APPENDIX 2

Devils Lake, North Dakota

Final
Integrated Planning Report
And
Environmental Impact Statement

U. S. Fish and Wildlife Service Coordination

Final

Fish and Wildlife Coordination Act Report

for the

Devils Lake Emergency Outlet
Devils Lake, North Dakota

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United States Department of the Interior
Fish and Wildlife Service
Mountain-Prairie Region
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1.0 EXECUTIVE SUMMARY

Devils Lake has a lengthy history of fluctuation. Current lake levels are at unrecorded high levels, primarily as a result of several years of above average precipitation and historic high runoff into the lake. Lake levels are further increased by aggressive wetland drainage throughout the Devils Lake basin.

As Devils Lake continues to rise, it has reclaimed thousands of acres of lake plain that have, in drier years, been encroached upon by agricultural, recreational, commercial and residential interests. Increasing infrastructure costs associated with levee and highway raises, home relocation, and city and county infrastructure alterations has created significant pressure on Federal, state, and local agencies to seek a solution to the rising water levels in Devils Lake.

One such proposed action consists of an outlet from Devils Lake to the Sheyenne River. Of the many possible alternatives, a 300 cubic feet per second (cfs) buried pipeline outlet from the Pelican Lake area using the Peterson Coulee alignment is considered the most likely project. The alignment may also be constructed as an open channel for part of its length. The Corps of Engineers (Corps) is currently evaluating outlet alternatives using a variety of possible operating scenarios. Outlet discharges of 300 cfs, constrained to a 600 cfs Sheyenne River channel capacity and 450 milligrams per liter (mg/l) sulfate standard, to a 480 cfs unconstrained outlet will be evaluated. The outlet will be limited to a 7-month operation beginning in May and running through November. The life of the project is 50 years, running from 2004 to 2054. In addition to the outlet, a future without the proposed project, upper basin management, expanded infrastructure measures, and combinations and sensitivity analysis of these alternatives will be studied.

The Fish and Wildlife Service (Service) is concerned about the impacts to both wetlands protected by easements and non-easement wetlands along the outlet route. All wetland impacts must be mitigated, or in the case of easement wetlands, exchanged, prior to construction.

A 300 cfs outlet is expected to produce a significant erosion and sedimentation problem along the full length of the Sheyenne River as a result of prolonged higher flows. The subsequent erosion and sedimentation will likely result in a decrease of mussels in the Sheyenne River. The result of the increased flows may result in the loss of slow riffle stream habitat on the upper Sheyenne, and a loss of shallow and medium pool habitat on the lower Sheyenne River. Several fish species will be affected by the loss of habitat necessary for various life stages. Additionally, many of the affected fish species are known host fish necessary for mussel survival. The loss of these fish species may in turn affect mussel populations. The water quality in both the Sheyenne and Red Rivers will be degraded as a result of this project. The Service is concerned that degraded water quality from the project will have a negative impact on freshwater mussel populations in the river.

The Pelican Lake outlet plan will remove the freshest of the lake inflow to the Sheyenne River, thereby reducing the freshening effect the inflow has on the lake. The result will be a general decline of the water quality of the lake, and a hastening of the impact poor water quality has on the lake's aquatic biota. The riparian habitat along the Sheyenne River will suffer from an increase in over-bank flooding for prolonged periods of time, resulting in a change in species composition and or loss of stream bank vegetation along the riparian corridor.

The Service's planning objectives recommend establishing a target elevation of 1443 mean sea level (msl) for Devil Lake to operate any outlet within State water quality standards, and to develop an adequate monitoring and mitigation plan to offset the loss of natural resource habitat and biota. The Service strongly encourages the management of the upper basin for the benefit of the lake in an effort to reduce the lake's inflow as much as possible. This includes effective upper basin water storage and the increase of water storage on public lands. Furthermore, an outlet operational plan must be developed within an interagency task force.

There are several outlet alternatives that have been evaluated by the Corps. The identified alternatives include:

1.01
West Bay 300 cfs and 480 cfs outlet from Devils Lake south of Minnewaukan
1.02
Pelican Lake 300 cfs and 480 cfs outlet from Pelican Lake north of Minnewaukan
1.03
East Devils Lake Outlet
1.04
Upper Basin Management
1.05
Expanded Infrastructure Measures
1.06
Raise the Natural Outlet/Natural Overflow Protection
1.07
Combination 1 (Upper basin storage and infrastructure protection)
1.08
Combination 2 (Upper basin storage, infrastructure protection, 300 cfs West Bay outlet)
1.09
No Action Future
1.10
Moderate Futures with lake levels of 1450 msl and 1455 msl.

There are many environmental impacts associated with all the outlet alternatives. They all include impacts to mussels, fish, and the habitats they require for continued existence. The primary impacts are the result of increased chloride concentrations in the Sheyenne and Red Rivers, erosion and sedimentation on the Sheyenne River and the subsequent impact on several

fish species, the riparian corridor along the Sheyenne River, and wetland impacts along the outlet alignment.

A long-term monitoring and mitigation plan must be developed that accurately assess the impact this project will have and how the impacts can be offset, prior to construction. Monitoring may include erosion and sedimentation, channel morphology, fish and mussel surveys, aquatic habitat, water quality, riparian vegetation surveys, soil salinity, endangered species, and groundwater monitoring. Mitigation features include increased upper basin water storage, establishment or enhancing riparian habitat along the Sheyenne River, acquisition of key riparian habitats or plantings, erosion control, fish and mussel stockings and reintroduction.

Key recommendations include the monitoring of all natural habitats likely to be affected and the development of an adequate mitigation plan to offset the loss of habitat and potentially species. The target elevation of 1443 msl for Devils Lake, preserving the future viability of Devils Lake's natural resources, and taking all measures to reduce inflow to the lake should be considered a primary recommendation.

After evaluating the various outlet alternatives, the Service is concerned that all the alternatives do not lower the lake or prevent a rise of lake elevation. In some cases, the rise of lake level, assuming the wet future, is as much as 10 feet, thereby failing to prevent any future infrastructure impacts associated with the future rise of the lake. Complicating this issue is the fact that all of the alternatives have water quality impacts to some degree. Additionally, the Service is concerned that the project will not meet the expectations of the local community.

At this time, the Service feels that the public's expectations are far greater than the capability of the outlet alternatives, thus making it difficult to operate any outlet in a manner perceived by the public as ineffective. Such pressures could result in the operation of the outlet in a way inconsistent with its original intent, thus creating potentially severe water quality degradation or other environmental consequences downstream on the Sheyenne and Red Rivers.

The findings of all final environmental studies, as well as those in the draft stage, should continue to be incorporated into the project development to better define project impacts.

2.0 IDENTIFICATION OF PURPOSE, SCOPE, AND AUTHORITY

The purpose and need statement set forth in the February 1999 Corps Scoping Document indicated that the proposed outlet's purpose was originally the *"reduction of flood damages and flood protection costs related to the rising lake levels in the flood-prone areas around Devils Lake."* Congressional interests, however, indicated that this purpose and need statement was too narrowly defined and limited the study. Of special concern was that the study did not evaluate the possible downstream impacts of an overflow of Devils Lake into the Sheyenne River. To address this issue, an expanded scope and new study was developed.

This Fish and Wildlife Coordination Act (FWCA) report is written under a revised Notice of Intent to prepare an Environmental Impact Statement (EIS) published in the Federal Register on December 22, 2000. The revised Purpose and Need Statement now reads, *"The purpose of the proposed action is to reduce the flood damages related to the rising lake levels in the flood-prone areas around Devils lake and to reduce the potential for a natural overflow event."*

In June 1997, Congress directed the Corps, under Public Law 105-18, the Emergency Supplemental Appropriations Act, to complete preconstruction engineering and design for an emergency outlet from Devils Lake to the Sheyenne River. The 1998 Energy and Water Development Appropriations Act, Public Law 105-62, signed in October 1997, authorized the Corps to begin construction. However, the law stipulated that before Federal funds could be used, the Corps must demonstrate that the project is technically sound, economically justified, environmentally acceptable, and in compliance with the National Environmental Policy Act (NEPA). The Corps did not complete the Report to Congress, which was intended to meet these directives.

The Energy and Water Development Appropriations Acts of 1998, 1999, and 2000 included funds for construction of the Devils Lake project subject to a determination of economic justification, compliance with the NEPA and the Boundary Waters Treaty Act of 1909, and technical soundness. A total of $2 million was provided from a supplemental appropriation in Fiscal Year 2000, and another $4 million in Fiscal Year 2001 appropriations. These funds are for preconstruction engineering and design of an emergency outlet to the Sheyenne River and the associated EIS. This supplements an earlier allocation of $5 million that was made available through the 1997 Emergency Supplemental Appropriations Act.

The Corps requested that the Service prepare a FWCA report to be submitted with the EIS for the Devils Lake Emergency Outlet project. In response to a negotiated scope of work, the Service is providing this FWCA report for the Devils Lake Emergency Outlet, Devils Lake, North Dakota. It is prepared under the authority of and in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e), and in accordance with the provisions of the Endangered Species Act (16 U.S.C. 1531 et seq.). This report constitutes the report of the Secretary of Interior as required by Section 2(b) of the FWCA.

3.0 ACKNOWLEDGMENT OF INPUT, COORDINATION AND CONCURRENCE OF STATE FISH AND WILDLIFE AGENCY

A copy of the Draft Fish and Wildlife Coordination Act Report (FWCA) for the Devils Lake Emergency Outlet was presented to the North Dakota Game & Fish Department (Department), for their review and comment. The Department provided the Service with general concurrence on the Draft FWCA Report in their letter of April 11, 2002, (Appendix 3). Comments offered by the Department have been incorporated into the Final FWCA Report.

