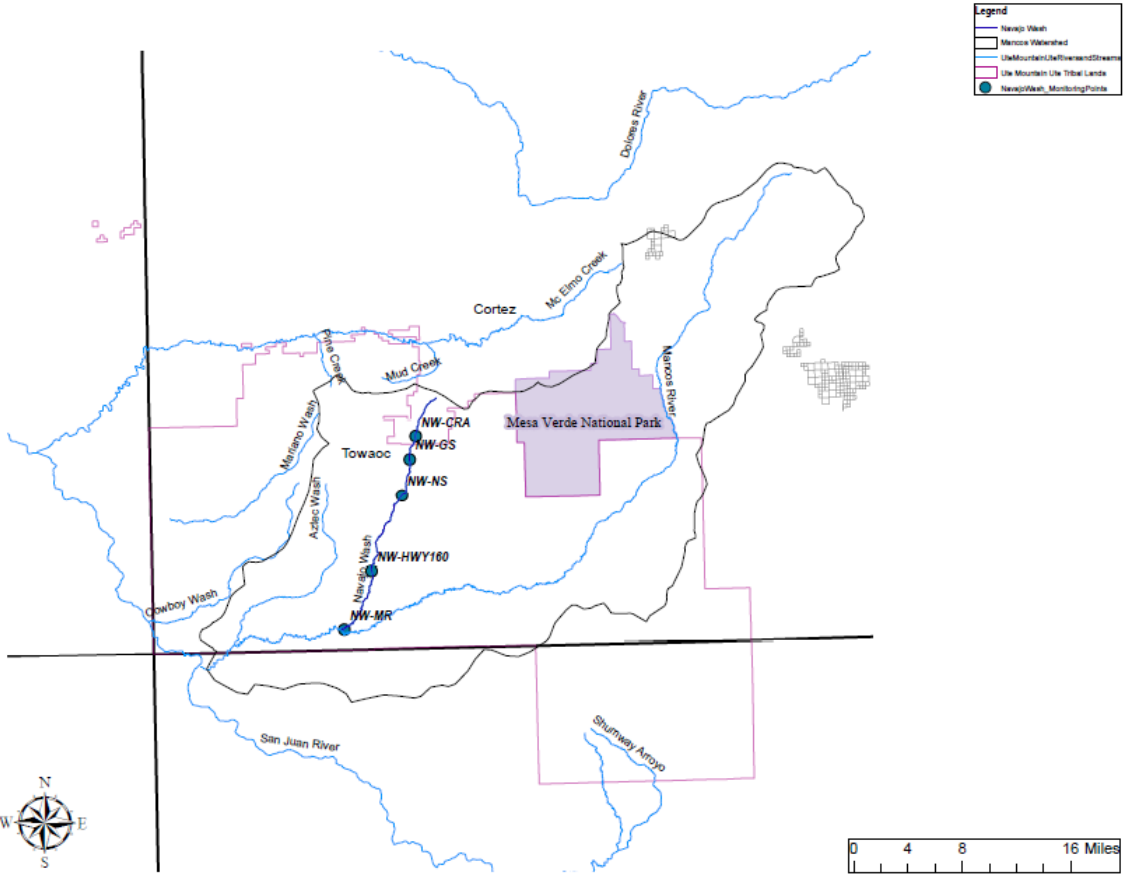
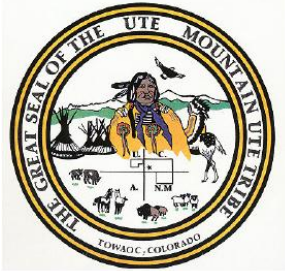


Navajo Wash Water Quality and Trends Assessment: 2008 – 2009



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Introduction

This Tribal Assessment Report, “Navajo Wash Water Quality and Trends Assessment, 2008 – 2009” consists of a description of the Ute Mountain Ute Tribe’s Section 106 funded Water Pollution Prevention Program monitoring strategy, a water quality assessment for historical and current (2008 – 2009) water quality data and a report of the Ute Mountain Tribe’s STORET submitted data for Fiscal Year 2009.

Ute Mountain Ute Tribal Lands (Tribal Lands) are located mostly in extreme southwestern Colorado, with portions extending in southeast Utah and northwestern New Mexico (Map 1). The Reservation is 597,288 acres or approximately 933 square miles in total area of trust land, with an additional 27,354 acres of fee land that is used for cattle ranching. It is the homeland for the Weeminuche Band whose population is approximately 2,100 members.

The Tribal seat is located in Towaoc, Colorado (pronounced Toy-uk), and is located at the base of the Sleeping Ute Mountain in Montezuma County, Colorado. This area is commonly known as "The Four Corners Region," describing the intersection of the states of Colorado, Utah, New Mexico, and Arizona. The intersection point of the four states is the most southwestern point in Colorado and also the most southwestern point on the Ute Mountain Ute Indian Reservation.

Water quality regulation on the Reservation exists under a few different programs. In 2002, the Ute Mountain Tribal Council adopted Water Quality Standards for Surface Waters of the Ute Mountain Ute Reservation. These standards follow the context of the Clean Water Act and guidance produced by U.S. EPA. In 2005, EPA approved the Tribe’s application for “Treatment in the Same Manner as a State,” thereby granting jurisdiction for the standards following EPA’s technical approval. The standards were recently under triennial revision and are currently awaiting approval by Tribal Council for those revisions. The triennial revision contains two significant changes: first, an anti-degradation implementation policy describing procedures of discharge permitting, the relationship to the nonpoint source program, and enforcement of violations of the standards; second, the revision designated three “Outstanding Tribal Resource Waters,” for the highest level of protection in the standards.

Other non-binding water quality regulations are the Nonpoint Source Management Program and the Ground Water Protection Plan. The former is a management plan for control of nonpoint source pollutants on the Reservation and Tribal fee lands. The Tribe has been awarded a small base-grant through Clean Water Act Section 319 funding to assist with implementing nonpoint source management strategies on the Reservation. The Ground Water Protection Plan describes the various aquifers on the Reservation, their vulnerability to various pollutant sources, and what each aquifer is used for. Thresholds are set for taking action to mitigate any pollution; those are mostly based on Safe Drinking Water Act Maximum Contaminant Levels. Both of these “non-binding” regulations do not specifically outline consequences of non-compliance such as the water

quality standards, but instead are intended to be pollution prevention measures to protect public health and environment. For more information and to view or download these documents, visit www.utemountainuteenvironmental.org.

The semi-arid climate and limited water resources on and around the Ute Mountain Ute Indian Reservation make the quality of available water resources a key to the survival and prosperity of the Tribe, its enterprises, and the ecosystems on the Reservation. The existing Clean Water Act Section 106 Water Pollution Prevention Program has begun to give the Tribe insight into the present problems and issues surrounding their water resources and the effect that the Tribe and surrounding land owners have on those resources. The San Juan River watershed is important habitat for many threatened and endangered species of fish and wildlife as well as home to the Ute Mountain Ute Tribe and many other people. With the continuing support of the EPA, through the Clean Water Act Section 106 Pollution Prevention Program, the Tribe hopes to research and protect the valuable resources of this watershed.

