx= | -1.33E+03 |
| SumYi2= | 4.22E+02 |
| Sy2= | 1.82E+04 |
| Sy2/n= | 1.01E+03 |
| Syy= | 1.72E+04 |
| Sx= | 1.64E+02 |
| Sx*Sy= | 6.83E+03 |
| (Sx*Sy)/n= | 3.79E+02 |
| Sxy= | -2.15E+02 |
| b1= | 1.62E-01 |
| bo= | |
| Sx= | 2.69E+04 |
| b1 | 1.62E-01 |
| Sxy2 | 4.64E+04 |
| Sxx | -1.33E+03 |
| Sxy2/Sxx | -3.49E+01 |
| b1*(Sxy/Sxx) | 4.64E+04 |
| bo= | 1.99E+02 |
| SEE | |
| Syy | 1.72E+04 |
| Sxy2 | 4.64E+04 |

| | |
|---|---|
| Sxy2/Sxx | -3.49E+01 |
| SEE= | 1.73E+04 |
| Sqr root error | 1.31E+02 |

# Appendix C-Table 83

TSS model Validation
USGS Gage at Crane Creek, 2001-2002 IDA Data
USGS Gage 1911-2002

| | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|
| 04/10/2001 | 78 | 6,051 | 10,498 | 110,201,846 | 816,593 |
| 04/24/2001 | 8 | 57 | 1,727 | 2,980,819 | 13,050 |
| 05/07/2001 | 21 | 424 | 1,099 | 1,208,128 | 22,639 |
| 05/22/2001 | 146 | 21,255 | 712 | 507,512 | 103,861 |
| 06/05/2001 | 30 | 891 | 402 | 161,586 | 11,996 |
| 06/19/2001 | 2,226 | 4,955,088 | 191 | 36,512 | 425,345 |
| 06/28/2001 | 8,478 | 71,882,918 | 637 | 405,421 | 5,398,408 |
| 07/17/2001 | 5,417 | 29,338,743 | 7,551 | 57,023,587 | 40,902,327 |
| 08/01/2001 | 15,779 | 248,974,772 | 11,530 | 132,936,655 | 181,928,210 |
| 08/15/2001 | 8,580 | 73,610,400 | 12,140 | 147,377,452 | 104,156,196 |
| 08/30/2001 | 21,291 | 453,321,533 | 7,926 | 62,827,460 | 168,763,267 |
| 09/13/2001 | 6,528 | 42,618,744 | 4,051 | 16,410,791 | 26,446,309 |
| 09/27/2001 | 2,180 | 4,750,332 | 996 | 992,682 | 2,171,536 |
| 10/25/2001 | 27 | 724 | 79 | 6,254 | 2,128 |
| 11/27/2001 | 69 | 4,826 | 198 | 39,106 | 13,738 |
| 12/19/2001 | 88 | 7,755 | 1,424 | 2,029,058 | 125,439 |
| 01/23/2002 | 108 | 11,584 | 8,702 | 75,721,732 | 936,585 |
| 02/19/2002 | 308 | 94,997 | 28,289 | 800,246,305 | 8,719,000 |
| 03/27/2002 | 954 | 910,118 | 37,372 | 1,396,695,171 | 35,653,298 |
| 04/09/2002 | 3,339 | 11,148,948 | 13,243 | 175,376,115 | 44,218,313 |
| 04/24/2002 | 763 | 582,476 | 1,727 | 2,980,819 | 1,317,670 |
| 05/15/2002 | 127 | 16,118 | 1,292 | 1,668,635 | 163,996 |
| 05/29/2002 | 215 | 46,338 | 484 | 233,939 | 104,116 |
| 06/12/2002 | 125 | 15,564 | 402 | 161,586 | 50,148 |
| 06/26/2002 | 587 | 344,660 | 411 | 169,256 | 241,528 |
| 07/11/2002 | 9,858 | 97,180,399 | 3,725 | 13,876,785 | 36,722,629 |
| 07/24/2002 | 11,365 | 129,159,690 | 10,354 | 107,204,680 | 117,671,251 |
| 08/08/2002 | 10,049 | 100,978,625 | 11,833 | 140,020,389 | 118,907,806 |
| 08/21/2002 | 11,918 | 142,031,000 | 11,082 | 122,809,198 | 132,070,864 |
| 09/05/2002 | 9,540 | 91,011,820 | 5,915 | 34,983,623 | 56,426,263 |
| 09/19/2002 | 8,777 | 77,032,404 | 2,492 | 6,208,463 | 21,868,992 |
| 10/03/2002 | 1,399 | 1,957,765 | 540 | 291,228 | 755,087 |
| 10/17/2002 | 147 | 21,541 | 257 | 66,306 | 37,793 |
| 10/31/2002 | 13 | 162 | 91 | 8,310 | 1,160 |
| 11/20/2002 | 178 | 31,800 | 43 | 1,822 | 7,612 |
| 12/18/2002 | 37 | 1,382 | 871 | 758,853 | 32,390 |
| 01/23/2003 | 95 | 9,101 | 8,702 | 75,721,732 | 830,155 |
| 02/20/2003 | 176 | 31,019 | 25,162 | 633,114,923 | 4,431,575 |
| | 141,023 | 1,582,112,025 | 234,149 | 4,123,464,737 | 1,112,469,274 |
| | 3,711 | 41,634,527 | 6,162 | 108,512,230 | 29,275,507 |
| | 38 | 38 | 38 | 38 | 38 |

| | |
|---|---|
| Percent Difference Measured | 5.9% |
| Percent Difference Predicted | 9.7% |
| Square Root Error | 63,376 |

| | |
|---|---|
| SumXi2= | 1.41E+05 |
| Sx2= | 1.99E+10 |
| Sx2/n= | 5.23E+08 |
| Sxx= | -5.23E+08 |
| SumYi2= | 2.34E+05 |
| Sy2= | 4.12E+09 |
| Sy2/n= | 1.09E+08 |
| Syy= | 4.01E+09 |
| Sx= | 1.41E+05 |
| Sx*Sy= | 1.11E+09 |
| (Sx*Sy)/n = | 2.93E+07 |
| Sxy= | -2.91E+07 |
| b1= | 5.57E-02 |

| | |
|---|---|
| bo= | |
| Sx= | 1.99E+10 |
| b1 | 5.57E-02 |
| Sxy2 | 8.49E+14 |
| Sxx | -5.23E+08 |
| Sxy2/Sxx | -1.62E+06 |
| b1*(Sxy/Sxx) | 8.49E+14 |
| bo= | 1.76E+06 |
| | |
| SEE | |
| Syy | 4.01E+09 |
| Sxy2 | 8.49E+14 |
| Sxy2/Sxx | -1.62E+06 |
| SEE= | 4.02E+09 |
| | |
| Sqr root error | 6.34E+04 |

## Appendix C-Table 84

TSS Model Validation
USGS Gage near Weiser 2000-2001 Idaho DEQ Data
USGS Discharge Data 1952-2002

| | | Sediment Monitored (kg/day) | USGS Gage | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|---|
| | 04/18/2000 | 2.72E+05 | 7.41E+10 | 4.94E+05 | 2.44E+11 | 1.34E+11 |
| | 05/24/2000 | 2.04E+05 | 4.15E+10 | 5.35E+05 | 2.86E+11 | 1.09E+11 |
| | 06/26/2000 | 1.93E+04 | 3.72E+08 | 3.71E+05 | 1.37E+11 | 7.15E+09 |
| | 07/26/2000 | 1.20E+04 | 1.43E+08 | 1.13E+04 | 1.28E+08 | 1.36E+08 |
| | 08/21/2000 | 9.89E+02 | 9.79E+05 | 8.77E+03 | 7.69E+07 | 8.68E+06 |
| | 09/18/2000 | 4.24E+03 | 1.79E+07 | 6.15E+03 | 3.78E+07 | 2.60E+07 |
| | 10/19/2000 | 2.88E+03 | 8.27E+06 | 5.92E+03 | 3.51E+07 | 1.70E+07 |
| | 11/21/2000 | 1.51E+03 | 2.27E+06 | 1.49E+04 | 2.23E+08 | 2.25E+07 |
| | 12/20/2000 | 9.74E+03 | 9.48E+07 | 5.27E+04 | 2.78E+09 | 5.13E+08 |
| | 01/18/2001 | 1.47E+04 | 2.16E+08 | 1.45E+05 | 2.11E+10 | 2.13E+09 |
| | 02/14/2001 | 1.74E+04 | 3.04E+08 | 1.41E+05 | 1.98E+10 | 2.45E+09 |
| | 03/13/2001 | 2.16E+05 | 4.68E+10 | 4.67E+05 | 2.18E+11 | 1.01E+11 |
| | 04/17/2001 | 2.04E+05 | 4.14E+10 | 4.87E+05 | 2.37E+11 | 9.91E+10 |
| | 05/16/2001 | 1.37E+05 | 1.89E+10 | 5.19E+05 | 2.69E+11 | 7.14E+10 |
| | 06/13/2001 | 5.63E+04 | 3.17E+09 | 2.61E+05 | 6.83E+10 | 1.47E+10 |
| | 07/19/2001 | 5.93E+04 | 3.51E+09 | 1.48E+04 | 2.18E+08 | 8.75E+08 |
| | 08/14/2001 | 5.28E+03 | 2.79E+07 | 8.83E+03 | 7.81E+07 | 4.66E+07 |
| | 09/12/2001 | 1.31E+04 | 1.73E+08 | 6.32E+03 | 3.99E+07 | 8.30E+07 |
| Sum of | | 1.3E+06 | 2.3E+11 | 3.5E+06 | 1.5E+12 | 5.4E+11 |
| Average | | 6.9E+04 | 1.3E+10 | 2.0E+05 | 8.4E+10 | 3.0E+10 |
| Count | | 18 | 18 | 18 | 18 | 18 |

| | |
|---|---|
| Percent Difference Measured | 5.8% |
| Percent Difference Predicted | 16.5% |
| Sqr root error | 1,196,632 |

| | |
|---|---|
| SumXi2= | 1.25E+06 |
| Sx2= | 1.56E+12 |
| Sx2/n= | 8.68E+10 |
| Sxx= | -8.68E+10 |
| SumYi2= | 3.55E+06 |
| Sy2= | 1.51E+12 |
| Sy2/n= | 8.36E+10 |
| Syy= | 1.42E+12 |
| Sx= | 1.25E+06 |
| Sx*Sy= | 5.43E+11 |
| (Sx*Sy)/n= | 3.02E+10 |
| Sxy= | -3.02E+10 |
| b1= | 3.48E-01 |
| bo= | |
| Sx= | 1.56E+12 |
| b1 | 3.48E-01 |
| Sxy2 | 9.11E+20 |
| Sxx | -8.68E+10 |
| Sxy2/Sxx | -1.05E+10 |
| b1*(Sxy/Sxx) | 9.11E+20 |
| bo= | 1.05E+10 |
| SEE | |
| Syy | 1.42E+12 |
| Sxy2 | 9.11E+20 |
| Sxy2/Sxx | -1.05E+10 |

| | |
|---|---|
| SEE= | 1.43E+12 |
| Sqr root error | 1.20E+06 |

# Appendix C-Table 85

TSS Model Validation
Actual Monitored data USBR 1987-1989 and Idaho DEQ 2000-2001
USGS Discharge Data 1952-2002
Estimated Average Discharge at Snake

| | Sediment Monitored (kg/day) | USGS Gage | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|
| 10/13/1987 | 1,585 | 2,512,572 | 6,090 | 37,084,716 | 9,652,877 |
| 10/13/1987 | 1,585 | 2,512,572 | 6,090 | 37,084,716 | 9,652,877 |
| 11/10/1987 | 783 | 612,729 | 9,735 | 94,776,206 | 7,620,508 |
| 12/08/1987 | 11,037 | 121,816,682 | 33,325 | 1,110,583,393 | 367,814,605 |
| 01/12/1988 | 5,372 | 28,855,809 | 31,286 | 978,786,077 | 168,058,514 |
| 02/08/1988 | 31,705 | 1,005,184,089 | 74,121 | 5,493,966,393 | 2,349,988,852 |
| 03/07/1988 | 82,264 | 6,767,407,352 | 230,093 | 52,942,892,013 | 18,928,447,286 |
| 04/13/1988 | 72,497 | 5,255,778,627 | 351,374 | 123,463,673,601 | 25,473,471,239 |
| 05/10/1988 | 13,601 | 184,977,186 | 185,279 | 34,328,399,626 | 2,519,914,830 |
| 06/07/1988 | 25,244 | 637,276,610 | 206,033 | 42,449,472,010 | 5,201,159,065 |
| 07/05/1988 | 5,010 | 25,097,386 | 17,709 | 313,593,957 | 88,715,210 |
| 08/02/1988 | 7,749 | 60,053,584 | 1,317 | 1,734,781 | 10,206,853 |
| 09/06/1988 | 1,233 | 1,519,951 | 2,029 | 4,116,937 | 2,501,508 |
| 10/04/1988 | 489 | 239,347 | 4,258 | 18,133,571 | 2,083,320 |
| 11/09/1988 | 949 | 900,808 | 8,880 | 78,853,895 | 8,428,059 |
| 12/07/1988 | 117 | 13,786 | 28,176 | 793,889,437 | 3,308,305 |
| 02/28/1989 | 181,275 | 32,860,587,855 | 249,986 | 62,493,244,432 | 45,316,274,659 |
| 03/14/1989 | 2,332,814 | 5,442,021,740,269 | 337,198 | 113,702,224,787 | 786,619,335,644 |
| 04/11/1989 | 176,436 | 31,129,802,423 | 360,428 | 129,908,685,926 | 63,592,701,829 |
| 05/09/1989 | 551,853 | 304,541,705,001 | 194,973 | 38,014,545,162 | 107,596,535,253 |
| 06/13/1989 | 30,369 | 922,278,388 | 144,639 | 20,920,425,990 | 4,392,545,591 |
| 07/06/1989 | 15,548 | 241,733,233 | 15,314 | 234,521,596 | 238,100,113 |
| 08/14/1989 | 18,082 | 326,958,401 | 665 | 442,834 | 12,032,803 |
| 09/11/1989 | 3,116 | 9,711,972 | 585 | 342,453 | 1,823,702 |
| 04/18/2000 | 279,948 | 78,370,865,246 | 325,305 | 105,823,567,829 | 91,068,570,727 |
| 05/24/2000 | 205,428 | 42,200,765,103 | 308,885 | 95,410,051,327 | 63,453,740,351 |
| 06/26/2000 | 33,806 | 1,142,837,994 | 49,196 | 2,420,215,998 | 1,663,103,964 |
| 07/26/2000 | 23,067 | 532,098,420 | 1,921 | 3,688,729 | 44,303,124 |
| 08/21/2000 | 8,610 | 74,140,227 | 20 | 393 | 170,619 |
| 09/18/2000 | 5,020 | 25,195,518 | 531 | 281,499 | 2,663,178 |
| 10/19/2000 | 3,170 | 10,050,290 | 3,239 | 10,489,689 | 10,267,639 |
| 11/21/2000 | 788 | 620,412 | 10,744 | 115,442,474 | 8,462,973 |
| 12/20/2000 | 2,495 | 6,225,424 | 37,214 | 1,384,917,182 | 92,853,091 |
| 01/18/2001 | 1,712 | 2,932,005 | 97,356 | 9,478,111,253 | 166,702,930 |
| 02/14/2001 | 3,229 | 10,425,969 | 95,642 | 9,147,317,751 | 308,819,778 |
| 03/13/2001 | 154,988 | 24,021,433,535 | 310,441 | 96,373,432,098 | 48,114,737,801 |
| 04/17/2001 | 56,203 | 3,158,765,815 | 340,053 | 115,636,128,739 | 19,111,971,391 |
| 05/16/2001 | 127,347 | 16,217,238,800 | 136,382 | 18,600,067,013 | 17,367,836,032 |
| 06/13/2001 | 13,833 | 191,352,351 | 144,700 | 20,938,106,474 | 2,001,638,304 |
| 07/19/2001 | 100,195 | 10,038,954,368 | 3,400 | 11,561,510 | 340,683,823 |
| 08/14/2001 | 22,610 | 511,204,291 | 665 | 442,834 | 15,045,887 |
| 09/12/2001 | 20,350 | 414,105,342 | 1,493 | 2,228,721 | 30,379,686 |
| Sum of | 4,633,513 | 6,003,078,487,744 | 4,366,771 | 1,102,777,526,020 | 1,306,722,324,801 |
| Average | 110,322 | 142,930,440,184 | 103,971 | 26,256,607,762 | 31,112,436,305 |
| Count | 42 | 42 | 42 | 42 | 42 |

| | |
|---|---|
| Percent Difference Measured | 10.6% |
| Percent Difference Predicted | 10.0% |
| Sqr root error | 1038467 |

| | |
|---|---|
| SumXi 2= | 4.63E+06 |
| Sx2= | 2.15E+13 |
| Sx2/n= | 5.11E+11 |

| | |
|---|---|
| Sxx= | -5.11E+11 |
| | |
| SumYi2= | 4.37E+06 |
| Sy2= | 1.10E+12 |
| Sy2/n= | 2.63E+10 |
| | |
| Syy= | 1.08E+12 |
| | |
| Sx= | 4.63E+06 |
| Sx*Sy= | 1.31E+12 |
| (Sx*Sy)/n= | 3.11E+10 |
| | |
| Sxy= | -3.11E+10 |
| | |
| b1= | 6.09E-02 |
| | |
| bo= | |
| Sx= | 2.15E+13 |
| b1 | 6.09E-02 |
| Sxy2 | 9.68E+20 |
| Sxx | -5.11E+11 |
| Sxy2/Sxx | -1.89E+09 |
| b1*(Sxy/Sxx) | 9.68E+20 |
| bo= | 1.90E+09 |
| | |
| SEE | |
| Syy | 1.08E+12 |
| Sxy2 | 9.68E+20 |
| Sxy2/Sxx | -1.89E+09 |
| SEE= | 1.08E+12 |
| | |
| Sqr root error | 1.04E+06 |

## Appendix C-Table 86

Total Phosphorus Model Validation
Actual Monitored data USBR 1987-1989 and Idaho DEQ 2000-2001
USGS Discharge Data 1952-2002
Estimated Average Discharge at Snake

| | | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|---|
| | 05/10/88 | 78.88 | 6222.63 | 604.26 | 365127.09 | 47666.04 |
| | 06/07/88 | 104.13 | 10843.66 | 468.77 | 219749.23 | 48814.81 |
| | 07/05/88 | 62.62 | 3921.47 | 146.68 | 21514.73 | 9185.28 |
| | 08/02/88 | 61.35 | 3763.77 | 55.32 | 3060.51 | 3393.98 |
| | 09/06/88 | 11.51 | 132.40 | 62.97 | 3964.73 | 724.53 |
| | 05/09/89 | 1120.95 | 1256531.94 | 606.61 | 367976.60 | 679981.14 |
| | 06/13/89 | 140.16 | 19646.17 | 392.82 | 154305.80 | 55059.22 |
| | 07/06/89 | 94.40 | 8910.83 | 45.23 | 2045.89 | 4269.73 |
| | 08/14/89 | 126.03 | 15882.55 | 76.99 | 5927.71 | 9702.95 |
| | 09/11/89 | 26.37 | 695.35 | 28.73 | 825.57 | 757.67 |
| | 05/24/00 | 453.15 | 205345.42 | 553.35 | 306191.51 | 250748.92 |
| | 06/26/00 | 311.01 | 96729.81 | 236.73 | 56039.39 | 73625.26 |
| | 07/26/00 | 90.26 | 8147.44 | 47.83 | 2287.26 | 4316.87 |
| | 08/21/00 | 33.63 | 1131.29 | 74.71 | 5581.22 | 2512.76 |
| | 09/18/00 | 37.65 | 1417.25 | 28.50 | 812.29 | 1072.95 |
| | 05/16/01 | 227.88 | 51931.10 | 555.76 | 308866.48 | 126648.24 |
| | 06/13/01 | 63.63 | 4049.02 | 392.76 | 154256.79 | 24991.76 |
| | 07/19/01 | 106.46 | 11333.04 | 64.65 | 4179.09 | 6881.99 |
| | 08/14/01 | 133.34 | 17779.56 | 75.06 | 5633.26 | 10007.84 |
| | 09/12/01 | 75.88 | 5757.74 | 138.74 | 19249.84 | 10527.85 |
| Sum of | | 3359.3 | 1730172.4 | 4656.4 | 2007595.0 | 1370889.8 |
| Average | | 168.0 | 86508.6 | 232.8 | 100379.7 | 68544.5 |
| Count | | 20 | 20 | 20 | 20 | 20 |

| | |
|---|---|
| Percent Difference Measured | 12.1% |
| Percent Difference Predicted | 16.8% |
| Root Mean Sq. | 1383.8 |

| | |
|---|---|
| SumXi2= | 3359.3047 |
| Sx2= | 11284928 |
| Sx2/n= | 564246.4 |
| Sxx= | -560887.09 |
| SumYi2= | 4656.4465 |
| Sy2= | 2007595 |
| Sy2/n= | 100379.75 |
| Syy= | 1907215.2 |
| Sx= | 3359.3047 |
| Sx*Sy= | 1370889.8 |
| (Sx*Sy)/n= | 68544.489 |
| Sxy= | -65185.185 |
| b1= | 0.116218 |
| bo= | |
| Sx= | 11284928 |
| b1 | 0.116218 |
| Sxy2 | 4.249E+09 |
| Sxx | -560887.09 |
| Sxy2/Sxx | -7575.6928 |
| b1*(Sxy/Sxx) | 4.249E+09 |
| bo= | 10934.997 |
| SEE | |
| Syy | 1907215.2 |

| | |
|---|---|
| Sxy2 | 4.249E+09 |
| Sxy2/Sxx | -7575.6928 |
| SEE= | 1914790.9 |
| | |
| Sqr root error | 1383.7597 |