4.0 DISCUSSION OF RELEVANT PRIOR STUDIES OR REPORTS

Background

Since 1980, several studies and reports on Devils Lake have been published. The Corps has produced the following studies: 1996 Emergency Outlet Plan; 1996 Environmental Assessment and Plans and Specifications for Raise of Existing Levee; 1996 Contingency Plan; 1992 Reconnaissance Report for Flood Control, Lake Stabilization, and Comprehensive Purposes; 1988 Devils Lake Basin Integrated Draft Feasibility Report and Environmental Impact Statement; 1983 Section 205 Detailed Project Report for Flood Control. These reports provide a significant background of information on the basin.

The Service has published the 1988 Draft Fish and Wildlife Coordination Act Report for Fish and Wildlife Resources in Relation to the Devils Lake Basin Flood Control Project; 1992 Substantiating Report; Planning Aid Letter, Devils Lake Emergency Outlet Study providing input on various outlet alignment alternatives, September 3, 1997; Planning Aid Letter and Substantiating Report, Devils Lake Feasibility Study, Lake Stabilization, Devils Lake, North Dakota, October 3, 1997; Fish and Wildlife Service letter to the Corps providing wetland drainage, restoration, and storage information for the Devils Lake basin, August 18, 1998; Devils Lake Emergency Outlet Study, Devils Lake, North Dakota, Planning Aid Letter and Substantiating Report, April 1, 1999; Planning Aid Letter providing Fish and Wildlife Service input on the potential natural resource impacts of an overflow from Devils Lake basin to the Sheyenne River through the Tolna Coulee, May 24, 1999; Planning Aid Letter providing Fish and Wildlife Service input on the Devils Lake outlet alternative known as the Stump Lake alternative, April 7, 1999.

WEST Consultants Upper Basin Storage Study

In the fall of 1999, the Corps initiated an upper basin storage evaluation. The evaluation was conducted by WEST Consultants, Inc., a San Diego, California, engineering firm specializing in the development of hydrologic models. The primary goal of the study was to identify and delineate topographic depressions as either “intact” or “drained” using digital elevation model (DEM) topographic information. Following the DEM depression classification, a physically based hydrologic model was developed to simulate the hydrologic functions of the depressions in order to calculate the amount of potential storage within the upper basin’s drained depressions. WEST’s final report, “Devils Lake Upper Basin Storage Evaluation,” was issued April 30, 2001.

The WEST report identified approximately 200,000 acres of intact depressions and 92,000 acres of drained depressions (see Table 10.2). The Service believes the estimate of drained depressions has been underestimated by at least 50 percent. In agreement with the Service,

WEST provided three reasons why they believe the numbers of intact and drained depressions are likely underestimated. They are:

1.01 The use of the NWI digital data represents only wetland boundaries, not the full capacity of the depression within which the wetland is situated.

1.02
A number of DEM depression polygons appeared to be smaller in area than the corresponding depressions when compared to aerial photos.

1.03
Both intact and drained depressions were likely missed by the DEM, especially in the 10-foot contour interval data. And the NWI data likely contains some error of wetland omission.

For the above stated reasons, WEST recommends that more intensive analysis be completed, along with a field verification, to refine the numbers.

WEST used drained depressions having an average depth of greater than or equal to 0.5 foot as candidates for restoration. There were a total of 13,464 drained depressions (26 percent of the total number of possibly drained depressions) having a surface area of 79,762 acres (86 percent of the total drained depression surface area) and a total volume of 127,835 acre-feet (96 percent of the total drained depression volume). Various levels of restoration were analyzed (25, 50, 75, and 100 percent by volume of the restoration candidates). The selection process was not optimized by drainage area or location. Table 10.3 summarizes the surface area and volume of the restored depressions for the different restoration levels.

Threatened or Endangered Species

In letters dated June 17, and August 25, 1998, the Service provided the Corps a threatened or endangered species list for North Dakota and Minnesota. At that time, the Service raised the concern of potential impacts to the western prairie fringed orchid as a consequence of higher water tables resulting from continuous bank-full conditions in the Sheyenne River from a 300 cfs west end Devils Lake outlet.

In a telephone conversation with Service personnel on July 16, 1998, the threatened and endangered species found in the project area were discussed. It was determined that there would be little or no impact to any species, with the exception of the western prairie fringed orchid. In response to the outstanding orchid impacts, the Corps contracted Barr Engineering to conduct a profile model analysis in the Sheyenne River Delta to assess the potential groundwater effects of the Devils Lake outlet.

Barr's report, dated April 1999, concluded that there would be no effect of the Devils Lake outlet

on groundwater levels farther than 2,100 feet from the Sheyenne River in the area of the Sheyenne Delta. At 1,500 feet from the river, the maximum predicted water level increase is less than 4 inches.

The Corps wrote a Biological Assessment, Federally Threatened and Endangered Species, Devils Lake Emergency Outlet, North Dakota, dated September 7, 1999. In the Biological Assessment, the Corps concluded that the proposed 300 cfs Devils Lake outlet, *"would not adversely affect the continued existence of any threatened or endangered species in the project area. No mitigative activities are required specifically for threatened or endangered species as a result of the proposed action. No further studies are proposed at this time.*"

In a December 9, 1999, letter, the Service concurred with the Corps' determination that the proposed 300 cfs outlet, as described in the Corps' Biological Assessment, is not likely to adversely affect listed species.

5.0 DESCRIPTION OF STUDY AREA

Devils Lake Basin

The Devils Lake basin is located in northeastern North Dakota. It is a closed basin encompassing 3,858 square miles (mi^2), or roughly 5 percent of North Dakota's land surface. Even as a closed basin, the Devils Lake watershed is considered part of the Red River-Hudson Bay system, although no flow outside of the basin has occurred in the past two centuries.

Within the Devils Lake basin lie a chain of waterways beginning with the Sweetwater group, and extending through Mauvais Coulee, Minnewaukan Flats, West Bay Devils Lake, Main Bay Devils Lake, East Bay Devils Lake, and East Devils Lake to Stump Lake. Mauvais Coulee, a principal tributary to Devils Lake, is the largest drainage channel in the Devils Lake system (Figure 5.1).

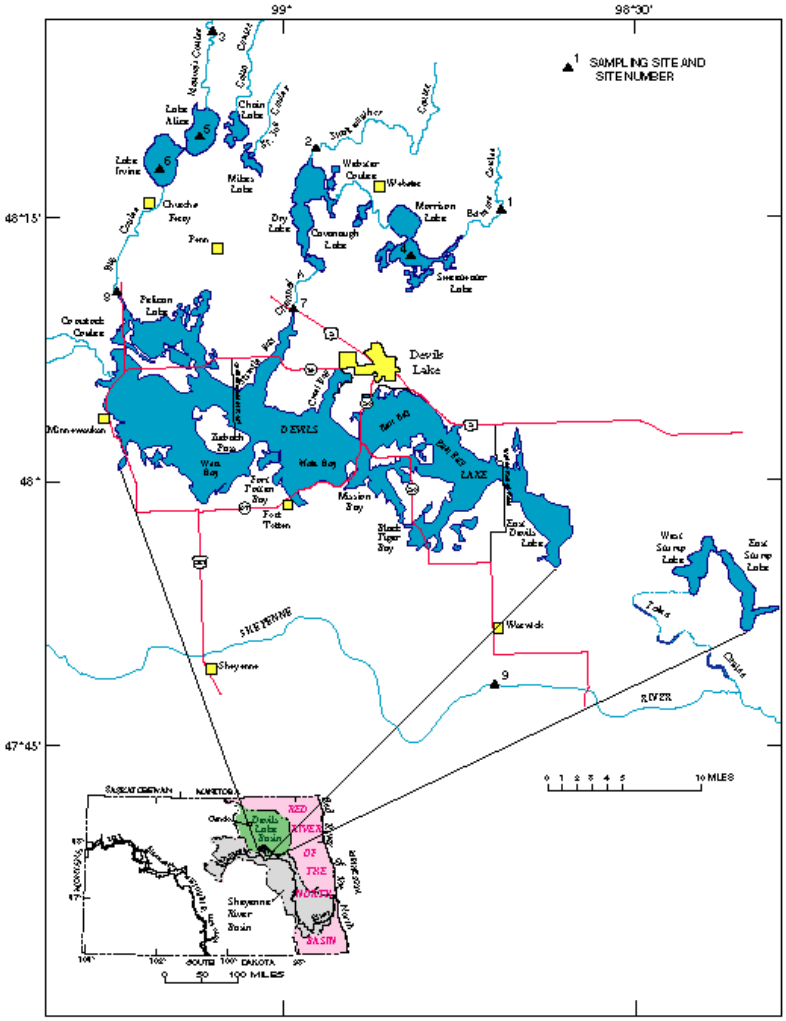
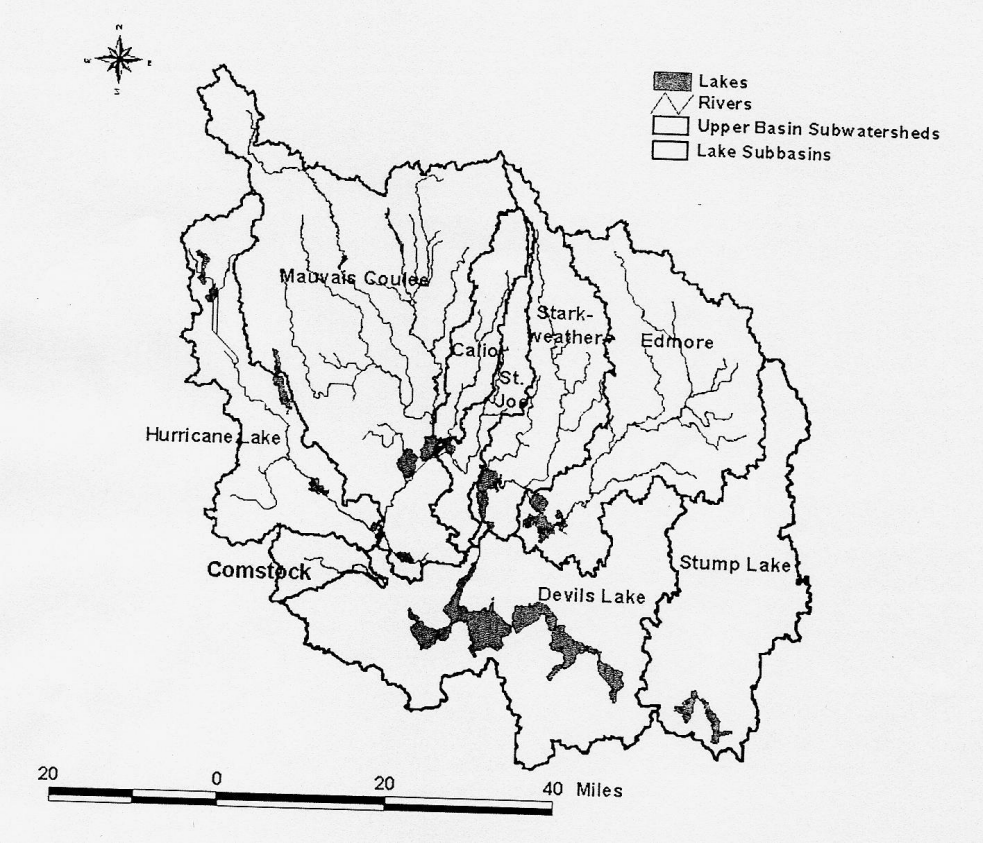