1. Description of Land Base

Topographically, the reservation is characterized as a high desert plateau, with the elevation ranging from 4,600 feet along the San Juan River to 9,977 on Ute Peak. Vegetation ranges from semi-arid grassland in the lower elevations to mixed conifer forests in the higher elevations (UMU, 1999). The reservation includes six vegetation zones (EMI, 2000) including semidesert grassland, sagebrush savanna, pinyon-juniper woodland, pinyon-juniper woodland/mountain browse, chaparral, and ponderosa pine-fir-spruce-aspen. Approximately 3,800 acres of noncommercial timber forests are represented in the pinyon-juniper woodland/mountain browse, chaparral, and fir-spruce-aspen. The reservation contains verified or potential habitat for several federally listed species of plants and animals. Early reports indicate that the Ute Mountain Ute land, as late as the 1870s, contained grasses, mowable as hay in nonwooded areas, with sagebrush sparse or absent. This condition was changed by heavy grazing, in part due to encroachment from non-Indian livestock (BIA, 1966).

Overgrazing resulted in serious range depletion, with invasion or increase of sagebrush and other undesirable species, the cutting of gullies and arroyos in the lowlands, and severe erosion in the uplands. Later reductions in livestock numbers have resulted in partial recovery of some reservation and surrounding rangelands (BIA, 1966). The Livestock Grazing Program within the Natural Resources Department was established to assist Tribal member cattlemen in developing and maintaining the best possible herds for their families and profit (UMU, 1999).

The climate of Four Corners region is classified as semi-arid and is characterized by low humidity, cold winters, and wide variations in seasonal and diurnal temperatures. Temperature varies with elevation. Average monthly maximum temperature ranges from 39°F to 86°F, and the average monthly minimum temperature ranges from 18°F to 57°F. The highest and lowest temperatures occur in July and January, respectively. Precipitation also varies with elevation, with average annual precipitation amounts of 8 to 10 inches in the lower elevations of the Ute Mountain Ute Reservation and about 13

inches at Cortez (Butler et al., 1995). The 50-year (1948 through 1997) annual precipitation minimum was approximately 5.2 inches at Cortez (1989) and the 50-year maximum was 30.8 inches at Mesa Verde National Park (1957) (Earthinfo, Inc., 2000). Average monthly precipitation varies from 0.65 inch in June to 2.00 inches in August. At the higher elevations, the monthly precipitation totals are relatively constant throughout the year with the exception of the dry season, which occurs in April, May, and June. At lower elevations, a relatively drier season occurs from April through June and a relatively wetter season occurs from August through October. Summer precipitation is characterized by brief and heavy thunderstorms. The snowfall season lasts for 7 to 8 months with the heaviest snowfall occurring in December.

1.1 Watersheds

The Ute Mountain Ute Indian Reservation is part of the San Juan River drainage basin (with the exception of some fee lands), a major tributary to the Colorado River. The San Juan River flows from the mountains of Colorado into Navajo Reservoir and northwestern New Mexico, through the Farmington, New Mexico area- a few miles south of the Ute Mountain Ute Reservation (in New Mexico), then turns northwest- crossing the Navajo Reservation and flows across approximately four miles of the most southwestern part of the Ute Mountain Reservation, near the Four Corners (Map 1).

The Mancos River (HUC 14080107) is the main tributary to the San Juan River from the Reservation. It enters the northeast corner of the Reservation, from Mesa Verde National Park into the Ute Mountain Ute Tribal Park. It joins the San Juan River just outside the southern Reservation boundary, flowing approximately 70 stream miles through the Colorado portion of the Reservation. The Mancos River drains some of the western slope of the La Plata Mountains, all of the south face of Mesa Verde, the southern half of Sleeping Ute Mountain, and areas south of the mountain by way of Navajo Wash, its tributaries and Aztec Wash. On the Western side of the Ute Mountains, water flows ephemerally and intermittently in Cowboy Wash, Coyote Wash, Marble Wash, and Mariano Wash which are tributary to the lower San Juan River in Colorado and Utah (HUC 14080201). The Tribe also has lands that are tributary to the San Juan in the Middle San Juan Watershed (HUC 14080105). McElmo Creek (HUC 14080202) drains the northern portion of the Sleeping Ute Mountains via small tributaries, flowing west from Cortez across two parcels of Reservation land into the San Juan River in Utah. Most lotic surface water bodies on the Reservation are ephemeral and/or intermittent with the exceptions of the San Juan River, the Mancos River, McElmo Creek, and Navajo Wash (Map 1).

The Monitoring Strategy for the Ute Mountain Ute Tribes' Clean Water Act 106 Water Pollution Prevention Program is designed with a triennial rotating basin approach. The monitoring strategy is described in further detail in Section 2. Navajo Wash, the focus of FY2009 monitoring and this assessment report is described in Section 1 and 2008 monitoring results are analyzed in Section 3.

1.2 Land Use Summary

In the Four Corners region, rangeland and forest account for roughly 85 percent of the entire area, and they cover large areas of the Ute Mountain Ute Reservation as well. Most of the Ute Mountain Ute land is either non-commercial timber land (forest) or rangeland used for open grazing (Table 1). The Weeminuche Construction Authority uses several acres as an equipment yard for storage and maintenance of equipment and construction materials. Other uses include recreational use (e.g., Tribal Park), resource extraction activities, and irrigated agriculture. Outside of Towaoc, urban land use is essentially non-existent.

Accordingly, primary land uses on the Ute Mountain Ute Reservation include housing for tribal members, oil, natural gas, and sand and gravel extraction, grazing for Tribal livestock, and the Farm and Ranch Enterprise south of Sleeping Ute Mountain. In addition, the Ute Mountain Utes operate several tourism facilities, including the 125,000-acre Ute Mountain Tribal Park, the Ute Mountain Casino Hotel/Resort, the Sleeping Ute RV park, and Ute Mountain Pottery. Table 1 summarizes the current land use on the reservation; Figure 2 shows the areas in which these uses take place.

