Utilizing Existing Program Documents, Information from Outside Agencies, and Data Analysis Techniques to Develop a NPS Assessment Report

Tim Spade, Water Quality Specialist
Flandreau Santee Sioux Tribe
Nonpoint Source Assessment Report for 319(h) Eligibility I-8

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Overview

- Description of Reservation Lands
- NPS Issues
- Key Conclusions

1. Overview

Today, nonpoint source (NPS) pollution remains the most significant source of water quality problems in the United States. It is the main reason that approximately 40 percent of surveyed rivers, lakes, and streams are not clean enough to meet basic uses such as fishing or swimming (USEPA, 2002a).

NPS pollution occurs when rainfall, snowmelt, or irrigation water flows over land or through the ground, mobilizes pollutants, and deposits them in rivers, lakes, and coastal waters or introduces them into ground water. NPS pollution also includes adverse changes to the hydrology of water bodies and their associated aquatic habitats caused by altering natural flow regimes.

The most common NPS pollutants are sediment and nutrients that storm water picks up as it flows over land to rivers and streams; for example, runoff from agricultural land and other treated open spaces, urban developments, construction sites, roads, and bridges. Pesticides, pathogens (bacteria and viruses), salt, oil, grease, toxic chemicals, and heavy metals are other common NPS pollutants.

This NPS Assessment Report for the Flandreau Santee Sioux Tribe analyzes NPS problems on the Flandreau Santee Sioux Reservation. The NPS Management Program Plan for the Flandreau Santee Sioux Tribe, which will be produced as a separate document, will set forth a process for correcting these problems. Figure 1 shows the location of the Flandreau Santee Sioux Reservation.

The Big Sioux River, the primary surface water flowing through the reservation, was identified as an impaired waterbody in the 1998 South Dakota 303(d) Water Body List (SDDENR, 1998). Identified pollutants of concern were ammonia, bacteria, nutrients, pH, accumulated sediment, and total suspended solids (TSS). South Dakota projected that 40 total maximum daily load (TMDL) analyses will be completed for different segments of the Big Sioux River.

As discussed in subsequent sections of this document, the primary NPS problems stem from:

- Agricultural runoff. Agricultural activities take place both on and upstream of the reservation and on animal feeding operations (AFOs) upstream of it. In particular, pesticides, herbicides, and fertilizers are being used on and off the reservation in unknown quantities and without sufficient best management practices (BMPs), such as vegetated buffers to prevent runoff from entering the streams. Elevated ammonia levels have been documented and are presumed to arise from springtime rainfall and snowmelt that liberate fertilizer applied during the fall.
- Road construction
- Road maintenance (both winter and routine)
- Projected development activities
2. Introduction

The Flandreau Santee Sioux Reservation is about 5700 acres that are checker boarded around the community of Flandreau, SD. The reservation is located in southeast South Dakota approximately 40 miles north of Sioux Falls, about 10 miles west of the SD/MN border. The land is comprised of approximately 33% Trust land and 63% Fee land.

The purpose of this NPS Assessment Report is to identify existing and potential water quality problems caused by NPS pollution on the Flandreau Santee Sioux Reservation. This report identifies the nature, extent, and effect of NPS pollution and the sources of such pollution. The assessment evaluates water quality monitoring data and information from various sources, such as anecdotal information from members of the Flandreau Santee Sioux Tribe and various documents and reports written for the Tribe.

The Tribe seeks to control agricultural runoff in an effort to reduce inputs of agricultural chemicals to receiving waters, thereby improving water quality and reducing the incidence of fish kills on the reservation. To achieve these goals, the Tribe has begun to incorporate reporting requirements for agricultural chemical use into tribal land leases. The Tribe is also considering including requirements in leases for the use of BMPs, such as establishing riparian buffer strips and limiting the use of approved chemicals.

The Tribe has three additional objectives for its NPS water pollution control program.

1. The Tribe seeks to minimize bank erosion and sloughing along surface waters within the reservation.
2. The Tribe seeks to restore native grasses and wetland areas within the reservation to facilitate natural attenuation of NPS pollution and instream flow levels.
3. The Tribe would like its NPS program and NPS pollution control projects to serve as models for communities adjacent to the reservation in South Dakota and Minnesota.
Methodology
- How and when field data were collected
- Timelines
- Spatial Analysis
- Sources of Historical Data
- Level of Quality of Data
- Sampling Design
- Sampling Parameters
- Standards Used
- Data Management
How and when field data were collected

Information found in the Monitoring Strategy included in the CWA 106 Program Documents

Surface Water Data Sources
- This analysis evaluates surface water quality data collected by the Flandreau Santee Sioux Tribe at five stations; three of the stations are on the Big Sioux River, one is on Mud Creek, and one is on Flandreau Creek, as well as one on the unnamed tributary. Samples were collected weekly, twice weekly when possible, for field parameters. Samples were collected monthly for lab parameters. Samples were collected quarterly for pesticides and herbicides. Samples were collected annually for metals.