Figure 5.1. Red River-Hudson Bay watershed and the Devils Lake basin.

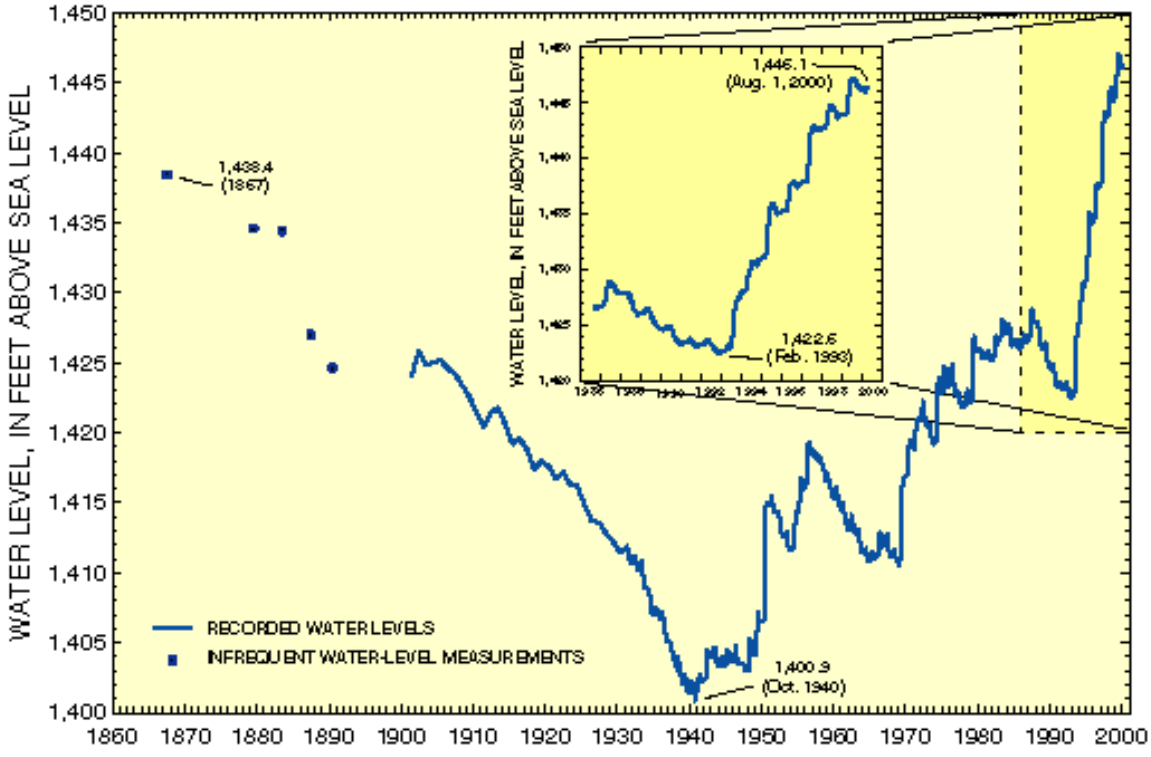
The topography within the watershed results in a north to south drainage pattern, with Devils Lake receiving 87 percent (3,373 mi^2) of the basin's runoff, and Stump Lake receiving the balance of 13 percent (485 mi^2). The Devils Lake basin is divided into nine sub-watersheds: Comstock, Mauvais Coulee, Edmore, Starkweather, St. Joe, Calio, Hurricane Lake, Devils Lake, and Stump Lake (Figure 5.2).

Figure 5.2. The Devils Lake watersheds.



The Devils Lake basin is the result of the last advance of continental ice sheets in North Dakota. Glacial Devils Lake was maintained at about elevation 1450 feet above mean sea level (msl) by

glacial meltwater flowing from the retreating ice sheet to the north and by precipitation.



Evidence in the basin suggests that water levels have fluctuated from the time the glacial ice sheets completely melted away through recent recorded time. The underlying causes of the changes in water levels are not fully understood, but certainly involve precipitation, evaporation, groundwater, and agricultural influences and their effects on lake levels (Figure 5.3).

Figure 5.3. Devils Lake fluctuations.

Devils Lake and its wetlands are maintained by spring runoff, precipitation, and ground water. The potential of the basin to store water has been greatly influenced by man's alteration of the land. Most notably by land tillage, increased surface runoff through the drainage of non-contributing wetland basins and alteration of drainage patterns. The result is water that would normally be stored and subjected to evapotranspiration in the basin is now adding to lake levels.

The weather of Devils Lake varies widely with the season. Records at the Devils Lake weather station show mean monthly temperatures from 68°F in the summer to 4°F in the winter. The maximum recorded temperature is 112°, and the minimum is 46° below zero. The frost free growing season lasts from about May 15 to September 23. Mean annual snowfall is 36 inches. The annual evaporation rate is approximately 30 inches.

Sheyenne River

The Sheyenne River is one of four major North Dakota tributaries to the Red River of the North, with a watershed of 6,910 square miles (Figure 5.1). For descriptive purposes, the Sheyenne River can be divided into three segments. From its headwaters in northwestern Sheridan County, the first segment flows east across the drift plain into Nelson County, where it turns southward, flowing to central Ransom County. From this point, the river turns northeast to its confluence with the Red River. From the town of Sheyenne, North Dakota, to Lake Ashtabula, the Sheyenne flows through a valley 100-150 feet deep, and ¼ to 1 mile wide, carved into Cretaceous Pierre Formation shale.

Lake Ashtabula, located about midway along the river's length, is a 5,430-acre impoundment formed by Baldhill Dam. Both the lake and dam were authorized in 1944. The construction of Baldhill Dam began in 1947 and was completed in 1951. The Corps of Engineers operates the lake for water supply and flood control.

This reservoir is a popular recreation area for eastern North Dakota residents, providing swimming, boating, and a diverse sport fishery for walleye, northern pike, muskellunge, yellow perch, and white bass. Lake Ashtabula also has provided a source for northern pike and walleye eggs for the Valley City National Fish Hatchery.

The second reach, from Lake Ashtabula to just below Lisbon, North Dakota, flows through a valley ½ to 1 mile wide and as deep as 200 feet, through glacial till and Cretaceous Niobrara and Pierre Formations. The third segment flows from below Lisbon to the confluence of the Red

River, across the Sheyenne Delta, through an extensive sandhills area and the floor of glacial Lake Agassiz, forming the Red River Valley.

The Sheyenne is approximately 550 miles in length, with an average slope of 1.5 feet per mile on the drift prairie, 2 feet per mile as it enters the Red River Valley, and approximately 1 foot per mile as it flows across the Red River Valley.

Red River of the North

The Red River of the North is a part of the Hudson Bay drainage system, which drains parts of North Dakota, South Dakota, and Minnesota in the United States, and parts of Manitoba and Saskatchewan in Canada (Figure 5.1). The Red River, formed at the confluence of the Bois de Sioux and Otter Tail Rivers, has a total drainage area in the United States of 39,200 square miles, of which 20,820 square miles are in North Dakota (including the non-contributing Devils Lake Basin).

In recent geologic times, the Red River region was covered by a large continental ice sheet. Retreating glaciers left a massive meltwater lake known as Lake Agassiz. The present day Red River Valley formed the bottom of the lake. The Red River flows north into Canada across the floor of the glacial lake bed for 394 river miles, forming the North Dakota-Minnesota boundary. The lake bed is nearly flat, with an average slope of about 0.4 foot per mile. The river has a high sediment load of silts and clays, which results in the muddy character of the Red. Additionally, the river is characterized by a low gradient and high sinuosity.

6.0 IDENTIFICATION OF FISH AND WILDLIFE RESOURCE CONCERNS AND PLANNING OBJECTIVES

Fish and Wildlife Resource Concerns:

- Wetland impacts to the Service's easement wetlands and non-easement wetlands.
- The reduction of lake inflow through wetland restoration.
- Water quality impacts to freshwater mollusks in the Sheyenne and Red Rivers.
- The impact to the fishery from the loss of riffle and pool habitat in the Sheyenne River due to continuous bank-full conditions.
- Loss of freshest inflow to the lake through pumping operations at Pelican Lake and its impact on water quality in Devils Lake.
- Maintenance of the high quality fishery in Devils Lake.
- Impact to riparian vegetation along the Sheyenne River subject to over-bank flooding.
- The use of rock rip rap measures to control erosion.

