THE STATE OF WYOMING

Water Development Office

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TECHNICAL MEMORANDUM

TO: Water Development Commission **DATE:** August 1, 2012

FROM: Philip Ogle **REFERENCE:** Snake/Salt River Basin Plan Update, 2012

SUBJECT: Surface Water Quality – *Tab XIV (2012)*

Contents

1.0 Introduction

Water quality is an important issue in the Snake/Salt River Basin. It was listed as one of the major issues for the basin in the 2007 framework water planning process (WWC Engineering 2007). The issue expanded from the initial water quality concern by the Snake/Salt Basin Advisory Group (BAG), as listed in the issues for the 2003 Snake/Salt River Basin Plan Final Report (Sunrise Engineering, Inc., 2003), to the need for water quality monitoring during the framework water planning process.

In the period prior to preparation of the 2003 Snake/ Salt River Basin Plan, there were no extensive water quality monitoring activities underway in the basin. Therefore, discussions of water quality in the Snake/Salt River Basin Plan, Water Quality, Technical Memorandum (Sunrise Engineering, Inc., 2002) and the 2003 Basin Plan were based on the Wyoming 2002, 305(b) State Water Quality Assessment Report, which included 303(d) impaired stream listings, and the three U.S. Geological Survey (USGS) gaging stations in the basin where water quality samples were taken.

There were three stream segments listed on the 303(d) list as having water quality threats including: North Fork Spread Creek due to habitat degradation, Flat Creek between Snake River and Cache Creek due to habitat degradation, and Salt River near the Etna USGS gaging station due to fecal coliform bacteria (*Escherichis coli* [*E. coli*]). A channel rehabilitation project had been completed on the North Fork Spread Creek but the stream remained on the 303(d) list because the riparian vegetation was not yet well established. It was stated in the 305(b) report that overall there were few threats to water quality in the basin and there were no waters in the basin requiring establishment of a total maximum daily load (TMDL) (Sunrise Engineering 2003).

Sunrise Engineering, Inc. (2002 and 2003) reviewed data from the three stations where water quality samples were collected within the basin (see Table 1). They used data from water year 2001, which ran from October 2000 to September 2001. These data indicated there were no water quality problems present, except the fecal coliform bacteria contamination at the gage station near Etna.

Table 1: USGS Water Quality Sampling Stations in the Snake/Salt River Basin

Station Name	Station Number
Snake River above Jackson Lake, at Flagg Ranch	13010065
Snake River at Moose	13013650
Salt River above Reservoir, near Etna	13027500

Note: This table was adapted from Sunrise Engineering, Inc. 2002 and 2003.

In the time period since the 2003 Snake/Salt River Basin Plan was completed, a number of water quality monitoring programs have been implemented. Discussions presented in this document summarize the information and results from these monitoring programs to provide an overall description of water quality in the basin. To organize the discussions, the basin has been broken into sub-basins similar to, but not exactly correlated to, those used by the Wyoming Department of Environmental Quality (WDEQ), Water Quality Division (WQD) in the Wyoming Water Quality Assessment and Impaired Waters List (WDEQ, WQD 2010).

2.0 Snake River Headwaters Sub-basin

Waters of the Snake River Headwaters Sub-basin originate in southern Yellowstone National Park, Grand Teton National Park, and the Grand Teton and Jedediah Smith Wilderness Areas (WDEQ, WQD 2010). Many of the waters in this sub-basin are WDEQ, WQD Class 1 waters including all waters within Yellowstone National Park, Teton National Park, Jedediah Smith Wilderness Area, and Teton Wilderness Area. Additionally, the main stem of the Snake River above Wyoming State Highway 22 bridge is a Class 1 water. Other waters in this sub-basin are class 2AB. Appendix A to this Technical Memorandum contains Wyoming's Surface Water Classification System, which was updated in 2007 (WDEQ, WQD 2007).

A Resource Brief for water quality published by the National Park Service (NPS) in 2009 indicates that a 2003 review of historical data found water quality is very high compared to Wyoming and Environmental Protection Agency (EPA) standards in the John D. Rockefeller Jr. Memorial Parkway and Grand Teton National Park. Data show there are limited impacts from human activities in the park, parkway and the upstream watersheds.

The USGS conducted water quality monitoring in the upper Snake River Basin in cooperation with the NPS to help meet the NPS's water resource management objectives (Clark et. al. 2004). Two of the sites were monitored from water year 1998 to 2002 and the others were monitored in water year 2002. Table 2, which is adapted from a table in the 2004 USGS report, provides a key to the sampling sites, and Figure 1 shows the sampling locations.