Groundwater Data Sources
- Groundwater data were collected on the reservation at two monitoring wells, MW-A and MW-B. The sites were selected to consider the surface and groundwater interaction near the Big Sioux River as it relates to the distance between row crop and the bank of the river. The following parameters were analyzed quarterly during the sample season.
Timelines

- Months and Years during which samples were collected
- Located in the introduction of the Methodology portion of the Assessment Report
  - Taken from the CWA 106 Monitoring Strategy

FSST Example:

- The Flandreau Santee Sioux Tribe collects surface water quality data at six stations on and near the reservation. Sampling data for conventional pollutants and pesticides are available for the period from April to November (established sampling season) from 2012 to 2015.
**Spatial Analysis Units**

- Depends on which type of GIS technology used
- FSST Example:
  - GIS data were obtained using a Garmin Handheld GPS unit which utilizes the WGS84 map datum, last revised in 2004.
  - Map was made by sending the GPS data to the most local BIA office.
Sources of Historical Data

Where to find?
- This information should be included throughout the NPS Assessment Report
- Any time an outside source is used it should be annotated and included in the *References* portion of the report.
The Level of Quality of the Data

- This should be included in a reference to the EPA approved CWA 106 QAPP documents. The data should already be considered high quality if the EPA’s QA department has given final approval of the QAPP.
- In the FSST NPS Assessment Report, a mention of this is included in the introduction to the Methodology portion of the report.
- **Sampling Design**
  - Matter of redundancy in this section.
  - Should already have addressed this in the “How and When” portion
  - In the FSST NPS Assessment report this is included in the introduction to the *Methodology* portion of the report.
  - It is also referenced in the outlined Surface and Groundwater Data Sources sections.
### Sampling Parameters

- This list is generally drawn from the CWA 106 Monitoring Strategy.
- Simple matter of Copying from the 106 document and Pasting them into the Assessment report.
- FSST Example:

![Table of Sample Parameters](image-url)
**Standards Used**

Once again, these should already be listed in the CWA 106 QAPP and Monitoring Strategy Documents. These are dependent on the Beneficial Use to be used for each water body.

- Federal
- State
- Tribal

**FSST Example:**

- Defer to the federal level as there are no State standards that differ from the Federal standards and no established tribal water quality standards.
- Where there are no Federal Standards, we have deferred to tribal goals.
- Example:
  - Pesticides
  - Tribal Goal is to have no pesticide or herbicide retention in the waterway, therefore any observable retention in the waterway would be considered as an impairment.

**Tables are used to include in the report.**
All tribal surface waters are designated the use of limited contact recreation. Therefore, these are the criteria that are used with respect to data analyses. However, the tribe also uses the water for full immersion recreation, cultural ceremonies, warmwater semipermanent fish life propagation and mitigation. The tribal goal of designating the use of all tribal waters as full immersion recreation was also considered during data analyses.

Table 1. South Dakota Surface Water Quality Standards

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criteria</th>
<th>Unit of Measure</th>
<th>Special Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total ammonium nitrogen as N</td>
<td>Equal to or less than the result from Equation 3 in Appendix A</td>
<td>mg/L</td>
<td>30-day average March 1 - October 31</td>
</tr>
<tr>
<td></td>
<td>Equal to or less than the result from Equation 4 in Appendix A</td>
<td>mg/L</td>
<td>30-day average November 1 - February 28</td>
</tr>
<tr>
<td></td>
<td>Equal to or less than the result from Equation 2 in Appendix A</td>
<td>mg/L</td>
<td>daily maximum</td>
</tr>
<tr>
<td>Dissolved oxygen as measured anywhere in the water column of a non-stratified water body, or in the epilimnion and metalimnion of a stratified water body</td>
<td>≥ 5.0</td>
<td>mg/L</td>
<td>daily minimum</td>
</tr>
<tr>
<td>Unchlorinated hydrogen fluoride</td>
<td>≤ 0.002</td>
<td>mg/L</td>
<td>daily maximum</td>
</tr>
<tr>
<td>pH</td>
<td>≥ 6.5 - &lt;9.0</td>
<td>mg/L</td>
<td>see § 74:51:01:15</td>
</tr>
<tr>
<td>Total Suspended Solids</td>
<td>≤ 40</td>
<td>mg/L</td>
<td>30-day average</td>
</tr>
<tr>
<td>Temperature</td>
<td>≥ 40</td>
<td>°F</td>
<td>see § 74:51:01:15</td>
</tr>
</tbody>
</table>

74:51:01:50.South Dakota Surface Water Quality Standards. The criteria for warmwater semipermanent fish life propagation waters. The criteria of parameters for warmwater semipermanent fish life propagation waters and their allowable variations that are not included under § 74:51:01:53 and Appendix B, unless not under § 74:51:01:24, are as found in the following table:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criteria</th>
<th>Unit of Measure</th>
<th>Special Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zootherobius coil</td>
<td>≤ 10</td>
<td>cfu/100 mL</td>
<td>geometric mean based on a minimum of 5 samples obtained during separate 24-hour periods for any 30-day period, and they may not exceed this value in more than 20 percent of the samples examined in this same 30-day period</td>
</tr>
<tr>
<td></td>
<td>≤ 200</td>
<td>cfu/100 mL</td>
<td>in any one sample</td>
</tr>
</tbody>
</table>