# Appendix C-Table 87

Total Phosphorus Model Validation
Actual Monitored data USGS 1996-2000 and Idaho DEQ 2000-2001
USGS Discharge Data 1952-2002
USGS Gage Site 13266000 near Weiser, Idaho

| | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|
| 05/21/1996 | 4847.8 | 23501102.3 | 562.7 | 316676.3 | 2728047.2 |
| 06/19/1996 | 137.0 | 18764.8 | 340.8 | 116152.2 | 46685.9 |
| 07/18/1996 | 86.9 | 7549.4 | 101.1 | 10215.7 | 8781.9 |
| 08/23/1996 | 96.6 | 9326.6 | 62.2 | 3865.4 | 6004.3 |
| 05/13/1997 | 1859.1 | 3456175.4 | 562.4 | 316281.3 | 1045525.5 |
| 05/25/1997 | 36.9 | 1363.6 | 261.4 | 68328.0 | 9652.6 |
| 08/14/1997 | 120.8 | 14602.3 | 79.0 | 6234.8 | 9541.6 |
| 09/18/1997 | 114.0 | 12986.7 | 66.3 | 4397.8 | 7557.3 |
| 05/11/1998 | 568.0 | 322621.3 | 567.6 | 322226.1 | 322423.6 |
| 06/15/1998 | 898.2 | 806814.9 | 381.6 | 145642.8 | 342792.6 |
| 07/15/1998 | 122.5 | 15010.1 | 111.8 | 12503.3 | 13699.5 |
| 08/10/1998 | 108.6 | 11785.4 | 80.4 | 6458.7 | 8724.5 |
| 09/10/1998 | 67.2 | 4518.6 | 80.4 | 6458.7 | 5402.2 |
| 05/09/2000 | 134.6 | 18127.0 | 573.6 | 329014.3 | 77227.2 |
| 06/08/2000 | 324.7 | 105447.8 | 553.8 | 306662.0 | 179824.5 |
| 07/11/2000 | 113.9 | 12966.1 | 457.2 | 209030.4 | 52060.5 |
| 08/22/2000 | 69.3 | 4804.5 | 77.0 | 5926.5 | 5336.1 |
| 09/12/2000 | 91.8 | 8436.1 | 128.4 | 16478.3 | 11790.4 |
| 05/24/2000 | 156.2 | 24386.8 | 89.0 | 7912.3 | 13890.8 |
| 06/26/2000 | 78.1 | 6100.5 | 78.7 | 6190.4 | 6145.3 |
| 07/26/2000 | 121.1 | 14661.5 | 77.0 | 5926.5 | 9321.5 |
| 08/21/2000 | 165.7 | 27465.5 | 67.2 | 4515.2 | 11136.1 |
| 09/18/2000 | 95.1 | 9045.3 | 79.2 | 6279.3 | 7536.5 |
| 05/16/2001 | 191.3 | 36591.7 | 559.8 | 313324.6 | 107075.1 |
| 06/13/2001 | 63.6 | 4049.0 | 402.5 | 162009.2 | 25612.1 |
| 07/19/2001 | 106.5 | 11333.0 | 101.1 | 10215.7 | 10759.9 |
| 08/14/2001 | 133.3 | 17779.6 | 79.0 | 6234.8 | 10528.6 |
| 09/12/2001 | 75.9 | 5757.7 | 78.7 | 6190.4 | 5970.1 |
| Sum of | 10984.7 | 28489573.4 | 6659.6 | 2731350.8 | 5089053.5 |
| Average | 392.3 | 1017484.8 | 237.8 | 97548.2 | 181751.9 |
| Count | 28 | 28 | 28 | 28 | 28 |

| | |
|---|---|
| Percent Difference Measured | 24.1% |
| Percent Difference Predicted | 14.6% |
| Root Square Error | 1625 |

| | |
|---|---|
| SumXi 2= | 1.10E+04 |
| Sx2= | 1.21E+08 |
| Sx2/n = | 4.31E+06 |
| Sxx= | -4.30E+06 |
| SumYi 2= | 6.66E+03 |
| Sy2= | 2.73E+06 |
| Sy2/n = | 9.75E+04 |
| Syy= | 2.63E+06 |
| Sx= | 1.10E+04 |
| Sx*Sy = | 5.09E+06 |
| (Sx*Sy)/n= | 1.82E+05 |
| Sxy= | -1.71E+05 |
| b1= | 3.97E-02 |

| | |
|---|---|
| bo= | |
| Sx= | 1.21E+08 |
| b1 | 3.97E-02 |
| Sxy2 | 2.92E+10 |
| Sxx | -4.30E+06 |
| Sxy2/ Sxx | -6.78E+03 |
| b1*(S xy/Sxx ) | 2.92E+10 |
| bo= | 1.78E+04 |
| | |
| SEE | |
| Syy | 2.63E+06 |
| Sxy2 | 2.92E+10 |
| Sxy2/ Sxx | -6.78E+03 |
| SEE= | 2.64E+06 |
| | |
| Sqr root error | 1625.0 |

# Appendix C-Table 88

Total Phosphorus Model Validation
Actual Monitored data DEQ 1983 and IDA 2001-2003
Crane Creek near Mouth
USGS Gage Site 13265500

| | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|
| 05/10/1983 | 49.7 | 2470.7 | 19.3 | 372.7 | 959.7 |
| 05/24/1983 | 13.0 | 169.4 | 16.0 | 256.7 | 208.5 |
| 06/07/1983 | 4.9 | 23.9 | 15.0 | 225.7 | 73.5 |
| 06/21/1983 | 4.4 | 19.4 | 11.8 | 140.3 | 52.2 |
| 07/06/1983 | 4.3 | 18.7 | 30.8 | 946.1 | 133.2 |
| 07/18/1983 | 5.0 | 25.2 | 57.4 | 3292.8 | 288.0 |
| 08/02/1983 | 406.3 | 165045.3 | 67.3 | 4522.6 | 27321.1 |
| 08/16/1983 | 12.7 | 161.2 | 69.3 | 4798.8 | 879.5 |
| 08/31/1983 | 45.3 | 2047.9 | 57.0 | 3245.1 | 2577.9 |
| 09/15/1983 | 14.1 | 198.5 | 39.7 | 1577.3 | 559.6 |
| 05/07/2001 | 0.7 | 0.5 | 23.7 | 560.3 | 17.1 |
| 05/22/2001 | 2.9 | 8.5 | 14.8 | 219.4 | 43.2 |
| 06/05/2001 | 1.8 | 3.2 | 14.9 | 221.0 | 26.6 |
| 06/19/2001 | 16.7 | 278.7 | 10.7 | 115.3 | 179.2 |
| 06/28/2001 | 84.8 | 7188.3 | 18.5 | 342.1 | 1568.1 |
| 07/17/2001 | 162.5 | 26404.9 | 56.5 | 3197.7 | 9188.8 |
| 08/01/2001 | 126.2 | 15934.4 | 68.5 | 4687.5 | 8642.5 |
| 08/15/2001 | 108.4 | 11745.0 | 70.1 | 4911.1 | 7594.8 |
| 08/30/2001 | 113.1 | 12793.9 | 57.8 | 3340.8 | 6537.8 |
| 09/13/2001 | 42.2 | 1777.6 | 42.7 | 1821.4 | 1799.4 |
| 09/27/2001 | 19.4 | 375.3 | 22.6 | 512.7 | 438.7 |
| 05/15/2002 | 4.2 | 17.9 | 25.5 | 648.3 | 107.8 |
| 05/29/2002 | 4.8 | 23.5 | 16.3 | 266.8 | 79.1 |
| 06/12/2002 | 3.7 | 14.0 | 15.0 | 225.7 | 56.2 |
| 06/26/2002 | 8.8 | 77.5 | 15.2 | 230.5 | 133.7 |
| 07/11/2002 | 91.0 | 8280.5 | 41.1 | 1688.4 | 3739.1 |
| 07/24/2002 | 128.5 | 16505.1 | 65.2 | 4253.3 | 8378.6 |
| 08/08/2002 | 77.3 | 5975.1 | 69.3 | 4798.8 | 5354.7 |
| 08/21/2002 | 123.4 | 15235.7 | 67.3 | 4522.6 | 8300.9 |
| 09/05/2002 | 59.1 | 3498.5 | 50.6 | 2564.2 | 2995.1 |
| 09/19/2002 | 61.1 | 3727.8 | 34.3 | 1173.9 | 2091.9 |
| Sum of | 1800.3 | 300046.3 | 1184.1 | 59680.2 | 100326.5 |
| Average | 58.1 | 9678.9 | 38.2 | 1925.2 | 3236.3 |
| Count | 31 | 31 | 31 | 31 | 31 |

| | |
|---|---|
| Percent Difference Measured | 24.2% |
| Percent Difference Predicted | 15.9% |
| Sqr root error | 240.4 |

| | |
|---|---|
| SumXi2= | 1.80E+03 |
| Sx2= | 3.24E+06 |
| Sx2/n= | 1.05E+05 |
| Sxx= | -1.03E+05 |
| SumYi2= | 1.18E+03 |
| Sy2= | 5.97E+04 |
| Sy2/n= | 1.93E+03 |
| Syy= | 5.78E+04 |
| Sx= | 1.80E+03 |
| Sx*Sy= | 1.00E+05 |
| (Sx*Sy)/n= | 3.24E+03 |
| Sxy= | -1.44E+03 |
| b1= | 1.40E-02 |
| bo= | |

| | |
|---|---|
| Sx= | 3.24E+06 |
| b1 | 1.40E-02 |
| Sxy2 | 2.06E+06 |
| Sxx | -1.03E+05 |
| Sxy2/Sxx | -2.01E+01 |
| b1*(Sxy/Sxx) | 2.06E+06 |
| bo= | 1.82E+03 |
| | |
| SEE | |
| Syy | 5.78E+04 |
| Sxy2 | 2.06E+06 |
| Sxy2/Sxx | -2.01E+01 |
| SEE= | 5.78E+04 |
| | |
| Sqr root error | 2.40E+02 |

# Appendix C-Table 89

Total Phosphorus Model Validation
Actual Monitored data DEQ 2000-2001
Little Weiser River

| | | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|---|
| | 00/5/24 | 71 | 5,084 | 69 | 4,713 | 4,895 |
| | 00/6/26 | 12 | 142 | 39 | 1,516 | 465 |
| | 00/7/25 | 3 | 12 | 16 | 268 | 57 |
| | 00/8/21 | 5 | 21 | 5 | 26 | 23 |
| | 00/9/19 | 3 | 7 | 4 | 15 | 10 |
| | 01/05/14 | 17 | 298 | 50 | 2,528 | 868 |
| | 01/06/13 | 13 | 170 | 48 | 2,283 | 623 |
| | 01/07/18 | 9 | 74 | 13 | 167 | 111 |
| | 01/08/14 | 3 | 12 | 4 | 13 | 13 |
| | 01/09/11 | 0 | 0 | 1 | 2 | 1 |
| Sum of | | 137 | 5,820 | 249 | 11,531 | 7,066 |
| Average | | 14 | 582 | 25 | 1,153 | 707 |
| Count | | 10 | 10 | 10 | 10 | 10 |

| | |
|---|---|
| Percent Difference Measured | 13.3% |
| Percent Difference Predicted | 24.2% |
| Root Mean Sq. | 102.8 |

| | |
|---|---|
| SumXi2= | 1.37E+02 |
| Sx2= | 1.87E+04 |
| Sx2/n= | 1.87E+03 |
| Sxx= | -1.73E+03 |
| SumYi2= | 2.49E+02 |
| Sy2= | 1.15E+04 |
| Sy2/n= | 1.15E+03 |
| Syy= | 1.04E+04 |
| Sx= | 1.37E+02 |
| Sx*Sy= | 7.07E+03 |
| (Sx*Sy)/n= | 7.07E+02 |
| Sxy= | -5.70E+02 |
| b1= | 3.30E-01 |
| bo= | |
| Sx= | 1.87E+04 |
| b1 | 3.30E-01 |
| Sxy2 | 3.25E+05 |
| Sxx | -1.73E+03 |
| Sxy2/Sxx | -1.88E+02 |
| b1*(Sxy/Sxx) | 3.25E+05 |
| bo= | 3.25E+02 |
| SEE | |
| Syy | 1.04E+04 |
| Sxy2 | 3.25E+05 |
| Sxy2/Sxx | -1.88E+02 |
| SEE= | 1.06E+04 |

Sqr root error 1.03E+02

## Appendix C-Table 90

Total Phosphorus Model Validation
Actual Monitored data DEQ 2000-2001
USGS 1974-82 and DEQ 2000-2001
Weiser River above Cambridge
USGS Gage 13258500

| | Monitored (kg/day) | | Model (kg/day) | | X*Y |
|---|---|---|---|---|---|
| 01/17/1974 | 5,123.2 | 26,247,493.8 | 56.8 | 3,231.0 | 291,212.0 |
| 04/05/1974 | 565.1 | 319,295.3 | 96.5 | 9,321.6 | 54,555.9 |
| 04/16/1974 | 435.9 | 190,013.3 | 102.0 | 10,411.2 | 44,477.8 |
| 06/11/1974 | 186.9 | 34,926.5 | 73.6 | 5,416.8 | 13,754.7 |
| 07/17/1974 | 7.3 | 53.9 | 22.4 | 502.3 | 164.5 |
| 08/13/1974 | 10.2 | 103.6 | 15.2 | 231.3 | 154.8 |
| 08/23/1974 | 3.3 | 11.1 | 15.6 | 242.0 | 51.8 |
| 08/23/1974 | 6.7 | 44.3 | 15.6 | 242.0 | 103.5 |
| 08/24/1974 | 3.3 | 10.9 | 15.9 | 254.4 | 52.7 |
| 08/24/1974 | 3.3 | 10.7 | 15.9 | 254.4 | 52.3 |
| 08/24/1974 | 6.6 | 43.0 | 15.9 | 254.4 | 104.6 |
| 09/18/1974 | 11.7 | 137.9 | 16.4 | 270.1 | 193.0 |
| 10/16/1974 | 5.5 | 30.3 | 19.7 | 388.7 | 108.5 |
| 11/12/1974 | 14.9 | 222.7 | 26.1 | 682.4 | 389.8 |
| 12/09/1974 | 3.5 | 12.4 | 34.7 | 1,202.2 | 122.1 |
| 01/13/1975 | 13.1 | 171.9 | 38.9 | 1,509.5 | 509.4 |
| 02/10/1975 | 19.9 | 397.5 | 48.9 | 2,395.2 | 975.7 |
| 03/12/1975 | 224.3 | 50,316.1 | 80.0 | 6,403.0 | 17,949.3 |
| 04/17/1975 | 396.3 | 157,035.8 | 103.5 | 10,711.7 | 41,013.7 |
| 05/13/1975 | 1,339.3 | 1,793,646.4 | 103.3 | 10,674.1 | 138,367.3 |
| 06/19/1975 | 72.9 | 5,313.7 | 62.6 | 3,924.6 | 4,566.7 |
| 07/15/1975 | 71.7 | 5,147.5 | 24.0 | 573.9 | 1,718.8 |
| 08/12/1975 | 5.7 | 32.8 | 15.3 | 233.4 | 87.5 |
| 09/17/1975 | 9.1 | 82.8 | 15.9 | 254.0 | 145.0 |
| 10/15/1975 | 13.8 | 190.3 | 19.7 | 388.7 | 272.0 |
| 11/11/1975 | 13.8 | 190.3 | 24.0 | 573.9 | 330.5 |
| 12/13/1975 | 36.5 | 1,330.2 | 37.2 | 1,387.0 | 1,358.3 |
| 12/21/1975 | 18.1 | 325.9 | 44.9 | 2,013.0 | 810.0 |
| 04/06/1976 | 1,104.4 | 1,219,787.3 | 99.1 | 9,830.1 | 109,502.0 |
| 12/08/1976 | 9.1 | 82.8 | 36.0 | 1,296.4 | 327.6 |
| 05/12/1977 | 31.4 | 986.5 | 103.8 | 10,772.0 | 3,259.9 |
| 09/15/1977 | 1.2 | 1.4 | 15.9 | 253.3 | 18.7 |
| 04/25/1978 | 138.9 | 19,304.8 | 106.6 | 11,355.7 | 14,806.1 |
| 09/12/1978 | 6.6 | 43.0 | 34.2 | 1,167.8 | 224.0 |
| 04/11/1979 | 97.6 | 9,516.5 | 97.3 | 9,468.5 | 9,492.5 |
| 08/16/1979 | 3.9 | 15.3 | 15.9 | 254.0 | 62.4 |
| 11/07/1979 | 5.1 | 25.9 | 21.5 | 461.1 | 109.3 |
| 05/21/1980 | 33.3 | 1,106.7 | 59.2 | 3,501.6 | 1,968.6 |
| 11/03/1980 | 9.6 | 91.9 | 21.0 | 440.7 | 201.3 |
| 05/27/1981 | 184.9 | 34,198.9 | 96.7 | 9,343.6 | 17,875.7 |
| 11/03/1981 | 11.5 | 133.3 | 21.0 | 440.7 | 242.4 |
| 03/09/1982 | 195.7 | 38,295.6 | 73.4 | 5,383.9 | 14,358.9 |
| 00/4/18 | 72.5 | 5,256.8 | 105.2 | 11,066.9 | 7,627.4 |
| 00/5/24 | 102.8 | 10,577.3 | 98.7 | 9,748.7 | 10,154.6 |
| 00/6/26 | 10.5 | 110.0 | 50.4 | 2,542.4 | 528.9 |
| 00/7/25 | 4.7 | 21.9 | 18.2 | 330.3 | 85.1 |
| 00/8/22 | 6.2 | 38.9 | 15.4 | 236.3 | 95.9 |
| 00/9/19 | 3.4 | 11.7 | 16.4 | 269.4 | 56.2 |
| 00/10/18 | 14.0 | 196.0 | 18.0 | 322.6 | 251.5 |
| 00/11/20 | 18.4 | 338.4 | 28.3 | 803.5 | 521.4 |
| 00/12/17 | 27.3 | 745.2 | 37.5 | 1,407.3 | 1,024.1 |
| 01/1/17 | 5.0 | 25.1 | 56.8 | 3,231.0 | 285.0 |
| 01/2/13 | 6.3 | 39.6 | 52.6 | 2,766.4 | 331.2 |
| 01/3/12 | 257.1 | 66,090.8 | 80.0 | 6,403.0 | 20,571.4 |
| 01/4/16 | 87.6 | 7,667.2 | 102.1 | 10,418.7 | 8,937.7 |
| 01/5/14 | 71.4 | 5,096.3 | 102.5 | 10,516.2 | 7,320.8 |
| 01/6/13 | 21.1 | 445.0 | 70.4 | 4,952.4 | 1,484.6 |
| 01/7/18 | 8.5 | 71.5 | 22.1 | 489.9 | 187.1 |
| 01/8/14 | 3.9 | 15.1 | 15.2 | 232.0 | 59.1 |
| 01/9/11 | 4.3 | 18.5 | 38.1 | 1,453.1 | 164.1 |

| | | | | | |
|---|---|---|---|---|---|
| Sum of | 11,180.0 | 30,226,946.3 | 2,890.4 | 205,106.3 | 845,737.1 |
| Average | 366.6 | 991,047.4 | 94.8 | 6,724.8 | 27,729.1 |
| Count | 60 | 60 | 60 | 60 | 60 |

| | |
|---|---|
| Percent Difference Measured | 81.6% |
| Percent Difference Predicted | 21.1% |
| Root Mean Sq. | 449.1 |

| | |
|---|---|
| SumXi2= | 1.12E+04 |
| Sx2= | 1.25E+08 |
| Sx2/n= | 2.08E+06 |
| Sxx= | -2.07E+06 |
| SumYi2= | 2.89E+03 |
| Sy2= | 2.05E+05 |
| Sy2/n= | 3.42E+03 |
| Syy= | 2.02E+05 |
| Sx= | 1.12E+04 |
| Sx*Sy= | 8.46E+05 |
| (Sx*Sy)/n = | 1.41E+04 |
| Sxy= | -2.92E+03 |
| b1= | 1.41E-03 |
| bo= | |
| Sx= | 1.25E+08 |
| b1 | 1.41E-03 |
| Sxy2 | 8.50E+06 |
| Sxx | -2.07E+06 |
| Sxy2/Sxx | -4.10E+00 |
| b1*(Sxy/Sxx) | 8.50E+06 |
| bo= | 1.12E+04 |
| SEE | |
| Syy | 2.02E+05 |
| Sxy2 | 8.50E+06 |
| Sxy2/Sxx | -4.10E+00 |
| SEE= | 2.02E+05 |
| Sqr root error | 4.49E+02 |

# Appendix D. Additional Data from the Weiser Watershed Advisory Group

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# *WEISER RIVER WATERSHED ADVISORY GROUP*



Ms. Toni Hardesty
Idaho Dept. of Environmental Quality
1410 N. Hilton
Boise, Idaho 83706-1255

Feb. 19, 2004

Dear Ms. Hardesty;

Thank you for coming to Weiser and meeting with the Weiser River Watershed Advisory Group on Feb. 11, 2004. We feel the meeting was very constructive. We hope to build on that meeting and to ultimately produce a TMDL for the Weiser River Watershed which will lead us to improved water quality while protecting the economic viability of our citizens and communities.