Table 2: Sampling Sites in the Upper Snake River Basin, Grand Teton National Park

Site Number	Site Name	Period of Record for the Analysis
Pt 1	Snake River above Jackson Lake at Flagg Ranch, WY	Water-years 1998-2002
Pt 2	Pilgrim Creek below National Park Boundary, near Moran, WY	2002
Pt 3	Pilgrim Creek near Moran, WY	2002
Pt 4	Pacific Creek above National Park Boundary, near Moran, WY	2002
Pt 5	Pacific Creek at Moran, WY	2002
Pt 6	Buffalo Fork above Lava Creek near Moran, WY	2002
Pt 7	Buffalo Fork near Moran, WY	2002
Pt 8	Spread Creek at diversion dam near Moran, WY	2002
Pt 9	Spread Creek near Moran, WY	2002
Pt 10	Ditch Creek below South Fork near Kelly, WY	2002
Pt 11	Ditch Creek near Moose, WY	2002
Pt 12	Snake River at Moose, WY	Water-years 1998-2002

Note: This table was adapted from USGS, 2004

Samples from the Snake River and the five tributaries were collected and analyzed for major ions and dissolved solids, nutrients, selected trace metals, pesticides, and suspended sediment (Clark et. al., 2004). The tributaries were also sampled for fecal indicator bacteria. Major ion chemistry of the Snake River changes from the upstream site to the downstream site, partly due to inflow from the tributaries. Chemistry of the Snake River at Flagg Ranch is a sodium bicarbonate type, while the chemistry of the Snake River at Moose is a calcium bicarbonate type. The five tributaries all have a calcium bicarbonate chemistry type. Nutrient concentrations in the Snake River and its tributaries were low and less than the Wyoming water quality standards. Concentrations of trace metals and pesticides were low and less than Wyoming water quality standards. Suspended sediments were highest during late spring and lowest during fall. The Snake River in Wyoming moves a substantial amount of sediment during high flows because of the erosive geology in much of the basin (WDEQ, WQD 2010). Fecal coliform bacteria concentrations in samples from the five tributaries ranged from less than one colony to more than 200 colonies per 100 milliliters of water. EPA's recommended single sample criterion, for primary contact recreation use, is 235 colonies per 100 milliliters of water (Willamette Riverkeepers 2012). Microbial source tracking determined that the major source matched wildlife with only a small percentage matching human sources (six percent or less of the samples).

North Fork of Spread Creek was placed on the 303(d) list of impaired streams in 1998 because of habitat degradation (WDEQ, WQD 2010). Aquatic life and cold water fisheries designations were threatened from sedimentation caused by historic livestock grazing, timber harvest activities, and road and dike construction (U.S. Environmental Protection Agency 2009). A watershed improvement project was undertaken by the U.S. Forest Service, Bridger-Teton National Forest to rehabilitate the stream channel. This project improved aquatic habitat and the stream now supports aquatic life uses. This stream segment was removed from the 303(d) list in 2008.

Wright (2010) conducted a study of hydrology and water quality in the Snake River alluvial aquifer at the Jackson Hole Airport, which is at the lower end of the Snake River Headwaters Sub-basin. It was found generally, that water in the alluvial aquifer was of good quality and was suitable for domestic and other uses without treatment. However, dissolved iron and dissolved manganese were found in concentrations exceeding EPA secondary maximum contaminant levels (SMCLs) in some samples. SMCLs are not enforceable but list constituents that may cause cosmetic or esthetic effects. Groundwater quality is discussed in more detail in the Available Groundwater Determination Technical Memorandum.