4:51:01:51. Criteria for limited contact recreation waters. The criteria of parameters for limited contact recreation waters and their allowable variations that are not included under § 74:51:01:53 and Appendix B, unless not under § 74:51:01:24, are as found in the following table and only apply May 1 - September 30:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Criteria</th>
<th>Unit of Measure</th>
<th>Special Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dissolved oxygen as measured anywhere in the water column of a non-stratified water body, or in the epilimnion and metalimnion of a stratified water body</td>
<td>≥ 5.0</td>
<td>mg/L</td>
<td>daily minimum</td>
</tr>
<tr>
<td></td>
<td>Forest Clear</td>
<td>≤ 1,000</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 50</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 500</td>
<td>mg/L</td>
</tr>
<tr>
<td></td>
<td></td>
<td>≤ 110</td>
<td>mg/L</td>
</tr>
</tbody>
</table>

The Tribe does not evaluate ground water data using any standards. For the purpose of this report, the data have been compared to South Dakota’s ground water quality standards to protect human health, which is presented below (Table 2). In addition, the USGS report Reconnaissance-Level Assessment of Water Quality near Flandreau, South Dakota compares ground water data collected from the reservation to EPA’s Maximum Contaminant Levels (MCLs) (Seckamp, 2002). Tribal data and results from the report are discussed in Section 6.2.

Table 2. South Dakota Ground Water Quality Standards

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>South Dakota Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidity</td>
<td>–</td>
</tr>
</tbody>
</table>
Data Management
- How will the data be organized for analysis?

FSST Example:
- Field data are immediately entered into an excel file from either field notebooks or digital download from the multiparameter sonde.
- Contract lab analysis entered as it is received.

Ambient Water Quality Monitoring System (AWQMS)
- Allows for a filter to organize the data so it can be properly uploaded into the STORET Database.
- Produces charts and graphs that can be exported for use in reporting.

The Ambient Water Quality Monitoring System (AWQMS)

Easy To Use, Full Featured Water Quality Monitoring System
The Ambient Water Quality Monitoring System (AWQMS) is a web-based data management system for ambient water quality data. AWQMS provides a single, intuitive tool for consolidating, validating, analyzing, assessing, and sharing your sampling results, observations, and assessments.

Download the AWQMS Brochure (pdf file)

Land Use Summary

- What are the different ways Tribal land is utilized?
- 4.1 General Setting
- 4.2 Land Use/Land Base
- 4.3 Climate, Physiography, Geology, Soils
- 4.4 Social and Economic Conditions
- 4.5 Structure of Government

4.1 General Setting

The Flandreau Santee Sioux Reservation is in southeastern South Dakota near the state border with Minnesota. The reservation is entirely within Moody County. The reservation occupies 5711 acres.
4.2 Land Use/Land Base

- FSST Example:
  - Primarily Agricultural
  - Broke out each agricultural product by percentage of land used for various crop
    - Row Crop - 50.6%
    - Pasture - 15.6%
    - Hay - 14%
    - Forest - 4.8%
    - Residential and Roads - 0.39%
    - Water and Wetlands - 2.8%
    - Casino and other offices - 11.81%

- FSST also considered the land use of the surrounding area to establish need for off reservation NPS remediation efforts.
Figure 3. Land Cover

4.3 Climate, Physiography, Geology, and Soils

Climate
- Information Sources
  - National Climate Data Center
    - Historical
  - University of SD
    - MESONET Weather Station
      - Current

Physiography
- The lay of the land.
- FSST Example:
  - *Physiography*. The elevation of reservation lands ranges between 1,500 and 1,700 feet above sea level. Topography is characterized by gently rolling hills, with wide floodplains adjacent to the Big Sioux River (USGS, 1972).
- Geology
- FSST Example:
- Geology. Eastern South Dakota was covered by glaciers several times beginning 2 million years ago. Early and Late Wisconsin glacial sediments were left behind after the glaciers retreated (SDDENR, 1992)
Soils

- Extensive list of all surface exposures of glacial till units.
- Primary Information Sources
  - USDA
  - NRCS
  - FSST Example:
    - 17 Separate Soils exposed

Alcester Silty Clay Loam: This silty clay loam consists of deep, well-drained and moderately well-drained soils. Slopes range from 0 to 2 percent. The soils have high available water capacity and high organic matter content.
Figure 4. Soils on the Flandreau Santee Sioux Reservation
4.4 Social and Economic Conditions

- A description of the people.
- Membership numbers
- Primary economic drivers of the community
- FSST Example:

The Tribe has 756 members, including 284 adult members who live on the reservation (Flandreau Santee Sioux Tribe, 2015). Much of the reservation is in agricultural use. Corn, soybeans, and hay are grown on 1,726 acres of reservation land, and buffalo are grazed on 844 acres of pasture (Tiller, 1996).

The major employers on the Flandreau Santee Sioux Reservation are tribal administration, tribal health care, education, and tribal casino operations. The Tribe owns and operates the Royal River Casino, Bingo, and Hotel, and a gas station and convenience store. Twenty-five percent of the casino employees are Native Americans. Other commercial businesses on the reservation include artists skilled in painting and handcrafts, musicians, and a recording studio. The Bureau of Indian Affairs’ Flandreau Indian School also employs members of the Tribe (Mni Sose Intertribal Water Rights Coalition, Inc., 2004).