TABLE 1	
Current Land Use:	
Use Area (acres)	
Irrigated farm land:	Farm and Ranch Enterprise 7,127
	Mancos Creek Farm 157
Timber land:	Commercial 0
	Non-commercial 163,767
Livestock Range	401,433
Other uses (non-agricultural)	1,614

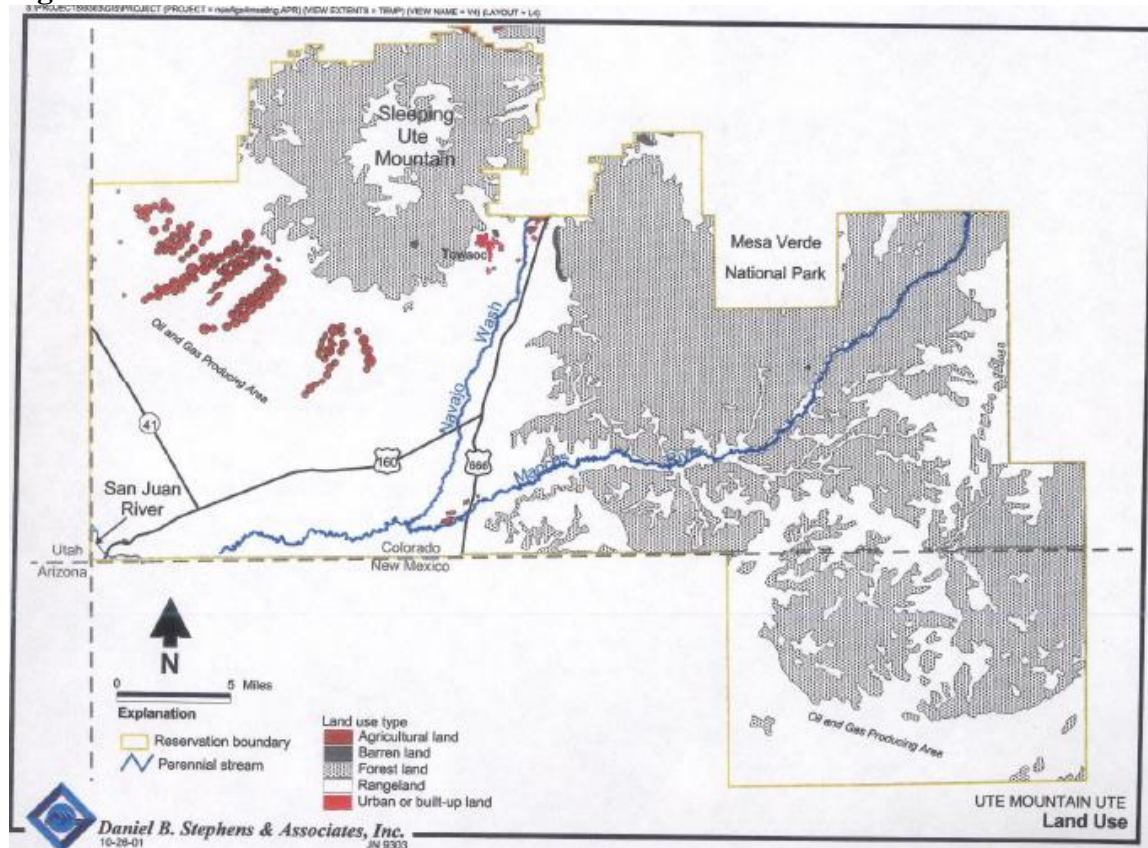
Source: Tribal Land Use Commission, as cited in Ute Mountain Ute Tribe, 1999

The Ute Mountain Ute Tribe Farm and Ranch Enterprise is an irrigated agricultural project designed for 7,634 acres of Ute Mountain Reservation land in southwest Colorado (UMU, 1999b). In addition, the Ute Mountain Ute Resources Department operates the smaller Mancos River Farm, which irrigates a few hundred acres. The Farm and Ranch Enterprise grows triticale and alfalfa hay and small grains including corn, wheat, and barley. The Mancos River farm grows hay and provides irrigated rangeland.

The Farm and Ranch Enterprise primarily grows crops, but also owns ~1,200 head of cattle. The purpose of the project is to operate a profitable agricultural enterprise, in addition to providing skilled year-round employment to Tribal members. The enterprise was established, in part, following a dispute in the 1950s over the completion by the Bureau of Reclamation (BOR) of a project that diverted water away from the reservation to non-Indian ranches. Settlement of the water rights issues raised by this project eventually led to the creation of the Dolores Project and Ute Mountain Ute Farm and Ranch Enterprise.

The Farm and Ranch Enterprise uses water entitled to the Ute Mountain Utes by the Colorado Ute Water Settlement Act of 1988, which facilitated the importation of water for irrigation, municipal and industrial, recreation, and wildlife uses. The Dolores Project is a water storage and delivery project that resulted, in part, from the water rights settlement. Water is stored in McPhee Reservoir, located 10 miles north of Cortez, Colorado and 20 miles from the Ute Mountain Ute Reservation. Water for irrigation, wildlife and recreation is transported from the reservoir through the Towaoc Highline Canal, and municipal water is transported by pipeline from Cortez to Towaoc. The Farm and Ranch Enterprise is designed to encompass roughly 7,600 acres of irrigated cropland, primarily south of Sleeping Ute Mountain, and to use on the order of 23,000 acre-feet per year of water.

Figure 1



Source: Ute Mountain Ute Tribe Nonpoint Source Assessment for the Ute Mountain Ute Reservation of Colorado, New Mexico and Utah. 2005 Revision Prepared by Scott Clow, Water Quality Specialist, Ute Mountain Ute Tribe And Daniel B. Stephens and Associates, Inc.

Oil and gas leases cover 61,745 acres in the south and east part of the reservation, 54,195 acres of which are actively producing (UMU, 1999). An additional 290,000 acres of reservation is available for oil and gas exploration and development.

The lands in Utah consist mainly of residential use and livestock use. Traditional plant gathering and limited gardening is practiced in Allen Canyon, the historical home of the Tribal Members who now live in White Mesa.

Traditional plant gathering activities and ceremonial land and water uses also occur throughout the Reservation.

1.2 Navajo Wash

Navajo Wash, which is a tributary of the Mancos River Watershed. It is described here as “semi-perennial” because it was probably originally ephemeral a century ago, but upstream irrigation has caused the groundwater table to become saturated and the stream flows unnaturally throughout most years. Drought conditions during 2001-2004 limited irrigation in the basin and reduced ground water return flow and it did not flow year-round. Navajo Wash has a variety of impairments from multiple sources. Chemical impairments include exceedances of selenium, arsenic, salinity (TDS/EC) standards, as well as high levels of sulfates and nitrates. Selenium exceeds the acute and chronic Tribal Water Quality Standard for warm water aquatic life and agriculture as well as the U.S. Fish and Wildlife recommended criterion for aquatic life at the Reservation boundary where it flows onto Tribal Lands. Salinity exceeds livestock watering standards in the winter (low flow) and during dry summers, and also exceeds irrigation standards year-round. Bacteria levels in Navajo Wash have regularly exceeded the standards for primary contact recreation use that is applied due to its proximity to residences in and around Towaoc.

Sources of pollutants include: upstream and on-reservation irrigation effects through groundwater return flows through Mancos Shale (Cretaceous-aged marine derived material naturally high in mobile selenium, arsenic and salt compounds), (non-discharging) wastewater treatment systems on the Reservation, grazing effects, and storm water run-off. Physical impairment is caused by: 1) deep channel incising from erosion of unstable stream banks that lack sufficient vegetation; 2) prohibition of lateral meandering; 3) fine sediment deposition from upstream irrigation; and 4) storm water discharge impacts from Towaoc and overgrazed rangeland. Biological impairment is related to all of the chemical and physical impairments—macroinvertebrate populations are limited in diversity of species because of chemical stressors and physical habitat limitations. Riparian health is also impacted by tamarisk infestation.