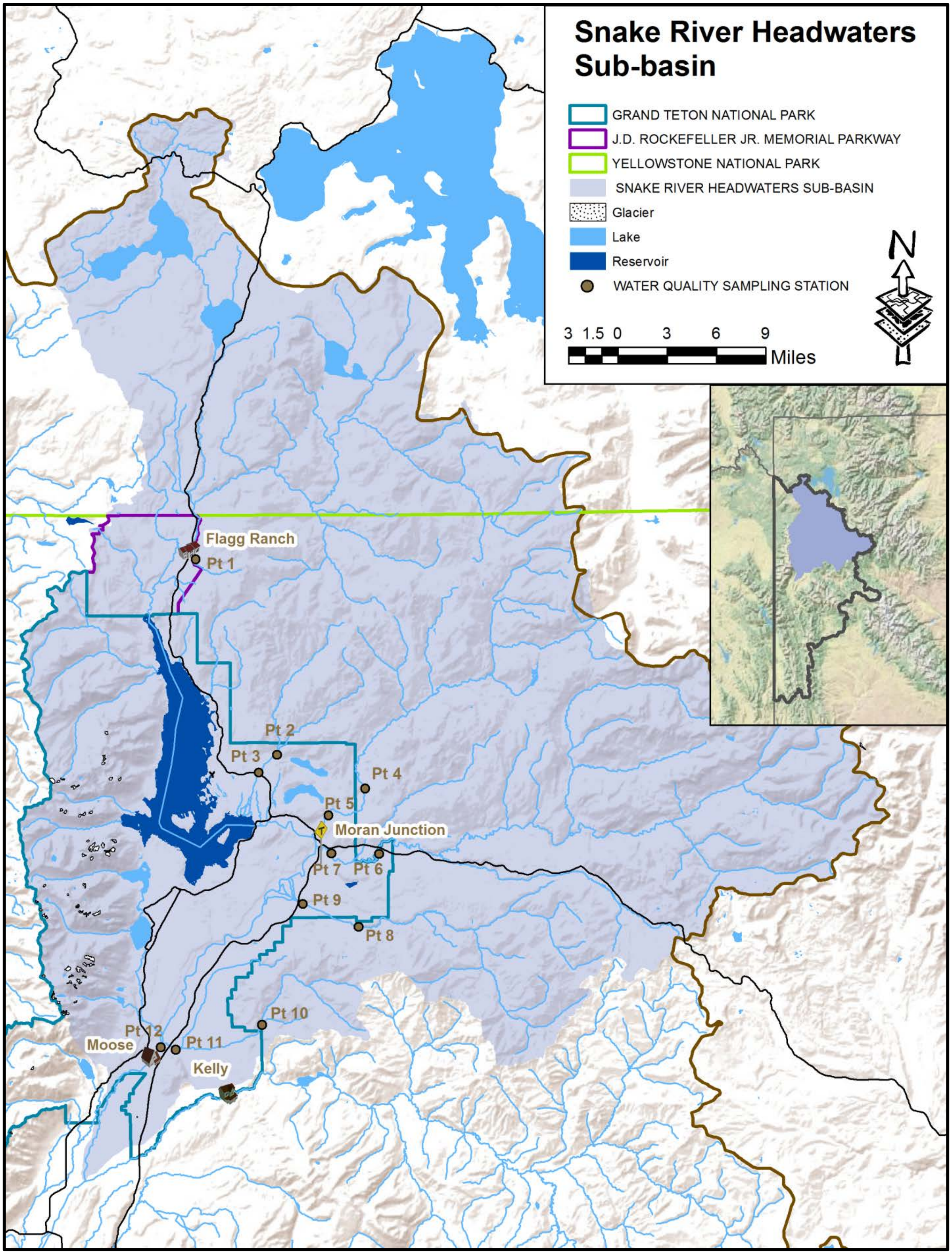

Figure 1: Snake River Headwaters Sub-basin

3.0 Gros Ventre River Sub-basin

The Gros Ventre River Sub-basin originates in the Bridger-Teton National Forest with a large portion of the watershed arising in the Gros Ventre Wilderness Area. The main stem of the Gros Ventre River is Class 2AB (WDEQ, WQD 2007). Streams within the Gros Ventre Wilderness Area, in addition to The Six Lakes and Clear Creek, are Class 1 waters. Other streams within the sub-basin are class 2AB.

Minimal development has occurred in the Gros Ventre Sub-basin. It is thought that this sub-basin may be impacted by wildlife grazing and browsing. However, monitoring to determine use support has not been conducted in the sub-basin (WDEQ, WQD 2010).

4.0 Greys River and Hoback River Sub-basin

This sub-basin has been divided into three watersheds for this technical memorandum. These watersheds are discussed in the following sections, and are listed as the Lower Snake River Watershed, the Greys River Watershed and the Hoback River Watershed.

4.1 Lower Snake River Watershed

The Lower Snake River Watershed begins at the confluence of the Gros Ventre River and the Snake River; and continues to the confluence of the Snake River and the Hoback River; and then continues from this confluence to Palisades Reservoir. It is the most populated area within the sub-basin. The Town of Jackson, communities of Wilson and Teton Village, and the rural developed area between the Town of Jackson and Hoback Junction are within this watershed.

Most streams in this watershed, including the main stem of the Snake River and Flat Creek, are classified as 2AB (WDEQ, WQD 2007). All waters in the Fish Creek drainage are Class 1 to its confluence with the Snake River.

Water quality within this watershed is considered good because quality of waters entering the watershed is good. There are impacts to this watershed from development which affect the water quality at least on a local basis. Flat Creek was listed on the 1996 303(d) list of impaired streams as being possibly impaired. Water quality assessments of Flat Creek indicated that urban runoff, primarily sediment, from the Town of Jackson limited aquatic habitat. Flat Creek was listed on the 2000 303(d) list because support for cold water game fishery and aquatic life other than fish was threatened from storm water runoff and it remains on the 2012 303(d) list as threatened (WDEQ, WQD 2012). The stream segment that is listed extends from the confluence with the Snake River to the confluence with Cache Creek (see Figure 2).

In 1999, a watershed committee (Flat Creek Watershed Committee) lead by the Teton Conservation District was formed to develop and implement a watershed management plan for Flat Creek. Intermountain Aquatics, Inc. Completed the plan in November 2006 for the Flat Creek Watershed Committee (Remlinger, 2006). The plan included goals for water quality, riparian habitat, and aquatic habitat. To address storm water runoff from the Town of Jackson, the Karns Meadow Storm Water Treatment Wetland was constructed in 2011. The project is designed to improve the chemical and physical quality of urban runoff entering Flat Creek (Leemon, 2012). The wetland will collect 27% of rainfall runoff from the Town of Jackson and during snowmelt the project will collect sediment from snow removal. The collected snow is stored at the rodeo grounds, which drains directly to the wetland.

Additionally, a project to rehabilitate Flat Creek is underway and portions of the stream have been rehabilitated. The project is being sponsored by Jackson Hole Chapter of Trout Unlimited in association with Teton Conservation District, Town of Jackson, Teton County, Wyoming Game and Fish Department, along with other agencies and groups (Jackson Hole Trout Unlimited, 2012). Aquatic habitat in a 3.5 mile segment of the stream running through Jackson has been altered over the years and is dominated by long wide, shallow riffles with few deep pools or meander pools. This condition allows formation of frazil ice and anchor ice during the winter. Icing likely impacts trout and other aquatic life. The project provides planning, design and implementation of instream fish habitat structures to allow the stream segment to reach its ecological potential (Jackson Hole Trout Unlimited, 2012).