The Tribal Housing Authority manages an award-winning housing program for the Native American community, which consists of low-rent housing projects and individual sites. Private housing is available in surrounding towns in South Dakota and Minnesota (Mni Sose Intertribal Water Rights Coalition, Inc., 2004).
### 4.5 Structure of Government

**FSST Example:**
- Constitution ratified in 1937.
- Established a 6 member Executive Council.
- Chairman, Vice-Chair, and 4 Trustees.

**Staggered elections**
- 4 year terms
- Alternating election cycles every 2 years in November.

**Natural Resources Department reports directly to the Executive Council**

**As do all other administrative entities.**

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**4.5 Structure of Government**

The Flandreau Santee Sioux Tribe operates under a constitution and is governed by an eight-member Executive Committee, or Tribal Council. The elected terms are 4 years long and are staggered in years. A candidate must live within the defined reservation to be an elected official (Flandreau Santee Sioux Tribe, 2004b). The Executive Committee includes a president, vice president, secretary, treasurer, and four trustees. The Tribe manages several departments, including a health department, maintenance department, social services department, housing authority, and natural resources department.

The Tribal Department of Natural Resources is responsible for the GAP, Brownfields, and Water Monitoring programs. The department also sponsors “monitoring day” every August. Monitoring day is an educational program that takes local schoolchildren to reservation surface waters to participate in water quality sampling and monitoring. To improve attendance, “monitoring day” has been transitioned to a Fish Derby and is used as a public outreach and education event.

The Tribe owns and manages one bison herd (103 head total) within the reservation; all other livestock are privately owned. Moody County, South Dakota performs road construction and maintenance, winter and general. Big Sioux Community Water System, a nonprofit entity serving the reservation and other local communities, provides domestic water. Septic systems are the responsibility of individual homeowners.
- **Surface and Ground Water Quality Summary**
- **Surface Water**
  - This section is used to identify each water resource that has been monitored.
  - Name each of the water bodies and give descriptions of how they relate to one another.
  - FSST Example:
    - Big Sioux River is the main water body that flows through Tribal land.
    - Flandreau Creek and Mud Creek are the primary tributaries.
    - Used for irrigation, drinking water, and sustaining a diverse fish population throughout it’s course through SD.
    - For the Tribe, it is also used for cultural purposes.
    - Our example refers to pictures taken at sampling sites, referred to in appendices.
### Groundwater

- This section is a description of the groundwater aquifers that can be effected by, and monitored for, NPS pollution.
- **FSST Example:**
  - Big Sioux Aquifer is an unconfined aquifer of glacial till sustained underneath by a semipermeable layer of Pierre Shale.
  - The aquifer is the primary source of drinking water for the Tribe and other residents in Moody County, SD.
- **Information Sources:**
  - SD Geological Survey
  - SD DENR
  - Big Sioux Community Water System
### Results

**FSST Example:**

- Water Quality Data and Interpretation
- Tables are the most useful tool to convey information.
- How the data are managed and analyzed should have been addressed previously in the methodology portion of the report.

<table>
<thead>
<tr>
<th>Subwatershed</th>
<th>Station number</th>
<th>Beneficial uses</th>
<th>Potential NPS pollution sources</th>
</tr>
</thead>
</table>
| Upper Big Sioux River       | BS-A           | Immersion - contact recreation, domestic supply, cultural uses, warmwater marginal fish life propagation | Agriculture
  • Irrigated crop production
  • Grazing/livestock production
  • Winter livestock feeding and calving |
| Upper Big Sioux River       | BS-C           |                                                                                 | Construction
  • Future road construction
  • Future land development |
| Lower Big Sioux River       | BS-D           | Limited - contact recreation, domestic supply, cultural uses, warmwater marginal fish life propagation | Hydromodification
  • Stream bank erosion |
| Flandreau Creek             | FC-A           | Limited - contact recreation, domestic supply, cultural uses, warmwater marginal fish life propagation | Other
  • Winter road maintenance
  • Routine road maintenance |
| Mud Creek                   | MC-A           |                                                                                 | Septic systems and drainfields
  • Storm water runoff |
| Unnamed Tributary           | BS-T           |                                                                                 | Agriculture
  • Grazing/livestock production |
| Black Hills Tribal Land     | BHTP           |                                                                                 | Other
  • Regional Mining operations |
| Black Hills Tribal Land     | BHTS           |                                                                                 |
- Reiterate potential NPS threats to Tribal waters.
  - Be more specific as to the Tribes individual concerns.

_Agricultural and Livestock Activities_. Agriculture is the largest land use on the Flandreau Santee Sioux Reservation, followed by livestock production. The Tribe leases land to individual entities for production of corn, soybeans, and grains on 3165.5 acres. Buffalo graze on 813 acres of pasture (Tiller, 1996). As previously mentioned, the Tribe owns and manages a bison herd of approximately 20 head, which are pastured on two separate tracts of land at different times of the year.

NPS pollutants from agricultural and livestock acreage include pesticides, herbicides, manure, and fertilizer conveyed to surface waters through storm water overland flow and shallow ground water. Anhydrous ammonia is a fertilizer known to be used on agricultural land within and adjacent to the reservation. Typically applied to fields in the fall, anhydrous ammonia can be mobilized during the winter during significant snowmelt events. A significant fish kill occurred in the Big Sioux River during the last week of February 2004. The South Dakota Game, Fish, and Parks Department attributed the kill to low water levels from drought conditions that gave way to a severe winter and hard freeze. These conditions likely trapped fish in some of the Big Sioux River’s isolated pools. When warmer temperatures thawed the ice, the dead fish (estimated to number between 30,000 and 50,000), mostly carp and bullheads, started to float downstream.