Enclosed is material which the Weiser River WAG agreed to provide to you. Included is temperature data, historic photos, and the most recent letter from the U.S. Army Corps of Engineers to Flood Control District No. 3.

Please note the time of sampling on the temperature data is nearly always in the morning, (coolest part of day). We know of no man caused sources of temperature increase. There are, however, many sources of natural hot water throughout the watershed.

The historic pictures taken in the 1940s, though not of high quality, show the meandering course the Weiser River once took from the Galloway diversion dam to the Snake River. Over time the Army Corps of Engineers has constructed flood control levees and straightened the River. As we discussed on Feb. 11, we believe much of the sediment load during high flow events is caused by these levees forcing high velocity water against unprotected dirt banks, causing erosion of those banks. Examples of this can be seen throughout the watershed. Please also note that the riparian vegetation appears to be quite short. The historic photos of Midvale show much less riparian vegetation than is present today.

The letter from the Corps of Engineers to Flood Control District No. 3 is particularly important as it pertains to riparian vegetation. Please note the recommendation that vegetation be removed from the levees.

Finally, we wish to remind you of the discussion we had concerning possible sources of natural background phosphorous. We believe the underlying volcanic tuff to be a possible source. We ask that a discussion of that potential be included.

Thanks again for your efforts. We look forward to the successful completion of our task.

Sincerely,

Joe Qualls

Joe Qualls
Vice chair, Weiser River Watershed Advisory Group

*847 East 9th Street Weiser, ID 83672 (208) 549-4250 Fax: (208) 549-4229*

prompted the early settlers to leave well established homes and loved ones, knowing qu    possibly they would never see them again. Traveling    der great hardships, with almost insurmountable problems, to sink their roots in the unknown. If a hill was in the way they went over it or around it. Only death could stop them. What was the force behind this? Whatever it was, it engulfed Middle Valley.

At the time of the white man's entrance this basin Here was a virgin land of rich unexploited soil. The fact that the Indians h    first right to it mattered naught. Friendship on the p   of the Indians availed them no rewards. They soon found their land occupied.

Our records show that the first white settler to look upon this paradise of beauty, land, wooded mountains, water and much game was J. H. Reed. The family settled here in 1868 on what is still known as the Reed place. Other settlers soon followed.

**An Early Picture of the Town**
**1909**

This was shipping day. Several stock men had brought their cattle in to be shipped out.

The tent and the covered wagon had been set up by the shippers. Looking at the picture with a glass, a woman, the cook, can be seen standing in the doorway of the tent. A man is riding away on a white horse.

Midvale in 1909
taken from "Roots of Middle Valley"
by Gerald Yongue
published by Idaho Mountain Graphics
Copyright 1980

94

Midvale, Idaho. 1907

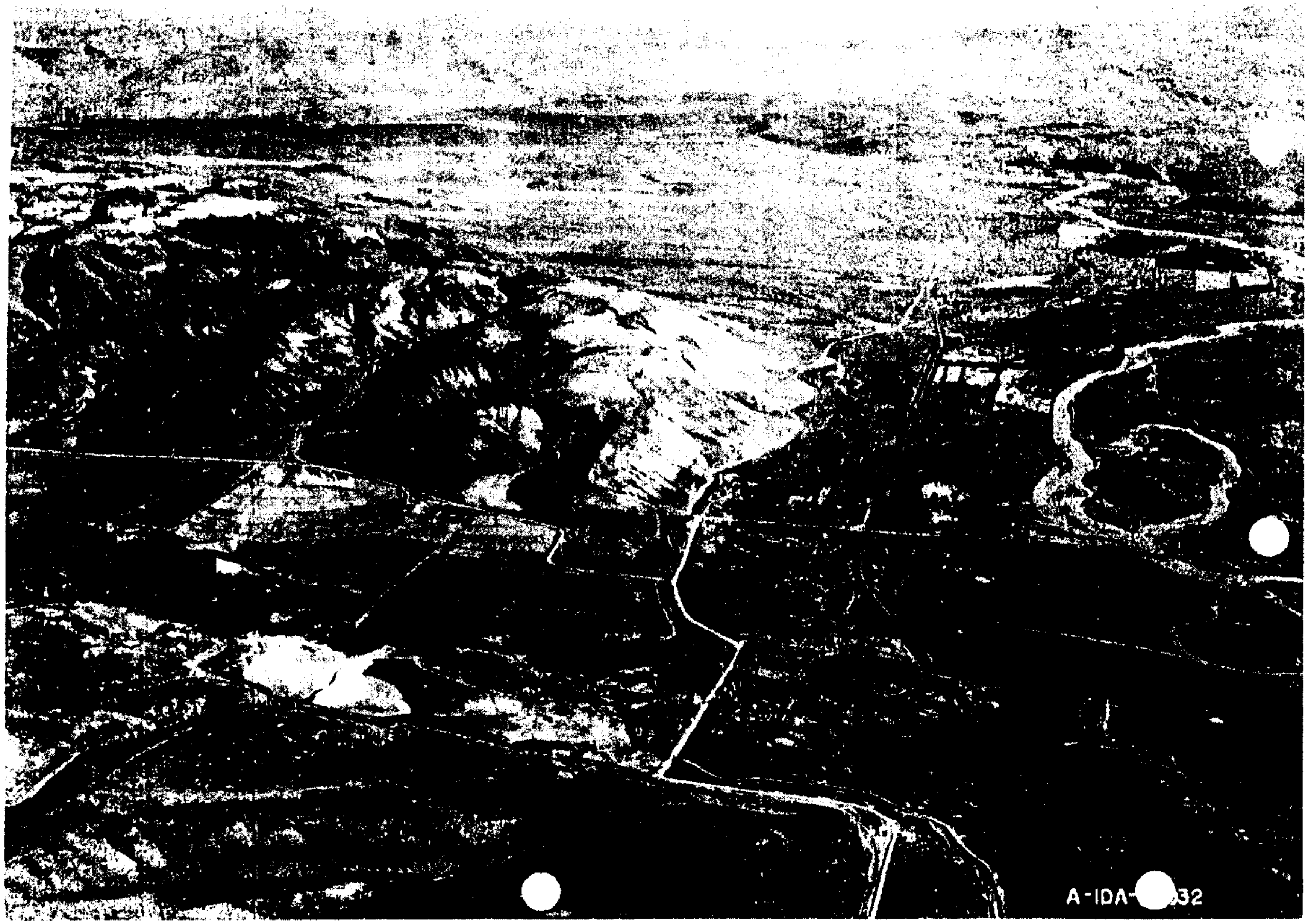
Original photo at Midvale Public Library

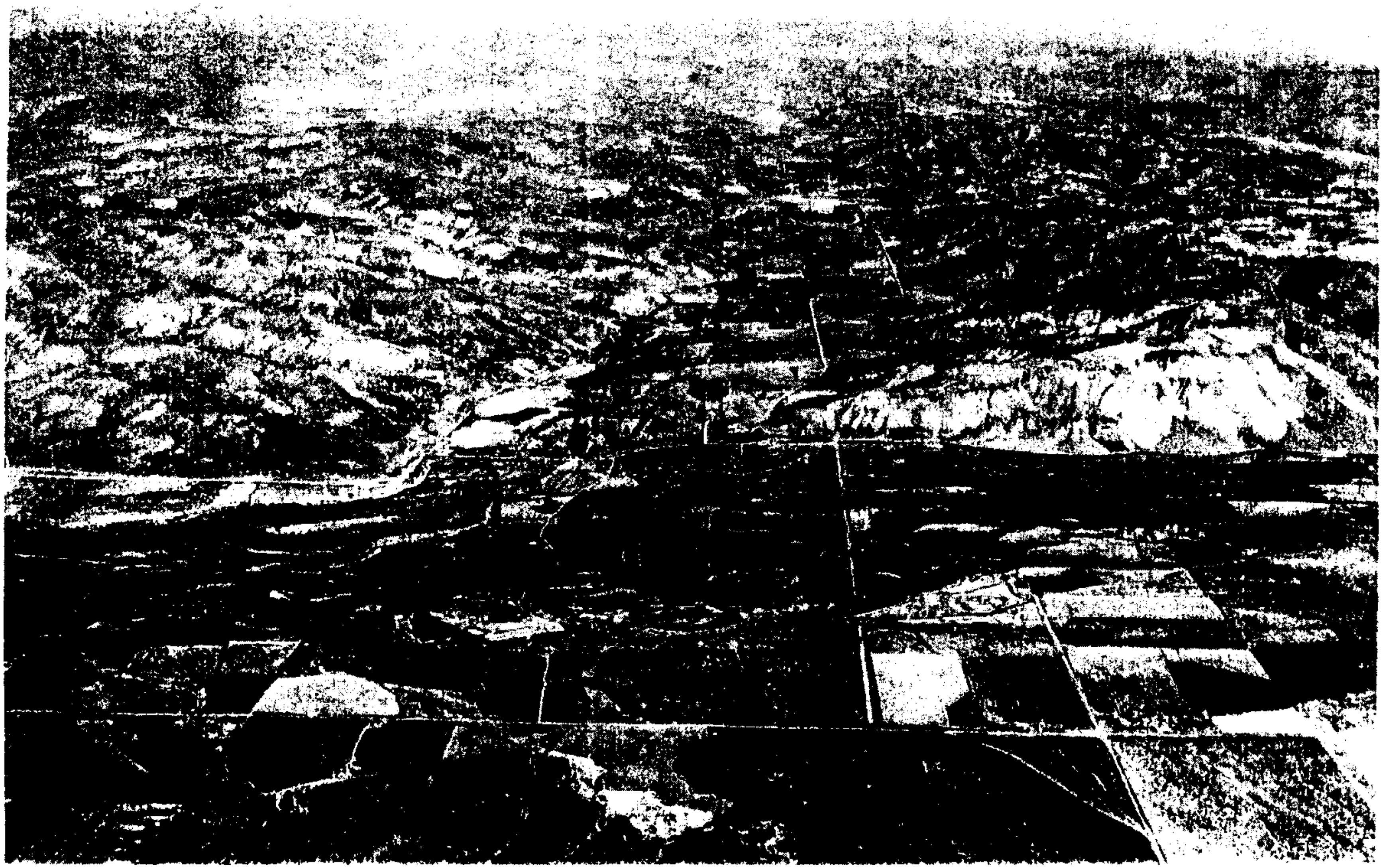
94

Looking East, up River from mouth of

Tom Yankey has original plate. (94)

circa 1940



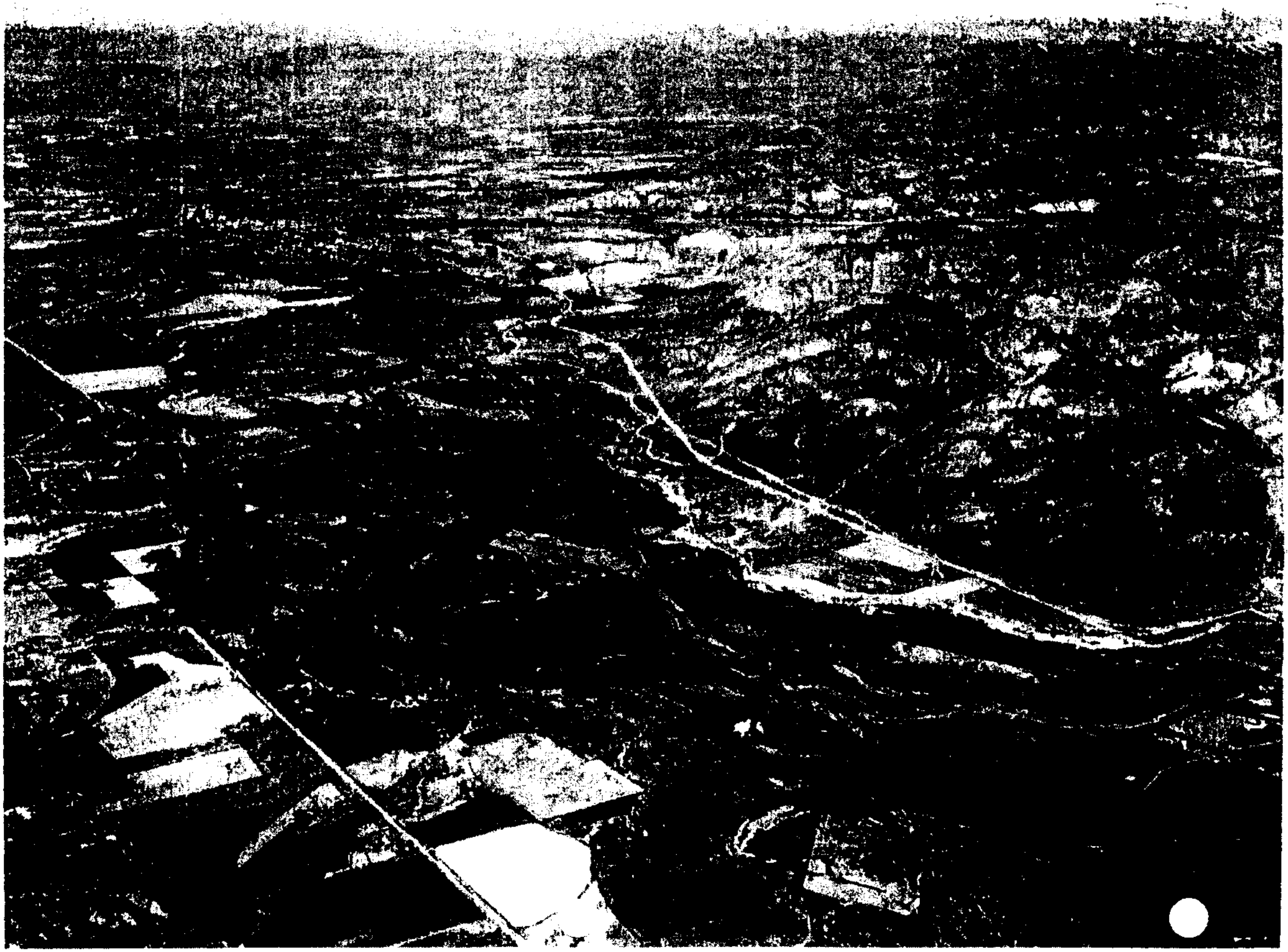


Weiser River at mouth of Mann Creek
Tom Yankey has original photo (JG) circa 1940

Looking West, down river, [illegible]

Tom Yankey has original photo.

circa 1940



U.S. ARMY CORPS OF ENGINEERS
WALLA WALLA DISTRICT
WALLA WALLA, WA
99362-9265

From: Karen Walker
Civil Engineer

TELEPHONE (509) 527-7147
FAX (509) 527-7821

To: Mr. Joe Qualls

Fax: 208-414-1816

- [ ] First Class
- [ ] Express Mail
- [ ] UPS/Federal Express
- [x] Facsimile ( 3 Pages)

Subject: Weiser River Vegetation

Enclosed please find:

A copy of the letter from the US Army Corps of Engineers to Flood Control District No. 3, attention Mr. Art Correia, regarding the inspection of the Weiser flood control projects performed in August 2003.

Thanks,

Karen Walker
Karen Walker

18-Feb-04
Date

DEPARTMENT OF THE ARMY
WALLA WALLA DISTRICT, CORPS OF ENGINEERS
201 NORTH THIRD AVENUE
WALLA WALLA, WASHINGTON 99362-1876

REPLY TO ATTENTION OF

February 19, 2004

Emergency

Flood Control District No. 3
Attn: Mr. Art Correia
1826 Cove Rd
Weiser ID 83672

Dear Mr. Correia:

On August 13, 2003, Karen Walker of the US Army Corps of Engineers, Walla Walla District Office, met with you and inspected the Weiser flood control projects located on the Weiser River in Cambridge ID. The projects consist of earthen levees. The inspection was in accordance with the Corps of Engineers Continuing Eligibility Inspection program under Public Law 84-99.

Smith & Green: The levees are located on the right bank of the river. They are approximately 9000 feet long. Access along the crest of the levees is excellent. The riprap protection on the upstream end of the Green levee is in good condition. There is no riprap protection on the downstream end. There are spots of riprap protection on the Smith levee. These are in good condition. There is vegetation at the toe of the levees, particularly willow trees, and a few large trees. The levees have ruts from vehicle access, but they do not endanger the integrity of the levees.

Lyle: The levee is located on the right bank of the river. It is approximately 1800 feet long. Access along the crest of the levee is excellent. There is little riprap protection on the slopes. There is vegetation on the riverside slope, especially at the toe of the levee.

Twin Bridges: The levee is located on the left bank of the river. It extends 1800 feet upstream of the bridge and 1100 feet downstream. Access along the crest of the downstream levee is excellent. Access to the upstream levee was not granted. There is a significant amount of vegetation on the riverside slopes and on the upstream landside slope. There is little riprap protection on the slopes.

Dickerson-Sweet: The levee is located on the right bank of the river. The Dickerson levee is approximately 3600 feet long and the Sweet levee is approximately 10550 feet long. Access along the crest of the levee is excellent. There is little riprap protection on the slopes. There is vegetation and some trees on the riverside slopes, particularly at the toe of the levee. The brush on the landside slope was recently burned. The Dickerson levee has ruts from vehicle access, but they do not endanger the integrity of the levee.

Kirk Downstream: The levee is located on the left bank of the river. It is approximately 4200 feet long. Access along the crest of the levee is excellent. The riprap area repaired since the 1996 flood is still in good condition. There is vegetation, particularly willow trees, at the toe of the levee.

Kirk Upstream: The levee is located on the left bank of the river. It is approximately 2500 feet long. Access for inspection is poor due to vegetation growth, but there is sufficient access across the field during an emergency. Only the upstream section was accessed for inspection. There are willows on the riverside toe of the levee. The riverside slope is steep and may be unstable during high flows.

There is a significant amount of vegetation on all six levees that may threaten the integrity of the projects and hinder visual inspections if allowed to continue to grow. The root structure of large trees have been known to lose strength during periods of high water or high winds, resulting in the tree tipping over, displacing riprap or portions of the levee section. This produces unwanted holes in the riprap protection or levee section, exposing the embankment to possible erosion. It is recommended the trees growing within the riprap sections be removed. The remaining trees growing within the levee prism should be monitored closely and removed if they show evidence of root failure.

The operation and maintenance of the Weiser Flood Control Projects is rated acceptable.

This letter does not constitute approval by the State of Idaho, National Marine Fisheries Service, or the Corps of Engineers Regulatory Office to perform maintenance work within riparian areas.

Please submit your maintenance report showing the activities and expenditures you have had in maintaining the flood control project during the past year. If we can be of any assistance, please contact Mr. Herb Bessey at 509-527-7144.

Sincerely,

Herb Bessey

G. Herbert Bessey
Chief, Emergency Branch

# Riparian Shade and Stream Temperature: A Perspective

**Larry L. Larson and Shane L. Larson**

Reductions in salmon populations over the past 20 years have created a sense of urgency for improved management of watersheds, fish habitat and water quality within the Columbia River Basin. One management approach that has gained in popularity is to increase woody vegetation in riparian zones. The intent behind these plantings is to increase bank stability, stream debris and provide shade for stream temperature control (Beschta 1991)

Oregon Department of Forestry (1994) has established forest rules and regulations for riparian zones of 40 live conifer trees per 1,000 feet along large streams and 30 live conifer trees per 1,000 feet along medium streams. Similarly, Oregon Department of Environmental Quality is developing water temperature standards for streams throughout the state. In northeastern Oregon the Upper Grande Ronde River Plan established watershed standards that require meadows to have at least 80% of the banks covered with shrubs, of which, at least 50% should be more than 8 feet tall (Anderson et. al. 1993). These approaches reflect the view that streamside forests profoundly influence habitat structure and food resources of stream systems. Additionally, tree height and distance away from the stream are considered meaningful indicators of aquatic habitat components including wood recruitment and degree of shade (Thomas et. al. 1993).

Activities by man that modify the amount of shade over streams have been associated with changes in water temperature (Brown et. al. 1971). Some researchers have concluded that loss of vegetation in a riparian area due to grazing, logging, or overuse by other activities can be directly linked to undesirable water temperatures due to the loss of shade (Anderson et. al. 1993).

The establishment of vegetation shade along streams to control stream temperature may seem reasonable upon first review. However this is a simplistic view of a complex and dynamic system. The purpose of this paper is to provide a discussion of energy exchange within a body of water and to consider the contribution of vegetation shade to that process. This discussion will occur in two sections: 1) Characteristics of water, water heating, and water cooling, and 2) The creation of woody vegetation shade in riparian areas. This paper is not intended to provide a complete review of the physics of energy exchange, nor will it provide discussions of more complicated forms of energy exchange in streams. Four equations (boxed) are provided as reference material in this paper. They are not required to read the text of this paper.

## Characteristics of Water, Water Heating, and Water Cooling

Energy exchange is described by the First and Second Law of Thermodynamics (Halliday and Resnick 1988). These laws tell us that we can transform but not create or destroy energy and that the direction of energy exchange will occur from areas of high concentration toward areas of lower concentration.