Navajo Wash has a range of instantaneous flow measurements from 0 to 20 cf/s based on 9 years of data collected by the Tribe and the BOR from 1992-2001. Storm event flows in Navajo Wash have been observed, but not measured, at much higher bank-full levels. Navajo Wash watershed has a reservoir—Hayfield Reservoir—with water supplied from the Dolores Project that is used for irrigation and wildlife/recreation. Another project was undertaken in May of 2004 to prevent further erosion and improve aquatic habitat in Navajo Wash in Towaoc, CO. This project involved grading eroded slopes around the bridge that crosses the stream in Towaoc; seeding the disturbed area; installing matting to hold the sloped banks and seed in place until it is sufficiently vegetated. In 2005, trees were planted along the stream to create shade and enhance aquatic habitat. Rocks were also placed around the project area to exclude recreational vehicles and trucks from

causing further disturbance and erosion. Re-treatment of invasive Tamarisk trees and maintenance and re-planting of native tree species has been undertaken annually since 2005 in the project area.

Baseflows of Navajo Wash consist mainly of irrigation return flows. Navajo Wash begins approximately four stream miles north of the Reservation boundary. Land use bordering this portion of the Reservation consists entirely of alfalfa growing and cattle grazing by non-Indian farmers and ranchers. Irrigation and grazing of fields adjacent to Navajo Wash results in large amounts of return flow to Navajo Wash- these return flows comprise the majority of stream flow for much of the year. Pre-irrigation flows in Navajo Wash were ephemeral; the water source for the irrigation water is a trans-basin diversion from the Dolores River Project. Bacteria loading is likely due to cattle grazing in and around the stream channel and the lack of riparian buffers along the stream. Other water quality issues (salinity, Selenium, arsenic) are attributed to the return flows leaching these water soluble elements from the local soils- which are comprised of Cretaceous-age Marine shales. Due to the semi-arid nature of the area, high evaporation rates, and generally low percolation rates into soil, the shale had not been exposed to a large volume of water, and as irrigation increased, the amount of selenium leached from the shale increased. As a result, the selenium content of Navajo Wash has been measured as high as 155.6 ug/L (3/24/2008), and consistently exceeds the acute aquatic life criterion of 20 ug/L selenium. It also often exceeds the agricultural use guidelines for selenium and salinity content.

Navajo Wash is a marginally fish-populated stream (limited species-- mostly dace), due to its poor water quality, but the fact that it flows directly into the Mancos River and subsequently into the San Juan River 17 miles downstream is significant. The Mancos and San Juan Rivers both maintain native and non-native fish populations, including round tail chub populations, a "threatened" species in nearby New Mexico. The San Juan River also supports populations of other endangered fish species including the razorback sucker and Colorado pikeminnow.

The primary nonpoint source pollutants on the Ute Mountain Ute Reservation and in the Navajo Wash basin are sediments, salinity, selenium, sulfates and bacteria. This pollution is caused by a variety of sources, including runoff from areas that have naturally high salinity and selenium (primarily the Mancos Shale and, in the southeastern corner of the Reservation, the Nacimiento Formation) or from irrigation return flow and erosion and sedimentation that may be accelerated by forest fires, grazing, construction activities, oil and gas development, and related road building activities.

Lentic surface waters are very limited in the Navajo Wash watershed. A small reservoir near Towaoc called Hayfield Reservoir is used to irrigate a field for alfalfa hay and provides some fishing and recreational use. This reservoir is filled with high quality water from the Dolores Project (Dolores River water). The reservoir does support a small fish population and is fished by Tribal members. Funding for a study of mercury accumulation in the biota and the sediments/water column is needed.

Three categories of water body impairment are described in the Tribes Nonpoint Source Assessment Report (UMU, 2005); *nonimpaired*, or waters meeting water quality standards and supporting designated uses; *moderately impaired*, those waters that have limitations on meeting water quality standards and supporting uses, but that are likely to recover from impairments through changes in management activities; and *severely impaired* waters, those waters that will require significant, long-term changes in management activities *and* significant on-the-ground projects to minimize or mitigate nonpoint source pollution

Navajo Wash (approximately 16 miles, or the entire stream reach on the Reservation) is severely impaired for chemical, physical and biological parameters with salinity, bacteria, selenium, and arsenic levels being of particular concern. Impairment and Water Quality Standards compliance in Navajo Wash is analyzed in greater detail in Section 3 (Data Review/Assessment).

2. Description of Monitoring Strategy

The document, “Ute Mountain Ute Environmental Programs Department Water Pollution Prevention Program Monitoring Strategy, revised July, 2009” (Appendix 1) includes a description of watersheds on the Reservation along with a general water quality summary for each watershed area. Monitoring objectives, monitoring design and parameters, frequency of sampling, data management, quality assurance, project effectiveness, data analysis and assessment, reporting and general support and infrastructure of the Water Pollution Prevention Program are all described in detail in the document. A summary of the monitoring strategy is presented below to facilitate interpretation of the 2008 monitoring results.

2.1 Monitoring Objectives

Monitoring objectives for the Ute Mountain Ute Clean Water Act Section 106 Water Pollution Prevention Program Monitoring Program have been developed in order to effectively assess the overall quality of Tribal waters in relation to the Tribes Water Quality Standards, the extent that water quality is changing over time, the identification of potential problem areas, areas needing protection and restoration, and the evaluation of the effectiveness of the Tribes’ clean water program and projects.

2.2 Monitoring Design and Parameters

The surface water monitoring program has used a rotating basin strategy to accomplish monitoring in each watershed within a three year period, as in the schedule table below. Specific sample sites chosen for the determination of surface water quality are chosen based on the following factors:

- Reservation boundaries
- Pollution sources
- Potentially impaired stream segments
- Tributaries
- Historical data collected by the U.S.G.S. and the B.O.R.
- Public interest and concern

- Accessibility

There are currently 101 sample locations in the Ute Mountain Ute Water Quality Database. Currently (FY09) eight sites on the Mancos River, two tributaries, ten ephemeral tributaries, three wells at Farm and Ranch Enterprise, five wells around Towaoc, ten springs on the Reservation, two wells near the White Mesa community and five springs around the perimeter of the mesa at White Mesa will be monitored. The number of actual locations sampled each year is dependent on funding, available staff, site access and weather conditions. Sample locations are reviewed annually to assess if changes, additions, or deletions of sites are appropriate.

YEAR (Oct-Sept)	BASIN(S)
FY 2007	Mid/Lower San Juan, incl. McElmo Creek, Cottonwood Wash, UT
FY 2008	Navajo Wash
FY 2009	Mancos River
FY 2010	Mid/Lower San Juan, incl. McElmo Creek, Cottonwood Wash, UT
FY 2011	Navajo Wash
FY 2012	Mancos River
Etc.	etc.

Each of the basins in the table above has some baseline data. Each has specific data gaps that will need to be addressed to meet the monitoring objectives described in Section II of the Monitoring Strategy (Appendix 1).