Samples collected by the Tribe at Flandreau Dam on the Big Sioux River showed elevated ammonia levels, consistent with mobilization of anhydrous ammonia during the rapid snowmelt experienced at the end of February 2004. Levels up to 12 ppm, high enough to kill fish, were observed (Vickie Kusava, pers. comm., December 9, 2004). Dead fish had accumulated upstream of the dam, which is downstream of the watersheds included in this assessment report; however, NPS contributions from tribal lands might have contributed to the kill.

_Winter Road Maintenance_. Winter road maintenance, performed by Moody County, is limited to plowing and sand application. Salt and other deicers have not been used for winter road maintenance. Adverse water quality effects from winter road maintenance have not been a major problem, but BMPs will be included in the NPS Management Program Plan.

_Septic Tanks and Drainfields_. Residents living on the reservation outside the town of Flandreau rely largely on individual septic tanks and drainfields for disposal of domestic sewage. The Tribe estimates that there are between 35 and 40 septic systems on the reservation. These systems have the potential to pollute surface water and ground water if not constructed and maintained properly.

_Concentrated Animal Feeding Operations_. The Tribe recently purchased Duncan Farms, a possible concentrated animal feeding operation (CAFO) on the reservation’s eastern boundary. As of this writing cattle or other livestock are not being pastured or confined at this location. There is a large manure pile at the farm, suggesting that this property might have been a CAFO. The Tribe does not have immediate plans for raising livestock at this site.

At the time of writing, no cities, towns, communities, CAFOs, or industrial facilities are located on Flandreau tribal land. They are all outside Indian Country in South Dakota and neighboring Minnesota. One CAFO is approximately 1 mile north of Flandreau, and another is 6 miles west of Flandreau. Additional operations are upstream of Spring Creek.
## Results Analysis

<table>
<thead>
<tr>
<th>Station</th>
<th>Maximum</th>
<th>Minimum</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Number of non-detects</th>
<th>Number of samples</th>
</tr>
</thead>
<tbody>
<tr>
<td>BSA</td>
<td>2420</td>
<td>1</td>
<td>867.66</td>
<td>486.81</td>
<td>0</td>
<td>70</td>
</tr>
<tr>
<td>BS-C</td>
<td>1414</td>
<td>2</td>
<td>284.79</td>
<td>341.75</td>
<td>0</td>
<td>64</td>
</tr>
<tr>
<td>BS-D</td>
<td>2420</td>
<td>2</td>
<td>378.07</td>
<td>584.42</td>
<td>0</td>
<td>68</td>
</tr>
<tr>
<td>FC-A</td>
<td>4688</td>
<td>2</td>
<td>646.71</td>
<td>898.86</td>
<td>0</td>
<td>69</td>
</tr>
<tr>
<td>MC-A</td>
<td>4368</td>
<td>0</td>
<td>665.87</td>
<td>876.10</td>
<td>1</td>
<td>62</td>
</tr>
</tbody>
</table>

*E. coli (CFU/100 mL)*

Applicable standards:

- ≤ 126 CFU per 100 mL 30-day geometric mean; ≤235 CFU per 100 mL in any one sample (immersion recreation waters).
- ≤ 630 CFU per 100 mL 30-day geometric mean; ≤1178 CFU per 100 mL in any one sample (limited contact recreation waters).

### BSA e. coli 2012-2016 (CFU)

![BSA e. coli 2012-2016 (CFU)](image-url)
- **Results Breakdown**
  - Surface water broken down for each water body monitored.
  - Should include:
    - Description each waterbody or subwatershed.
    - Potential NPS pollution that could effect the area.
    - Tribal uses in the subwatershed,
  - Findings
    - Overview of what the data represent with regard to water quality.

- **FSST Example:**

  **Upper Big Sioux River Subwatershed**
  The Upper Big Sioux River subwatershed covers the northwestern portion of the reservation. The subwatershed includes the Big Sioux River and perennial and ephemeral tributaries. The general nonpoint sources across the watershed are agriculture (mostly crop production), road maintenance, stream bank erosion, and septic tanks and drainfields. Several CAFOs, including an industrial chicken operation, are located upstream of this subwatershed, off-reservation.

  There are two water quality monitoring stations in the subwatershed, BS-A and BS-C. BS-A is located where the Big Sioux River enters the reservation. The Big Sioux River supports the following beneficial uses in this subwatershed: immersion-contact recreation, domestic supply, cultural uses, and warmwater marginal fish life propagation; tribal goals for water quality criteria are based on full immersion recreation use designation. Below is a summary of significant findings for the Upper Big Sioux River subwatershed:

  - The pesticide 2,4-dichlorophenoxyacetic acid (2,4-D) was detected on 5-31-13 at BS-A and BS-C with an increase in concentration downstream. This is the only date of detection for 2,4-D. The herbicides acetochlor, atrazine, desipropylatrazine, desethylatrazine, dimethamid, and metolachlor were detected at some level during each sample season with an increasing trend in concentration for each herbicide except atrazine, which is the only one that decreased consistently. There were no detections of Atrazine in either the 2015 or 2016 sample seasons. Desipropylatrazine (DIA) and desethylatrazine (DEA) are daughter products of atrazine (Thurman, et. al., 1994). Therefore, increasing concentrations of DIA and DEA that coincide with decreasing concentrations of atrazine in a system makes sense as a possible explanation of the data. There have also been no detections of DIA or DEA in the 2015 or 2016 sample seasons. There was a single detection of EPIC at BS-C in 2013. There was a singular detection of dimethamid at BS-A during the 2014 sample season. There were several detections of Metolachlor between 2012 and 2014, but no detections have been found during either the 2015 or 2016 sample seasons. There were Picloram detections at both BS-A and BS-C in both 2012 and 2016.

  - pH exceeded the high threshold (9) at both BS-A and BS-C during late-September and early-November of 2012. Otherwise pH levels have stayed within recommended standards.

  - Total phosphorus concentrations were consistently above ecoregional reference conditions, up to 8 times the reference condition.

  - The ecoregional reference criterion for total nitrogen (2.18 mg/L) was consistently exceeded at both BS-A and BS-C. Total Nitrogen has shown a consistent gradual increase over the last four years.

  - *E. coli* levels generally remained below the tribal goal criteria (235 CFU/100mL), which is a single sample maximum, based on the designated use of full immersion recreation. Periodically, mainly during spring and early summer, *E. coli* levels spike severely as a result of manure spread runoff. Lack of resources required this analysis to be based on single sample criteria as a result of not being able to obtain 5 samples during a 30-day period through the 2015 sample season. However, sufficient resources became available for the 2016 sample season. Data in 2016 show monthly mean concentrations consistently exceeding criteria of 126 CFU/100mL.
- **Use Impairment Determination**
  - What criteria were used and where was it obtained.
    - CWA Section 304 (a)
  - Numeric values for definitions of level of impairment based on percentage of exceedance.
    - Low - 10% to 33% exceedance
    - Medium - 34% to 66% exceedance
    - High - 67% exceedance or higher
  - The best way to convey this information is through tables.
    - FSST Example:
<table>
<thead>
<tr>
<th>Waterbody</th>
<th>Miles of stream</th>
<th>Impaired beneficial uses</th>
<th>Cause of impairment</th>
<th>Percentage of exceedances</th>
<th>Degree of impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segment 1 of Big Sioux River (from BS-A to the reservation boundary)</td>
<td>0.5</td>
<td>Immersion recreation, domestic supply, warmwater marginal fish life propagation</td>
<td>E. coli</td>
<td>49</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Nitrogen</td>
<td>57</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phosphorus</td>
<td>100</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TSS</td>
<td>51</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,4-D*</td>
<td>13</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acetochlor</td>
<td>30</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Atrazine</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desisopropylatrazine</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desethylatrazine*</td>
<td>50</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dimethamid</td>
<td>10</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Metolachlor</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Picloram</td>
<td>30</td>
<td>Medium</td>
</tr>
<tr>
<td>Segment 2 of Big Sioux River (from BS-C to BS-A)</td>
<td>3.8</td>
<td>Immersion recreation, domestic supply, warmwater marginal fish life propagation</td>
<td>E. coli</td>
<td>38</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Nitrogen</td>
<td>50</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>Phosphorus</td>
<td>100</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TSS</td>
<td>34</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,4-D*</td>
<td>20</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acetochlor*</td>
<td>20</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Atrazine*</td>
<td>50</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desisopropylatrazine*</td>
<td>50</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
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<td>Desethylatrazine*</td>
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<td>Medium</td>
</tr>
<tr>
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<td></td>
<td></td>
<td>EPTC*</td>
<td>20</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Picloram*</td>
<td>33</td>
<td>Low</td>
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<td></td>
<td></td>
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<td>Metolachlor*</td>
<td>67</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>pH</td>
<td>1</td>
<td>Low</td>
</tr>
<tr>
<td>Segment 3 of Big Sioux River (from BS-D to BS-C)</td>
<td>2.5</td>
<td>Immersion recreation, domestic supply, warmwater marginal fish life propagation</td>
<td>E. coli</td>
<td>20</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Nitrogen</td>
<td>60</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phosphorus</td>
<td>100</td>
<td>High</td>
</tr>
<tr>
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<td></td>
<td>TSS</td>
<td>24</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2,4-D*</td>
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<td>Low</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Acetochlor</td>
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<tr>
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<td></td>
<td></td>
<td>Atrazine</td>
<td>14</td>
<td>Low</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>Desisopropylatrazine</td>
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<tr>
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<td></td>
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<td>Desethylatrazine*</td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Dimethamid</td>
<td>10</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Metolachlor</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Picloram</td>
<td>27</td>
<td>Low</td>
</tr>
<tr>
<td>Flandreous Creek (from confluence with Big Sioux River to reservation boundary)</td>
<td>1.6</td>
<td>Limited-contact recreation, domestic supply, warmwater marginal fish life propagation</td>
<td>E. coli</td>
<td>67</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Total Nitrogen</td>
<td>53</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Phosphorus</td>
<td>73</td>
<td>High</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td>Dissolved oxygen</td>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>TSS</td>
<td>20</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Acetochlor</td>
<td>10</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desisopropylatrazine</td>
<td>10</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Desethylatrazine*</td>
<td>13</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Metolachlor</td>
<td>40</td>
<td>Medium</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Picloram</td>
<td>70</td>
<td>High</td>
</tr>
</tbody>
</table>
Discussion