Fish Creek is a Class 1 stream and its headwaters are in Teton National Park. It flows south, parallel to the Snake River through the valley and passes through the community of Wilson. In the 1990's residents began noticing excessive algal growth in the creek. Average summer flows range from 4 cubic feet per second (cfs) at Teton Village to greater than 500 cfs at Wilson, with groundwater being a major source of the stream flow (Leemon, 2012). Studies of Fish Creek conducted by the USGS in cooperation with the Teton Conservation District began in 2007. The USGS looked at interactions of surface water and near surface groundwater along Fish Creek. They studied three cross sections of the stream and found: the Teton Village reach was strongly influenced by snowmelt and large fluctuations in the water table, and was dry in the summer; Resor's Bridge reach was influenced by snowmelt, a rise in the Snake River flood plain water table, and recharge from irrigation; and the Wilson reach was influenced by main stem and tributary flows and by small but consistent groundwater inflows (Eddy-Miller et.al, 2009). In 2007 and 2008, the USGS studied water quality and biological communities of Fish Creek to evaluate the cause of nuisance algal growth. Nutrient concentrations causing the algal growth were evaluated and found to be low in the stream. However, the algal growth was quickly consuming the nutrients, which resulted in the high standing crop of algae. Groundwater was the probable source of the nutrients since groundwater was found to have higher concentrations of nutrients than surface waters and groundwater contributes considerably to the flow of Fish Creek (Eddy-Miller et. al., 2010).

Studies are continuing on Fish Creek to evaluate the algae and nutrient problems. Biological community data were variable and additional data are needed to establish a baseline (Leemon, 2012). There are also plans to collect isotope data to help describe the origin of the nutrients. The Teton Conservation District through Intermountain Aquatics, Inc. is conducting the Fish Creek Wastewater Treatment Wetland Demonstration Project. This is an alternative single-home wastewater treatment system rather than a traditional septic tank and leach field system. They have found from the first few months of operation that the treatment wetland improves water quality significantly (Intermountain Aquatics, Inc., 2011; Leemon 2012). They have gained approval from DEQ, WQD to install these systems in place of traditional systems to better treat single-home wastewater.

4.2 Greys River Watershed

The Greys River Watershed originates in the Bridger-Teton National Forest with very little private land and limited development within the watershed. The Greys River drains directly to Palisades Reservoir near the Town of Alpine. It is located between the Salt River Range and the Wyoming Range, which are part of the overthrust belt. The river and its tributaries are Class 2AB (WDEQ,WQD 2007). There are fairly high rates of erosion from the sedimentary rocks forming these geologically young mountains (WDEQ,WQD 2010). Although there has not been any reported monitoring in the watershed, the water quality is expected to be good due to lack of development.

4.3 Hoback River Watershed

The Hoback River Watershed begins in the Gros Ventre Mountains to the east and the Wyoming Range to the west. A ridge that extends between the two mountain ranges divides the Green River Basin from the Hoback River Watershed. Streams in the watershed are classified as 2AB, except those in the Gros Ventre Wilderness area and the full length of Granite Creek, which are Class 1 (WDEQ, WQD 2007). Development is limited in the watershed to the upper basin near the community of Bondurant. The lower segment of river flows through Hoback Canyon which restricts the river and potential for development. U.S. Highway 191/189 follows the river through the canyon and is very close to the river in some locations.

The Sublette County Conservation District (SCCD) has been monitoring surface water quality in the county since 2000. There are seven monitoring sites in the Hoback River Watershed (Figure 2). The sites are located on the Hoback River (two sites), Jamb Creek, Fisherman Creek, Dell Creek, Cliff Creek and Granite Creek, and were first monitored in 2002. No exceedances of the WDEQ, WQD surface water quality standards for chemical parameters have been found to date (SCCD 2009).

The SCCD contracted with River Continuum Concepts to sample macroinvertebrates at the seven water quality monitoring locations within the Hoback River Watershed. Sampling was conducted between 2000 and 2007, and was a baseline assessment of the macroinvertebrate communities. It was found that the Wyoming Stream Invertebrate Index (WSII) for the region did not seem to reflect conditions of streams in the Hoback River Watershed. It was suggested that if the WSII were used the streams would be considered ecologically impaired. Metrics used in this baseline sampling indicate the streams are not impaired. However, the study did indicate that benthic communities of Granite Creek appeared to be influenced by introduced sediment and nutrients, and Dell Creek communities appeared to be influenced by nutrients possibly from the elk feed grounds upstream (Marshall, 2011).

Western Watersheds Project collected fecal coliform samples in 2010 on Clark’s Draw, a small tributary to the Hoback River near Bondurant, and a five-sample geomantic mean exceeded the primary and secondary standards protective of recreational use. The source of the bacteria appeared to be from livestock grazing. A 1.9 mile segment of Clark’s Draw (Figure 2) adjacent to U.S. Highway 191/189 was placed on the 303(d) list of impaired streams in 2012 (WDEQ, WQD 2012).