The heating of a natural body of water is governed by two primary radiation sources: the sun, and the ambient radiation emitted by the atmosphere and the earth. A representative value for this daily incoming radiation in the temperate zone on a clear summer day would be 332 W m$^{-2}$ of solar radiation and 330 W m$^{-2}$ of ambient radiation (Satterlund and Adams 1992). The distinction between radiation sources is necessary because rock, vegetation, water, road surfaces etc. absorb, emit and reflect radiation differently, and can significantly affect radiation inputs in a given area.

An average of 19% of the solar radiation striking the atmosphere actually reaches the surface of the earth as direct radiation. An additional 28% will arrive at the earth surface as diffuse and scattered radiation (Trewartha 1968). Shade is created by intercepting direct solar radiation and preventing it from reaching the surface of the earth.

Visible solar radiation is predominantly in the range from violet to red (400 nanometers to 700 nm). These wavelengths are mid-range to the total solar radiation that reaches the earth. Water is transparent to visible solar radiation (the radiation is not absorbed) and is least likely to absorb the energy contained in the blue (400 nm) and green (500 nm) color bands (Hollaender 1956). Approximately 95% of visible radiation will penetrate a column of clear water to a depth of 3 feet and over 75% will penetrate to a depth of 30 feet (Hollaender 1956, Sellers 1974). This characteristic permits us to see objects in the water and photosynthesis to occur beneath the surface of the water.

In contrast, water is opaque to near-infrared (700–1,000 nm) and ambient (>1,000 nm) radiation. Nearly 90% of this radiation is absorbed in the top 0.5 inch of a water column and 100% will be absorbed within the top 4.0 inches (Hollaender 1956, Sellers 1974). The absorption of this energy warms the top 4 inches of the water column without directly warming the water at greater depths. These interactions (visible, near-infrared, and ambient radiation) vary with the season of the year, time of day, water turbidity, and surface turbulence.

Energy exchange between water nd incoming radiation can be estimated mathematically (Equations derived from Sec. 7-8, Eqn. 21 and Sec. 20-3, Eqn. 3 are provided in the the following box; Halliday and Resnick 1988).

$$\tau = \frac{Q}{P} = \frac{Q}{SA}$$

Where

$$Q = mc\,(T_f - T_i)$$

Here, $\tau$ is time (s); P is the total energy delivered to the water per second (W); **Q** is the amount of heat deposited in the body of water (J); **A** is the surface area of the body of water exposed to the radiation ($m^2$); m is the mass of the body of water (kg); c is the specific heat capacity of water (4,190 J $kg^{-1}$ @ 288°K); $T_f$ is the final temperature of the body of water (K); $T_i$ is the initial temperature of the body of water; and S is the radiation at the surface of the water (W $m^{-2}$).

To illustrate, assume there is a stationary column of water (12 inches x 12 inches x 12 inches deep at 60°F) that is receiving the radiation amount (average) received at La Grande, Oregon at Noon and 2 PM, 734 W $m^{-2}$ and 674 W $m^{-2}$ respectively (Solar Monitoring Lab. 1987). Also assume that none of the incoming radiation is reflected by the water surface and that none of the radiation can escape once it penetrates the surface of the water column. Given these constraints it would take 16 minutes to raise the temperature of the water column by 1° F at Noon and 17.5 minutes at 2 PM. However to be accurate this estimation would need to be corrected for changes in the water surface reflectance, the transparency of water to visible radiation, heat exchange with other thermal bodies (i.e. soil), and the mixing associated with a stream environment. These factors increase the length of time required to detect a measurable increase in water temperature. If shade were introduced into this example it would intercept direct solar radiation. It would have little influence on diffuse, scattered or ambient radiation sources.

The problem of water cooling is a more complex issue both conceptually and mathematically. Water must convert and radiate its internal energy (in the form of heat) out into the thermal reservoir of the atmosphere. This process is governed by a partial differential equation known as the 'one dimensional heat equation,' or the 'diffusion equation' (Sec. 8-3, Eqn. 8-60, equations are provided as follows; Matthews and Walker 1970).

$$\frac{\partial^2 T}{\partial x^2} - \frac{1}{\kappa}\frac{\partial T}{\partial t} = 0$$

Where

$$\kappa = \frac{k}{\rho c}$$

Here x is the position in the water column (m), $\kappa$ is a constant depending on the thermal conductivity $k$, the heat capacity c, and the mass density $\rho$.

The solutions to this equation depend strongly on the initial temperature distribution assumed for the body of water, and the temperature of the air mass over the water. For simplicity we will use the water column previously described and assume that there is no heat exchange through the sides or bottom of the water column. In addition, we assume that the water and air each have uniform temperatures (water, 77°F; air, 68°F) before the onset of cooling, then as it cools, a temperature gradient forms between the top (coolest) layer of water, and the deepest (warmest) layer. Given these constraints, the rate of cooling will be a strong function of time and water depth, slowing down as the water and air mass approach the same temperature. In this example, water at a depth of 4 inches will cool only 4.5°F in approximately 1.5 days. This demonstrates that cooling water by diffusion is a relatively slow process. It does not illustrate the influence of stream mixing or any of the more complex thermal exchanges that could occur within a water channel.

This example would seem to be contrary to one's ideas about cooling. When one steps from full sunlight into shade, it appears to be cooler. This is not because of a rapid cooling effect brought on by shade, but rather a manifestation of a human body's response to full sunlight. **Shade does not produce cooling, but rather prevents heating by direct solar radiation.**

If the water is in contact with an energy source (i.e. air, soil, etc.) that has a greater temperature, energy will be transferred into the water body. As a result water traveling through shade will gain energy if the air mass temperature is greater than the temperature of the water.

### The Creation of Woody Vegetation Shade in Riparian Areas

Shade creation is bound by a number of constraints. The angle and direction of solar radiation is controlled by global position, time of year and time of day. The greatest solar angle during the summer in the northern hemisphere occurs at Noon on June 21 and decreases on the days preceding and following the summer solstice. Similarly, the greatest daily solar angle occurs at Noon (standard time) and decreases in both the AM and PM.

The greatest intensity of solar radiation occurs when the sun is directly overhead. Deviations from the zenith position reduce the intensity of radiation by spreading energy over a larger surface area (Trewartha 1968, Satterlund and Adams 1992). Therefore the greatest reduction in direct radiation through the use of shade would occur at the time of the greatest solar angle.

An illustration of the influence of the solar angle on shading is provided in Figure 1. In this illustration the trees are 20 and 50 feet in height and July shadows (45° N Lat.) are being cast at 12:00 Noon and 2:00 PM, respectively. The trees are 10 feet from the edge of a 40 foot wide water channel that flows from east to west. Given these parameters the 20 foot tree does not cast a shadow on the water at either time. The 50 foot tree would cast a shadow extending 12 feet into the

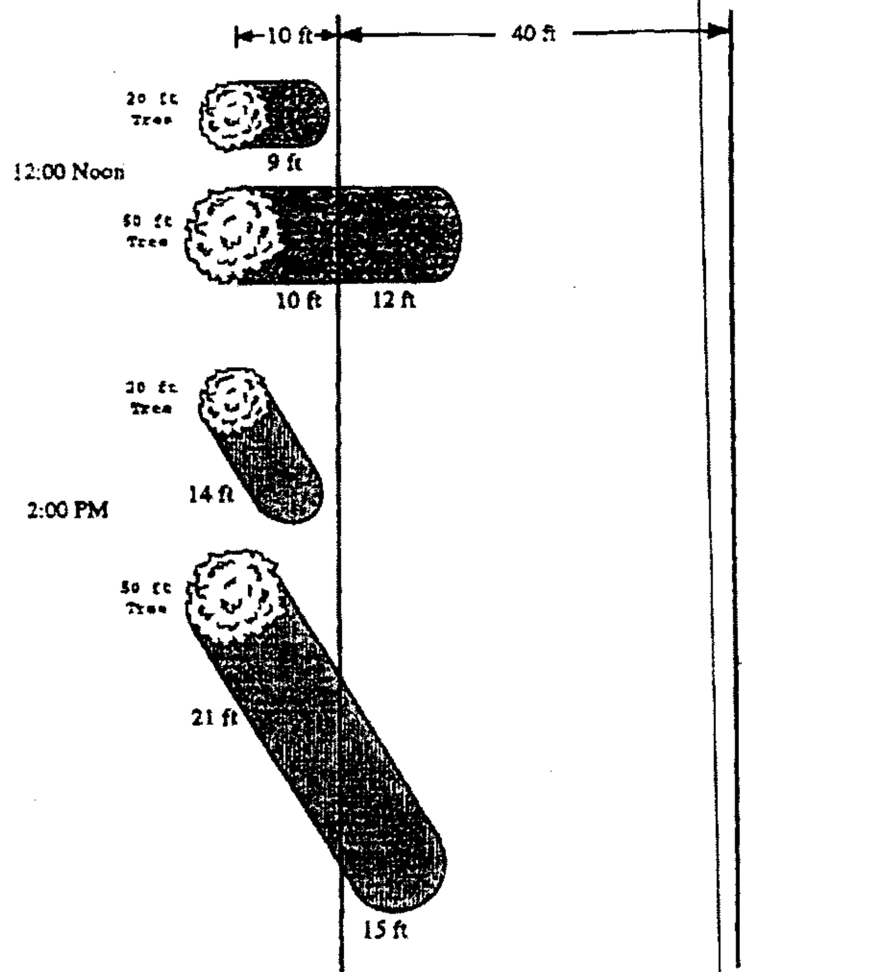



Fig. 1. *Shadows cast by 20 and 50 foot trees in July (45° North Latitude) at 12:00 noon and 2:00 PM along a 40 foot wide stream channel flowing east to west. Shadow lengths are measured along the centerline of the shadow. The trees are planted 10 feet from the stream channel.*

channel at noon and 15 feet into the channel at 2:00 pm. The implication of this illustration is that a 'windbreak' of 50 foot trees would expose 60 to 70% of the water to direct solar radiation.

## Observations and Conclusions

Based upon the above discussion there are a number of observations that can be made. The capacity of a stream to buffer against temperature increase is directly influenced by water volume and the size of the surface area that is exposed to the energy source. This capacity can be modified directly through the addition of snowmelt and interflow. Similarly, over-night low air temperature will modify the daily temperature range of a stream by influencing pre-dawn water temperature.

The specific heat of water allows water to absorb considerable amounts of energy before its temperature will increase. Similarly, a warmed stream must release significant amounts of energy before cooling can take place. The minimum temperature that water can be cooled will be the lowest temperature in the local environment (i.e. air or stream bank temperature). This means that it will be difficult to cool a stream in a warm environment. This statement is true whether the stream is shaded or not.

It is true that shade can be used to intercept direct solar radiation over water. However, in reality this interception will yield only limited benefit in many situations. Total surface radiation is comprised of solar radiation (direct, diffuse and scattered) and ambient radiation. Direct sunlight only accounts for approximately 20% of the total, and as a result, shaded areas can receive up to 80% of the total radiative energy available at the surface. Furthermore the ability of woody vegetation (the physical limitation of height growth) to shade a stream decreases with increasing stream width. The value of shade is further influenced by the structure and orientation of the woody vegetation that creates the shade. A stream running east or west will have an entirely different shading pattern than one running north or south. Shade generated from a tall canopy of cottonwoods with an open understory will result in a different shading influence (i.e. canopy closure and air movement) than a mixed conifer community with multiple vegetation strata. Shade generated by the topography and/or stream channel will also contribute different levels of shading and exposure for water. Consequently, shade standards should indicate the amount of shade needed, not the quantity and size of woody vegetation.

Woody vegetation is only one component in a riparian ecosystem. Its importance is dependent upon site conditions and is site specific. Watershed attributes such as air mass characteristics, elevation gradient, adiabatic rate, channel (water) width and depth, water velocity, surrounding landscape, and interflow inputs all influence water temperature and can be of equal or greater importance to stream temperature than vegetation shade.

The history of land management in riparian zones includes periods of channelization, tree removal, the development of stream structures, the removal of large woody debris, and corridor fencing. All of these management strategies, like the current desire to control stream temperature with vegetation shade, were intended to meet a recognized land management need. Unfortunately the application of a standardized management strategy that does not account for the dynamic nature of a riparian zone will likely lead to more failures than successes. Land nanagement decisions need to be site specific and they need to be made by qualified land managers. Streamside vegetation can improve bank stability, increase habitat for some species of wildlife, and serve as a component in the system as a whole, but shade does not control stream temperature.

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Authors are associate professor Department of Rangeland Resources, Oregon State University, Corvallis, ORE. 97331 and graduate research assistant Department of Physics, Montana State University, Bozeman, Mont. 59717.

Irrigation Company Name, Address

SUNNYSIDE

WEISER

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS

EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-10-03 | |
| Location of Application: BRIDGE BELOW DIVERSON | |
| Aquatic weeds(s) present: MILFOIL | |
| Condition Code: (A,B,C, etc.) B | |
| Magnacide H per cfs: .5 | |
| Flow rate in canal: 40 | cfs |
| Treatment time: 1 | hrs |
| Water Temperature: 70 | °F |
| Container No. DW 8523 | |
| Start contents: 43.9 | gal |
| Total quantity used: (GPH X hours) (actual) 9.9 | gal |
| Quantity remaining: 34.0 | gal |
| Time started: [illegible] | am / pm (am circled) |
| Time ended: 8.06 | am / pm (am circled) |
| Time (actual): 2 HRS | |
| Approximate Wind Velocity: 0 | mph |
| Wind Direction: | |

Certified Applicator's Name: CARL McELHINNEY

Certified Applicator's License #: 2500

Application recommended by: ART CORRIEA

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 9 | |
| Gallon per hour: (actual) 9.9 | |
| Orifice size: 043 | inches |
| Pressure setting: 20 | p.s.i.g |

Application concentration:
ppm (not to exceed 15 ppm)

(gal/cfs X 1884) = ppm
(time (min.) )

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 408 GROSS

20 min

53208 Billed

Irrigation Company Name, Address
SCHWENK FELDER
CAMBRIDGE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS

EPA Registration #10707-9

Date of Application: 07-07-03

Location of Application: DIVERSION

Aquatic weeds(s) present: MIL FOIL - MOSS

Condition Code: (A,B,C, etc.) D-E

Magnacide H per cfs:

Flow rate in canal: 15-20 cfs

Treatment time: 2½ hrs

Water Temperature: 64 °F

Container No. E 8440

Start contents: 33.3 gal

Total quantity used: (GPH X hours) (actual) 33.3 gal

Quantity remaining: gal

Time started: 8:20 am / pm (am circled)

Time ended: 11:30 am / pm (am circled)

Time (actual): 2½ HRS

Approximate Wind Velocity: 0 mph

Wind Direction:

Certified Applicator's Name: CARL McELHINNEY

Certified Applicator's License #: 2500

Application recommended by: BROCK ROBBINS

Worker Protection Notification
Date of Contact: NA
Time of Contact: NA
Name of Person Contacted: NA

Gallons per hour: (calculated) 13

Gallon per hour: (actual) 13.3

Orifice size: .048 inches

Pressure setting: 20 p.s.i.g

Application concentration: ppm (not to exceed 15 ppm)

(gal/cfs X 1884) = ppm
(time (min.) )

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: WEIR 1 HR
BARN 1 HR
WEST of SCHWENKFELDER ½ HR
Billed 53175

Irrigation Company Name, Address
SUNNYSIDE IRRIG
WEISER ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 6-17-03 | |
| Location of Application: DIVERSION | |
| Aquatic weeds(s) present: MILFOIL | |
| Condition Code: (A,B,C, etc.) B | |
| Magnacide H per cfs: .5 | |
| Flow rate in canal: 40 | cfs |
| Treatment time: 1 | hrs |
| Water Temperature: 65 | °F |

| | |
|---|---|
| Container No. E 8440 | |
| Start contents: 42.2 | gal |
| Total quantity used: (GPH X hours) (actual) 8.9 | gal |
| Quantity remaining: 33.3 | gal |
| Time started: 7.00 | (am) pm |
| Time ended: 8.00 | (am) pm |
| Time (actual): 1 | |
| Approximate Wind Velocity: 0 | mph |
| Wind Direction: | |

| |
|---|
| Certified Applicator's Name: CARL McELHINNEY |
| Certified Applicator's License #: 2500 |
| Application recommended by: ART CORRIEA |

| |
|---|
| Worker Protection Notification |
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 9 | |
| Gallon per hour: (actual) 8.9 | |
| Orifice size: .043 | inches |
| Pressure setting: 20 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) | |
| (gal/cfs X 1884) = / (time (min.) ) | ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 407# GROSS LEFT
235# NET "

29m

Billed
52916

Irrigation Company Name, Address

SUNNY SIDE

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 6-2-03 | |
| Location of Application: AT DIVERSION | |
| Aquatic weeds(s) present: Milfoil | |
| Condition Code: (A,B,C, etc.) | C |
| Magnacide H per cfs: | .50 |
| Flow rate in canal: | 40 cfs |
| Treatment time: | 1 hrs |
| Water Temperature: | 56 °F |

| | |
|---|---|
| Container No. SA 10892 EB 410 | 3.25 GAL full |
| Start contents: | gal |
| Total quantity used: (GPH X hours) (actual) | 13.45 gal |
| Quantity remaining: | 42.2 gal |
| Time started: | 7:00 am |
| Time ended: | 8:00 am |
| Time (actual): | 1 HR |
| Approximate Wind Velocity: | -0- mph |
| Wind Direction: | |

| | |
|---|---|
| Certified Applicator's Name: | CARL McELHINNEY |
| Certified Applicator's License #: | 2500 |
| Application recommended by: | ART CORRIEA |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) | 13. |
| Gallon per hour: (actual) | 13.45 |
| Orifice size: | .048 inches |
| Pressure setting: | 20 p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = (time (min.)) | 10.5 ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes:
20 mi
Billed
52625

Irrigation Company Name, Address
JW HOLMES
INDIAN VALLEY ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: | 7-31-02 |
| Location of Application: | SOUTH OF INDIAN VALLEY STORE |

| | |
|---|---|
| Aquatic weeds(s) present: | MIL FOIL |
| Condition Code: (A,B,C, etc.) | C |
| Magnacide H per cfs: | .5 |
| Flow rate in canal: | 5 cfs |
| Treatment time: | 2 hrs |
| Water Temperature: | 65 °F |

| | |
|---|---|
| Container No. | |
| Start contents: | 34.7 gal |
| Total quantity used: (GPH X hours) (actual) | 2.3 gal |
| Quantity remaining: | 32.4 gal |
| Time started: | 9:30 (am) pm |
| Time ended: | 11:30 (am) pm |
| Time (actual): | 2 HR |
| Approximate Wind Velocity: | W 3 mph |
| Wind Direction: | WEST |

| | |
|---|---|
| Certified Applicator's Name: | CARL McELHINNEY |
| Certified Applicator's License #: | 2500 |
| Application recommended by: | JOE HOLMES |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) | 1.25 |
| Gallon per hour: (actual) | 1.15 |
| Orifice size: | .016 inches |
| Pressure setting: | 15 p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = / (time (min.) ) | ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes:
# 49826
100 miles

Irrigation Company Name, Address
[illegible]

# MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS

EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-10-02 | |
| Location of Application: AT DIVERSION | |
| Aquatic weeds(s) present: MILFOIL | |
| Condition Code: (A,B,C, etc.) C-D | |
| Magnacide H per cfs: | |
| Flow rate in canal: 1000 INCH 2½ WEIR 40 cfs | |
| Treatment time: 1 hrs | |
| Water Temperature: 7- °F | |

| | |
|---|---|
| Container No. | |
| Start contents: 52.4 gal | |
| Total quantity used: (GPH X hours) (actual) 10.5 gal | |
| Quantity remaining: 41.9 gal | |
| Time started: 7:58 8:58 am (circled) pm | |
| Time ended: 8:58 am (circled) pm | |
| Time (actual): 1 HR | |
| Approximate Wind Velocity: 0 mph | |
| Wind Direction: | |

| | |
|---|---|
| Certified Applicator's Name: CARL MC | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: ART CORRIEA | |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) | |
| Gallon per hour: (actual) 10.5 | |
| Orifice size: .045 inches | |
| Pressure setting: 20 p.s.i.g | |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = ppm (time (min.) ) | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: Billed #49739 20 mi.