Planning Objectives:

- Target elevation 1443 msl as operational level for Devils Lake. The lake should be at elevation 1443 msl by the end of September.
- Operate within State water quality standards for the Sheyenne and Red Rivers.
- Establish an upper basin water storage target of at least 50,000 acre-feet for the life of the project.
- Monitor drainage within the basin to eliminate additional water being added to the outlet project.
- Require water management regulation of authorized drainage during predicted flood events to reduce inflow to the lake.
- Coordinate Federal, state, local agencies and the public in implementing a holistic water management practice on a basin wide scope to reduce inflow to the lake.
- Maximize the use of public lands in the upper basin for multi-purpose functions that increase water storage on the landscape.
- Develop and implement a plan to mitigate all natural resource impacts.
- Establish a monitoring plan to evaluate environmental issues of concern.
- Develop an operational plan for outlet alternatives.
- Develop a monitoring plan for possible natural resource impacts.

7.0 DESCRIPTION OF EVALUATION METHODS

Project impacts on fish and wildlife resources are evaluated using the HEC5Q water model with a water quality component, and on Resource Categories, as defined in the Service's Mitigation Policy, Federal Register, Vol. 46, No. 15, Friday, January 23, 1981. This policy establishes the *"final policy guidance for Service personnel involved in making recommendations to protect or conserve fish and wildlife resources."*

The primary Service evaluation tool is the HEC5Q water model. The HEC5Q model is a lake level water quality model for Devils Lake. The model's backbone is the "5-box model," which is a water mass-balance model that simulates future volumes and sulfate concentrations in Devils Lake, with and without outlet operation. The need for greater flexibility and ability to model other water quality constituent (e.g. chloride, TDS, sulfate, non-carbonate hardness, and total hardness) concentrations in Devils Lake, with and without outlet operation, resulted in the selection of the HEC5 and HEC5Q models.

The HEC5Q's ability to write its output to a graphical user interface (GUI) makes this water model an effective tool to use in evaluating various outlet alternatives, as the GUI allows graphical representation of model results. The GUI displays a schematic representation of the model on a map display, which allows the user to select various locations along the modeled reach to plot results. Time series plots display non-animated model results for a user-selected constituent and location for the desired time series (e.g. the 50-year life of the project). Longitudinal plots display the results for a user-specified constituent along one or more reaches of the model. The user may select to use the animation option to view the results over time.

The HEC5Q water model is an effective way to select an outlet alternative and a water quality constituent and view its impact to any point along the Sheyenne and Red Rivers. This model is the primary tool used to determine potential water quality impacts and their possible impact to adjacent natural resources.

The Service evaluates the importance of habitat areas to species of special concern and whether or not the habitat is unique and irreplaceable on a national or ecoregion basis. This evaluation results in the Service establishing a planning goal, thus the degree of replacement reflects the value of the habitat.

There are four Resource Categories of decreasing importance, with mitigation planning goals of decreasing stringency developed for these categories (Table 7.1).

Table 7.1. Service Resource Categories.

Resource Category	Designation Criteria	Mitigation Planning Goal
1	Habitat to be impacted is of high value for evaluation species and unique and irreplaceable on a national basis or in the ecoregion section.	No loss of existing habitat value.
2	Habitat to be impacted is of high value for evaluation species and is relatively scarce or becoming scarce on a national basis or in the ecoregion section.	No net loss of in-kind habitat value.
3	Habitat to be impacted is of high to medium value for evaluation species and is relatively abundant on a national basis.	No net loss of habitat value, while minimizing loss of in-kind habitat value.
4	Habitat to be impacted is of medium to low value for evaluation species.	Minimize loss of habitat value.

Effects of the project on fish and wildlife resources are evaluated based on the Resource Category and acreage of the impact. The Service evaluates the importance of habitat areas to species of special concern and on whether or not the habitat is unique and irreplaceable on a national or ecoregion basis. These evaluations result in the Service establishing a planning goal, thus the degree of replacement reflects the value of the habitat.

One-of-a-kind habitat areas, such as a Resource Category 1, warrant a planning goal recommendation of no net loss of existing habitat value. These areas of habitat are not replaceable in-kind, based on present day scientific and engineering skills or within a reasonable timeframe. West Stump Lake, which is in the project area, is an example of such a habitat.

Examples of Resource Category 2 habitats include prairie pothole wetlands, native prairie grasslands and prairie streams acting as fluvial wetlands. All of these habitats are of high value that are relatively scarce or becoming scarce on a national and or ecoregion basis. The planning goal recommendation for these habitats is no net loss of in-kind habitat value. These high value areas can be mitigated or replaced in-kind within a reasonable timeframe through restoration, creation or enhancement of similar systems or physical habitats.

Non-native grasslands and woodlands are of high to medium value and are relatively abundant on a national basis, and are considered to be Resource Category 3 habitats. The associated planning goal is no net loss of habitat value, thus minimizing loss of in-kind habitat value. If in-kind development is not desirable or possible, then out-of-kind replacement would be suggested.

Habitat such as agricultural fields are common in the project area and are of medium to low value for wildlife, thus they are considered to be Resource Category 4 habitats. Generally, losses of habitats will not have significant adverse effects on important fish and wildlife resources.

Other evaluation methodologies used for this report include the use of relevant literature, local experts, and qualitative observations made by Service personnel and recognized experts in the natural resource field.

7.1 STOCHASTIC VERSUS A SCENARIO BASED APPROACH TO OUTLET ANALYSIS

The Corps is using various hydrological methods to determine the effectiveness of an outlet alternative. Among those being utilized are the traditional stochastic approach, which use the U.S. Geological Survey's 10,000 traces of possible lake level futures, the Wet Future scenario, and the Moderate Future 1450 msl and 1455 msl, which assumes the lake only reaches these elevations.

Stochastic Approach: The U.S. Water Resource Council specifies the use of "expected" annual flood damage. The "expected" damage accounts for the risk of various magnitudes of flood damage in a given year and is weighed against the probability of occurrence. The National Economic Development plan is the scale of the flood damage reduction alternative that maximizes the "expected" net benefits. The stochastic based analysis for Devils Lake is consistent with this direction. The stochastic approach represents the standard approach used by the Corps for determination of probability and weighted damages.

An important assumption of the stochastic approach is that climate is stationary, meaning that climatic conditions in the study (e.g. Devils Lake) in the "recent" past are characteristic of climate conditions for the future. This approach suggests that the climate in the Devils Lake basin has remained relatively homogeneous from 1980 to the present (the "recent" past being defined as the period from 1980-1999). Therefore, it is assumed that the climate for the next 10-15 years is likely to be similar to that experienced from 1980-1999.

The stochastic approach determines the likelihood of future lake levels using a set of 10,000 possible traces of future lake levels. The first 15 years, until 2015, the traces are generated based on the assumption that climatic conditions would be similar to those experienced during 1980-1999. After 2015, the model assumes that climate conditions can be represented by the longer historic period of 1950-1999. The average peak lake level is 1451.7 msl.

Wet Future Scenario Approach: On the other hand, there are those who feel that the climate of the Devils Lake basin may be non-stationary. The existence of natural climate cycles caused by global ocean and atmospheric circulation patterns or the existence of global warming due to anthropogenic causes are cited as reasons why the basin's weather

may be non-stationary, and therefore the use of a stochastic approach is not an accurate predictor of future lake levels. If this is the case, and we can accurately predict future changes, then a scenario-based approach to predicting future lake levels may result in a better model.

Those who believe that the Devils Lake basin climate is non-stationary argue that small changes in precipitation and evaporation are not significant considerations when looking at riverine flood peak hydrology, but become important when they affect a terminal lake, as they are cumulative in their impact and are subject to persistent weather patterns. As a result, a scenario approach was developed that assumed that a set of 7 years of wet conditions (1993-1999) are repeated until Devils Lake reaches elevation 1459 msl. Once the lake reaches its overflow elevation of 1459 msl, the 7-year cycle is repeated once more so impacts can be simulated downstream.

Moderate Future 1450 msl and 1455 msl: These evaluation methodologies use actual traces from the 10,000 traces of possible lake futures used in the stochastic approach. They represent the case whereby the lake elevation only rises to these more moderate elevations within the next 15 years. This is referred to as a more moderate trace and was selected to assess more likely and perhaps more significant water quality impact compared to the Wet Future trace, because conditions downstream are not as wet and therefore do not have as much dilution to attenuate impacts.

8.0 DESCRIPTION OF FISH AND WILDLIFE RESOURCES

8.1 EXISTING CONDITION

8.1.1 Aquatic Resources

Wetlands

The wetland resources of the Prairie Pothole Region provide many functions and values. In general, wetlands follow a yearly cycle, beginning with the spring catch of snow melt runoff. Through the summer months, wetlands receive direct precipitation and runoff from the surrounding watershed, while simultaneously exporting water through evapotranspiration and losing surface water through seepage. By late summer, the wetlands are generally drawn down or dry and enter the fall and winter months in a condition that prepares them to repeat the cycle the next spring.

Historically, North Dakota had approximately 4.9 million acres of wetlands, representing about 11 percent of the land surface. Dahl (1990) estimates that North Dakota has approximately 2.5 million acres remaining. This translates into a 49 percent loss of the State's wetland base. The Service estimates that the Devils Lake basin originally had at least 400,000 acres of wetlands. The Service estimates that between 183,000-189,000 acres of drained wetlands exist in the Devils Lake basin (U.S. Fish and Wildlife Service 1997. Substantiating Report, Devils Lake Feasibility Study, Lake Stabilization, Devils Lake, North Dakota. Bismarck, North Dakota. p. 23-24). The National Wetlands Inventory (NWI) data shows that the basin has 210,000 acres of wetland. This represents a 50 percent loss of wetlands.