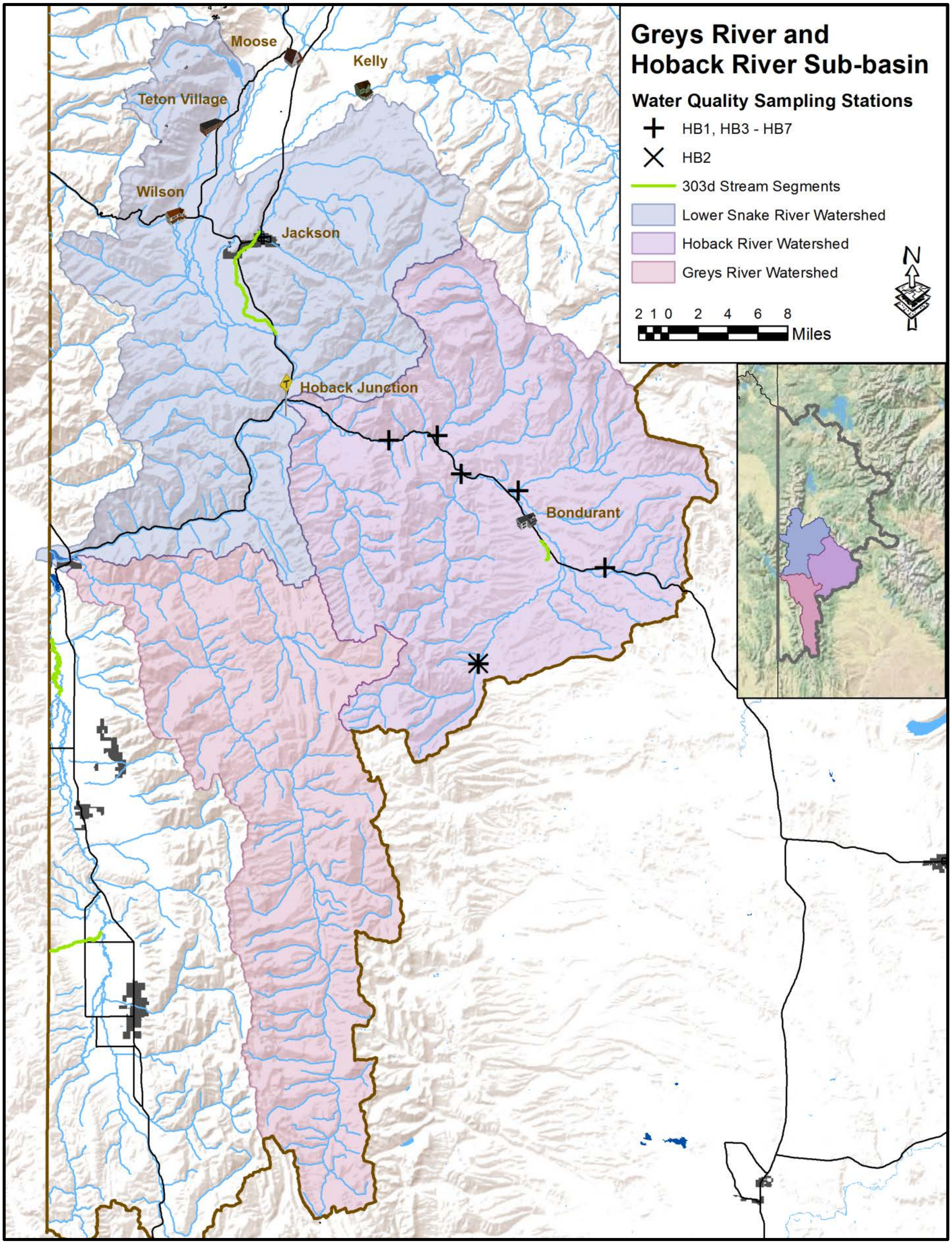

Figure 2: Greys River and Hoback River Sub-basin

5.0 Salt River Sub-basin

The Salt River Sub-basin drains the Star Valley and the surrounding mountains and is tributary to Palisades Reservoir (Figure 3). Salt River and the majority of its tributaries are classified as 2AB. There are no Class 1waters in this sub-basin.

Water quality monitoring in the Salt River Sub-basin has primarily focused on bacterial contamination. Sunrise Engineering, Inc. (2002) reported that the Salt River near the Etna USGS gaging station was on the 2000 303(d) list of impaired streams due to fecal coliform bacteria contamination. In 2002, the lower reach of Salt River was placed on the 303(d) list as threatened because of fecal coliform contamination (Ashworth 2012). This segment was listed in 2008 as impaired and not fully supporting contact recreation uses. The stream segment shown on Figure 3 remained on the 303(d) list in 2010 and 2012 due to fecal coliform contamination.

Stump Creek, a tributary to the Salt River, was also placed on the 303(d) list in 2008 for fecal coliform contamination and non-support of recreational uses (Ashworth 2012). Stump Creek has the highest concentration of fecal coliform bacteria of any of the sampling sites in the sub-basin. Samples are taken at nine sites in the sub-basin as shown on Figure 3. Many of the sampling sites show some level of fecal coliform bacteria contamination and additional segments may be placed on future 303(d) list. At this time, a TMDL study is planned for the Salt River Sub-basin, which would help the Star Valley Conservation District acquire Clean Water Act Section 319 funds to help address the issues causing the contamination.

There are concerns about potential high selenium (Se) concentrations in Crow Creek, a tributary to Salt River. Phosphate mining at the Smoky Canyon Mine in Idaho has impacted surface and groundwater resources through selenium contamination (WDEQ, WQD 2012). Crow Creek flows from Idaho, within the phosphate mining district, into the Salt River in Wyoming. A grab sample taken in 2006 from Crow Creek at the Idaho/Wyoming boarder during spring runoff had a total recoverable selenium concentration greater than Wyoming’s chronic criterion (WDEQ, WQD 2012). However, samples taken by WDEQ, WQD in 2008 at the state-line and near Fairview, Wyoming had concentrations below the state’s chronic selenium criterion of 5 micrograms per liter.