Irrigation Company Name, Address
MIDDLE DITCH
MIDVALE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-2-02 | Certified Applicator's Name: CARL McElhinny |
| Location of Application: MIDVALE DIVERSON | Certified Applicator's License #: 2500 |
| | Application recommended by: BOSCO BOSLER |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL | **Worker Protection Notification** |
| | Date of Contact: NA |
| Condition Code: (A,B,C, etc.) D | Time of Contact: NA |
| Magnacide H per cfs: | Name of Person Contacted: NA |
| Flow rate in canal: 40 cfs | Gallons per hour: (calculated) 10 |
| | Gallon per hour: (actual) 12 |
| Treatment time: 3 hrs | Orifice size: .045 inches |
| | Pressure setting: 24 p.s.i.g |
| Water Temperature: 72 °F | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = ppm / (time (min.) ) |

| | |
|---|---|
| Container No. | Cylinder = 52.4 gal |
| Start contents: 36.5 gal | 2450 skid = 347.0 gal |
| Total quantity used: (GPH X hours) (actual) 36.5 gal | 2300 skid = 325.8 gal |
| Quantity remaining: -0- gal | 2500 skid = 354.1 gal |
| Time started: 12:50 am (pm) | 3000 skid = 424.9 gal |
| Time ended: 4.00 am pm | Magnacide H wt. = 7.06 lbs/gal |
| Time (actual): 3.HR 10min | Notes: 1.4 w[illegible] #49613 |
| Approximate Wind Velocity: 0 mph | |
| Wind Direction: | |

Irrigation Company Name, Address
SCHWEN FELDER
CAMBRIDGE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-2-02 | |
| Location of Application: DIVERSION | |
| Aquatic weeds(s) present: MILFOIL | |
| Condition Code: (A,B,C, etc.) D-E | |
| Magnacide H per cfs: | |
| Flow rate in canal: 15 | cfs |
| Treatment time: 2½ | hrs |
| Water Temperature: 64 | °F |
| Container No. DW 10529 | |
| Start contents: 79.1 52.4 | gal |
| Total quantity used: (GPH X hours) (actual) 30 | gal |
| Quantity remaining: | gal |
| Time started: 900 | (am) pm |
| Time ended: 12:30 | am (pm) |
| Time (actual): 2½ | |
| Approximate Wind Velocity: 0 | mph |
| Wind Direction: | |

| | |
|---|---|
| Certified Applicator's Name: CARL McELHINNEY | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: BROCK ROBBINS | |

| |
|---|
| Worker Protection Notification |
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 12 | |
| Gallon per hour: (actual) 12 | |
| Orifice size: .085 | inches |
| Pressure setting: 24 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) | |
| (gal/cfs X 1884) = / (time (min.) ) | ppm |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 4 WEIR
28 miles Billet 49612
*WEIR
*BARN
*WEST 46
SCHWENK ROAD
73 miles

Irrigation Company Name, Address
SUNNYSIDE DITCH
WEISER

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

Date of Application: 6-29-02

Location of Application: SUNNY SIDE CANAL DIVERSION

Aquatic weeds(s) present: MILFOIL

Condition Code: (A,B,C, etc.) C

Magnacide H per cfs: 1

Flow rate in canal: 25-30 cfs

Treatment time: 24RS hrs

Water Temperature: 73 °F

Container No. DW 10529

Start contents: 27.2 gal

Total quantity used: (GPH X hours) (actual) 13.1 gal

Quantity remaining: 14.1 gal 270#

Time started: 6:00 am pm

Time ended: 8:00 am pm

Time (actual): 24RS

Approximate Wind Velocity: 0 mph

Wind Direction:

Certified Applicator's Name: CARL McELHINNEY

Certified Applicator's License #: 2500

Application recommended by: CARL McELHINNEY

Worker Protection Notification
Date of Contact: NA
Time of Contact: NA
Name of Person Contacted: NA

Gallons per hour: (calculated) 7.2

Gallon per hour: (actual) 6.55

Orifice size: .035 inches

Pressure setting: 20 p.s.i.g

Application concentration: ppm (not to exceed 15 ppm)

$\frac{\text{(cal/cfs X 1884)}}{\text{(time (min.))}}$ = ppm

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: .80 ON WEIR
APPROX 1200 IN
20 miles
Billed 49569

Irrigation Company Name, Address
SUNNY SIDE DITCH
WEISER ID 83672

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 6 3 02 | Certified Applicator's Name: CARL McELHINNEY |
| Location of Application: SUNNY SIDE CANAL | Certified Applicator's License #: 2500 |
| | Application recommended by: CARL McELHINNEY |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL PONDWEED | Worker Protection Notification |
| | Date of Contact: NA |
| | Time of Contact: NA |
| | Name of Person Contacted: NA |
| Condition Code: (A,B,C, etc.) C | |
| Magnacide H per cfs: 1 | Gallons per hour: (calculated) 7.2 |
| Flow rate in canal: 1250 inch 25-30 cfs | Gallon per hour: (actual) 5.9 |
| | Orifice size: .035 inches |
| Treatment time: 3 HR hrs | Pressure setting: 20 p.s.i.g |
| Water Temperature: 55 °F | Application concentration: ppm (not to exceed 15 ppm) |
| | (cal/cfs X 1884) = ppm / (time (min.) ) |

| | |
|---|---|
| Container No. DW 10529 | |
| Start contents: 52.4 gal | Cylinder = 52.4 gal |
| Total quantity used: (GPH X hours) (actual) 17.7 gal | 2450 skid = 347.0 gal |
| | 2300 skid = 325.8 gal |
| | 2500 skid = 354.1 gal |
| Quantity remaining: 34.7 gal | 3000 skid = 424.9 gal |
| Time started: 6:15 am pm | Magnacide H wt. = 7.06 lbs/gal |
| Time ended: 9.30 am pm | Notes: Billed 49157 20 mi |
| Time (actual): 3 HRS | |
| Approximate Wind Velocity: 0 mph | |
| Wind Direction: | |

Irrigation Company Name, Address
LOWER CRANE CR
WEISER ID

COST
43.52

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 8-21-01 | Certified Applicator's Name: CARL McELHINNEY |
| Location of Application: CRANE CR DIVERSION DWIGHT MADDOX | Certified Applicator's License #: 2500 |
| | Application recommended by: DAVE MADDOX |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL MOSS | Worker Protection Notification |
| Condition Code: (A,B,C, etc.) C | Date of Contact: NA |
| | Time of Contact: NA |
| | Name of Person Contacted: NA |
| Magnacide H per cfs: 1 | Gallons per hour: (calculated) 3.2 |
| Flow rate in canal: 350-400" 7 cfs | Gallon per hour: (actual) 3.2 |
| | Orifice size: .025 inches |
| Treatment time: 2 hrs | Pressure setting: 15 p.s.i.g |
| Water Temperature: 68 °F | Application concentration: ppm (not to exceed 15 ppm) |
| | (gal/cfs X 1884) = ppm<br>(time (min.) ) |

| | |
|---|---|
| Container No. E 9223 | |
| Start contents: 12.9 gal | Cylinder = 52.4 gal |
| Total quantity used: (GPH X hours) (actual) 6.4 gal | 2450 skid = 347.0 gal<br>2300 skid = 325.8 gal<br>2500 skid = 354.1 gal |
| Quantity remaining: 6.5 gal | 3000 skid = 424.9 gal |
| Time started: 10:45 am / pm (am circled) | Magnacide H wt. = 7.06 lbs/gal |
| Time ended: 12.45 am / pm (pm circled) | Notes: 8-11-d #47184 28 mi |
| Time (actual): 2 HRS | |
| Approximate Wind Velocity: 0 mph | |
| Wind Direction: — | |

Irrigation Company Name, Address

MIDDLE DITCH
MIDVALE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS

EPA Registration #10707-9

Date of Application: 8-1-01

Location of Application: MIDVALE DIVERSION

Aquatic weeds(s) present: MILFOIL POND WEED

Condition Code: (A,B,C, etc.) C - D

Magnacide H per cfs: 1.0

Flow rate in canal: 40 cfs

Treatment time: 3 hrs

Water Temperature: 68 °F

Container No. E 8726 E9223

Start contents: 24.1 EMPTIED 19.2 gal

Total quantity used: (GPH X hours) (actual) 24.1 30.4 6.3 gal

Quantity remaining: E9223 12.9 gal

Time started: 10 am (circled) pm

Time ended: 1 am pm (circled)

Time (actual): 3 HRS

Approximate Wind Velocity: 3 mph

Wind Direction: SE

Certified Applicator's Name: CARL McELHINNEY

Certified Applicator's License #: 2500

Application recommended by: BOSCO

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

Gallons per hour: (calculated) 11.8

Gallon per hour: (actual) 10.1

Orifice size: .045 inches

Pressure setting: 20 p.s.i.g

Application concentration: ppm (not to exceed 15 ppm)

(gal/cfs X 1884) / (time (min.)) = 8 ppm

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 1.4 ON WEIR

Billed # 47112

58 M.

Irrigation Company Name, Address
SUNNY SIDE DITCH
WEISER ID

331
172
159

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-17-01 | |
| Location of Application: SUNNY SIDE DITCH GALLOWAY DIVERSION | |

| | |
|---|---|
| Aquatic weeds(s) present: MIL FOIL PONDWEED | |
| Condition Code: (A,B,C, etc.) | C |
| Magnacide H per cfs: | 1 |
| Flow rate in canal: 1250 (?) 2530 | cfs |
| Treatment time: 3 | hrs |
| Water Temperature: 65 | °F |

| | |
|---|---|
| Container No. E 9223 | |
| Start contents: 41.65 | gal |
| Total quantity used: (GPH X hours) (actual) 22.5 | gal |
| Quantity remaining: 19.2 | gal |
| Time started: 5:55 | am (circled) / pm |
| Time ended: 9:15 | am (circled) / pm |
| Time (actual): 3.HR 20 min | |
| Approximate Wind Velocity: 0 | mph |
| Wind Direction: – | |

| | |
|---|---|
| Certified Applicator's Name: CARL McELHINNEY | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: CURTIS HICKEY | |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 7.2 | |
| Gallon per hour: (actual) 7.5 | |
| Orifice size: .035 | inches |
| Pressure setting: 20 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) / (time (min.)) = 7.85 | ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 1.0 ON WEIR
20 min
Billed 46980

Irrigation Company Name, Address
SCHWENK FELDER DITCH
CAMBRIDGE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-10-01 | |
| Location of Application: SCHWENK FELDER DIVERSION | |
| Aquatic weeds(s) present: MILFOIL PONDWEED | |
| Condition Code: (A,B,C, etc.) | D-E |
| Magnacide H per cfs: | 1.5 |
| Flow rate in canal: | 15-17 cfs |
| Treatment time: | 3½ hrs |
| Water Temperature: | 70 °F |
| Container No. | E 9223 |
| Start contents: | 52.4 gal |
| Total quantity used: (GPH X hours) (actual) | 10.75 gal |
| Quantity remaining: | 41.65 gal |
| Time started: | 9:15 am (circled) / pm |
| Time ended: | 12:55 am / pm (circled) |
| Time (actual): | 3.25 |
| Approximate Wind Velocity: | -0- mph |
| Wind Direction: | -0- |

| | |
|---|---|
| Certified Applicator's Name: | CARL MCELHINNEY |
| Certified Applicator's License #: | 2500 |
| Application recommended by: | BROCK ROBBINS |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) | 6.8 |
| Gallon per hour: (actual) | 3.3 plugged filter |
| Orifice size: | .045 inches |
| Pressure setting: | 6.7 p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) | |
| (gal/cfs X 1884) = / (time (min.) ) | ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 2½ HR AT WEIR 76 mi
.75 HR AT Schwenkfelder Hom
546
464 plugged filter
76#
WEIR 4-5 | BILLED 46979 | 10.75

Irrigation Company Name, Address

MIDVALE DITCH

MIDVALE

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS

EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-6-01 | |
| Location of Application: MIDVALE | |
| Aquatic weeds(s) present: POND WEED milfoil | |
| Condition Code: (A,B,C, etc.) | D-E |
| Magnacide H per cfs: | |
| Flow rate in canal: | 40 cfs |
| Treatment time: | 3 HR 20 min hrs |
| Water Temperature: | 74 °F |

| | |
|---|---|
| Container No. E9222 DW10416 | |
| Start contents: | 26.4 / 16.0 gal |
| Total quantity used: (GPH X hours) (actual) | 26.4 / 16.0 / 42.4 gal |
| Quantity remaining: | 0 / 0 gal |
| Time started: | 9:40 am / pm (am circled) |
| Time ended: | 1:10 am / pm |
| Time (actual): | 3 HRS 30 MIN |
| Approximate Wind Velocity: | -0- mph |
| Wind Direction: | |

| | |
|---|---|
| Certified Applicator's Name: | CARL McELHINNEY |
| Certified Applicator's License #: | 2500 |
| Application recommended by: | BOSCO |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) | 14 |
| Gallon per hour: (actual) | 12.2 |
| Orifice size: | .045 inches |
| Pressure setting: | 29-30 p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) $\frac{(gal/cfs \times 1884)}{(time\ (min.))} =$ ppm | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 58 miles
1.81 HR BRIDGE
1½ VALLEY ROAD
Bill'd 46859

Irrigation Company Name, Address
MIDDLE DITCH
MIDVALE ID

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

Date of Application: 6 12-01

Location of Application: MIDVALE

Aquatic weeds(s) present: MILFOIL PONDWEED (SOME?)

Condition Code: (A,B,C, etc.) C

Magnacide H per cfs: .5

Flow rate in canal: 40 CFS cfs

Treatment time: 2 1/2 hrs

Water Temperature: 57 °F

Container No. SA08368

Start contents: 355 G GROSS 26 gal

Total quantity used: (GPH X hours) (actual) 26 gal

Quantity remaining: -0- gal

Time started: 9.00 am 11.30 pm

Time ended: 11.30 am pm

Time (actual): 2 1/2

Approximate Wind Velocity: 5 mph

Wind Direction: W

Certified Applicator's Name: CARL McELHINNEY

Certified Applicator's License #: 2500

Application recommended by: 30SCO

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

Gallons per hour: (calculated) 10

Gallon per hour: (actual) 10.4

Orifice size: .043 inches

Pressure setting: 17 p.s.i.g

Application concentration: ppm (not to exceed 15 ppm)

(gal/cfs X 1884) = 8.2 ppm
(time (min.) )

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: Billed 46510 58 miles

Irrigation Company Name, Address

SUNNY SIDE DITCH

WEISER ID 83672

**MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS**

EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 5-31-01 | Certified Applicator's Name: CARL McELHINNEY |
| Location of Application: SUNNY SIDE DITCH | Certified Applicator's License #: 2500 |
| | Application recommended by: CURTIS HICKEY |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL MOSS | **Worker Protection Notification** |
| Condition Code: (A,B,C, etc.) C | Date of Contact: NA |
| Magnacide H per cfs: 1 | Time of Contact: NA |
| Flow rate in canal: 1250 INCH 25-30 cfs | Name of Person Contacted: NA |
| Treatment time: 3 hrs | Gallons per hour: (calculated) 7.2 |
| Water Temperature: 65 °F | Gallon per hour: (actual) 7.8 |
| | Orifice size: .035 inches |
| | Pressure setting: 20 p.s.i.g |
| | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = 9.6 ppm (time (min.) ) |

| | |
|---|---|
| Container No. DW 11483 | Cylinder = 52.4 gal ✓ |
| Start contents: 23.4 gal | 2450 skid = 347.0 gal |
| Total quantity used: (GPH X hours) (actual) 23.4 gal | 2300 skid = 325.8 gal |
| Quantity remaining: 0 gal | 2500 skid = 354.1 gal |
| Time started: 9.00 am/pm (am circled) | 3000 skid = 424.9 gal |
| Time ended: 12.00 am/pm (pm circled) | Magnacide H wt. = 7.06 lbs/gal |
| Time (actual): | Notes: 20 miles Billed 46508 |
| Approximate Wind Velocity: -0- mph | |
| Wind Direction: — | |

Irrigation Company Name, Address
MIDDLE DITCH
MIDVALE

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 8-18-00 | Certified Applicator's Name: CARL McELHINNEY |
| Location of Application: WASH CO MIDVALE | Certified Applicator's License #: 2500 |
| | Application recommended by: BOSCO BOSLER |

| | |
|---|---|
| Aquatic weeds(s) present: PONDWEED MILFOIL | |
| Condition Code: (A,B,C, etc.) D | |
| Magnacide H per cfs: | |
| Flow rate in canal: 30 cfs | |
| Treatment time: 3 hrs | |
| Water Temperature: 65 °F | |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| |
|---|
| Gallons per hour: (calculated) 10 |
| Gallon per hour: (actual) ~~8~~ 10 |
| Orifice size: .043 inches |
| Pressure setting: 20 p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = ppm (time (min.) ) |

| |
|---|
| Container No. DW 11493 |
| Start contents: 52.4 gal |
| Total quantity used: (GPH X hours) (actual) 29 gal |
| Quantity remaining: 23.4 gal |
| Time started: 11:00 am (circled) pm |
| Time ended: 2:00 am pm (circled) |
| Time (actual): 3 HRS |
| Approximate Wind Velocity: -0-0 mph |
| Wind Direction: — |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes:
Bill #44175 58 mi
1.1 x 2 x 12
90 SEC X 26.7

Irrigation Company Name, Address
SCHWENK FELDER CANAL
CAMBRIDGE

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-26-00 | |
| Location of Application: SCHWENK FELDER DIVERSION | |
| Aquatic weeds(s) present: MILFOIL MOSS POND WEED | |
| Condition Code: (A,B,C, etc.) E | |
| Magnacide H per cfs: 1.50 | |
| Flow rate in canal: 15 | cfs |
| Treatment time: 4 | hrs |
| Water Temperature: 68 | °F |

| | |
|---|---|
| Container No. SAO 4937 | |
| Start contents: 43 | gal |
| Total quantity used: (GPH X hours) (actual) 29.7 | gal |
| Quantity remaining: 13.3 | gal |
| Time started: 9:30 | am (circled) pm |
| Time ended: 2:30 | am pm (circled) |
| Time (actual): 5 HRS | |
| Approximate Wind Velocity: 0 | mph |
| Wind Direction: — — | |

| | |
|---|---|
| Certified Applicator's Name: CALL MCELHINNEY | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: ROYCE SCHWENKFELDER | |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 6.5 | |
| Gallon per hour: (actual) 5.9 | |
| Orifice size: .032 | inches |
| Pressure setting: 25 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = 12.4 ppm (time (min.) ) | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 11:40 76 miles
1 3/4 HR AT N EIR
1 1/4 HR A Y BARN Billed
1 1/2 SCHWENKFELDERS # 43968
4 IN WEIR
IS 500"

Irrigation Company Name, Address
FARMERS SUPPLY
WEISER

**MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS**
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-7-00 | |
| Location of Application: MIDVALE DITCH | |

| | |
|---|---|
| Certified Applicator's Name: CARL McELHINNEY | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: HARMON HORTON | |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL MOSS POND WEED | |
| Condition Code: (A,B,C, etc.) | |
| Magnacide H per cfs: | |
| Flow rate in canal: 25-30 | cfs |
| Treatment time: 3 hr 20 min | hrs |
| Water Temperature: 65 | °F |

| | |
|---|---|
| Worker Protection Notification | |
| Date of Contact: NA | |
| Time of Contact: NA | |
| Name of Person Contacted: NA | |

| | |
|---|---|
| Gallons per hour: (calculated) | |
| Gallon per hour: (actual) 17 | |
| Orifice size: .048 | inches |
| Pressure setting: 29 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = (time (min.) ) | ppm |

| | |
|---|---|
| Container No. SA02526 SA04937 | |
| Start contents: 36.3 54.2 | gal |
| Total quantity used: (GPH X hours) (actual) 45.7 | gal |
| Quantity remaining: 43 | gal |
| Time started: 10.20 | (am) pm |
| Time ended: 1.00 | am (pm) |
| Time (actual): | |
| Approximate Wind Velocity: -0- | mph |
| Wind Direction: – | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes:
43929
58 miles

Irrigation Company Name, Address

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 7-5-00 | |
| Location of Application: SUNNY SIDE DITCH GALLOWAY | |

| | |
|---|---|
| Aquatic weeds(s) present: MILFOIL MOSS POND WEED | |
| Condition Code: (A,B,C, etc.) D, E | |
| Magnacide H per cfs: 1.5 | |
| Flow rate in canal: 25-30 1250 in | cfs |
| Treatment time: 3 | hrs |
| Water Temperature: 65 | °F |

| | |
|---|---|
| Container No. DW 16636 SA02526 | |
| Start contents: 52.4 21.4 | gal |
| Total quantity used: 37.4 (GPH X hours) (actual) | gal |
| Quantity remaining: DW 16636 36.3 | gal |
| Time started: 10:30 | (am) pm |
| Time ended: 1:45 | am (pm) |
| Time (actual): 3:15 | |
| Approximate Wind Velocity: 5 | mph |
| Wind Direction: S | |

| | |
|---|---|
| Certified Applicator's Name: CARL McELHINNEY | |
| Certified Applicator's License #: 2500 # | |
| Application recommended by: CURTIS HICKEY | |

| Worker Protection Notification |
|---|
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 11.5 | |
| Gallon per hour: (actual) | |
| Orifice size: .048 | inches |
| Pressure setting: 19 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) = ppm (time (min.) ) | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: # 43929 20 miles

Irrigation Company Name, Address

MAGNACIDE H APPLICATION RECORD FOR IRRIGATION CANALS
EPA Registration #10707-9

| | |
|---|---|
| Date of Application: 6.22.00 | |
| Location of Application: MIDDLE DITCH NORTH OF MIDVALE | |

| | |
|---|---|
| Aquatic weeds(s) present: MILLFOIL PONDWEED MOSS | |
| Condition Code: (A,B,C, etc.) D | |
| Magnacide H per cfs: 1.05 | |
| Flow rate in canal: 40 | cfs |
| Treatment time: 2 1/2 | hrs |
| Water Temperature: 65 | °F |

| | |
|---|---|
| Container No. OW 1114 SAO 8526 | |
| Start contents: 11 GAL 52.4 | gal |
| Total quantity used: 42 (GPH X hours) (actual) | gal |
| Quantity remaining: OW 1114 EMPTY SAO 8526 21.4 | gal |
| Time started: 9:50 | am (circled) / pm |
| Time ended: 12:50 | am / pm (circled) |
| Time (actual): 3 HRS | |
| Approximate Wind Velocity: 10-12 | mph |
| Wind Direction: FROM NORTH | |

| | |
|---|---|
| Certified Applicator's Name: CARL McELHINNEY | |
| Certified Applicator's License #: 2500 | |
| Application recommended by: BOSCO BOSLER | |

| |
|---|
| Worker Protection Notification |
| Date of Contact: NA |
| Time of Contact: NA |
| Name of Person Contacted: NA |

| | |
|---|---|
| Gallons per hour: (calculated) 14.2 | |
| Gallon per hour: (actual) 14 | |
| Orifice size: .048 | inches |
| Pressure setting: 30 | p.s.i.g |
| Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) / (time (min.)) = 11 | ppm |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