Wetland habitats can be grouped into broad categories, which provide several functions and values unique to wetlands such as flood water storage, habitat for wildlife, filtering of polluted water, and groundwater recharge. Using "Classification of Wetlands and Deepwater Habitats of the United States" by Cowardin et al. (1979) and the NWI, prairie pothole habitats found in the Devils Lake basin can generally be grouped into palustrine, emergent, temporarily, seasonally and semipermanently flooded wetlands (PEMA, PEMC and PEMF, respectively). The upper basin chain of lakes can be described as a lacustrine, limnetic, unconsolidated bottom, intermittently exposed wetland (L1UBG), with a shallow ring of lacustrine, littoral, aquatic bed, semipermanently flooded habitat (L2ABF).

Temporary wetlands (PEMA) are the most common wetland type on the glaciated prairie of North Dakota. They are characterized as usually being less than 1 acre in size and less than 1 foot deep. They typically lose water rapidly during the first few

weeks after spring snow melt and are dry within a month or so. Despite their fleeting existence, temporary wetlands are very important. The temporary wetlands are the first wetland type to melt in the spring, thus providing the first invertebrate food supply for migrating waterfowl. This food supply is a critical source of protein used by breeding birds during the egg laying period, as well as food for other spring migrant waterbirds.

Swanson et. al. (1985) and Krapu (1974a & b) showed that not only do temporary wetlands provide a major source of protein for nesting hens, but that poor quality diets lead to reduced clutch and egg size, laying rate, and number of nesting attempts (Eldridge and Krapu 1988). Waterfowl such as mallards, gadwall, blue-wing teal, northern shoveler, and northern pintail are heavy users of temporary wetlands.

In addition to providing invertebrate food supply, seasonal wetlands (PEMC) provide isolation for duck pairs and locations for over water nesters. In high water years, seasonal wetlands provide good brood habitat and molting areas. They are heavily used by dabbling, diving, and stiff-tailed ducks due to their greater average depth and duration of inundation. Mallard, blue-winged teal, gadwall, northern pintail, northern shoveler, redhead, green-winged teal, ruddy duck, wigeon, lesser scaup, canvasback, and ring-necked ducks are all extensive users of seasonal wetlands.

Semipermanent wetlands (PEMF) provide nearly all the requirements of the waterfowl that nest on the North Dakota prairies. Emergent vegetation contained in these wetlands provide the primary breeding habitat for diving and stiff-tailed ducks, such as redhead, canvasback, and ruddy duck. Due to their large size, relative to temporary and seasonal wetlands, semipermanent wetlands are the last of the prairie wetlands to become ice free in the spring. As a result, they are not a source of invertebrates early in the spring for nesting dabbling hens.

The Service, through its Small Wetlands Acquisition Program, acquires wetland protection easements and fee-title and Waterfowl Production Areas (WPA) throughout the basin. These wetlands are protected from draining, filling, burning, or leveling activities. The Devils Lake Wetland Management District (WMD), which encompasses the Devils Lake basin, is comprised of eight counties. Currently, the Devils Lake WMD manages approximately 154,748 acres of wetlands protected under easement, and 48,066 acres of WPA and Wildlife Development Units. All Service administered wetlands are providing annual hydrologic benefits by reducing inflow to the lake.

The Sheyenne River is classified as a riverine, lower perennial, unconsolidated bottom, intermittently exposed (R2UBG), for the upper one-third; and riverine, lower perennial, unconsolidated bottom, permanently flooded (R2UBH) for the lower two-thirds of the river's length. In addition to the river habitat, there are several other

types of floodplain wetlands that occur in the Sheyenne River floodplain. For the most part, they are characterized as palustrine, emergent, temporarily, and seasonally flooded wetland habitats (PEMA and PEMC, respectively). In some areas, sedge meadow wetlands are found adjacent or near the Sheyenne River and are maintained by river flows and ground water tables. The forested banks of the Sheyenne are occasionally identified by the NWI as palustrine, forested, temporarily flooded (PFOA) linears or polygons.

The Red River of the North is characterized as a riverine, lower perennial, unconsolidated bottom, permanently flooded (R2UBH) river. There are occasional exposed river bars which have been classified as riverine, lower perennial, unconsolidated shore, temporarily or seasonally flooded (R2USA, and R2USC, respectively). Unlike the Sheyenne River, the Red River floodplain is largely void of wetland polygons of PEMA and PEMC. Floodplain wetlands, when identified, typically exist in old river scars and oxbows.

Fishery

Prior to 1965, no game fishery existed in Devils Lake (U.S. Fish and Wildlife Service 1992). Routine stocking of game fish was initiated in 1965. During the 1980's, the fishery improved, which resulted in a dramatic increase in recreational use of the lake. Most fishing activity occurs in Devils Lake west of Highway 57.

The sport fishery of Devils Lake is a valuable resource, which has greatly improved since the 1980's with rising water levels. Devils Lake is a brackish lake, developed through lake level fluctuations, which are beneficial to the support of the current fishery. The fishery remained relatively stable during the drought of 1988-1990. Primary species pursued by anglers are walleye, northern pike, yellow perch, and white bass. White suckers and black bullheads are also present, but have not increased sufficiently to degrade the quality of the sport fishery. Tiger muskellunge are also present in low numbers. Prior to the recent rise in lake levels, virtually all game fish were artificially stocked due to low reproduction potential from brackish water quality. With current high lake levels freshening the lake, yellow perch, northern pike, white bass, crappie, and possibly walleye are experiencing successful natural reproduction. Table 8.1 lists the fish species that occur in Devils Lake.

The rising waters of Devils Lake have created ideal conditions for fish reproduction due to thousands of acres of flooded terrestrial vegetation. The rise of Devils Lake has increased food supplies for macro invertebrates and created excellent spawning areas for northern pike and yellow perch (Hiltner 2001a). Currently, northern pike and yellow perch comprise more of the total fish population by weight than they did in the early 1990's. Walleye and white bass make up a slightly smaller portion (Hiltner 2001b).

Table 8-1. Fishery Resources of the Sheyenne and Red Rivers and Devils Lake.

Scientific name	Common Name	Sheyenne River	Red River	Devils Lake
Ambloplites rupestris	rock bass	X	X	
Ameiurus melas	black bullhead	X	X	X
Ameiurus nebulosa	brown bullhead	X	X	X
Aplodinotus grunniens	freshwater drum	X	X	
Catostomus commersoni	white sucker	X	X	X
Culaea inconstans	brook stickleback	X	X	X
Cyprinus carpio	carp	X	X	
Esox lucius	northern pike	X	X	X
Esox lucius X E. masquinongy	Tiger muskie	X		X
Esox masquinongy	muskellunge	X	X	X
Etheosoma exile	Iowa darter	X	X	
Etheosoma nigrum	Johnny darter	X	X	
Hiodon alosoides	goldeye	X		
Ictalurus punctatus	channel catfish	X	X	X
Lepomis gibbosus	pumpkinseed	X	X	
Lepomis humilis	orange spotted sunfish	X	X	
Lepomis macrochirus	bluegill	X	X	
Lota lota	ling		X	
Micropteris dolomieui	smallmouth bass	X		
Micropterus salmoides	largemouth bass	X	X	
Morone chrysops	white bass	X	X	X
Morone saxatilis	striped bass			X
Moxostoma anisurum	silver redhorse	X		
Moxostoma macrolepidotum	shorthead redhorse	X	X	
Notemigonus chrysoleucas	golden shiner	X	X	
Notropis comutus	common shiner	X		
Notropis dorsalis	bigmouth shiner	X		
Notropis heterolepsis	blacknose shiner	X		
Notropis hudsonius	spottail shiner	X		
Notropis spilopterus	spotfin shiner	X		
Notropis stramineus	sand shiner	X		
Noturus flavus	stonecat	X		
Noturus gyrinus	tadpole madtom	X		
Osmerus mordax	rainbow smelt		X	
Perca flavescens	yellow perch	X	X	X
Percina maculata	blackside darter	X		
Percopsis omiscomaycus	trout-perch	X	X	
Phoxinus eos	northern redbelly dace	X		
Pimephales notatus	bluntnose minnow	X	X	
Pimephales promelas	fathead minnow	X	X	X
Pomoxis annularis	white crappie	X	X	
Pomoxis nigromaculatus	black crappie	X	X	X
Rhinichthys atratulus	blacknose dace	X	X	
Rhinichthys cataractae	longnose dace	X	X	
Semotilus atromaculatus	creek chub	X	X	
Stizostedion canadense	sauger	X	X	
Stizostedion vitreum	walleye	X	X	X

Recent netting surveys have documented a resurgence in perch populations. Surprisingly, perch populations make up a higher percentage of total game fish weight. In 1993, 4 percent of game fish weight was perch, compared to 27 percent in 1999, and 22 percent in 2000. With the resurgent population of perch in Devils Lake, the fishing has gained region-wide notoriety. North Dakota Game and Fish Department fishery biologists indicate that the lake has all the factors necessary for perch to thrive: a large, relatively shallow basin, ideal spawning habitat, and abundant food. As a result, Devils Lake perch are in excellent body condition as compared to other perch populations around the Midwest. A healthy food supply of invertebrates, such as freshwater shrimp, chironomid larvae, and corixids are keeping Devils Lake perch well fed and growing rapidly (Hiltner 2001a).