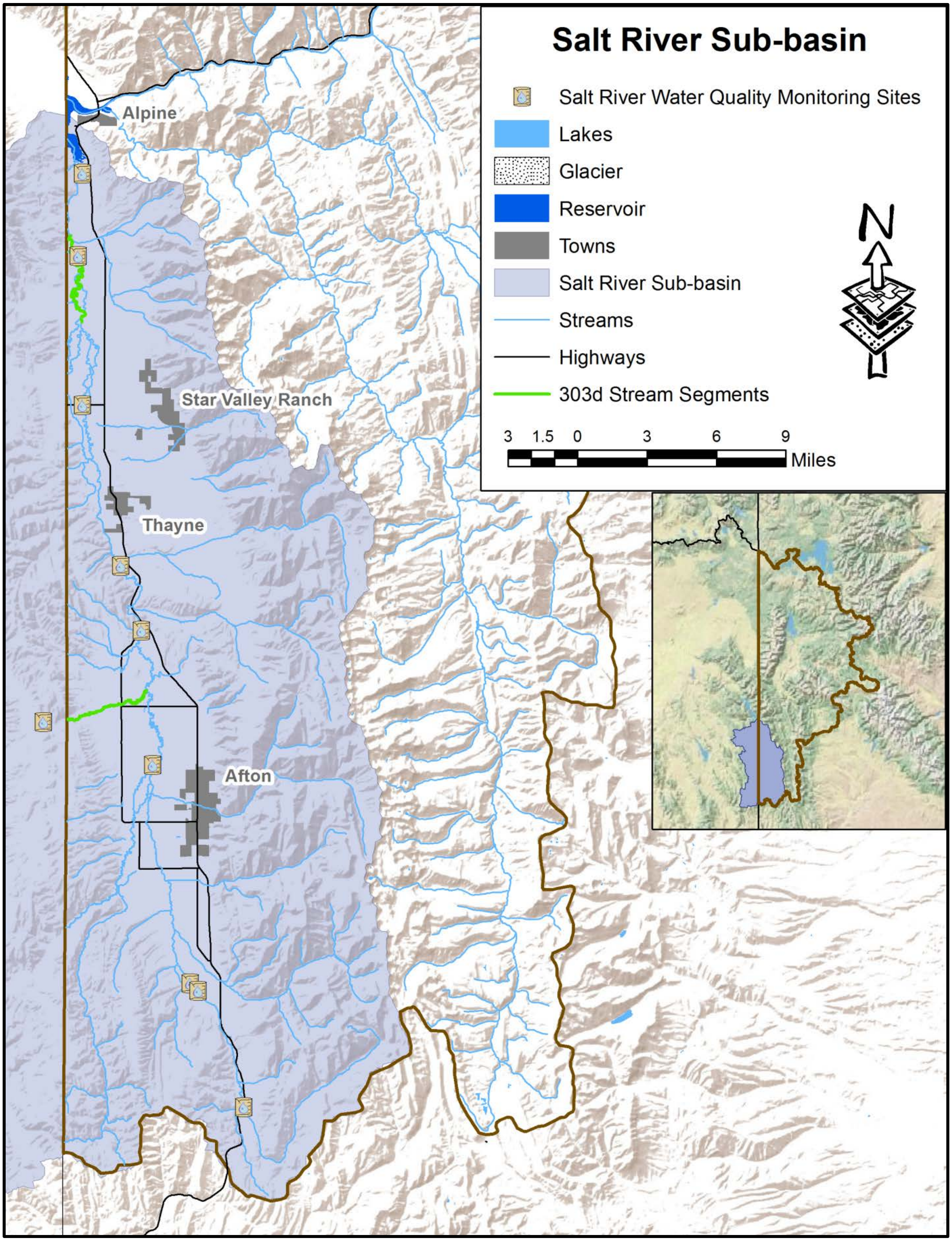

Figure 3: Salt River Sub-basin

6.0 Summary

Much of the Snake/Salt River Basin is comprised of wildlands including forests, sagebrush steppes and grasslands. There are several designated wilderness areas within the basin. These wildland watersheds provide high quality surface water to the basin. Environmental and recreational land uses are important in the basin; therefore considerable monitoring has been conducted to evaluate and help protect these high quality water resources. Most water quality problems, identified in the basin, result from human activities and management. Because the area for development is relatively small, human activities have been concentrated. This leads to potential impacts on streams and water quality, such as loss of stream habitat because of sedimentation and channel alteration, and bacterial contamination.

References

Ashworth, Brenda. 2012. Salt River Watershed. Presentation at the Snake/Salt River Basin Advisory Group Meeting. Alpine, WY. June 12, 2012. Star Valley Conservation District, Afton, WY.

Clark, Melanie L. Sadler, Wilfrid J. O'Ney, Susan E. 2004. Water-Quality Characteristics of the Snake River and Five Tributaries in the upper Snake River Basin, Grand Teton National Park, Wyoming, 1998-2002. USDI, U.S. Geological Survey. Scientific Investigation Report 2004-5017.