Magnacide H wt. = 7.06 lbs/gal

Notes: 58 miles
1.4
VALLEY & LOUIE FAYE ROAD
SECOND APPLIC NEXT TIME #43651

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 8·23·99 | OPERATOR'S NAME CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION MIDVALE | LICENSE NUMBER 2500 |

| | |
|---|---|
| Aquatic weed(s) present: | Gallons per hour: (calculated) |
| Weed growth condition: (A,B,C, etc.) B | Gallons per hour: (actual) GPH |
| Application concentration: gal/cfs | Orifice size: 045 0.0 inches |
| Flow rate in canal: cfs | Pressure setting: 40 p.s.i.g |
| Treatment time: hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) = ppm |
| Water temperature: 70 F | |

| | |
|---|---|
| Container No. DIVL 1455 | |
| Start contents: gal | |
| Quantity used: (GPH X hours) (actual) 28 gal | |
| Quantity remaining: 21.6 gal | |
| Time started: 9:50 AM | |
| Time ended: 11:50 | |
| Time (actual): 2 hrs | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

322
- 169
153

41049

58

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-28-99 | OPERATOR'S NAME CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION MIDVALE | LICENSE NUMBER 2500 |

| | |
|---|---|
| Aquatic weed(s) present: | Gallons per hour: (calculated) |
| Weed growth condition: (A,B,C, etc.) B | Gallons per hour: (actual) GPH |
| Application concentration: gal/cfs | Orifice size: .045 0.0 inches |
| Flow rate in canal: cfs | Pressure setting: 40 p.s.i.g |
| Treatment time: hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.) ) = ppm |
| Water temperature: 70 F | |

| | |
|---|---|
| Container No. | SA02646 Empty DWL1485 Full |
| Start contents: | 28 gal |
| Quantity used: (GPH X hours) (actual) | 29 gal |
| Quantity remaining: | gal |
| Time started: | 10 AM |
| Time ended: | 12 AM |
| Time (actual): | 2 hrs |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

41048

29

38

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>6-25-99 | OPERATOR'S NAME<br>CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY<br>MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME<br>(if different from operator) |
| LOCATION OF APPLICATION<br>MIDVALE | LICENSE NUMBER<br>2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MIL FOIL | Gallons per hour:<br>(calculated) |
| Weed growth condition:<br>(A,B,C, etc.) D | Gallons per hour:<br>(actual) GPH |
| Application concentration:<br>gal/cfs | Orifice size:<br>.045 0.0 inches |
| Flow rate in canal:<br>cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) = ppm |
| Water temperature:<br>54 F | |

| | |
|---|---|
| Container No. | SA 05057<br>SA 02646 |
| Start contents: | 10 gal<br>52.4 |
| Quantity used:<br>(GPH X hours)<br>(actual) | 28 gal |
| Quantity remaining: | 22.4 gal 0 |
| Time started: | 10:00 AM |
| Time ended: | 12:30 |
| Time (actual): | hrs |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

58

#41046

28

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>8-24-98 | OPERATOR'S NAME<br>CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY<br>MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME<br>(if different from operator) |
| LOCATION OF APPLICATION<br>WASH CO | LICENSE NUMBER<br>2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>PONDWEED<br>MILFOIL | Gallons per hour:<br>(calculated) 12 |
| Weed growth condition:<br>(A,B,C, etc.)<br>C-D | Gallons per hour:<br>(actual) 15 GPH |
| Application concentration:<br>.50 gal/cfs | Orifice size:<br>.045 0.0 inches |
| Flow rate in canal:<br>42 cfs | Pressure setting:<br>20 p.s.i.g |
| Treatment time:<br>2 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) = ppm |
| Water temperature:<br>65 F | |

| | |
|---|---|
| Container No.<br>SA05057 | |
| Start contents:<br>39 gal | 445A |
| Quantity used: 29 gal<br>(GPH X hours)<br>(actual) | 239A |
| Quantity remaining: 10 gal | |
| Time started:<br>10:15 Am | |
| Time ended:<br>12:15 | |
| Time (actual): 2 hrs | |

| | |
|---|---|
| Cylinder | = 152.4 gal |
| 2450 skid | = 1347.0 gal |
| 2300 skid | = 1325.8 gal |
| 2500 skid | = 1354.1 gal |
| 3000 skid | = 1424.9 gal |

1.8
WEIR

168 TARE

58 miles

#37537

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>7-22-98 | OPERATOR'S NAME<br>Bruce Gochnour |
| IRRIGATION DISTRICT/COMPANY<br>Weiser | CERTIFIED APPLICATOR'S NAME<br>(If different from operator) |
| LOCATION OF APPLICATION<br>Grimmett Lateral<br>at Pringle Road | LICENSE NUMBER<br>2855 |

| | |
|---|---|
| Aquatic weed(s) present:<br>Moss | Gallons per hour:<br>(calculated) 7.2 |
| Weed growth condition:<br>(A,B,C, etc.) A | Gallons per hour:<br>(actual) GPH |
| Application concentration:<br>0.18 gal/cfs | Orifice size:<br>0.035 0.0 inches |
| Flow rate in canal:<br>40 cfs | Pressure setting:<br>20 p.s.i.g |
| Treatment time:<br>1 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) 5.65 = ppm |
| Water temperature: 78° F | |

| | |
|---|---|
| Container No. SA05057 | |
| Start contents: | gal |
| Quantity used:<br>(GPH X hours)<br>(actual) | gal |
| Quantity remaining: | gal |
| Time started: 9:15 AM | |
| Time ended: 10:15 AM | |
| Time (actual): 1 | hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

5.7 gal

37192

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-22-98 | OPERATOR'S NAME Bruce Gochnour |
| IRRIGATION DISTRICT/COMPANY Weiser | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION Galloway Canal Lyle Bridge | LICENSE NUMBER 2855 |

| | |
|---|---|
| Aquatic weed(s) present: Moss | Gallons per hour: (calculated) 7.2 |
| Weed growth condition: (A,B,C, etc.) A | Gallons per hour: (actual) GPH |
| Application concentration: 0.048 gal/cfs | Orifice size: .35 0.0 inches |
| Flow rate in canal: 150 cfs | Pressure setting: 20 p.s.i.g |
| Treatment time: 1 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 1.51 = ppm |
| Water temperature: 74° F | |

| | |
|---|---|
| Container No. SA05057 | |
| Start contents: 49.8 gal | 520# 445# |
| Quantity used: (GPH X hours) (actual) gal | |
| Quantity remaining: gal | |
| Time started: 0735 | |
| Time ended: 0835 | |
| Time (actual): 1 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

5.3 gal

# 37191

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-17-98 | OPERATOR'S NAME CARL MCELHINNEY |
| IRRIGATION DISTRICT/COMPANY MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION WASH CO | LICENSE NUMBER 2500 |

| | |
|---|---|
| Aquatic weed(s) present: milfoil moss | Gallons per hour: (calculated) 7.8 |
| Weed growth condition: (A,B,C, etc.) B-C | Gallons per hour: (actual) 7.8 GPH |
| Application concentration: .50 gal/cfs | Orifice size: .035 0.0 inches |
| Flow rate in canal: 38-40 cfs | Pressure setting: 30 p.s.i.g |
| Treatment time: 2 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.) ) = ppm |
| Water temperature: 70 F | |

| | |
|---|---|
| Container No. SA 10955 | |
| Start contents: 15.6 gal | 280 # |
| Quantity used: (GPH X hours) (actual) ~~7.8~~ 15.6 gal | |
| Quantity remaining: 0 gal | |
| Time started: 10.00 AM | |
| Time ended: NOON | |
| Time (actual): 2 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

1.6 WEIR

~~78~~ SEC
73
~~128~~ 36

36993

58 miles

9' X 3' deep
38-40
~~24~~ CFS

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 8-20-97 | OPERATOR'S NAME Carl McElhinney |
| IRRIGATION DISTRICT/COMPANY MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION WASH County | LICENSE NUMBER 2500 |

| | |
|---|---|
| Aquatic weed(s) present: MILFOIL MOSS | Gallons per hour: (calculated) 7.9 |
| Weed growth condition: (A,B,C, etc.) B, C | Gallons per hour: (actual) 7.9 GPH |
| Application concentration: gal/cfs | Orifice size: .036 0.0 inches |
| Flow rate in canal: 45 cfs | Pressure setting: 25 p.s.i.g |
| Treatment time: 2 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 5.5 = ppm |
| Water temperature: 68 F | |

Billed # 33766

| | |
|---|---|
| Container No. DW 10337 SA 10955 | |
| Start contents: 52.4 gal 2.5 gal 52.4 | |
| Quantity used: (GPH X hours) (actual) 15.8 gal | |
| Quantity remaining: 39.1 gal | |
| Time started: 10:45 | |
| Time ended: 12:45 | |
| Time (actual): 2 hrs | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

1.3 WEIR

537

443 # Left

½ HOUR 2.5 gal

58 miles

94 # used FROM SA 10955

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-29-97 | OPERATOR'S NAME |
| IRRIGATION DISTRICT/COMPANY Weiser IRRIG | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION WASH CO | LICENSE NUMBER |

| | |
|---|---|
| Aquatic weed(s) present: milfoil | Gallons per hour: (calculated) |
| Weed growth condition: (A,B,C, etc.) B | Gallons per hour: (actual) 7 GPH |
| Application concentration: gal/cfs | Orifice size: 36 0.0 inches |
| Flow rate in canal: 120 cfs | Pressure setting: 20 p.s.i.g |
| Treatment time: 1 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) = ppm |
| Water temperature: 70 F | |

38572

| | |
|---|---|
| Container No. DW10337 | |
| Start contents: gal | |
| Quantity used: (GPH X hours) (actual) 7 gal | |
| Quantity remaining: 26.5 gal | |
| Time started: 11:30 | |
| Time ended: 12:30 | |
| Time (actual): 1 hrs | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

7

Bosc... middle Di... 355-2281

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-21-97 | OPERATOR'S NAME Gene Fro...shiesman |
| IRRIGATION DISTRICT/COMPANY middle Ditch | CERTIFIED APPLICATOR'S NAME (if different from operator) |
| LOCATION OF APPLICATION midvale | LICENSE NUMBER 4179 |

| | |
|---|---|
| Aquatic weed(s) present: melfoil + moss | Gallons per hour: (calculated) 7.9 |
| Weed growth condition: (A,B,C, etc.) B+C | Gallons per hour: (actual) GPH |
| Application concentration: gal/cfs | Orifice size: 0.0 inches .35 |
| Flow rate in canal: cfs | Pressure setting: p.s.i.g 25 |
| Treatment time: 2.5 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.) ) = ppm |
| Water temperature: F 70° | |

33568

| | |
|---|---|
| Container No. DW 10337 | |
| Start contents: gal 52.4 | |
| Quantity used: gal (GPH X hours) (actual) | |
| Quantity remaining: gal | |
| Time started: 11:15 Am | |
| Time ended: 1:55 PM | |
| Time (actual): hrs | |

| | |
|---|---|
| Cylinder | = 52.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

58 miles

15.9

7-21-97
539 gross
417 used
112

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 6-24-97 | OPERATOR'S NAME Gene Froshiesar |
| IRRIGATION DISTRICT/COMPANY Schwenf Elden-Ditch | CERTIFIED APPLICATOR'S NAME (if different from operator) Carl McElhinney |
| LOCATION OF APPLICATION Adams Co | LICENSE NUMBER 2500 |

| | |
|---|---|
| Aquatic weed(s) present: milkfoil + moss | Gallons per hour: (calculated) 9.2 |
| Weed growth condition: (A,B,C, etc.) C - D | Gallons per hour: (actual) GPH |
| Application concentration: 6.7 gal/cfs | Orifice size: 0.0 inches .035 |
| Flow rate in canal: 13 cfs | Pressure setting: p.s.i.g 35 |
| Treatment time: 3 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 6.7 = ppm |
| Water temperature: 55 F | |

| | |
|---|---|
| Container No. DW 12088 | |
| Start contents: 32.8 gal | |
| Quantity used: (GPH X hours) (actual) 32.8 gal | |
| Quantity remaining: 0 gal 0 | |
| Time started: 10:30 Am | |
| Time ended: 2:30 pm | |
| Time (actual): hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

76

Billed 32912

Water guage 1.2

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION June 20, 97 | OPERATOR'S NAME |
| IRRIGATION DISTRICT/COMPANY Middle Ditch | CERTIFIED APPLICATOR'S NAME (if different from operator) Gene Froshiesar |
| LOCATION OF APPLICATION Midvale | LICENSE NUMBER 4176 |

| | |
|---|---|
| Aquatic weed(s) present: Milfoil + Moss | Gallons per hour: (calculated) |
| Weed growth condition: (A,B,C, etc.) B + C | Gallons per hour: (actual) ~~,~~ GPH |
| Application concentration: .25 gal/cfs | Orifice size: 0.0 .035 inches |
| Flow rate in canal: 5.0 cfs | Pressure setting: 25 p.s.i.g |
| Treatment time: 2.5 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) = ppm |
| Water temperature: 56 F | |

| | |
|---|---|
| Container No. DW 120 88 | |
| Start contents: 52.4 gal | |
| Quantity used: (GPH X hours) (actual) 19.6 gal | |
| Quantity remaining: 32.8 gal | |
| Time started: 10:10 | |
| Time ended: | |
| Time (actual): hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed 32911

58 miles

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>Aug 6, 1996 | OPERATOR'S NAME<br>Carl McElhinney |
| IRRIGATION DISTRICT/COMPANY<br>Middle Ditch | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Froshiesar |
| LOCATION OF APPLICATION<br>Midvale | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>milfoil + moss | Gallons per hour:<br>(calculated) 7.9 |
| Weed growth condition:<br>(A,B,C, etc.) BC | Gallons per hour:<br>(actual) GPH |
| Application concentration:<br>.25 gal/cfs | Orifice size:<br>0.0 inches 35 |
| Flow rate in canal:<br>5.0 cfs | Pressure setting:<br>p.s.i.g 25 |
| Treatment time:<br>2.5 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) = ppm |
| Water temperature:<br>F 62 | |

| | |
|---|---|
| Container No. | AC 10 96 |
| Start contents: gal | 234 lb. |
| Quantity used: (GPH X hours) (actual) gal | 18.7 |
| Quantity remaining: gal | 234 lb |
| Time started: | 11:00 Am |
| Time ended: | 1:30 |
| Time (actual): hrs | 2½ |

| | |
|---|---|
| Cylinder | = 152.4 gal |
| 2450 skid | = 347.0 gal |
| 2300 skid | = 325.8 gal |
| 2500 skid | = 354.1 gal |
| 3000 skid | = 424.9 gal |

We used 132 lb.

#29421 58 miles

18.7 GAL

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>July 18, 1996 | OPERATOR'S NAME<br>Carl Mclhinney |
| IRRIGATION DISTRICT/COMPANY<br>Middle Ditch Co | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Froshiesar |
| LOCATION OF APPLICATION<br>[illegible] | LICENSE NUMBER<br>c-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>Milfoil [illegible] | Gallons per hour:<br>(calculated) 7.9 |
| Weed growth condition:<br>(A,B,C, etc.) B.C. | Gallons per hour:<br>(actual) GPH |
| Application concentration:<br>.25 gal/cfs | Orifice size:<br>0.0 inches .035 |
| Flow rate in canal:<br>50 cfs | Pressure setting:<br>25 p.s.i.g |
| Treatment time:<br>2.5 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) = 4.3 ppm |
| Water temperature:<br>F 65 | |

| | |
|---|---|
| Container No. | Sh04966 |
| Start contents: gal | 19.5 |
| Quantity used: gal<br>(GPH X hours)<br>(actual) | 19.5 |
| Quantity remaining: gal | 0 |
| Time started: | 11:30 AM |
| Time ended: | 2:30 |
| Time (actual): hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

29275

58.6

Water gauge 1 ft 3.0

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION July 2, 96 | OPERATOR'S NAME Carl McKinney |
| IRRIGATION DISTRICT/COMPANY MIDDLE DITCH | CERTIFIED APPLICATOR'S NAME (If different from operator) Gene Froshiesar |
| LOCATION OF APPLICATION MIDVALE | LICENSE NUMBER C-6805 |

| | |
|---|---|
| Aquatic weed(s) present: Milfoil & Moss | Gallons per hour: (calculated) 7.9 |
| Weed growth condition: (A,B,C, etc.) B,C | Gallons per hour: (actual) GPH |
| Application concentration: gal/cfs .25 | Orifice size: 0.0 inches .035 |
| Flow rate in canal: cfs 5.0 | Pressure setting: p.s.i.g 25 |
| Treatment time: hours 2.5 | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 4.3 = ppm |
| Water temperature: 65 F | |

| | |
|---|---|
| Container No. SH0 4966 | |
| Start contents: gal 46.7 | |
| Quantity used: (GPH X hours) (actual) 20.25 gal | |
| Quantity remaining: 26.45 gal | |
| Time started: 11:00 Am | |
| Time ended: 1:30 pm | |
| Time (actual): hrs 2 1/2 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

#2895

Gross left 351.1 lb.

miles 58.4

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>7-2-96 | OPERATOR'S NAME<br>CAL MhChinney |
| IRRIGATION DISTRICT/COMPANY<br>Weiser irrigaton | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene FroSliesAr |
| LOCATION OF APPLICATION<br>Washington-Co. | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MilFoil + moss | Gallons per hour:<br>(calculated)<br>2. |
| Weed growth condition:<br>(A,B,C, etc.)<br>A | Gallons per hour:<br>(actual) GPH 2.9 |
| Application concentration:<br>gal/cfs | Orifice size:<br>0.0 inches 35 |
| Flow rate in canal:<br>cfs | Pressure setting:<br>20 p.s.i.g |
| Treatment time:<br>1 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) = ppm |
| Water temperature:<br>64° F | |

| | |
|---|---|
| Container No. AC1104 | |
| Start contents: gal 7.9 | |
| Quantity used: gal<br>(GPH X hours)<br>(actual) | |
| Quantity remaining: gal | |
| Time started: 8:05 | |
| Time ended: 9:05 | |
| Time (actual): hrs 1 hr | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

20 miles

Bill'd 28949

10:37

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>6-20-96 | OPERATOR'S NAME<br>Carl McElhinney |
| IRRIGATION DISTRICT/COMPANY<br>SCHWENFELDER DITCH | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Froshiesar |
| LOCATION OF APPLICATION<br>ADAMS CO. | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MILLFOIL / MOSS | Gallons per hour:<br>(calculated) 9.2 |
| Weed growth condition:<br>(A,B,C, etc.) C-D | Gallons per hour:<br>(actual) 8.3 GPH |
| Application concentration:<br>6.7 gal/cfs | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal:<br>13 cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>3 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) 6.7 = ppm |
| Water temperature:<br>58 F | |

| | |
|---|---|
| Container No. | AC-1104 |
| Start contents: | 36.5 gal |
| Quantity used:<br>(GPH X hours)<br>(actual) | 25.5 gal |
| Quantity remaining: | 11 gal |
| Time started: | 10:35 AM |
| Time ended: | 1:35 PM |
| Time (actual): | 3 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed 28670

70 miles

END GROSS

257

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>6-12-96 | OPERATOR'S NAME<br>Carl McLhinney |
| IRRIGATION DISTRICT/COMPANY<br>Weiser irrigation | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Fooshiesan |
| LOCATION OF APPLICATION<br>Washington County | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MilFoil & moss | Gallons per hour: (calculated) 7 |
| Weed growth condition: (A,B,C, etc.)<br>A | Gallons per hour: (actual) 8.2 GPH |
| Application concentration: gal/cfs | Orifice size: .035 0.0 inches |
| Flow rate in canal: 80 cfs | Pressure setting: 20 p.s.i.g |
| Treatment time: 2.5 hours | Application concentration: ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) = ppm |
| Water temperature: 65 F | |

| | |
|---|---|
| Container No. DW 85 80 AC1104 | |
| Start contents: 11.1 gal | |
| Quantity used: 20.5 gal<br>(GPH X hours)<br>(actual) | |
| Quantity remaining: 43 gal AC1104 | |
| Time started: 9:00 AM | |
| Time ended: 12.25 | |
| Time (actual): 2 1/2 hrs | |

(MOVING TIME OUT)