2.2.1 Water Quality Monitoring Site Descriptions: Navajo Wash Watershed

The following text includes surface water sample site names and rationales for surface water quality monitoring sites in the Navajo Wash Basin (within the Mancos River Watershed), Map 2, attached graphically illustrates the locations of these sites.

NW-CRA: This site is directly upstream of the Reservation on Tribally owned private land; it indicates what flows onto the Reservation from upstream landowners: selenium, arsenic, bacteria and salts in very high numbers. Tribal WQS have a variance and a long-term goal of no net gain of selenium on the Reservation to meet WQS at this site.

NW-GS: This site indicates pollutant loads incoming from adjacent upstream irrigation and tributaries from residential areas.

NW-NS: This site is downstream of the urban area, Navajo Spring, old landfills, wastewater treatment lagoons and indicates the overall effect of the Town of Towaoc.

NW-Hwy160: This site is 10 miles downstream of Towaoc and indicates additional pollutants from grazing lands and small tributaries- major sediment movement and erosion in progress.

NW-MR: This site is at the mouth of Navajo Wash at Mancos River, location of long-term selenium target as Navajo Wash has the highest selenium levels of any stream in the watershed.

2.3 Frequency of Sampling Events

Surface water monitoring is undertaken based on a hydrograph for perennial streams and rivers, targeting four flow regimes: high flow (spring run-off), low flow (winter), low flow (mid-summer), and a storm event. Storm event flows are unique in magnitude in this region and can have significant upland influence on water quality that is otherwise undetected by sampling at other times. Limitations on completing this frequency of sampling usually occurs at some sample sites. Limitations include: staff limitations, access to sites during specific weather conditions or times of year, vehicle issues, lack of storm events during reasonable sampling hours, and other unforeseen factors.

2008 – 2009 sampling: Navajo Wash

Surface water monitoring was limited due to staff changes; winter low flow samples were not collected, two spring runoff samples were collected in March, 2008. Five sampling events were conducted between April, 2008 and August, 2008 (spring runoff and summer low-flow periods) on Navajo Wash. A total of fifteen distinct water quality samples were collected, analyzed, reviewed for quality assurance and uploaded to the regional STORET database. Results are analyzed and discussed in Section 3.

2.4 Quality Assurance

The Ute Mountain Ute Tribe's Water Pollution Prevention Program collects data and uses data for decision-making within the context of the Tribe's EPA-approved Quality Assurance Project Plan (QAPP), "Ute Mountain Ute Indian Tribe Water Pollution Prevention Program Quality Assurance Project Plan for the Monitoring of Surface and Ground Waters Revision No. 6, March 2007". Standards Operating Procedures (SOP's) are also used, as referenced in the QAPP. These documents can be obtained from EPA's Regional QA Officer, the Tribe's Project Officer for the Clean Water Act Section 106 Program—Randy Brown of the EPA Region VIII' Tribal Assistance Program, or directly from the Tribe's Water Quality Specialist. The Quality Assurance Project Plan for the Water Pollution Prevention Program was revised by the Tribe in 2007 and subsequently approved by EPA Region.

Field calibration procedures, staff training and quality control measures (QC) (blank and duplicate collection, data evaluation and record keeping) are all described in detail in the Tribe's QAPP and are summarized below.

2.5 Field Measurement and Observation Data

In the field, this information is recoded on field data sheets. Field data sheets are penned with a unique sample number at the lab/office when samples are also penned and stored in refrigeration. Sample number corresponds to the respective number in the *Sample Log Book*. Field data and observations are transcribed to the computer in a Microsoft Excel spreadsheet. It is saved with the sample number as its file name. Hardcopies are filed by

year for reference. Data entered electronically is reviewed following procedures outlined in the QAPP by either the Water Quality Technician, Environmental Specialist, Nonpoint Source Coordinator or the Water Quality Specialist.

2.6 Laboratory Data (in-house)

Data are collected on laboratory bench sheets; following QC verification, calculated values are transcribed into the appropriate location on the Microsoft Excel spreadsheet created with the field data sheet. QC data are transcribed into an analysis-specific QC spreadsheet that identifies the analyst, date, and QC sample recovery and/or duplicate precision. Once ion balance and other QA procedures have validated the data in this sample spreadsheet, the data are exported to the Aquatic Water Quality Monitoring System (AWQMS) Water Quality Exchange (WQX) network database.

2.7 Laboratory Data (contracted)

Contracted data are received in two formats, depending on the laboratory: hard copy and/or electronic. Following QA/QC validation, hard copy data are transcribed into an appropriate location on Microsoft Excel spreadsheet specified for that analyte and sample. This is a different spreadsheet, developed by Gold Systems, Inc. for EPA Region 8, that is set up in a database format for easy exporting to the AWQMS interface program. Contract Laboratory QC data is included in a separate tab on the spreadsheet, with the sample number being the unique identifier for each analysis.

2.8. Data Analysis/Assessment

Quality assured water quality data collected for each fiscal year (October through September) in accordance with the Tribal Water Quality Monitoring Strategy and QAPP are analyzed for determination of statistical relation to either Tribally-collected or historical data. Quality approved data used for review and analysis is stored electronically on the EPA hosted Water Quality Exchange (WQX) network. The Ambient Water Quality Monitoring System (AWQMS) interface is used to upload and export data from the WQX database. AWQMS also includes tools for graphical and statistical data analysis, which may be used to incorporate Tribal Surface water quality standards data and ground water action levels to provide benchmarks for data analysis. Each fiscal year, a watershed report is written for quality assured data collected during the previous monitoring season. The annual watershed report contains quality control summaries for the collected data along with an analytical summary of the data considering Tribal Water Quality Standards and potential sources of impairments. The annual watershed report is a tool used to collect and present water quality data for decisions on protecting and improving the physical, chemical and biological integrity of Tribal Waters.

2.9 Surface Waters-Compliance with Water Quality Standards

The Tribe's water quality standards are the foremost benchmark for surface water quality on the Reservation, and it is the intention of the Tribe to meet the level of quality outlined in the standards in order to protect the designated uses for each water body. Where the standards are comprehensive for all parameters for all designated uses, it is certainly not the intention of the Tribe to test for every possible parameter. Instead, the Water Quality

Specialist and his staff will determine which parameters are pertinent to each water body and designated uses and then which parameters are logical to analyze. The Tribe does not have the staff or financial capability to monitor every parameter in their standards, so these will be selected carefully. The minimum parameters shall be the nine “fundamental” water quality parameters described in EPA 832-R-06-003, “Elements of a Tribal Monitoring and Assessment Program” but most water bodies will have the “intermediate” parameters and “mature” parameters described in EPA 832-R-06-003. In addition, many water bodies have specific pollutants of concern for various reasons, and those pollutants will be monitored.

The available water quality data were compared to the Revised Ute Mountain Ute Water Quality Standards, adopted November 2002. Beneficial use designations for Tribal waters are determined by the Tribe, in accordance with Sections 101(a)(2) and 303 of the Clean Water Act, and the implementing federal regulation at 40 of CFR Part 131.10. Water uses that are defined in these standards include:

- Cold water aquatic life (CWAL)
- Warm water aquatic life (WWAL)
- Drinking water source (DW)
- Recreation, primary contact (REC1)
- Recreation, secondary contact (REC2)
- Agriculture, irrigation and/or livestock watering (AG)
- Industrial use (IND)
- Tribal Ceremonial Use (T)
- Fish consumption (FSH)

Navajo Wash has been designated for the following beneficial uses: WWAL, REC1, AG, IND.