Eddy-Miller, Cheryl A. Wheeler, Jerrod D. Essaid Hedeff I. 2009. Characterization of Interactions between Surface Water and Near-Stream Groundwater along Fish Creek, Teton County, Wyoming, by Using Heat as a Tracer. USDI, U.S. Geological Survey. Scientific Investigation Report 2009-5160.

Eddy-Miller, Cheryl A. Peterson, David A. Wheeler, Jerrod D. Leemon, Daniel J. 2010. Characterization of Water Quality and Biological Communities, Fish Creek, Teton County, Wyoming, 2007-2008. USDI, U.S. Geological Survey. Scientific Investigation Report 2010-5188.

Intermountain Aquatics, Inc. 2011. Fish Creek Residential Wastewater Treatment Wetland Demonstration Project. Draft Progress Report. Prepared for: One Percent for the Tetons, Teton Conservation District, Teton County Engineering Department, and Wyoming Department of Environmental Quality.

Jackson Hole Trout Unlimited. 2012. Flat Creek Project. Web Site (www.jhtroutunlimited.org/about_jhtu/projects.php)

Leemon, Dan. 2012. Teton Conservation District Water Quality Program. Presentation at the Snake/Salt River Basin Advisory Group Meeting, Alpine, WY. June 12, 2012. Teton Conservation District, Jackson, WY.

Marshall, Brett. 2011. Baseline Biological Condition of the Hoback River, Sublette County Wyoming: 2002-2007. Prepared for Sublette County Conservation District, Pinedale, WY, By: River Continuum Concepts, Willow Creek, MT 59760.

National Park Service. 2009. Grand Teton Water Quality Resource Brief. USDI, National Park Service. (www.greateryellowatonescience.org).

Remlinger, Brian. 2006. Flat Creek Watershed Management Plan, Teton County Wyoming. Prepared for: The Flat Creek Watershed Committee, By: Intermountain Aquatics, Inc.

Sublette County Conservation District. 2009. Sublette County Surface and Ground Water Monitoring 2000-2008 (Newspaper Insert). Pinedale, WY.

Sunrise Engineering, Inc. 2002. Technical Memorandum: Water Quality. Snake/Salt River Basin Plan. Prepared for the Wyoming Water Development Commission, Cheyenne, WY. (http://waterplan.state.wy.us/plan/snake/techmemos/cropping.html).

Sunrise Engineering, Inc. 2003. Snake/Salt River Basin Plan, Final Report. Prepared for the Wyoming Water Development Commission, Cheyenne, WY. (http://waterplan.state.wy.us/plan/snake/finalrept/finalrept.html).

United States Environmental Protection Agency. 2009. Section 319, Nonpoint Source Program Success Story, Wyoming, Restoring Natural Hydrology Improves Fish Habitat. USEPA, Office of Water, Washington D.C.

Willamette Riverkeepers. 2012. Web Site. (www.willametteriverkeeoers.org)

Wright, Peter R. 2010. Hydrogeology and Water Quality in the Snake River Alluvial Aquifer at Jackson Hole Airport, Jackson, Wyoming, September 2008-June 2009. USDI, U.S. Geological Survey. Scientific Investigations Report 2010-5172.

WWC Engineering, Inc. 2007. Wyoming Framework Water Plan Volume I, and Volume II Planning Recommendations. Prepared for the Wyoming Water Development Commission, Cheyenne, Wyoming. Prepared in association with Hinckley Consulting; Collins Planning Associates; Greenwood Mapping, Inc.; and States West Water Resources Corporation.

Wyoming Department of Environmental Quality, Water Quality Division. 2007. Water Quality Rules and Regulations, Chapter 1, Wyoming Surface Water Quality Standards, 2007, Appedix A. WDEQ,WQD, Cheyenne, WY.

Wyoming Department of Environmental Quality, Water Quality Division. 2010. Wyoming Water Quality Assessment and Impaired Waters List (2010 Integrated 305(b) and 303(d) Report). WDEQ,WQD, Cheyenne, WY. Document #10-0230.

Wyoming Department of Environmental Quality, Water Quality Division. 2012. Wyoming Water Quality Assessment and Impaired Waters List (2012 Integrated 305(b) and 303(d) Report). WDEQ,WQD, Cheyenne, WY. Document #11-1058.

APPENDIX A
WYOMING SURFACE WATER CLASSIFICATIONS

Appendix A: Wyoming Surface Water Classifications

The Wyoming Surface Water Classifications presented in this Appendix were taken directly from The Wyoming Department of Environmental Quality, Water Quality Rules and Regulations, Chapter 1, Wyoming Surface Water Quality Standards, 2007, Appendix A, Wyoming Surface Water Classifications. For additional information, refer to Chapter 1 of the Rules and Regulations

Wyoming Surface Water Classifications

Class 1 waters (Outstanding Waters) are those surface waters in which no further water quality degradation by point source discharges other than from dams will be allowed. Nonpoint sources of pollution shall be controlled through implementation of appropriate best management practices. Pursuant to Section 7 of these regulations, the water quality and physical and biological integrity which existed on the water at the time of designation will be maintained and protected. In designating Class 1 waters, the Environmental Quality Council shall consider water quality, aesthetic, scenic, recreational, ecological, agricultural, botanical, zoological, municipal, industrial, historical, geological, cultural, archaeological, fish and wildlife, the presence of significant quantities of developable water and other values of present and future benefit to the people.