- Where the rubber meets the road.
- Allows for a layperson to understand everything that has been laid out.
- Each constituent that poses a threat to water quality is discussed individually and addressed with regard to threat potential by water body or segment.
- Presented in narrative form with a separate paragraph for each constituent addressed.
7. Discussion

As discussed in Sections 3.4 and 6.3, several potential sources of NPS pollution are present on the Flandreau Santee Sioux Reservation and could be impairing beneficial uses.

High levels of *E. coli* bacteria have been observed at all the monitoring stations. Stations that had especially high levels of *E. coli* bacteria are BS-A, BS-D, MC-A and FC-A. High levels of *E. coli* ranged from 250 to 2420 CFU/100 mL, and exceedance rates ranged from 49 to 69 percent. Possible sources of high *E. coli* levels include runoff from cattle wintering areas and open rangeland. In addition, AFOs upstream of the reservation could be contributing to high *E. coli* levels, especially during and after extreme rainfall events.

Dissolved oxygen level exceedances throughout the last five years were isolated to two at FC-A station with a reading of 4.57 mg/L and 4.42 mg/L, with both taking place during low flow periods in the fall, and one at MC-A station with a reading of 4.18 mg/L.

Levels of Total Nitrogen were high throughout the study area based on ecoregional reference criteria. High levels ranged from 2.2 to 9 mg/L and exceedance rates ranged from 50 to 67 percent. The exceedances were concentrated more highly on the Big Sioux River than the tributaries. While the maximum threshold of 10 mg/l has been exceeded, total N has shown a consistent gradual increase over the last four years. Nonpoint sources of nitrogen could include animal waste in runoff from dairies and rangeland areas and runoff from agricultural areas where nitrogen-based fertilizers are applied.

Phosphorus levels were consistently higher than ecoregional reference criteria. Exceedances ranged from 0.14 to 0.7 mg/L. Levels on the Big Sioux River exceeded reference condition 100% of the time. The tributaries were impaired to a lesser degree, 72 to 83 percent in Flandreau Creek and Mud Creek, respectively.

With the exception of one sample at each station on the Big Sioux River in late September 2012, pH levels remained within established water quality standards. High pH typically suggests excessive nutrient loadings, which could be caused by agricultural runoff (fertilizers), animal waste from dairies and rangeland areas, and storm water runoff. Flandreau Creek stayed within water quality standards, as did Mud Creek with only one high reading late in May, 2013.

The Tribal goal for surface water retention of pesticides and herbicides is a non-detect in all samples. Therefore, any detection represents an exceedance. Since there weren’t a minimum of ten samples, all tribal waters are threatened with regard to the following pesticides and herbicides in surface waters throughout tribal land. The Big Sioux River is threatened by 2, 4-D, acetochlor, atrazine, desisopropylatrazine, desethylatrazine, dimethanamid, metolachlor, and picloram. Flandreau Creek is threatened by the presence of acetochlor, desisopropylatrazine, metolachlor, and picloram. Mud Creek is threatened by the presence of acetochlor, atrazine, desethylatrazine, and picloram. Picloram is not present in any BS-A or BS-C samples, but is present in both tributaries and at BS-D.

The impairment analysis discussed in Section 6 indicated that for the most part, impairments are consistent throughout the reservation. In addition, upstream segments of the Big Sioux River are 303(d)-listed for many of the same impairments found on the reservation. This suggests that the NPS pollution sources are located throughout and upstream of the reservation. *E. coli* bacteria levels exceeded the applicable standards more frequently than any of the other parameters analyzed. The NPS Management Program Plan will therefore focus on strategies for implementing programs and BMPs to control *E. coli* pollution in the reservation’s waters in addition to expanding the tribal monitoring program to help determine locations of NPS pollution.
Existing NPS Pollution Programs and Selection of Best Management Practices (BMPs)

In the FSST example, both of these sections were included together.

- First, make a table of existing NPS Pollution programs and the types of pollution they address.
- Then, use existing programs to find partnerships and determine what new BMPs could be utilized.
- Finally, discuss what efforts have already taken place with regard to protection and remediation.

The Tribe is currently participating in programs to address NPS pollution. It has designated 82 acres as a wetland reserve under the Wetland Reserve Program. The Tribe is also evaluating other areas that might be suitable for easements under the Wetland Reserve Program and the Conservation Reserve Program.

The Tribe has also completed a stream bank restoration project on Flandreau Creek that included grading stream banks and installing riprap on approximately 100 feet of stream bank. This project was completed with Ag Dollars and Bureau of Indian Affairs (BIA) funds. Finally, the Tribe has recently begun to require the installation of BMPs in its Tribal Lease Agreements.