The abundant perch population has lead to a renown winter fishery. Perch accounted for 85 percent of the total game fish harvested from Devils Lake during the 1998-99 winter. Anglers kept 89 percent of the perch caught, with the average perch approximately 10 inches in length and weighing more than one-half pound (Hiltner 2001a).

Long-term maintenance of the fishery in Devils Lake is dependent on the balanced relationship of nutrients, salinity, water levels, and Total Dissolved Solids (TDS) concentrations. This balance helps to prevent oxygen depletion from occurring, has limited fish reproduction, and regulates algae blooms. The result has been a simple but highly-valued fishery.

Both the Sheyenne and Red River systems provide spawning habitat and nursery areas for forage fish, as well as a migrational avenue for sport fish, including channel catfish, northern pike, walleye, sauger, rock bass and crappie. Lake Ashtabula provides the primary recreational fishing site on the Sheyenne River.

The Corps initiated a fish health study in 2001, to assist in assessing the potential risk factors associated with transfer of fish pathogens from Devils Lake through an emergency outlet to the Sheyenne and Red Rivers. The Corps contracted with the Service's Missouri River Fish and Wildlife Assistance Office in Bismarck, North Dakota, to conduct fish sampling work and the Bozeman Fish Health Center (FHC) in Bozeman, Montana, to conduct the fish health analysis. The goal of the fish health study is to collect representative fish from Devils Lake, the Sheyenne River, and the Red River and test their tissues for specific fish pathogens. The first phase of the study was carried out in October, 2001. Fish were captured using gill nets and modified fyke nets from sample sites in Six Mile Bay on Devils Lake. A total of 180 fish were collected and transferred to the FHC for fish pathogen analysis (60 walleye, *Stizostedion vitreum*, 41 northern pike, *Esox lucius*, 60 yellow perch, *Perca flavescens*, and 19 black crappie, *Pomoxis nigromaculatus*).

During October 2001, fish collected from Devils Lake were tested for a list of primary fish pathogens using protocols for the National Wild Fish Health Survey. Peters (2002) provides the following summary of test results for the initial phase of the study. Detection of soluble antigen of *Renibacterium salmoninarum,* causative agent of bacterial kidney disease (BKD), was the only evidence of any exposure to specific fish pathogens in fish from Devils Lake. Active infection by *R. salmoninarum* could not be confirmed because all kidney samples tested with the polymerase chain reaction (PCR) assay were negative. None of the fish examined, regardless of species or size, had any external or internal clinical signs of disease. All fish appeared healthy and in good general condition.

Work on the fish health study will continue with the next phase of sampling (Sheyenne and Red Rivers) anticipated to begin in early August 2002. When the final results of the fish health study are available, the Service will be able to provide further analysis and recommendations to the Corps regarding the potential for transfer of fish pathogens from Devils Lake to the Sheyenne and Red Rivers.

Aquatic Mollusks

There are 13 species of freshwater mussels inhabiting the Red and Sheyenne Rivers (Cvancara 1974). Of these 13 species, 8 are found in the Red River and 9 in the Sheyenne River. The most common species found are White heelsplitter (*Lasmigona complanata*), Giant floater (*Anodonta grandis*), Fatmucket (*Lampsilis siliquoides*), and Cylindrical papershell (*Anodontoides ferussacianus*). Less common species include Wabash pigtoe (*Fusconia flava*), Three-ridge (*Amblema costata*), Mapleleaf (*Quadrula quadrula*), Creek heelsplitter (*Lasmigona compressa*), Fluted-shell (*Lasmigona costata*), Squaw Foot (*Strophitus rugosus*), Pink heelsplitter (*Proptera alata*), Black sandshell (*Ligumia recta latissima*), and Pocketbook (*Lampsilis ventricosa*).

At least 44 species of aquatic mollusks inhabit North Dakota, 13 (perhaps as many as 15) mussels (*unionacean bivalves*), 9 pill clams (*sphaeriid bivalves*), and 22 snails (4 *prosobranch* and 18 *pulmonate gastropods*) (Cvancara 1975). Cvancara, Norby, and Van Alstine (1976) state that the Sheyenne River has the greatest diversity of molluscan fauna in the State of North Dakota, hosting 31 species (12 mussel, 6 pill clam, and 13 snails). The Red River is home to 8 species of mussels (Cvancara 1970).

In September 1993, The American Fisheries Society published a paper entitled, "Conservation Status of Freshwater Mussels of the United States and Canada," by Williams et al., wherein several threats to mussels were identified. A few of the identified reasons for mussel declines were habitat destruction, channel modification, siltation, and pollution. The paper cites habitat destruction as the single most serious

threat to mussel populations.

Mussels are considered good indicators of the health of aquatic ecosystems, as they are dependent on good water quality and physical habitat conditions, as well as a suitable environment that will support host fish species (Williams et al. 1993). Williams also cites erosion, caused by poor agricultural practices and destruction of riparian habitats, as a major factor in increased silt loads and unstable stream bottoms, which combine to produce unfavorable habitats for mussels.

The Service is concerned that the introduction of Devils Lake water into the Sheyenne River will significantly degrade water quality, increase erosion and sedimentation, and result in conditions detrimental to aquatic mollusks, such as freshwater mussels, pill clams, and snails.

Water Quality

Devils Lake: The water quality of the Devils Lake basin is affected by factors such as climate, topography, and geology. Warm dry periods generally increases evaporation efficiency, which results in a concentration of dissolved solids, while during wet periods, increased runoff, stream flow and lake levels tend to dilute dissolved solids. Topography and drainage also affect water quality by influencing the amount and rate of runoff (Lent and Zainhofsky 1995).

The issue of water quality in Devils Lake and its relationship to the fishery and the proposed outlet to the Sheyenne River is not entirely understood. Because freshwater flows enter Devils Lake on the west end, TDS concentrations are the lowest there. The TDS gradient increases eastward in Devils Lake, resulting in more saline conditions on the east side.

Based on field data gathered at Devils Lake, it is generally agreed that the existence of a healthy fishery depends on a balance between TDS and nutrient levels. Operation criteria for each of the features designed will have an impact on future fishery. To maximize protection of the valuable fish resource operation criteria should consider long-term impact to the fish resource.

Nutrient loading is believed to be occurring in Devils Lake, in part, due to runoff from the intensively farmed basin, and to a lesser degree from livestock operations. Wetland drainage, fall cultivation, and fertilizer application are some of the agricultural practices suspected of contributing to water quality degradation.

Removal of fresh water from the west end of Devils Lake by a proposed outlet will result in a general degradation of water quality in the future. To lessen potential

impacts from the water quality degradation, all steps should be taken to enhance remaining water quality. These include, but are not limited to, protection and enhancement of riparian zones, reduce inflow nutrients and soil through grassed waterways, and in connecting historic waterflow routes, which will slow water movement and remove nutrients, and encourage Best Management Practice that enhance water quality.

8.1.2 Terrestrial Resources

Wildlife

Wildlife in the Devils Lake basin is closely associated with water and wetlands (Table 8.2). Historically, the Devils Lake basin has had one of the highest concentrations of prairie wetlands in the Northern Great Plains. These wetlands range from numerous large lakes to thousands of small, shallow potholes or marshes.

Shallow water wetland habitats are clearly the most valuable habitat types for waterfowl. Shallow, seasonally flooded wetlands provide important pair habitat and breeding sites for dabbling ducks, including mallard, pintail, gadwall, and teal. Over-water nesters such as scaup, canvasback, and redhead build nests in vegetation, which grows in water depths of 5 feet and less. Broods feed and take cover in shallow, vegetated wetlands. Other wildlife such as white-tailed deer, fox, raccoon, muskrat, mink, beaver, and ring-necked pheasant rely on shallow water wetlands for food and cover.

Vegetation associated with these wetlands are especially valuable during winter as cover for upland species. Drainage of shallow wetland habitat for agricultural purposes has been significant in the Devils Lake basin.

Open water habitats provide, to varying degrees of importance, brood, migratory, molting, and staging areas for most ducks, geese, and swans. Some diving ducks such as scaup, ringneck and redhead use these wetlands as feeding areas. Sub-irrigated meadows are used to some extent by feeding waterfowl, but to a greater extent by feeding and nesting shorebirds.

Table 8-2. Partial list of wildlife species found in the Devils Lake basin and the Red and Sheyenne River corridors.

Common Name - Mammals	Scientific Name	Common Name - Birds	Scientific Name
Beaver	*(Castor canadensis)*	American kestrel	*(Falco sparverius)*
Eastern chipmunk	*(Tamias striatus)*	American Robin	*(Turdus migratorius)*
Cottontail rabbit	*(Sylvilagus floridanus)*	Bald eagle	*(Haliaeetus leucocephalus)*
Coyote	*(Canis latrans)*	Black-capped chickadee	*(Parus atricapillus)*
Fox squirrel	*(Sciurus niger)*	Broad-winged hawk	*(buteo platypterus)*
Grey squirrel	*(Sciurus carolinensis)*	Brown thrasher	*(Toxostoma rufum)*
Jackrabbit	*(Lepus townsendi)*	Canada goose	*(Branta canadensis)*
Mink	*(Mustela vison)*	Chipping sparrow	*(Spizella passerina)*
Moose	*(Alces alces)*	Common crow	*(Corvus brachyrhynchos)*
Muskrat	*(Ondatra zibethica)*	Cooper's hawk	*(Accipiter cooperii)*
Raccoon	*(Procyon lotor)*	Downy woodpecker	*(Dendrocopos pubescens)*
Red fox	*(Vuples fulva)*	Grackle	*(Quiscalus quiscula)*
Red squirrel	*(Tamiasciurus hudsonicus)*	Great horned owl	*(Bubo virginianus)*
Striped Skunk	*(Mephitis mephitis)*	Greater prairie chicken	*(Tympanuchus cupido)*
Long-tailed weasel	*(Mustela frenata)*	Grey partridge	*(Perdix perdix)*
White-tailed deer	*(Odocoileus virginianus)*	Hairy woodpecker	*(Dendrocopoc villosus)*
		Hooded merganser	*(Lophodytes cucullatus)*
		House wren	*(Troglodytes brunneicollis)*
		House sparrow	*(Passer domesticus)*
		Mallard	*(Anas platyrhynchos)*
		Mourning dove	*(Zenaida asiatica)*
		Northern Harrier	*(Circus cyaneus)*
		Peregrine falcon	*(Falco peregrinus)*
		Pheasant	*(Phasianus colchicus)*
		Piping plover	*(Charadrius melodus)*
		Purple martin	*(Progne subis)*
		Red-tail hawk	*(Buteo jamaicensis)*
		Sharptail grouse	*(Pedioecetes phasianellus)*
		Swainson's hawk	*(Buteo swainsoni)*
		Wild turkey	*(Meleagris gallopavo)*
		Wood duck	*(Aix sponsa)*
		Yellow warbler	*(Dendrocia petechia)*

Saline wetland habitats are used heavily by nesting and feeding ducks. Saline wetlands or bays less than 4 feet deep, which permit growth of aquatic vegetation, are more productive for waterfowl and shorebirds than deeper, open water areas. Because of their physical and chemical nature, few of these wetlands are drained.