Class 2 waters (Fisheries and Drinking Water) are waters, other than those designated as Class 1, that are known to support fish or drinking water supplies or where those uses are attainable. Class 2 waters may be perennial, intermittent or ephemeral and are protected for the uses indicated in each sub category listed below. There are five subcategories of Class 2 waters.

> Class 2AB waters are those known to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where a game fishery and drinking water use is otherwise attainable. Class 2AB waters include all permanent and seasonal game fisheries and can be either "cold water" or "warm water" depending upon the predominance of cold water or warm water species present. All Class 2AB waters are designated as cold water game fisheries unless identified as a warm water game fishery by a "ww" notation in the "Wyoming Surface Water Classification List". Unless it is shown otherwise, these waters are presumed to have sufficient water quality and quantity to support drinking water supplies and are protected for that use. Class 2AB waters are also protected for nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value uses.

> Class 2A waters are those that are not known nor have the potential to support game fish but are used for public or domestic drinking water supplies, including their perennial tributaries and adjacent wetlands. Uses designated on Class 2A waters include drinking water, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.

Class 2B waters are those known to support or have the potential to support game fish populations or spawning and nursery areas at least seasonally and all their perennial tributaries and adjacent wetlands and where it has been shown that drinking water uses are not attainable pursuant to the provisions of Section 33. Class 2B waters include permanent and seasonal game fisheries and can be either "cold water" or "warm water" depending upon the predominance of cold water or warm water species present. All Class 2B waters are designated as cold water game fisheries unless identified as a warm water game fishery by a "ww" notation in the "Wyoming Surface Water Classification List". Uses designated on Class 2B waters include game and nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value.

Class 2C waters are those known to support or have the potential to support only nongame fish populations or spawning and nursery areas at least seasonally including their perennial tributaries and adjacent wetlands. Class 2C waters include all permanent and seasonal nongame fisheries and are considered "warm water". Uses designated on Class 2C waters include nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.

Class 2D waters are effluent dependent waters which are known to support fish populations and where the resident fish populations would be significantly degraded in terms of numbers or species diversity if the effluent flows were removed or reduced. Class 2D waters are protected to the extent that the existing fish communities and other designated uses are maintained and that the water quality does not pose a health risk or hazard to humans, livestock or wildlife. Uses designated on Class 2D waters include game or nongame fisheries, fish consumption, aquatic life other than fish, recreation, wildlife, industry, agriculture, and scenic value.

Class 3 waters (Aquatic Life Other than Fish) are waters, other than those designated as Class 1, that are intermittent, ephemeral or isolated waters and because of natural habitat conditions, do not support nor have the potential to support fish populations or spawning, or certain perennial waters which lack the natural water quality to support fish (e.g., geothermal areas). Class 3 waters provide support for invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage of their life cycles. Uses designated on Class 3 waters include aquatic life other than fish, recreation, wildlife, industry, agriculture and scenic value. Generally, waters suitable for this classification have wetland characteristics, and such characteristics will be a primary indicator used in identifying Class 3 waters. There are four subcategories of Class 3 waters.

Class 3A waters are isolated waters including wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable.

Class 3B waters are tributary waters including adjacent wetlands that are not known to support fish populations or drinking water supplies and where those uses are not attainable. Class 3B waters are intermittent and ephemeral streams with sufficient hydrology to normally support and sustain communities of aquatic life including invertebrates, amphibians, or other flora and fauna which inhabit waters of the state at some stage of their life cycles. In general, 3B waters are characterized by frequent linear wetland occurrences or impoundments within or adjacent to the stream channel over its entire length. Such characteristics will be a primary indicator used in identifying Class 3B waters.

Class 3C waters are perennial streams without the natural water quality potential to support fish or drinking water supplies but do support wetland characteristics. These may include geothermal waters and waters with naturally high concentrations of dissolved salts or metals or pH extremes.

Class 3D waters are effluent dependent waters which are known to support communities of aquatic life other than fish and where the existing aquatic habitat would be significantly reduced in terms of aerial extent, habitat diversity or ecological value if the effluent flows are removed or reduced. Class 3D waters are protected to the extent that the existing aquatic community, habitat and other designated uses are maintained and the water quality does not pose a health risk or hazard to humans, livestock or wildlife.

Class 4 waters (Agriculture, Industry, Recreation and Wildlife) are waters, other than those designated as Class 1, where it has been determined that aquatic life uses are not attainable pursuant to the provisions of Section 33 of these regulations. Uses designated on Class 4 waters include recreation, wildlife, industry, agriculture and scenic value. There are three subcategories of Class 4 waters.

Class 4A waters are artificial canals and ditches that are not known to support fish populations.

Class 4B waters are intermittent and ephemeral stream channels that have been determined to lack the hydrologic potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b)(ii) of these regulations. In general, 4B streams are characterized by only infrequent wetland occurrences or impoundments within or adjacent to the stream channel over its entire length. Such characteristics will be a primary indicator used in identifying Class 4B waters.

Class 4C waters are isolated waters that have been determined to lack the potential to normally support and sustain aquatic life pursuant to the provisions of Section 33(b)(i), (iii), (iv), (v), or (vi) of the regulations. Class 4C includes, but is not limited to off-channel effluent dependent ponds where it has been determined under Section 33(b)(iii) that removing a source of pollution to achieve full attainment of aquatic life uses would cause more environmental damage than leaving the source in place.