

CHEYENNE RIVER PHASE I TMDL ASSESSMENT

PROJECT SUMMARY

The Cheyenne River discharges into the Missouri River reservoir, Oahe Reservoir. The watershed is approximately 24,240 square miles and is located in western South Dakota and crosses into eastern Wyoming. The Cheyenne River basin is diverse, containing Black Hills National Forest and portions of Badlands National Park. Land use is primarily rangeland with some irrigated and dryland farming and a few mining areas. The Cheyenne River Watershed has several lakes and stream segments listed as impaired due to exceedences of standards set for various water quality parameters. A major emphasis of this project will be to identify contributing areas to impairment. This will be accomplished through analysis of historic water quality and stream flow data, along with land use, riparian vegetation, and stream physical habitat analysis. A detailed and focused sampling plan with emphasis on identified critical areas will be the focus of the final report. Feasible restoration recommendation will also be included where possible. Currently, the Belle Fourche River Watershed is in the implementation stage of the TMDL process; therefore, it will not be specifically focused on as part of this project.

The South Dakota Department of Environment and Natural Resources (SD DENR) is responsible for assessing all impaired water bodies listed in the 2004 South Dakota Integrated Report for Surface Water Quality Assessment. SD DENR has identified impairments for the following parameters in the Cheyenne River Watershed:

- Total suspended solids (TSS)
- Fecal coliform bacteria
- Total dissolved solids (TDS)
- Conductivity
- Water temperature
- pH.

In total, 19 stream segments were listed in the Cheyenne River Watershed (excluding the Belle Fourche River Watershed) for impairment in the 2004 Integrated Report. Nine of these segments were listed as in progress for TMDL assessment. All segments listed as in progress are above Angostura Reservoir or in the Rapid Creek tributary basin. Additionally, ten lakes are listed as impaired for Trophic State Index (TSI), four of which were also listed for pH. Four of the listed lakes are listed as in progress.

Beneficial uses assigned to waters in the Cheyenne River Watershed include

- Domestic water supply.
- Cold-water permanent fish life propagation.

- Cold-water marginal fish life propagation.
- Warm-water permanent fish life propagation.
- Warm-water semipermanent fish life propagation.
- Warm-water permanent fish life propagation.
- Immersion recreation.
- Limited contact recreation.
- Fish and wildlife propagation, recreation, and stock watering.
- Irrigation.

SUMMARIZATION OF MAJOR GOALS

The goal of the Phase I Cheyenne River Assessment Project is to locate and document sources of nonpoint source pollution (primarily excess sediment loading) in the watershed. This project will identify critical areas of the watershed which will lead to a focused sampling plan for development of a Total Maximum Daily Load (TMDL) assessment project.

To accomplish the Phase I goal for the Cheyenne River Watershed TMDL, the effort has been divided into five major tasks. These tasks are

1. Compile and Analyze Historical Flow Data.
2. Compile and Analyze Historical Water Quality Data.
3. Identify High Potential Sediment Load Contributors Outside the Riparian Zone.
4. Collect and Analyze Stream Assessments at 50 Selected Sites.
5. Information and Education Focused on Data Dissemination and the Creation of a Watershed Technical Working Group.

Figure 1 presents a conceptual process flow diagram of the approach to the project. Each task is discussed in more detail in the following sections.

Task 1: Compile and Analyze Historical Flow Data

Flow records for this Watershed date back to 1903. Many USGS gage stations started collecting flow information before 1950 with a few newer stations initiated in the 1980s and 1990s. The objective is to compile this data and develop statistical comparisons between stations for the years available.

Task 2: Compile and Analyze Historical Water Quality Data

Water samples were collected and analyzed by many organizations in the past. USGS and SD DENR have collected the most samples. USGS and SD DENR have been collecting water quality samples from streams and lakes during