In addition to waterfowl, many other species of marsh and shorebirds use the lakes and wetlands of the basin for migration and nesting habitat, including black-crowned night herons, great blue herons, great or common egrets, American bitterns, western and eared grebes, white pelicans, double-crested cormorants, and ring-billed gulls.

The Chain of Lakes located north of Devils Lake in the middle of the basin provides a unique combination of feeding and resting habitats utilized by migrating waterfowl. Large concentrations of migrating geese, ducks (primarily canvasbacks, scaups, and mallards), cranes, swans, cormorants, and pelicans congregate in this area during spring and fall migrations. It is one of the most important areas remaining in eastern North Dakota for recreational activities such as hunting of small game, white-tailed deer, and waterfowl; photography; bird watching; and nature study.

The Sheyenne River flows southeast through land dominated by agriculture to its confluence with the Red River of the North near Fargo. The riparian areas along the Sheyenne River provide valuable habitat for a variety of wildlife species. Game species found along the river's riparian corridor and adjacent uplands include white-tailed deer, moose, wood duck, dabbling ducks, pheasant, greater prairie chicken, sharptail grouse, grey partridge, mourning dove, wild turkey, squirrels (grey, red, and fox), and rabbits (cottontail and jackrabbits). Another important wildlife resource is the numerous furbearing species such as red fox, coyote, muskrat, beaver, mink, weasel, and raccoon. Migratory non-game birds use the river corridor for migration or the wooded areas along the river for feeding and nesting areas. These birds include many species of passerine song birds, wading and shore birds, and raptors including Swainson's hawk, northern harrier, Cooper's hawk, red-tail hawk, broad-winged hawk, and migrating bald eagles.

The Sheyenne River flows through a unique natural area in southeastern North Dakota known as the Sheyenne Sandhills. The Sandhills are home to several State listed species as Endangered, Threatened, or Peripheral in North Dakota (Link 1989). Additionally, the U.S. Forest Service manages the 70,000-acre Sheyenne National Grasslands located in Ransom and Richland Counties. An important State Wildlife Management Area (WMA) along the Sheyenne River is Mirror Pool WMA, consisting of three public tracts in the Sheyenne Sandhills, scattered along 4 miles of the Sheyenne River, southeast of Enderlin, North Dakota (Heidel 1988).

Although the areas supporting fish and wildlife resources along the Red River have been substantially altered, the remaining habitats provide several important functions. Shelterbelts and riparian woodlands provide denning and nesting sites, food, escape and winter cover, and travel lanes for many wildlife species, including red and gray squirrels, chipmunk, cottontail rabbit, striped skunk, red fox, raccoon, and white-tailed deer. Common bird species include brown thrasher, American kestrel, yellow warbler, crow, robin, downy and hairy woodpeckers, flycatchers, black-capped chickadee, and warblers. Passerine birds use shelter belts and riparian forests along the river corridor as migrational routes. Species which have adapted to man's activities on the river include the house wren, robin, chipping and house sparrows, grackle, and purple martin.

The riverine habitat provides feeding and resting areas, primarily during migrational periods, for several species of waterfowl; namely mallards, Canada geese, and hooded mergansers. Wood ducks commonly breed in the area, nesting in cavities provided by the mature trees. Mink and muskrat also utilize the riparian zone, along with migrating shorebirds and birds of prey.

Grasslands

The Devils Lake basin is located within the transitional zone between the tall grass and mixed grass prairies. Historically, nearly 2 million acres of the Devils Lake basin was native grasslands, interspersed with wetlands, woodlands, and shrub lands. By the mid-1970's, only 127,875 acres of native grassland remained, comprising 8 percent of the basin's cover type (Devils Lake Basin Advisory Committee 1976). Conversion of native grassland to cropland continues, but at a much reduced rate, because most lands suitable for farming have already been plowed. Remaining grasslands are grazed or cut for hay. Various conservation programs such as Conservation Reserve Program, waterbank, and planted wildlife cover have established tame grass as an important habitat in the basin.

Grassland in association with wetlands is vital to upland nesting waterfowl and other migratory birds. Native grasslands are also important habitat for resident species such as sharp-tailed grouse, ring-necked pheasant, gray partridge, white-tailed deer, jack rabbit, skunk, badger, fox coyote, and many nongame bird species.

There are three major types of native grassland sites in the basin, each with its own distinctive plant community. These types are silty, overflow, and thin upland range sites. Silty range sites are the most common, occurring on nearly level to rolling glacial till plains, lake plains, and on high stream terraces. This grassland type is dominated by cool season grasses. In good condition, this type would be expected to have needle and thread, green needlegrass, western wheatgrass, porcupine grass, numerous forb species, and a few shrubs.

The overflow range site occurs on nearly level swales and depressions in glacial till plains and on stream terraces and floodplains, and is the second most frequently occurring grassland site. Dominant species of this type include big bluestem, switch grass, little bluestem, green needlegrass, and porcupine grass. Forbs and shrubs such as Maximilian sunflower, fringed sagebrush, western snowberry, chokecherry, and Juneberry are also common.

The other common grassland site in the basin is the thin upland site. This site is found on gently sloping to moderately steep glacial till uplands. A mixture of both cool and warm season grasses dominate this type. Principal species are needle and thread, porcupine grass, green needlegrass, and little bluestem. All native grassland areas, regardless of type, are extremely important to both game and nongame wildlife species.

Woodlands

Woodlands cover 3 percent of the basin. The native forest surrounding the Devils Lake chain ranks as one of the three largest blocks of contiguous forest remaining in the State. The North Dakota Forest Service classifies the native forest in the basin into four types: lowland hardwoods, aspen-birch, oak timber, and brush timber. Acre-for-acre prairie woodlands are second only to wetlands in providing diverse breeding habitat and cover for birds and mammals.

The lowland hardwoods type is composed primarily of American elm, green ash, box elder, cottonwood, and basswood. This type predominates along water drainages and river bottoms.

The primary species in the aspen-birch type are trembling aspen, balsam poplar, and paper birch. Stands of these trees prefer northern and eastern slopes or other sites where soils are well drained, but moisture is abundant.

The oak timber type is composed primarily of bur oak. It dominates dry forest sites in the area, especially in the area south of Devils Lake. Bur oak also grows on moist sites, but in association with other species such as green ash.

The brush timber type is composed of native forest shrubs such as willows, chokecherry, American or beaked hazel, red-stemmed dogwood, hawthorne, Juneberry, pincherry, silverberry, buffaloberry, American plum, highbush cranberry, and others. Scattered native trees like bur oak and green ash are normally associated with the shrubs.

A forest inventory of the Devils Lake area by the North Dakota Forest Service in January 1980, revealed that during 1971-1977 about 6,700 acres of native forest were

converted to other uses. Agricultural clearing for cropland, hayland, and pastures, along with clearing for residential development, were the principal causes for forest conversion. In addition to the losses from clearing, about 25 percent of the native forest lands in the area are grazed by livestock.

Because North Dakota has such limited woodlands, prairie woodland habitats in the basin are valuable to a wide variety of wildlife. Prairie woodlands are especially important during winter when they provide protective cover for both game and nongame wildlife. Raptors such as the Swainson's hawk and great horned owl require woodlands for nesting.

Deciduous woodlands are the most important habitat type in the Sheyenne River Valley. Primary tree species include bur oak, basswood, American elm, box elder, aspen, and cottonwood. Mirror Pool Wildlife Management Area in southeastern North Dakota includes Mirror Pool Swamp, the largest fen or peatland (dense alder and bog birch brush) on the Sheyenne River (Heidel 1988).

Most of the original prairie, which once stretched beyond the river corridor, has been replaced by farmland. Dominant tree species along the Red River include American elm, box elder, cottonwood, green ash, and basswood. Common understory species in riparian areas include willow, gooseberry, hawthorn, Juneberry, and buck brush. Species such as Solomon's seal, nodding trillium, asters, wood nettle, violets, Canada anemone, hawksbeard, bedstraw, and columbine are common in the herb layer. The riparian vegetation also provides shading along the bank, and the fallen trees in the river provide spawning areas, create eddies, and scour holes which are used by the fisheries resource.

Since 1993, Devils Lake has inundated approximately 4,090 acres of forest. Over 1.1 million trees have died as a result (North Dakota Forest Service 1999).