Navajo Wash currently has a variance with a temporary standard for selenium due to a natural source (Marine derived cretaceous-aged soils rich in selenium) and human-caused conditions (irrigation, grazing impacts). Irrigation of selenium-rich soils has caused elevated levels of selenium in leachate from those soils. An interim goal of an annual geometric mean of 13 ug/L dissolved Selenium has been set as the temporary standard (measured on a four sample minimum, including high flow and low flow conditions).

Prior to querying the database files for regulatory exceedances, a single “most stringent” standard for each sample location was identified. In order to identify the most stringent standard, all applicable designated uses for each waterbody were considered. For example, in the case of selenium, the designated use with the lowest numeric standard (5 ug/L) is warm water aquatic life. Therefore, this number becomes the most stringent standard for all samples with this designated use, and all dissolved selenium concentrations above 5 ug/L were considered to be exceedances. Some of the metals standards are based upon hardness, and ammonia criteria rely on pH, temperature, and the presence or absence of salmonid fish species. In these cases, the appropriate equation was used to determine if the standards were exceeded.

3. 2008 STORET Submitted Data

Fifteen distinct water quality sampling events in the Navajo Wash Watershed for FY2008 were submitted to the Regional STORET database, this data is analyzed in the following sections. Table 2 below summarizes sample locations, dates and data types collected for each sample. Complete analytical results for each sample event are included with this report as Table 3 at the end of Section 3.

Table 2				
Ute Mountain Ute Water Pollution Prevention Program				
Sampling Locations, Dates and Data Types for Navajo Wash FY2007 - 2008				
Location Description	Latitude/Longitude	Station ID	Sample Date	Data Type
Directly Upstream on Tribally-owned private land. 20 meters north side of crossing at CR A	37.224972 / - 108.68907	NW-CRA	3/24/2008 5/7/2008 7/8/2008 8/13/2008	Field Parameters ¹ , Major Ion Data ² , Nutrient Data ³ , Bacteria ⁴ , Metals ⁵ ,
Old gauging station near Mike Wash Road Crossing near Towaoc	37.200679 / - 108.6984	NW-GS	3/24/2008 5/7/2008 7/8/2008 8/13/2008	Field Parameters ¹ , Major Ion Data ² , Nutrient Data ³ , Bacteria ⁴ , Metals ⁵ ,
Navajo Wash at Navajo Springs Location	37.08166 / - 108.75212	NW NS	7/31/2008	Field Parameters ¹ , Major Ion Data ² , Nutrient Data ³ , Bacteria ⁴ , Physical ⁶
10 miles downstream of Towaoc on Highway 160 at north side of bridge crossing Navajo Wash	37.019814 / - 108.79276	NW HWY 160	5/1/2008 7/8/2008 7/31/2008	Field Parameters ¹ , Major Ion Data ² , Nutrient Data ³ , Bacteria ⁴ , Metals ⁵ , Physical ⁶

Navajo Wash at Mancos River	37.019814 / - 108.79276	NW - MR	5/1/2008 7/8/2008 7/31/2008	Field Parameters ¹ , Major Ion Data ² , Nutrient Data ³ , Bacteria ⁴ , Metals ⁵ , Physical ⁶
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¹ Field Parameters: pH, Temperature, Flow, Dissolved Oxygen, Specific Conductance

² Major Ion Data includes: Calcium, Carbonate, Chloride, Magnesium, Potassium, Sodium, Sulfate, Hardness, Alkalinity

³ Nutrient Data includes Nitrite-Nitrate, Organic Nitrogen, Ammonia, and Phosphorus

⁴ Metals Data includes Arsenic, Barium, Boron, Cadmium, Chromium, Copper, Iron, Lead, Mercury, Nickel, Selenium, Silver and Zinc

⁵ Physical parameters include Total Dissolved Solids, Total Suspended Solids

Note: Complete parameters listed for each of the five data types were not collected for every sample

Table 3 includes complete sample results for each sample collected

3.1.1 Basic Statistical Summary

Table 2 includes a basic statistical summary for selected parameters from sample data uploaded to the STORET warehouse for the 2008 Navajo Wash watershed sampling events. Additional statistical analyses (minimum, maximum, mean, median, 90th percentile) are presented as Appendix B, "Single Characteristic Statistics by Location Reports".

Table 2 Basic Statistical Summary for Selected Parameters¹ by Location

Activity Start Date	Monitoring Location	Escherichia coli cfu/100ml - Comb Available	pH s.u.	Specific conductance uS/cm	Temperature, water deg C	Total Coliform cfu/100ml - Comb Available
3/24/2008	NW-CRA ~ Navajo Wash above CR A on Don Schwindt's land		7.96	5770	8	
5/7/2008		151.5				2420
7/8/2008		128.13	8.31	1879	19.5	1613.5
8/13/2008		816.4	8.14	4100	19.9	2420
Maximum		816.4	8.31	5770	19.9	2420
Minimum	128.13	7.96	1879	8	1613.5	
Average	365.34	8.14	3916.33	15.8	2151.17	
3/24/2008	NW-GS ~ Navajo Wash at gauging station #1	19.9	8.4	3020	12.7	143
5/7/2008		45.5				2419.17
7/8/2008		3255	8.33	2190	19.5	2420
8/13/2008		286.8	8.11	4260	19.4	2420
Maximum		3255	8.4	4260	19.5	2420
Minimum	19.9	8.11	2190	12.7	143	

Average		901.8	8.28	3156.67	17.2	1850.54
5/1/2008	NW-HWY 160 ~ Navajo Wash at Highway 160, upstream from bridge	226.75	8.4	2755	12.7	1119.85
7/8/2008		613.1	8.26	2160	23.3	2420
7/31/2008		980.4	8.35	4870	26.3	2420
Maximum		980.4	8.4	4870	26.3	2420
Minimum		226.75	8.26	2160	12.7	1119.85
Average		606.75	8.34	3261.67	20.77	1986.62
5/1/2008	NW-MR ~ Navajo Wash at Mancos River	230.8	8.4	3020	12.7	993.39
7/8/2008		1986.28	8.34	3030	22.7	2420
7/31/2008		18.7	8.35	4430	25.9	2420
Maximum		1986.28	8.4	4430	25.9	2420
Minimum		18.7	8.34	3020	12.7	993.39
Average		745.26	8.36	3493.33	20.43	1944.46

¹ Parameters selected had a minimum of 3 data points for the station. "Single Characteristic Statistics by Location Reports" for parameters of concern (arsenic, nutrients, selenium, total dissolved solids, bacteria) include more detailed statistical analysis and evaluation alongside appropriate water quality standards, these reports are discussed below and are included as an attachment to this report

3.1.2 QA/QC Summary

Samples were collected, analyzed and stored electronically according to procedures outlined in the programs EPA approved QAPP ("Ute Mountain Ute Indian Tribe Water Pollution Prevention Program Quality Assurance Project Plan for the Monitoring of Surface and Ground Waters Revision No. 6, March 2007").