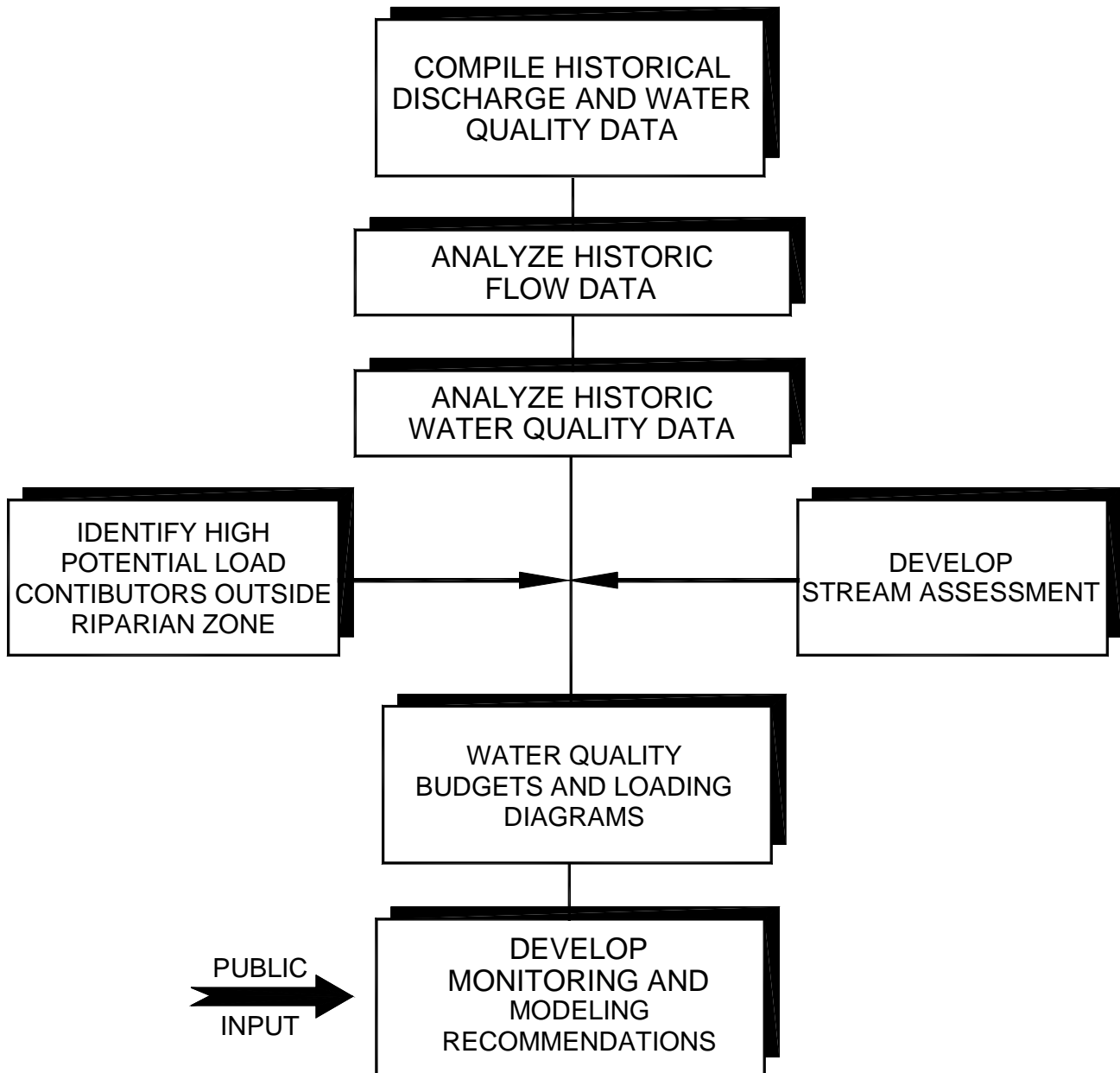


Figure 1. Schematic Diagram of the Cheyenne River Phase I Total Maximum Daily Load Assessment Project.

different time periods for over 30 years at several locations throughout the Watershed. This incredible data source provides a great foundation to compare other “grab sample type” water quality results within the watershed and to look for relationships that further our understanding of the nonpoint source pollution and potential remediation measures. The focus of this task will be on the contributing drainage area below Angostura Reservoir, with the exception of drainage areas where the TMDL process has already occurred and remediation is already occurring. This includes Belle Fourche River Watershed and most of Rapid Creek Watershed. The final report will summarize the contributions of the area above Angostura Reservoir and Belle Fourche River and Rapid Creek Watersheds based on the previous work completed.

Task 3: **Identify High Potential Sediment Load Contributors Outside the Riparian Zone**

Using existing geographic information system (GIS) coverages of soil erodibility (USDA-NRCS State Soil and Geographic Database (STATSGO)), slope, distance to the stream, and land use, a soil erosion potential map will be created using the Revised Universal Soil Loss Equation (RUSLE).

Task 4: **Collect and Analyze Stream Assessment Data at 50 Selected Sites**

Stream physical habitat can offer insight into the state of the watershed. Correlations have been found between channel metrics and water quality, especially TSS, as well as watershed activities. Numerous stream assessments have been performed in the Cheyenne River Watershed above Angostura Reservoir, as well as in Belle Fourche River, Spring Creek, and Rapid Creek Watersheds. This project will sample stream channel and riparian zones throughout the watershed in areas not previously sampled. The complete set of stream assessments can be used to correlate landscape parameters such as geology, soil types, and land use.

A list of 50 site locations is being developed, with sites being preferentially located where USGS gages are currently located or have previously been located. Stream assessments have previously been performed above Angostura Reservoir, in the upper portions of Spring Creek Watershed, in Rapid Creek Watershed, and in Belle Fourche River Watershed. Additional sites in these areas will be limited. Data from the previous work will augment the characterization of the stream physical habitat throughout the entire watershed. Figure 2 shows the locations of the stations that are on the current site sampling list.

The stream channel at each of the chosen sites will be classified using SD DENR Physical Habitat Characterization, along with additional parameters measured for stream morphology. This assessment will identify seven general physical habitat attributes important in influencing stream ecology:

- Channel Dimensions.
- Channel Gradient.