FSST Example:
### Table 6. Nonpoint Source Control Programs

<table>
<thead>
<tr>
<th>Program</th>
<th>Agriculture</th>
<th>Construction</th>
<th>Septic systems and drainfields</th>
<th>Storm water</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bureau of Indian Affairs Water Resource Grants.</strong> This program, funded through the Indian Self-Determination and Education Assistance Act, provides grants for the collection and analysis of baseline data.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Clean Water State Revolving Fund.</strong> The Clean Water SRF program was established to provide low-interest loans to governmental entities for clean water and NPS pollution control projects.</td>
<td>✓</td>
<td>✓</td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>Conservation Reserve Program.</strong> The CRP program offers long-term rental payments and cost-share assistance to establish long-term, resource-conserving cover to reduce soil erosion and improve water quality.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Consolidated Water Facilities Construction Program.</strong> This program was established to provide grants and loans for water-related projects. The amount of funds available is dependent on the amount appropriated by the legislature and the amount of funds previously awarded.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Corps of Engineers Section 404 Dredge and Fill Permit Program.</strong> This program regulates the discharge of fill or dredged material into lakes, rivers, and wetlands.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Drinking Water State Revolving Fund.</strong> The Drinking Water SRF Program was established to provide low-interest loans for drinking water projects. The amount of funds available is dependent on the amount of appropriations from the U.S. Congress and the amount of repayment of funds previously loaned.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Environmental Quality Incentives Program.</strong> EQIP was created to provide a voluntary conservation program for farmers and ranchers that promotes agricultural production and environmental quality as compatible goals. The program offers technical, financial, and educational assistance for approved farm improvement practices.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Natural Resources Conservation Service Farm Bill Programs.</strong> NRCS has several funding programs, including the Wetland Reserve Program, conservation of private grazing lands, the Farmland Protection Program, and the conservation farm option.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>South Dakota Department of Agriculture, Conservation Tillage Loan.</strong> This program has loans available for 80 percent purchase of conservation tillage equipment and grass seeding and harvesting equipment. Loans are available to conservation districts at a low interest rate.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>South Dakota Wellhead Protection Program.</strong> This program was created to help protect public drinking water sources by encouraging local communities to develop management plans to ensure safe drinking water supplies. This program offers technical support and guidance.</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>U.S. Department of Agriculture (USDA) Rural Development Administration.</strong> U.SDA supports the construction of new water/wastewater systems and the improvement of existing systems.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USDA Sustainable Agriculture Research and Education.</strong> In the SARE program, the funding is aimed at reducing the use of chemical pesticides, fertilizers, and toxic materials in agricultural production.</td>
<td>✓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>USEPA Section 106 Program.</strong> This program assists in establishing and maintaining adequate measures for preventing and controlling surface and ground water pollution.</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td><strong>USEPA Section 319 Program.</strong> This program assists in implementing USEPA-approved Section 319 NPS management programs.</td>
<td>✓</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
9. Conclusions

As described in Section 6, water quality analyses indicate that beneficial uses in all of the Tribe’s watersheds are impaired. The most significant problem appears to be periodic high levels of *E. coli* bacteria, which endanger human health during immersion and limited-contact recreation activities. In addition, occasional low dissolved oxygen levels threaten warmwater marginal fish life propagation. High Total Nitrogen and Phosphorus levels and high pH levels, which threaten the domestic water supply, have been observed in reservation waters. Finally, several pesticides, which have varying degrees of toxicity, could also harm aquatic life.

The impairment analysis indicated that high *E. coli* levels are of particular concern. The *E. coli* levels have exceeded the standards for immersion recreation at all the monitoring stations. These exceedances are significant because the waters are not safe for immersion recreation (swimming) and cultural uses. The *E. coli* levels have also exceeded the standard for limited-contact recreation (boating [tubing and canoeing] and fishing). Although high levels of *E. coli* bacteria were observed at stations throughout the reservation, the standards were most frequently exceeded in the lower segments of the Big Sioux River and Flandreau Creek. This finding suggests that addressing potential nonpoint sources of *E. coli* bacteria by using BMPs in the Lower Big Sioux River and Flandreau Creek subwatersheds should be a primary concern in the NPS Management Program Plan for the Flandreau Santee Sioux Tribe. The Tribe is also concerned about stream bank erosion occurring on parts of the Big Sioux River in the northern areas of the reservation and will make addressing these areas a high priority in the management program.

Groundwater data indicate increased presence of various contaminants in MW-B, which is placed in close proximity between both a row crop field and the Big Sioux River. The lack of the any contamination at MW-A can be attributed to the quarter mile buffer zone between any agricultural activity and the Big Sioux River.

Addressing data gaps identified in Section 7 will also be important in creating a more complete picture of the nonpoint sources of pollution affecting reservation waters. By continuing to monitor for the parameters for which the Tribe is currently testing, in addition to expanding monitoring efforts to include stations at the reservation boundaries and areas where agriculture is occurring on steep slopes or permeable soils, the Tribe will be able to determine the types of BMPs and locations for the BMPs that will be the most effective in preventing and abating pollution from nonpoint sources.
Questions?

Everything in nature is alive and influences your thoughts whether you know it or not. Whose to say the rock does not hear your thoughts? Nor the river? Or, the mountain ranges?

We all belong to this living world and there is nothing that does not belong.

Tony Ten Fingers/Wanbli Natai Oglala Lakota

Tim Spade
Water Quality Specialist
Flandreau Santee Sioux Tribe
tim.spade@fsst.org