Duplicate samples were collected and concentrations of all analytes from duplicate samples were within 20% relative percent difference (RPD). Table 4, attached, contains duplicate sample results and RPD calculations.

Field Blanks (Field Blank data is attached as Table 5) indicated that potential contamination in sample bottles, preservatives, shipping or sampling methodology was minimal to none. Sulfate was detected in two samples (3/24/08 at MW-MR 0.7 mg/L and 5/01/08 at NW-GS 1.0 mg/L) and chloride detection (8/13/08 at NW-GS 3.6 mg/L).

3.2 Navajo Wash Assessment 2008

The Navajo Wash Basin is part of the Mancos River Watershed (HUC 14080107) which drains into the San Juan River and ultimately the Colorado River at Lake Powell. The impaired condition of Navajo Wash including parameters of concern (Selenium, Salinity and Bacteria) is discussed in detail in Section 1 of this report along with the causes/sources of pollution which from human and natural sources and are non-point source in nature. Sampling in 2008 confirmed historic, longstanding (presumably since irrigation and grazing were initiated in the area circa 1880) trends in water quality impairment for selenium, salinity and bacteria persist.

3.2.1 Selenium

Selenium is the major contaminant associated with irrigation return flows in the San Juan River Basin (Abell, 1994). A reconnaissance survey conducted by the USGS indicated that selenium concentrations exceeded the chronic aquatic-life criterion for selenium in most water samples from newly irrigated areas and from McElmo Creek, Navajo Wash, and the Mancos River 59 (Butler et al., 1995). The largest selenium concentration seen in fish samples from the Montezuma Valley was in a sample from Navajo Wash, and the maximum selenium concentration on the reservation was from a site in Navajo Wash.

The USGS study indicates irrigation drainage may be the primary source of selenium to McElmo Creek. Butler et al. (1997) indicated that there were high concentrations of selenium in Navajo Wash and Mud Creek, a tributary to McElmo Creek, and selenium was also detected in bottom sediments and biota samples in the Mancos River Basin. Selenium that has been detected in springs on Sleeping Ute Mountain (Geldon, 1985) could potentially contribute to the selenium levels in Navajo Wash. Because of the proximity in the San Juan Basin to endangered fish, the Colorado pikeminnow and the razorback sucker, selenium is particularly important.

Selenium in Navajo Wash is one of the more prominent nonpoint source concerns on the Reservation. The lower Montezuma Valley has been irrigated for about 100 years, since the construction of the Dolores Tunnel brought irrigation water to the valley. The surface geology of the valley is mostly Mancos shale and shale-related soils. These rocks and soils are very high in soluble nitrogen, arsenic, and selenium compounds as well as overall minerals capable of being dissolved. The phenomenon that results when irrigation occurs is that during the summer growing season, irrigation returns dilute in-stream ambient conditions, while contributing slight levels of selenium and salts. During the winter, the saturated ground water table causes flows laterally along the confining shale, leaching arsenic, selenium, and salts, including nitrates. See Se vs. flow in Figure 2 for this inverse relationship. The effect on aquatic life is consequently detrimental. Livestock use (drinking water) is also threatened.

Figure 2

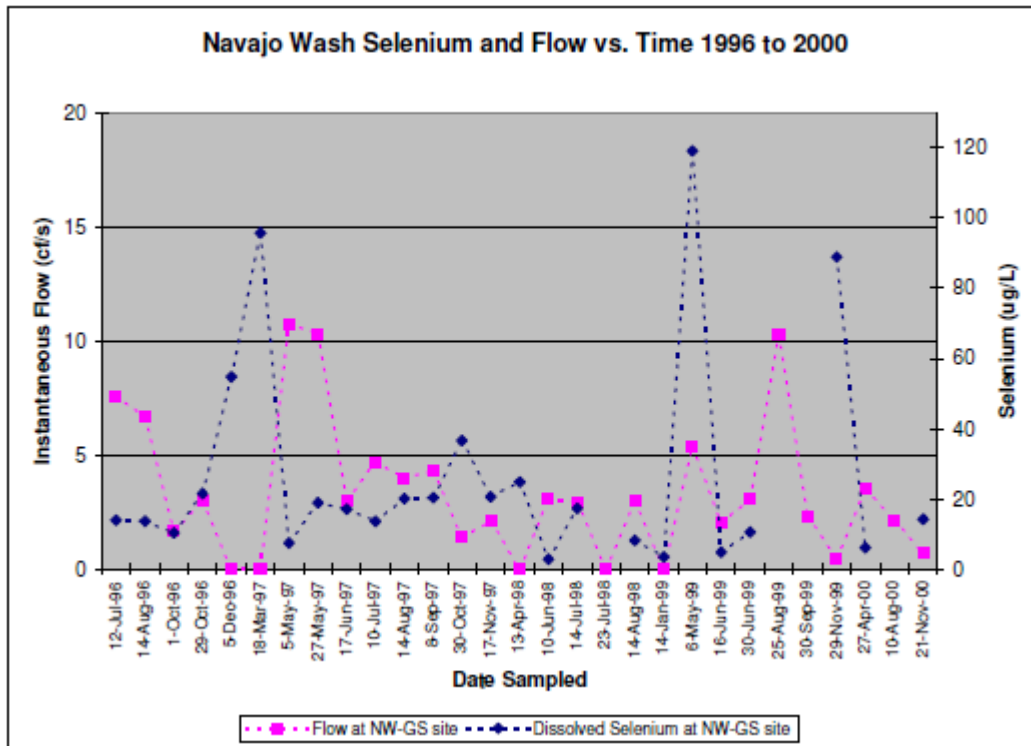
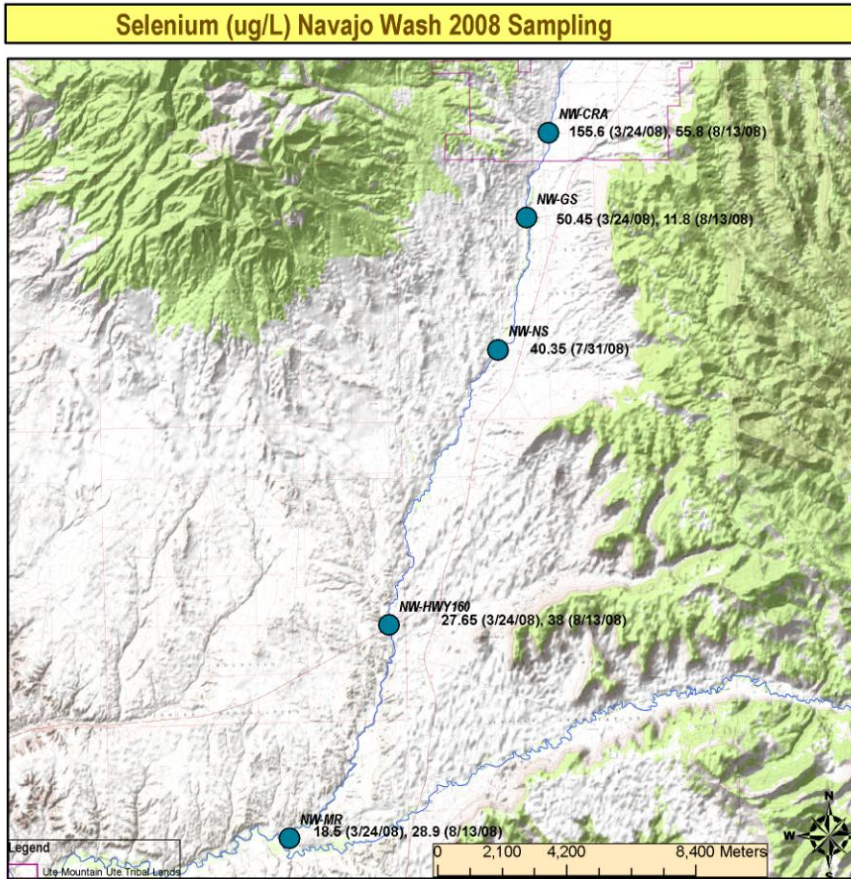