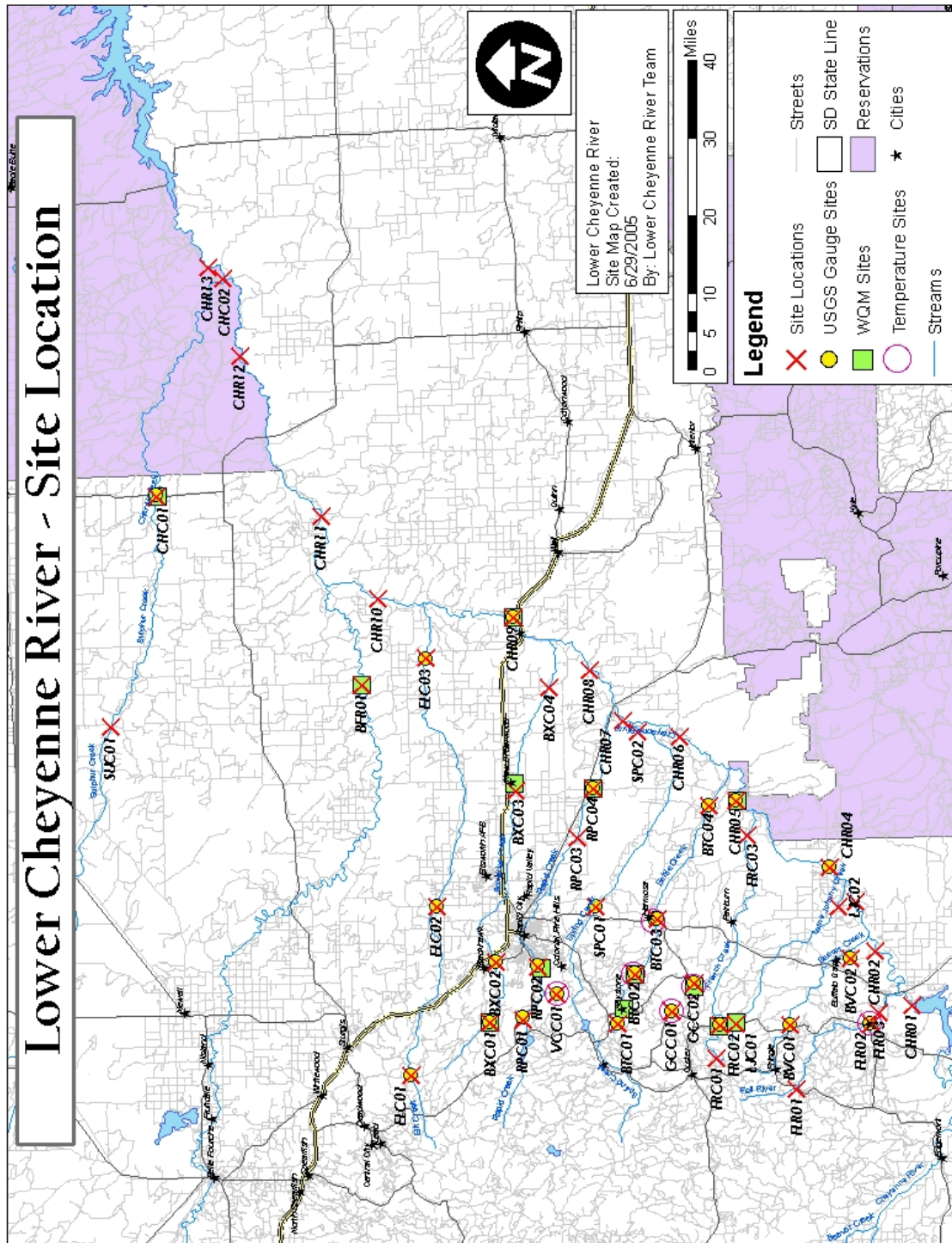


Figure 2. Selected Stream Assessment Sampling Sites for the Phase I Lower Cheyenne TMDL.

- Channel Substrate Size and Type.
- Habitat Complexity and Cover.
- Riparian Vegetation Cover and Structure.
- Anthropogenic Alterations.
- Channel-Riparian Interaction.

Based on the assessment data, each sampling site will be classified using Rosgen's Geomorphologic Classification system and Schumm's Channel Evolution model. Some of the parameters used for classification will be calculated using GIS applications based on 1-meter resolution color digital orthoquads (DOQ). Some examples of measurements that will be estimated from DOQs are sinuosity, valley widths, riparian extent.

Task 5: Information and Education Focused on Data Dissemination and the Creation of a Watershed Technical Working Group

Working at a watershed scale, there is a need for information and educational efforts to ensure the success of the project. Dissemination of educational materials, networking data and findings, and providing technical information to the understanding of the whole watershed will be achieved by the formation of the Cheyenne River Watershed Technical Working Group. Outreach meetings at the end of project meetings will allow updates to the public and stakeholders. Development of a Web site will provide access to the data online, providing stakeholders and the group with information throughout the project duration. This will be done in an efficient and acceptable administrative manner.

CONTACT INFORMATION

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