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

20 miles

Billed

# 28498

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>aug 22-95 | OPERATOR'S NAME<br>Carl McKinney |
| IRRIGATION DISTRICT/COMPANY<br>Weiser Irrigation | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Froshiesar |
| LOCATION OF APPLICATION<br>Wash County | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MiL Foil & Moss | Gallons per hour:<br>(calculated)<br>7 |
| Weed growth condition:<br>(A,B,C, etc.)<br>A | Gallons per hour:<br>(actual) 7.5 GPH |
| Application concentration: ~~45 20 cfs~~ gal/cfs | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal: ~~45~~<br>4500 cfs | Pressure setting:<br>20 p.s.i.g |
| Treatment time:<br>8 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) = ppm |
| Water temperature:<br>65 °F | |

| | |
|---|---|
| Container No. | DW1025 |
| Start contents: | 15 gal |
| Quantity used: (GPH X hours) (actual) | 15 gal |
| Quantity remaining: | 51.4 gal DW8580 \| -0- DU1025 |
| Time started: | 8:18 Am |
| Time ended: | 10:20 |
| Time (actual): | 2 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed:
25253
20 miles

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>7-25-95 | OPERATOR'S NAME<br>Carl McHinney |
| IRRIGATION DISTRICT/COMPANY<br>WEISER IRRIG | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>Gene Strosdines |
| LOCATION OF APPLICATION<br>WASH COUNTY | LICENSE NUMBER<br>C-6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>Mil Foil & Moss | Gallons per hour:<br>(calculated) 7 |
| Weed growth condition:<br>(A,B,C, etc.) A | Gallons per hour:<br>(actual) 6.56 GPH |
| Application concentration:<br>gal/cfs | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal:<br>80 cfs | Pressure setting:<br>20 p.s.i.g |
| Treatment time:<br>2.5 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) = ppm |
| Water temperature:<br>F 72 | |

| |
|---|
| Container No.<br>DW9486 |
| Start contents: 52.4 gal |
| Quantity used: 16.4 gal<br>(GPH X hours)<br>(actual) |
| Quantity remaining: 36 gal |
| Time started:<br>11:53 Am |
| Time ended:<br>3.30 |
| Time (actual): 2.5 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed
#24744

20 miles

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-21-95 | OPERATOR'S NAME Carl McLHinney |
| IRRIGATION DISTRICT/COMPANY midvale Ditch | CERTIFIED APPLICATOR'S NAME (if different from operator) Gene Froshiesar |
| LOCATION OF APPLICATION Midvale | LICENSE NUMBER C-6805 |

| | |
|---|---|
| Aquatic weed(s) present: milFoil / Moss | Gallons per hour: (calculated) 7.9 |
| Weed growth condition: (A,B,C, etc.) B-C | Gallons per hour: (actual) GPH |
| Application concentration: .25 gal/cfs | Orifice size: .035 0.0 inches |
| Flow rate in canal: 50 cfs | Pressure setting: 25 p.s.i.g |
| Treatment time: 2.5 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 4.3 = ppm |
| Water temperature: 70 F | |

| | |
|---|---|
| Container No. OW 11686 | |
| Start contents: 16 gal | |
| Quantity used: (GPH X hours) (actual) 16 gal | |
| Quantity remaining: -0- gal | |
| Time started: 11:15 Am | |
| Time ended: 2:15 PM | |
| Time (actual): 2.5 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed #24638

54.6 miles

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 7-3-95 | OPERATOR'S NAME CARL McELHINNEY / GREG MI(?) |
| IRRIGATION DISTRICT/COMPANY MIDVALE DITCH | CERTIFIED APPLICATOR'S NAME (if different from operator) TIM KAUTZ |
| LOCATION OF APPLICATION MIDVALE | LICENSE NUMBER C-6805 |

| | |
|---|---|
| Aquatic weed(s) present: MILFOIL / MOSS | Gallons per hour: (calculated) 7.9 |
| Weed growth condition: (A,B,C, etc.) B-C | Gallons per hour: (actual) 6.9 GPH |
| Application concentration: .25 gal/cfs | Orifice size: .035 0.0 inches |
| Flow rate in canal: 50 cfs | Pressure setting: 25 p.s.i.g |
| Treatment time: 2.5 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 4.3 = ppm |
| Water temperature: 58 F | |

| | |
|---|---|
| Container No. SA04823 52.4 DW10625 | |
| Start contents: 8.9 gal 52.4 8.9 8.1 | |
| Quantity used: 17.1 gal (GPH X hours) (actual) | |
| Quantity remaining: 44.3 gal | |
| Time started: 10:20 AM | |
| Time ended: 12:50 | |
| Time (actual): 2.5 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

1.5 ON WEIR

800' 743-5964

52 miles

Billed 24280

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>6-29-95 | OPERATOR'S NAME<br>CARL McELHINNEY / Gene CROSHE |
| IRRIGATION DISTRICT/COMPANY<br>SCHWONKFELDER DITCH | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>TIM KAUTZ |
| LOCATION OF APPLICATION<br>ADAMS CO. | LICENSE NUMBER<br>0-2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MILLFOIL / MOSS | Gallons per hour:<br>(calculated) 9.2 |
| Weed growth condition:<br>(A,B,C, etc.) C-D | Gallons per hour:<br>(actual) 8.3 GPH |
| Application concentration:<br>6.7 gal/cfs | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal:<br>13 cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>3 hours | Application concentration:<br>ppm ~~6.7~~ (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) 6.7 = ppm |
| Water temperature:<br>58 F | |

3' ON WEIR

| | |
|---|---|
| Container No. | SA04823 |
| Start contents: | 33.8 gal |
| Quantity used: (GPH X hours) (actual) | 24.9 gal<br>8.3 |
| Quantity remaining: | 8.9 gal |
| Time started: | 10:50AM |
| Time ended: | 1:50 PM |
| Time (actual): | 3 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Billed 24242

~~42~~ miles 76

Billed #24242

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 8-4-94 | OPERATOR'S NAME CARL MCELHINNEY |
| IRRIGATION DISTRICT/COMPANY MIDVALE | CERTIFIED APPLICATOR'S NAME (if different from operator) TIM KRAUTZ |
| LOCATION OF APPLICATION WASH COUNTY | LICENSE NUMBER C 6805 |

| | |
|---|---|
| Aquatic weed(s) present: POND WEED | Gallons per hour: (calculated) 12 |
| Weed growth condition: (A,B,C, etc.) D | Gallons per hour: (actual) 13.7 GPH |
| Application concentration: ~~48~~ gal/cfs | Orifice size: 45 0.0 inches |
| Flow rate in canal: 48CFS cfs | Pressure setting: 30 p.s.i.g |
| Treatment time: 2 hr 20 min hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) = ppm |
| Water temperature: 75° F | |

| | |
|---|---|
| Container No. SA 04756 DW 10220 | |
| Start contents: 14.3 52.4 gal | |
| Quantity used: (GPH X hours) (actual) 14.3 13.4 27.7 gal | |
| Quantity remaining: 0 39.0 gal | |
| Time started: 9:40 AM | |
| Time ended: 12 NOON | |
| Time (actual): hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

#20978

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>7-12-94 | OPERATOR'S NAME<br>CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY<br>middle Ditch | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>TIM KAUTZ |
| LOCATION OF APPLICATION<br>MIDVALE | LICENSE NUMBER<br>C-6805 |

52 miles

| | |
|---|---|
| Aquatic weed(s) present:<br>milfoil moss | Gallons per hour:<br>(calculated) 6.8 |
| Weed growth condition:<br>(A,B,C, etc.)<br>C | Gallons per hour:<br>(actual) 6 GPH |
| Application concentration:<br>gal/cfs | Orifice size:<br>.032 0.0 inches |
| Flow rate in canal: 1.3 on weir<br>48.78 cfs | Pressure setting:<br>28 p.s.i.g |
| Treatment time:<br>1½ hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) = ppm |
| Water temperature:<br>67° F | |

| | |
|---|---|
| Container No. | SA 04756 |
| Start contents: | 50.4 gal |
| Quantity used: (GPH X hours) (actual) | 9 gal |
| Quantity remaining: | 41.4 gal |
| Time started: | 10:35 AM |
| Time ended: | 12:05 |
| Time (actual): | 1½ hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

Bill
#20521

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION 6-20-94 | OPERATOR'S NAME Harold / Froehlich |
| IRRIGATION DISTRICT/COMPANY Schwenkfelder/Ditch Co. | CERTIFIED APPLICATOR'S NAME (if different from operator) Tim Kautz |
| LOCATION OF APPLICATION Schwenkfelder | LICENSE NUMBER 0-2500 |

| | |
|---|---|
| Aquatic weed(s) present: Milfoil / Moss | Gallons per hour: (calculated) 7.9 ~~7.7~~ ~~9.6~~ |
| Weed growth condition: (A,B,C, etc.) C + D- | Gallons per hour: (actual) ~~8~~ 8.03 GPH |
| Application concentration: 7.9 gal/cfs | Orifice size: 35 0.0 inches |
| Flow rate in canal: 13 cfs | Pressure setting: 30 p.s.i.g |
| Treatment time: 3 hours | Application concentration: ppm (not to exceed 15 ppm) (gal/cfs X 1884) (time (min.)) 6.28 = ppm |
| Water temperature: 64° F | |

| | |
|---|---|
| Container No. | DW 4162 W |
| Start contents: | 52.4 gal |
| Quantity used: (GPH X hours) (actual) | 24.1 gal 8.03 |
| Quantity remaining: | 28.3 gal |
| Time started: | 10:30 |
| Time ended: | 13:30 Pm |
| Time (actual): | 3.0 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

$\frac{8/15 \times 1884}{180}$ = 6.28 ~~5.58~~ ppm

Billed 20256

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>6-13-94 | OPERATOR'S NAME<br>TIM KAUTZ |
| IRRIGATION DISTRICT/COMPANY<br>Middle Ditch | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>CARL MCELHINNEY |
| LOCATION OF APPLICATION<br>Midvale | LICENSE NUMBER<br>0-2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>Moss - Pondweed | Gallons per hour:<br>(calculated) 9.2 |
| Weed growth condition:<br>(A,B,C, etc.)<br>A-B | Gallons per hour:<br>(actual) 7.7 GPH |
| Application concentration:<br>.18 gal/cfs | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal:<br>42 cfs | Pressure setting:<br>30 PSI p.s.i.g |
| Treatment time:<br>1½ hours | Application concentration:<br>ppm 3.8 (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) 3.8 = ppm |
| Water temperature:<br>65 F | |

Applied by CARL + GENE CROSHIESAR

| | |
|---|---|
| Container No. | DW 10283 |
| Start contents: | 18.1 gal |
| Quantity used: (GPH X hours) (actual) | 11.5 gal |
| Quantity remaining: | 6.6 gal |
| Time started: | 10 AM |
| Time ended: | 11:30 AM |
| Time (actual): | 1½ hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

2.25' X 10'
57 SEC
58 CFS
42 By Weir measure
i.e.

52 miles Round trip

Billed #20091

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>9-3-93 | OPERATOR'S NAME<br>TIM KRAUTZ |
| IRRIGATION DISTRICT/COMPANY<br>MIDVALE | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>TIM KRAUTZ |
| LOCATION OF APPLICATION<br>MIDVALE | LICENSE NUMBER<br>C 6805 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MIL FOIL | Gallons per hour:<br>(calculated) 6.64 |
| Weed growth condition:<br>(A,B,C, etc.) A-B | Gallons per hour:<br>(actual) 6.3 GPH |
| Application concentration:<br>.166 gal/cfs | Orifice size:<br>.032 0.0 inches |
| Flow rate in canal:<br>40 cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>1 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) 5.2 = ppm |
| Water temperature:<br>64 F | |

| | |
|---|---|
| Container No. | DW11612 |
| Start contents: | 6.3 gal |
| Quantity used:<br>(GPH X hours)<br>(actual) | 6.3 gal |
| Quantity remaining: | -0- gal |
| Time started: | 9:30 AM |
| Time ended: | 10:30 |
| Time (actual): | 1 hrs |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

TIM KRAUTZ
CARL McELHINNEY

BILLED #16983

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>8-6-93 | OPERATOR'S NAME<br>CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY<br>MIDVALE DITCH | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>TIM KAUTZ |
| LOCATION OF APPLICATION<br>WASH CO.<br>HEAD OF DITCH | LICENSE NUMBER<br>O 2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>MILL FOIL MOSS<br>PONDWEED | Gallons per hour:<br>(calculated) 12.5 |
| Weed growth condition:<br>(A,B,C, etc.) C | Gallons per hour:<br>(actual) ~~12.5~~ 10.75 GPH |
| Application concentration:<br>.5 gal/cfs | Orifice size:<br>.041 0.0 inches |
| Flow rate in canal:<br>50 cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.)) 6.75 = ppm |
| Water temperature:<br>68 F | |

| | |
|---|---|
| Container No.<br>DW 11612 | |
| Start contents: 27.8 gal | |
| Quantity used: 21.5 gal<br>(GPH X hours)<br>(actual) | |
| Quantity remaining: 6.3 gal | |
| Time started:<br>9:30 AM | |
| Time ended:<br>11:30 | |
| Time (actual): 2 hrs | |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

1.8 on weir

3 x 10 x 60 Sec 100'

GENE FROSHIESAR
CARL McELHINNEY
TIM KAUTZ

Billed on # 16562

# MAGNACIDE H APPLICATION RECORD

EPA Reg. #10707-9

| | |
|---|---|
| DATE OF APPLICATION<br>7-8-93 | OPERATOR'S NAME<br>CARL McELHINNEY |
| IRRIGATION DISTRICT/COMPANY<br>MIDVALE DITCH CO | CERTIFIED APPLICATOR'S NAME<br>(if different from operator)<br>TIM KAUTZ |
| LOCATION OF APPLICATION | LICENSE NUMBER<br>0 2500 |

| | |
|---|---|
| Aquatic weed(s) present:<br>WATER MILL FOIL<br>POND WEED | Gallons per hour:<br>(calculated) 9.0 |
| Weed growth condition:<br>(A,B,C, etc.) C | Gallons per hour:<br>(actual) 8.7 GPH |
| Application concentration:<br>.66 gal/cfs<br>Adjusted for water temp | Orifice size:<br>.035 0.0 inches |
| Flow rate in canal:<br>30 cfs | Pressure setting:<br>30 p.s.i.g |
| Treatment time:<br>2 hours | Application concentration:<br>ppm (not to exceed 15 ppm)<br>(gal/cfs X 1884)<br>(time (min.) ) 10.3 = ppm |
| Water temperature:<br>59 F | |

| | |
|---|---|
| Container No. | DW 3536 |
| Start contents: | 52.4 gal |
| Quantity used:<br>(GPH X hours)<br>(actual) | 17.4 gal |
| Quantity remaining: | 36 gal |
| Time started: | 10:55 AM |
| Time ended: | 1:00 PM |
| Time (actual): | 2 hrs 5 min |

| | | |
|---|---|---|
| Cylinder | = | 52.4 gal |
| 2450 skid | = | 347.0 gal |
| 2300 skid | = | 325.8 gal |
| 2500 skid | = | 354.1 gal |
| 3000 skid | = | 424.9 gal |

PRESENT GENE KROSHIESAK
Ron HANDEL
CARL McELHINNEY
DALE CARPENTER

Billed #15925

# Appendix E. Distribution List

JEROME GRANDI
2294 WEISER RIVER ROAD
WEISER ID 83672

RONALD POUND
889 MANN CREEK ROAD
WEISER ID 83672

JOE QUALLS
55 W IDAHO STREET
WEISER ID 83672

VICKI LUKEHART
WEISER RIVER SCD
847 EAST 9TH STREET
WEISER ID 83672

JOHN FIELD
1025 LOWER CRANE CREEK
WEISER ID 83672

ART CORREIA
1826 COVE ROAD
WEISER ID 83672

KIRK CAMPBELL
DEPT OF AGRICULTURE
2270 PENITENTIARY ROAD
BOISE ID 83701

LAVELLE BRAUN
1129 OLDS FERRY ROAD
WEISER ID83672

VERN LOLLEY
732 HALE ROAD
WEISER ID 83672

SCOTT KOBERG
IASCD
6003 OVERLAND ROAD
SUITE 204
BOISE ID 83709

BILL GAMBLE
COUNCIL RANGER DISTRICT
PO BOX 567
500 EAST WHITLEY
COUNCIL IDAHO 83612

LEIGH WOODRUFF
EPA-IOO
1435 NORTH ORCHARD
BOISE IDAHO 83706

## Notice of Request for Public Comment and Public Meeting on Weiser River Watershed Assessment

The Idaho Department of Environmental Quality (DEQ) is seeking public comment on a draft assessment of water quality in the Weiser River Watershed.

Based on a recent study of the physical, chemical and biological conditions in the Weiser River Watershed, DEQ is proposing to develop the following water quality management plans:

- Weiser River from Galloway Dam to the Snake River to control sediment, bacteria and temperature
- Weiser River from the Little Weiser River to the Galloway Dam to control sediment
- Crane Creek from the reservoir dam to the Weiser River to control sediment and bacteria
- Little Weiser River from Indian Valley to the Weiser River to control bacteria and sediment.

DEQ has also determined that certain waterbodies in the Weiser River Watershed meet water quality standards and is proposing to remove the following from the 2002 Idaho §303(d) list of impaired waterbodies:

- Weiser River from West Fork Weiser River to Little Weiser River for nutrients and sediment
- Mann Creek from the reservoir to the Weiser River for sediment
- Cove Creek for nutrients and sediment
- Johnson Creek for unknown pollutants
- West Fork Weiser River for unknown pollutants
- North Crane Creek for bacteria, flow alteration, nutrients, sediment and temperature
- South Crane Creek for unknown pollutants

Assessment of Crane Creek Reservoir will be delayed until 2006, so that additional data can be collected. The Weiser River watershed will be required to meet a phosphorus allocation set forth in the Snake River – Hells Canyon TMDL.

**Two public meetings on the draft assessment will be held on:**

1) **Monday, August 23rd from 7:00 p.m. to 9:00 p.m. at the Vendome Event Center, 309 State Street, Weiser, Idaho.**
2) **Tuesday, August 24th from 7:00 p.m. to 9:00 p.m. at the DEQ conference center, conference room B. The address is 1410 N. Hilton, Boise, Idaho.**

Copies of the draft assessment are available for review at DEQ's Boise Regional Office; the public libraries in Weiser and Boise, Idaho; Washington County Courthouse in Weiser and the Adams County Courthouse in Council; and in PDF format on DEQ's Web site at www.deq.state.id.us starting Monday, August 9th 2004. Public comment on the proposed actions will be accepted through 5 p.m., Friday, September, 24, 2004. Questions, comments and requests may be addressed to:

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# Appendix F. Public Comments

| **Comments From:**<br>Weiser River Watershed Advisory Group<br>Received via email: September 24, 2004 | Response: |
|---|---|
| **1)** Page XXIV – Key findings – include discussion of temperature as potential limiting factor in number of sediment intolerant species. | There is a discussion of the possible effects of temperature on periphyton on page 104. Periphyton communities do not seem to be adversely affected by temperatures between 15 and 30°C. Temperatures in the lower Weiser River have not been shown to go above the threshold of 30°C. For assessment purposes, macroinvertebrate communities seem to be more dependent on substrate and habitat. That is, acceptable communities tolerate higher temperatures, but usually are not found in poor substrate conditions. |
| 2) Page XXXV – 2nd paragraph – Why is statement about warm water intolerant species in here? | This paragraph will be removed from the document. |
| 3) Page XXXVII – WAG reponse – | This space is reserved for comments from the WAG. |
| 4) Page 10 – “banks will more stable as vegetation is established.” Only small vegetation is allowed on Corp of Engineers Dikes. Should this statement be eliminated? | The word “historic" has been added to the sentence. The statement is an attempt to show that were the lower Weiser River allowed to establish a floodplain, temperature conditions would in all likelihood improve. However, since the river has been channelized and is no longer allowed to create a floodplain, achieving the temperature standard will be more difficult. |
| 5) Page 19 – 5h paragraph sites existence of volcanic tuff. Discussion somewhere in this document of volcanic tuff as potential source of natural phosphorous should be included. | A statement concerning this potential will be added. |
| 6) Page 32 & 33 – Maps show entire Lower River as bull trout water. THIS NEEDS TO BE FIXED. | The figures will be adjusted accordingly. |
| 7) Page 36 and 37 – This time frame is false and needs addressing. As Craig Shepherd explained during our November 18, 2003 meeting, due to work on another TMDL, the DEQ staff assigned to the Weiser River Wateshed TMDL was unable to focus on the SBA until March of 2003. During the June WAG meeting, DEQ staff discussed DEQ’s work to date on the SBA, and advised the WAG that DEQ would not make a draft available for WAG review. In response to the WAG’s written request, DEQ distributed a “very rough”, incomplete draft of the SBA to the WAG. No additional information was distributed until DEQ provided the draft SBA and TMDL to the WAG on October 16, and gave the WAG until November 14, 2004 to provide comments to be included in the Executive Summary, presumably in a paragraph or two. DEQ | The public outreach section of the Executive Summary has been revised to more accurately reflect the process that has occurred since 2004. |

| | |
|---|---|
| intended to issue the draft SBA and TMDL for a 30-day public comment period on December 1, and submit the SBA and TMDL to EPA for approval in February. This is noted in a letter from WAG Chairman Art Correia dated December 5, 2003. | |
| 8) Page 52 – Table 14 – This table is very confusing. | We have changed "IDAPA" to "Water Quality Standards" and hope this clarifies Table 14. |
| 9) Page 75 – Allocations – Nutrient allocations and in-stream targets are not applicable. Should be developed in the implementation plan. There is no impairment by nutrients. The only allocation that applies is the one from SR-HC at the mouth of the Weiser River. | We anticipate nutrient allocations will occur in the implementation plan. |
| 10) Page 86 – 1st paragraph – the discussion of shade shows up again. Needs to be removed! | We could not find the word "shade" on page 86. However, on page 223, the reference to shade will be removed. The completion of the Potential Natural Vegetation TMDL and its acceptance by the WAG has made this comment moot. |
| 11) Page 117 – Table 39, 2nd paragraph shows 3 testing sites, which are not in table 39. | We have corrected this in the document. |
| 12) Page 117 – 1st paragraph USGS guage site is above Crane inflow, sentence should be deleted. | The gauge you refer to (USGS 13265300) has been inactive since 1952. The gage we refer to (USGS 13266000) is located below Crane Creek and has been active since 1952. |
| 13) Page 223 – 4th paragraph – the discussion of shade shows up again??? | The reference to shade will be removed. The completion of the Potential Natural Vegetation TMDL and its acceptance by the WAG has made this comment moot. |
| 14) Page 244 – Table 120 – Clarification of table 120. The source of pollution needs to be proven, such as DNA testing | See pages 60 and 61 "Sources of Bacteria". These paragraphs specify that only controllable sources of bacteria will be addressed in implementation. |
| 15) The testing should be done first to alleviate the confusion in solving the problem. | Additional monitoring will be performed in the future to refine the needs of implementation. |
| 16) Page 259 – Glossary – recommend moving this to the front of the document. | The location of the Glossary is standard in all TMDLs. |
| 17) In summary the WAG would like to see the basis and how data was computed. The tables and charts should be marked as average and not estimates. Some of the tables are not dated. Not all sources of data are identified. The glossary is lacking some definitions. | All data used to compile averages is available in our office. If the WAG desires to see this information, we can make it available. Be advised that the information sought would be many times larger than the document itself. We have also added dates to all tables for clarification. |
| 18) Crane Creek data has not factored in the effects of the hot springs, it has not been documented. | See the Potential Natural Vegetation TMDL for more information. |

| | |
|---|---|
| 19) The whole TMDL process is unorganized. A starting point and an ending point should be established. The WAG is not asking for anything other than proof of a problem. The process would like to set targets before identifying what or who the problem is. Identify the source of the problem, and then ask the landowners to do their part. | Comment noted. |
| **Comments from:**<br>U.S. Environmental Protection Agency<br>Received via email: September 24, 2004 | Response: |
| We found the Executive Summary especially helpful in presenting a summary of each of the segments, their listings, and conditions. The information in the tables in particular is very well presented. | Thank you. |
| Use of the appendices for presentation of the raw data and data analysis is also very helpful. | Thank you. |
| We are concerned that the temperature TMDLs presented in the document are missing important required information and elements. No quantifiable analyses have been presented in the document to support the proposed loadings, capacities, or allocations. If the data are not available or the proper analysis and modeling have not been completed, perhaps the temperature TMDLs should be rescheduled for a time when such data and analyses are available. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Several of the waterbodies are proposed for delisting due to their intermittent flow. These proposed delistings will be evaluated by EPA under a separate review process and EPA will provide comments under separate correspondence. However, we are concerned with the conclusion that no TMDLs are required for these waterbodies due to their intermittence. Idaho water quality standards require that the use be protected in intermittent waterbodies when water is present in the streams. The water quality standards and criteria apply during those times. Perhaps a more detailed analysis of the seasonal variations and conditions of the streams are needed to demonstrate that the designated uses are being protected during the time of year when water is present. | DEQ is currently awaiting guidance from the EPA on protocols for monitoring streams that are likely to be dry during base flow periods (July 1 through October 1). If the decision is made to monitor macroinvertebrates, habitat and fish during late winter and early spring runoff periods, then we will pursue monitoring at that time. |
| **Specific Comment** | |

| | |
|---|---|
| **Executive Summary**<br>As mentioned in your correspondence of August 25, 2004, the listings for temperature on Crane Creek and Little Weiser River were not included in Table A or the discussion of listed pollutants. It is unclear if you intend to develop a TMDL for temperature in this submittal. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Table C. Per the discussion above, the application of intermittent water body standards as a justification for delisting should be reevaluated. | DEQ is currently awaiting guidance from the EPA on protocols for monitoring streams that are likely to be dry during base flow periods (July 1 through October 1). If the decision is made to monitor macroinvertebrates, habitat and fish during late winter and early spring runoff periods, then we will pursue monitoring at that time. |
| Given the lack of temperature data and analysis, temperature should be considered as a data gap and discussed here and elsewhere in the document. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| **Chapter 2.0** | |
| As mentioned in your correspondence of August 25, 2004, the listing for temperature on Crane Creek and Little Weiser River were not included in Table 13 or the discussion of listed pollutants. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| The discussions on listings, uses, standards, and targets are well presented and helpful. | Thank you. |
| Table 14. It should be noted for Cove, North Crane, and South Crane creeks that while no uses have been designated, the presumed use is Cold Water Aquatic Life and Primary Contact Recreation. | Comment noted. |
| Page 58 presents the discussion of the application of standards to intermittent waters. The numeric water quality standards do apply to intermittent waters during optimum flow periods sufficient to support their designated uses. At all times, including optimal and sub-optimal flows, the narrative standards, such as for nutrients and sediment, would apply. | Comment noted. |
| Page 62. Temperature. This section discusses natural and non-quantifiable background influences on the Weiser as the suspected cause of the increased water temperatures. While this may be the case, additional documentation of modeling is needed to support these claims, as suggested in Concepts and Recommendations for Using the "Natural Conditions" Provisions of the Idaho Water Quality Standards, IDEQ, April 2003. In addition, required elements of a TMDL include an analysis of | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |

| | |
|---|---|
| loading and quantification or modeling of temperature loadings in the listed waterbody. Based on this quantification and/or modeling, and a source analysis concluding that temperature criteria are exceeded, system potential conditions could be established. Heat load reductions are then applied to segments of the waterbody through surrogate (such as shade increases) or other appropriate means. No such analyses have been presented in the document. Therefore the statement is unsubstantiated. | |
| Page 63, first paragraph. The document discusses the gross nonpoint source temperature load allocation as being established at no greater than a 0.14$^{o}$C increase for nonpoint sources in the basin. It is unclear as to how this target/allocation was derived, since we can find no basis in the Idaho water quality standards for such an allocation for nonpoint sources. Perhaps there is some confusion with the provision allowing point sources to increase stream temperatures 0.3$^{o}$C above natural temperatures. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 63, second paragraph. The mainstem TMDL should identify now what allocations are needed at the mouth of each tributary to meet the water quality criteria. If an analysis indicates that tributary temperature reductions are required, load reductions should be assigned at the mouth of the tributaries or a TMDL should be performed on the entire watershed including the tributaries. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| The examples of how nutrient criteria were applied to create a linkage to nutrient levels and beneficial use support on page 65 and 66 are very well presented and very helpful. | Thank you. |
| Page 66. The document references the 1986 EPA Gold Book several times, including in Table 16. This reference has been replaced by the Ecoregion analysis (EPA, 2000). It is suggested that more recent ecoregional values be cited rather than the Gold Book, since they represent EPA's most current thinking regarding nutrient levels. | The Ecoregion Analysis is also mentioned on page 66. |
| Page 88. Lower Weiser, Temperature. This section does not present any summary or analysis of the data. Available data should be utilized to develop the temperature TMDL, or the appropriate thermal load and shade could be modeled and presented in this discussion. If insufficient data are available, additional data should be collected and the state should consider delaying the submittal of the temperature TMDL until such data and analysis are available. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |

| | |
|---|---|
| Page 93. Lower Weiser, Nutrients. The use of Dissolved Oxygen as an indicator of nutrient loading can be used as one line of evidence of nutrient impacts on a waterbody. Investigations and surveys documenting the lack of nuisance growth should also be performed to support this analysis in order to address the narrative portions of Idaho water quality standards that relate to nutrients (IDAPA 58.01.02.200.05 and .06). | This contradicts the previous comment about how well the nutrient linkage was made. |
| Page 109-111. Mid-Weiser. Page 109 mentions that temperature data were collected for this segment of the river. However, none of the data or discussion of the analyses is presented. Figure 40 shows significant temperature excursions above the criteria. Table 40 should also be revised to indicate that temperature is being added as a pollutant of concern. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 126. Status of Beneficial Uses. Second-to-last sentence should read: 'E. coli bacteria are not impairing…' | The document will be changed accordingly. |
| Page 135. Cove Creek. The second paragraph discusses the hydrologic conditions leading to the conclusion that the stream does not support cold water aquatic life. However, more detail should be considered with respect to streambed conditions, aquatic life that is present during flow periods, and whether water quality during periods of flow is adequate to meet water quality standards and support designated and existing beneficial uses. | DEQ is currently awaiting guidance from the EPA on protocols for monitoring streams that are likely to be dry during base flow periods (July 1 through October 1). If the decision is made to monitor macroinvertebrates, habitat and fish during late winter and early spring runoff periods, then we will pursue monitoring at that time. |
| Page 138. Crane Creek. Per your August 25 memo, a discussion of temperature as a listed pollutant should be included in this section. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 144. Crane Creek. The first paragraph states that it is unclear from the data whether or not nutrients are impairing the water quality of Crane Creek. Based on this data, delisting the water for nutrients (Table B) may not be supported. In the absence of adequate data it may be preferable to postpone the nutrient TMDL until implementation of the Weiser River-SR/HC reductions. Once water quality improvements are realized, delisting could then be considered. | Due to the colloidal nature of the particle size in Crane Creek Reservoir, the water in Crane Creek usually has turbidity concentrations that preclude the development of excessive algae. |
| Page 149. Little Weiser River. Temperature should be added as a listed pollutant and discussed here. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 152. Little Weiser River. It is stated that a determination regarding sediment and nutrient impairment will be made when macroinvertebrate | Assessment of the referenced data is now included in the document. |

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| data collected in 2002 become available. It is unclear as to why data collected two years ago is still not available. Why is the data not available and will it become available? If the data may not become available, then perhaps sediment and nutrient TMDLs should be developed at this time based on existing index scores, which indicate impairment. Until the data confirm no impairment from nutrients, delisting the waterbody for nutrients (Table B) may not be supported. (See Crane Creek comment above) Further, the sentence in the paragraph on page 157 states that '…nutrients are thought to be at levels that (are) impairing designated uses.' | |
| Page 156 - 164. Johnson Creek and West Fork Weiser River. These sections provide limited data and analysis. No flow data nor water column data are presented. If additional information is available, better descriptions of the waterbodies and their condition should be provided. | Additional reconnaissance level information has been added to the document. |
| Page 165 – 174. North Crane Creek and South Crane Creek. The application of the intermittent water quality criteria should be evaluated. The water quality criteria still apply during times that water is present in the stream. | The data presented indicates both streams are dry from June through December in 2001 and 2002. Further discussion and guidance from the EPA on what biological communities are expected during winter and spring is needed. |
| Page 181. Data Gaps. Temperature data has not been presented. It should be either presented or identified as a data gap. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| **Chapter 3.0** | |
| Page 185. Sources of Pollutants of Concern. Any CAFOs that may be present in the watershed should be identified as possible sources. Although they are prohibited from discharging, identifying them will assure they receive a waste load allocation of zero. | An inventory of CAFOs in the watershed will be made during implementation planning. This approach was used for the Weiser Flat TMDL and approved by the EPA. |
| Page 186. Temperature. The document mentions that the SSTEMP analytical model was run on data from the Weiser River. The elements of this modeling should be presented in the document and results summarized in a manner that allows a critical review. The temperature loading calculations and modeling results should support the general discussion of the conditions in the watershed. The analysis should be presented on a section-by-section basis. The document should also present a comprehensive source analysis. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 191. Total Phosphorous Allocations. It should be explained why a phosphorous analysis is presented in this chapter and not an analysis of the other pollutants. Is it to present the load allocations | Allocations for other pollutants are included in Section 5.4 of the document. |

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| for all of the unlisted tributaries for the downstream Snake River TMDL? | |
| Section 3.2. This section presents a subheading for Point Sources, but not for Nonpoint Sources. | This was an oversight and will be corrected. |
| Section 3.2. The second sentence states that neither WWTP facility requires a waste load allocation at this time. This is technically incorrect. They may not need any reductions in their discharges, but a specific waste load allocation is needed because they are a source of pollutant loading. If no WLA is assigned, it will be assumed to be zero, and zero limits will be carried into the NPDES permit. | The following is an excerpt from an email from Mark Phillipini to Mike Ingham on February 23, 2004: *We gave Mike some misdirected advice on the last go-round. We had him include specific discussions of the POTW WLA's. But in reviewing the document, if the Upper Weiser supports delisting for nutrient and sediment, then no WLAsfor the POTWs would be necessary. The POTWs would not be discharging to a 303(d) listed stream. So there are numerous places in the document where the discharges are discussed in terms of WLAs and the wording should be changed to correct this.* |
| Section 3.2. The Point Source discussion should include industrial and municipal storm water discharges. Although point sources, they receive a load allocation, not a waste load allocation. CAFOs should also be identified. | See page 226 of the document. The wastewater treatment plants in the cities of Cambridge and Council are having negligible influence on water quality. The data indicated that discharges to the river had little to no affect of total phosphorus loads. These facility's waste load allocations should be established at the current NPDES permitted levels. |
| Page 206. Total Phosphorous Point Sources. This section presents data for the city of Cambridge WWTP, but no data is presented on the city of Council's WWTP. In order to determine an accurate current loading and distribute the loading capacity, relevant data should be presented. | We will add appropriate data for the City of Council. |
| **Chapter 5.0** | |
| Page 219. The fourth paragraph discusses the need to base the load capacity on critical conditions. The document should present a discussion of how critical conditions were addressed for each pollutant in each waterbody. | See Seasonal Variation on page 228. Bacteria loads are based on the critical period when a high probability exists for primary contact recreational use, such as swimming. However, load reductions should be based on reducing bacteria levels throughout the year and should also provide for full support of secondary contact recreation, which includes activities such as fishing where the possibility of ingesting river water is still a concern.<br><br>Targets selected for sediments are based on the use of biological indicator species. Water column targets for TSS are designed to reduce the slugs of sediment associated with high discharge periods. However, all sediment sources must be addressed to meet the substrate targets.<br><br>See the Addendum to the Weiser River Subbasin Assessment and TMDL for information about the Potential Natural Vegetation (PNV) temperature TMDL. |

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| Table 103. The temperature target for the Lower Weiser is expressed as 22°C, and when above 22°C, no more than 0.14°C increase from anthropogenic sources. It is unclear how this target was derived from the water quality criteria and how it was determined to be appropriate for this segment. Also, the temperature target should include the 19°C daily average criteria as well as the 22°C instantaneous criteria. There is no analysis that demonstrates that the temperature exceeds criteria naturally. Surrogate targets such as shade, which provide a linkage to implementation, are also missing. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Table 103. Temperature targets should be calculated and stated for both the Little Weiser River and Crane Creek. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Table 105. The Load Capacity for the Lower Weiser is expressed as the temperature criteria target. This is not an appropriate expression of the Load Capacity. A relevant surrogate or capacity in terms of heat units (e.g. Joules per square meter per second) is needed. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Table 109. Existing Loads. It is unclear where the 69.1 j/m2/sec load was derived. Please provide an appropriate analysis. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Table 113. It is unclear how the margin of safety of 10% sampling error plus 4% analytical error were derived for sediment and bacteria. How was this determined to be an appropriate margin of safety? | The margin of safety varies by pollutant. In these cases, the margin of safety for sediment and bacteria is based on the statistical analysis of existing data and is compared to water quality modeling results. |
| Page 228. Waste Load Allocations. The last sentence of the first paragraph in this section states that the WLAs for the WWTPs 'should' be established at the current NPDES permitted levels. If this is DEQ's intent, specific WLAs for these facilities must be included in the TMDL. A term such as 'have been' would be more appropriate. Also, the temperature loads for these two point sources must be identified in order to establish an appropriate WLA. Otherwise, it will be assumed that these point sources have a zero WLA. Again, analyses of the capacities or loading for temperature are missing. | We will change the language from "should be" to "have been". |
| Table 114. Background Allocations. It is unclear how the background levels were established for each of the pollutants in each of the waterbodies. | Further refinement of natural and background sources will be ongoing as more data is collected. Since TMDLs are a dynamic process, the document will be |

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| Background levels must be based on some level of data or reference condition. These values appear arbitrary. | updated as appropriate. |
| Page 231. Construction Storm Water and Allocations. This section presents a good analysis of how these elements are addressed in the TMDL. However, discussions of industrial discharges and municipal discharges should also be presented. Industrial operations should be covered under a general permit for discharge of stormwater. The two municipalities likely also have stormwater discharges which, while considered a point source, do not require a permit. These sources should be addressed and accounted for in the load capacity and non-point source allocations. | Neither Cambridge (pop. 355) nor Council (pop. 765) is currently designated as a regulated small MS4 that requires an NPDES permit. They also (to DEQ's knowledge) do not have any industries that would require a *Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activities (MSGP).* |
| Page 233. Table 115. The Load Allocation presented in this table for thermal is not considered a valid means of expressing an allocation for heat. A more complete analysis and allocation scheme needs to be presented. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |
| Page 244. Table 120. The TMDL, which is presented for thermal loads to the Lower Weiser River, is not considered a valid expression of a TMDL. A valid analysis and presentation of the temperature TMDL will be required. | A Potential Natural Vegetation TMDL has been developed to address temperature in the Weiser River watershed. |

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# Appendix G. §303 (d) List Crosswalk

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HUC 17050124
2002 §303 (d) list

| Basin | Segment Name | Bac | Cd | Ukn | Pb | Hg | Met | Nut | O/G | Org | DO | IOrg | Path | Pest | pH | P | Sa | Se | Sed | TSS | Tem | TDG | Tox | NH3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ID17050124SW002_02** | **Cove Creek - 1st and 2nd order** |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |
| *No change from 1998 §303 (d) list* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW003_05** | **Crane Creek - Crane Creek Reservoir Dam to mouth** | 1 |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  | 1 |  | 1 |  |  |  |
| *1998 §303 (d) list did not include temperature* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW022_02** | **Johnson Creek - source to mouth** |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *No change from 1998 §303 (d) list* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| ID17050124SW022_03 | Johnson Creek - source to mouth |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *No change from 1998 §303 (d) list* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW008_02** | **Little Weiser River - source to mouth** |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |
| *1998 §303 (d) list did not inlcude temperature* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW008_04** | **Little Weiser River - source to mouth** |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |
| *No change from 1998 §303 (d) list* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW008_03** | **Little Weiser River - source to mouth** |  |  |  |  |  |  | 1 |  |  |  |  |  |  |  |  |  |  | 1 |  |  |  |  |  |
| *No change from 1998 §303 (d) list* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW006_04** | **North Crane Creek - 4th order** |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *1998 §303 (d) list included bacteria, nutrients, sediment and temperature* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW006_02** | **North Crane Creek - 1st and 2nd order** |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *1998 §303 (d) list included bacteria, nutrients, sediment and temperature* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| **ID17050124SW006_03** | **North Crane Creek - 3rd order** |  |  | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| *1998 §303 (d) list included bacteria, nutrients, sediment and temperature* |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

| Basin | Segment Name | Bac | Cd | Ukn | Pb | Hg | Met | Nut | O/G | Org | DO | IOrg | Path | Pest | pH | P | Sa | Se | Sed | TSS | Tem | TDG | Tox | NH3 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **ID17050124SW005_02** | **South Crane Creek - 1st and 2nd order** | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |
| **ID17050124SW005_03** | **South Crane Creek - 3rd order** | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |
| **ID17050124SW005_04** | **South Crane Creek - 4th order** | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |
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| **ID17050124SW001_06** | **Weiser River - Keithly Creek to mouth** | 1 | | | | | | 1 | | | | | | | | | | | 1 | | 1 | | | |
| *This assessment unit includes 2 segments from the 1998 §303 (d) list.* | | | | | | | | | | | | | | | | | | | | | | | | |
| *Galloway Dam to Snake River - bacteria, DO, nutrients, sediment and temperature* | | | | | | | | | | | | | | | | | | | | | | | | |
| *Little Weiser River to Galloway Dam - bacteria nutrinets and sediment* | | | | | | | | | | | | | | | | | | | | | | | | |
| **ID17050124SW001_05** | **Weiser River - Keithly Creek to mouth** | 1 | | | | | | 1 | | | | | | | | | | | 1 | | 1 | | | |
| *This assessment unit includes 2 segments from the 1998 §303 (d) list,* | | | | | | | | | | | | | | | | | | | | | | | | |
| *Galloway Dam to Snake River - bacteria, DO, nutrients, sediment and temperature* | | | | | | | | | | | | | | | | | | | | | | | | |
| *Little Weiser River to Galloway Dam - bacteria nutrinets and sediment* | | | | | | | | | | | | | | | | | | | | | | | | |
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| **ID17050124SW007_05** | **Weiser River - source to Keithly Creek** | | | | | | | 1 | | | | | | | | | | | 1 | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |
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| **ID17050124SW017_03** | **West Fork Weiser River - source to mouth** | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |
| **ID17050124SW017_02** | **West Fork Weiser River - source to mouth** | | | 1 | | | | | | | | | | | | | | | | | | | | |
| *No change from 1998 §303 (d) list* | | | | | | | | | | | | | | | | | | | | | | | | |