Figure 3 shows the mean selenium levels in Navajo Wash at sampling sites. The water quality standards for Navajo Wash have a site-specific standard, variance from the 5 ug/L chronic warm water aquatic life standard for selenium. The interim goal described in the variance is an annual geometric mean of 13 ug/L dissolved Se has been set as the temporary standard (measured on a 4-sample minimum, including highflow and low-flow conditions).

2008 sampling results do indicate that while selenium levels persist at toxic levels, the highest result (155 ug/L) was recorded at NW-CRA, above the reservation boundary and results exhibited a decreasing trend downstream. However, of nine selenium samples, only one was below the the 13 ug/L interim goal (11.8 ug/L 8/13/08 at NW-GS). The average Selenium concentration for FY08 samples is 47.45 ug/L.



3.2.2 Salinity

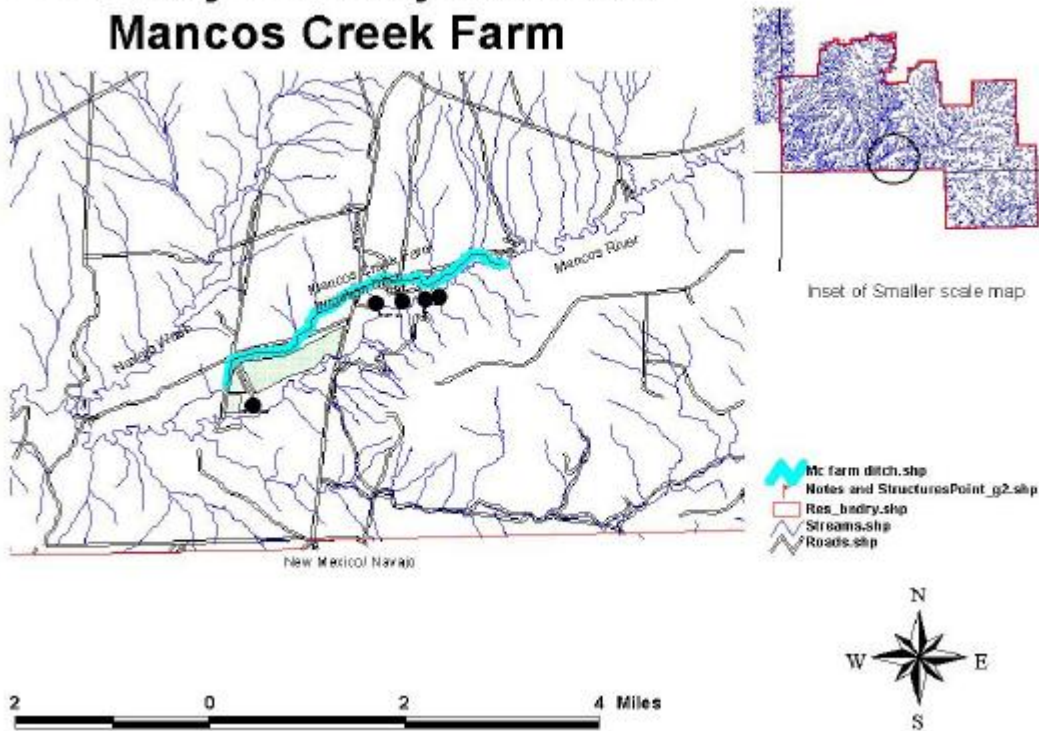
Navajo Wash does not meet the salinity criteria for irrigation. Because of its proximity to the Mancos Creek Farm (see map in Figure 4), it would be beneficial to the Tribe to have that water meet irrigation standards. As it is, Navajo Wash is impaired for that use. Standards require that irrigation have Total Dissolved Solids (TDS) less than 1500 mg/L if the Sodium Absorption Ratio (SAR) is greater than 4.0. Irrigation use of water in Navajo Wash may damage soil structure and kill or impair the growth of crops.

Sodium Absorption Ratio (SAR)		
3/24/2008 Sampling Event		
	SAR ¹	TDS (mg/L) ²
NW-CRA	10	10424
NW-GS	8	5295
NW-HWY160	6	2920
NW-MR	9	2348

¹ SAR calculation: $\text{Na} / (\text{Square Root of } \text{Ca} + \text{Mg}/2)$ with ionic compounds in milliequivalent/L

² TDS is expressed here as the sum of the major ions

Proximity of Navajo Wash to Mancos Creek Farm



TDS can exceed 5,000 mg/L, the Tribe's livestock consumption standard. TDS was measured for three samples during July, 2008 (07/31/2008 sample event). TDS at the Navajo Springs sample site was 5,367 mg/L, above the livestock consumption standard, the results from NW-Hwy 160 (4,896 mg/L) and NW-MR (4,374 mg/L) were above the irrigation criteria and close to violating the livestock consumption standard.

3.2.3 Bacteria

Navajo Wash has been designated a Primary Contact Recreational use due to its proximity to the community of Towaoc. 2008 Bacteria results (E. Coli) indicate that Navajo Wash continues to often be impaired for this designated use for the entire stream reach. Six out of fourteen samples exceeded the single sample value of 235 colony forming units/100mL with the average of the 14 samples 639 col/100mL. Bacteria loading in Navajo Wash is due in large part to grazing and grazing management. Cattle have access to the full reach of the stream from its beginning north of the reservation to its confluence with the Mancos and frequently are in the stream channel itself. Riparian health and the range condition in general is very poor due to the overgrazed condition there is a severe lack of riparian buffers or diverse healthy vegetation anywhere that would filter and prevent bacteria laden runoff from washing into the stream. The Resources Department, in cooperation with the NRCS, has recently (2009) fenced off several 40 acre parcels in the Navajo Wash range units to exclude cattle and experiment with revegetation with several seed mixtures.

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