Riparian Habitats

Riparian habitats are generally defined as the zone of vegetation influenced by the hydrology of streams and rivers. Riparian vegetation usually exhibit a higher degree of robustness than that located in adjacent areas, and as such, represents a transitional zone between wetland and upland environments. Riparian corridors along intermittent streams and tributaries to the Red River, Sheyenne River, and Devils Lake provide valuable habitat for fish and wildlife. Marsh habitat within riparian corridors often provide waterfowl habitat as good as prairie wetlands. Riparian areas in the Devils Lake basin and along the river corridors are important not only as habitat for fish and wildlife, but also for flood control, streambank stabilization, and to improve water quality.

During high precipitation or runoff events, riparian corridors slow the rate of surface water runoff or overland flow. The dense, thick vegetation of a healthy, unaltered riparian corridor, and its deep humus layer of soil, act as retardants, holding back and slowing runoff. Cottonwood, ash, and elm with their deep roots, and willow, dogwood, and buck brush with shallow, dense roots effectively hold the soil in place and deflect water to reduce streambank erosion. Riparian areas can improve water quality by acting as filters to remove chemical compounds, toxic substances, sediments, and trash as the water moves through the system.

8.1.3 Threatened or Endangered Species and Rare Species

North Dakota Threatened or Endangered Species: Federally endangered and threatened species that may be present in the Devils Lake basin include the bald eagle (*Haliaeetus leucocephalus*) and piping plover (*Charadrius melodus*). The bald eagle generally migrates through the area, but beginning in 1998, eagles have nested on the shore of Devils Lake. Piping plovers migrate through the project area and are recorded as nesting on exposed alkaline shoreline within the basin.

Federally endangered and threatened species that may be present along the Sheyenne and Red River corridors include the bald eagle (*Haliaeetus leucocephalus*) and western prairie fringed orchid (*Platanthera praeclara*). Bald eagles often utilize water courses and river valleys as migration routes and temporary feeding sites. The Red River Valley and its tributaries, including the Sheyenne River, are primary migration routes across eastern North Dakota.

A list of federally endangered and threatened species for each county in the project areas is provided in Table 8.3. This list fulfills requirements of the Fish and Wildlife Service under Section 7 of the Endangered Species Act.

If a Federal agency authorizes, funds, or carries out a proposed action, the responsible Federal agency, or its delegated agent, is required to evaluate whether the proposed action "may affect" listed species. If it is determined that the action "may affect" a listed species, then the responsible Federal agency shall request formal Section 7 consultation with this office. If the evaluation shows a "no effect" situation on the listed species, further consultation is not necessary.

Table 8-3. County Occurrence of Threatened and Endangered Species in North Dakota.

Species	Ramsey	Benson	Towner	Cavalier	Nelson	Walsh	Sheridan	Wells	Eddy	Griggs	Barnes	Ransom	Richland	Cass	Gr. Forks	Pembina	Traill
Devils Lake Counties																	
Bald Eagle - T	X	X	X	X	X	X											
Whooping Crane - E		X	X	X													
Gray Wolf - E			X	X		X											
Piping Plover -T		X															
Sheyenne River Counties																	
Bald Eagle - T		X			X		X	X	X	X	X	X	X	X			
Whooping Crane - E		X					X	X	X	X	X						
Piping Plover - T		X					X	X	X								
W. P. Fringed Orchid - T												X	X				
Red River Counties																	
Bald Eagle - T						X							X	X	X	X	X
Whooping Crane - E																	
Piping Plover - T																	
W. P. Fringed Orchid - T													X				
Gray Wolf - E						X									X	X	

As a result of this and other projects, the Service maintains a concern for the western prairie fringed orchid, a federally listed threatened species located throughout the Sheyenne National Grasslands and adjacent areas in Ransom and Richland Counties. The western prairie fringed orchid is a perennial orchid of the North American tallgrass prairie and is found most often on unplowed, calcareous prairies and sedge meadows. In North Dakota, the orchid most frequently occurs in the sedge meadow community on the glacial Sheyenne Delta and also in the moist tallgrass prairies.

The major cause of the species' decline was the conversion of habitat to cropland. The tallgrass prairie is arguably the most impacted ecosystem in North America, with an estimated 1-5 percent remaining throughout its original range. Three orchid metapopulations exist, two in the United States (Sheyenne Delta, North Dakota, and Pembina Trail prairie complex in Minnesota), and one in Canada (Vita Prairies, Manitoba). On the Sheyenne Delta, about 95 percent of the orchids occur on the Sheyenne National Grasslands administered by the U.S. Forest Service and 5 percent on private land.

During the summer of 1998, the Service discussed the proposed Devils Lake 300 cfs outlet project and its potential orchid impacts with several orchid experts and a Service hydrologist. Based on the preliminary discussions, the Service expressed a concern about the additional water in the Sheyenne River system resulting from a Devils Lake outlet, causing the Sheyenne River to flow at or near bank full for extended periods of time. The Service's concern was that high river flow conditions in the Sheyenne Delta region may prolong the naturally occurring, seasonal reverse gradient of the Sheyenne Delta aquifer. Concern was expressed that maintaining a reverse gradient for an extended period of time into the growing season could prevent wetlands and low lying swales from percolating their spring snow melt and precipitation into the aquifer until very late into the growing season.

Wetlands and low lying swales that support orchid populations could be negatively impacted by disrupting the natural hydrologic wetland fluctuation, thought to be necessary for orchid survival. Periodic floods and drought are two of several natural events that play a significant role in perpetuating wetlands and swales that support orchids. Hydrologic factors such as the timing, duration, and extent of flooding could have a significant impact on orchids, especially flowering, seed set, and seed germination. Additionally, a stable hydrologic condition would likely result in a shift in the vegetative composition of the associated wetlands, which could have ramifications to both the soil and water chemistry, as well as water quality in orchid habitat.

As a result of Service concerns, the Corps contracted Barr Engineering Company (Barr) to produce a groundwater report to address these issues. Barr produced a report entitled, "Devils Lake Outlet/Baldhill Pool Raise, Independent Analysis of

Effects of the Planned Operation of the Devils Lake Outlet and Baldhill Pool Raise Projects on Groundwater Levels in the Sheyenne Delta, September 1998."

The report assumed a continuous volume of water in the Sheyenne River of 300 cfs, and that the additional water will increase the river stage of the river between Lisbon and Kindred, North Dakota, for a 7-month pumping period (May 1 through December 1). The objective of the study was to determine the effects of increased river stages due to the operation of the outlet on groundwater levels and groundwater quality in the Sheyenne Delta Aquifer in the Sheyenne National Grasslands.

To determine potential effects to the groundwater, the study constructed a series of profile models of groundwater flows, perpendicular to the river, and parallel to regional groundwater flow directions, spaced across the Sheyenne Delta aquifer. The computer code MODFLOW was used to construct these models. The results of the MODFLOW simulation determined that with the exception of cross section 4, water levels in the remaining five cross sections increased less than 0.1 foot (1.2 inches) at a distance of 600 feet from the river. Water level increases in cross section 4 are below 0.1 feet at approximately 750 feet from the river. The report determined that there is essentially no effect to the groundwater from the outlet project at a distance of 1,400 feet from the river for any of the six cross sections.

The results of this study imply that there will be a minor effect to the Sheyenne Delta aquifer, as a result of additional water levels in the Sheyenne River from the Devils Lake outlet project.

Table 8-4 lists the threatened Minnesota species for Clay, Norman, Polk, Marshall, and Kittson Counties. These counties border the Red River of the North from Moorhead, Minnesota, north to the Canadian border. The Canada lynx is being proposed only for Kittson County.

Table 8-4. County Occurrence of Threatened Species in Minnesota.

Species	Clay	Norman	Polk	Marshall	Kittson
Western prairie fringed orchid (*Platanthera praeclara*)	X	X	X		X
Gray wolf (*Canis lupus*)			X	X	X
Bald eagle (*Haliaeetus leucocephalus*)			X	X	X
Canada lynx (*Lynx canadensis)*					X

North Dakota Rare Species: The North Dakota Parks and Recreation Department, Natural Heritage Inventory, compiles and maintains a database documenting the statewide status and location of rare flora and fauna, ecological communities, and unique geological features. Of special significance and importance are The Nature Conservancy's Pigeon Point Preserve and North Dakota Game & Fish's Mirror Pool State Nature Preserve. It is noteworthy that the Sheyenne Delta, which includes these two important natural resource preserves, supports the largest diversity of plant species in North Dakota.

The Pigeon Point Preserve is located in Ransom County, at T. 135 N., R. 53 W., Section 19, and SE¼, and W½, NE¼ of Section 18. Pigeon Point is very unique, with respect to the diversity of wetland habitats and plant species. This preserve consists of a series of spring fed wetlands along the Sheyenne River. This site is host to at least 18 rare species, which have been recorded in its fen and wetland thickets. Pigeon Point has one of the best developed spring fed streams along the Sheyenne River located in Section 19.

Mirror Pool State Nature Preserve is a 431-acre preserve in Richland and Ransom Counties, consisting of two units located both north and south of the Sheyenne River. The Preserve is noted for possessing some of the best quality wetlands along the Sheyenne River. The wetland community is comprised of both fen and thicket communities, which are home to 15 rare plant species. Of special note is the green keeled cottonsedge (*Eriophorum viridicarinatum*), a rare fern known to be located in

only one other site in North Dakota, and moonwort (*Botrychium minganense*), which is known to be located in two other sites in the State. Mirror Pool is an excellent example of an eastern deciduous forest, complemented by an assemblage of rare fern species and extensive oxbow wetlands, with alder lined spring-fed tributaries. It is important to note that all the primary features of Mirror Pool are located in the valley bottom or associated with groundwater seepage and springs near the valley wall. It will be critical that these unique natural features are studied closely for any alteration due to excessively high water resulting from Devils Lake water in the Sheyenne River.

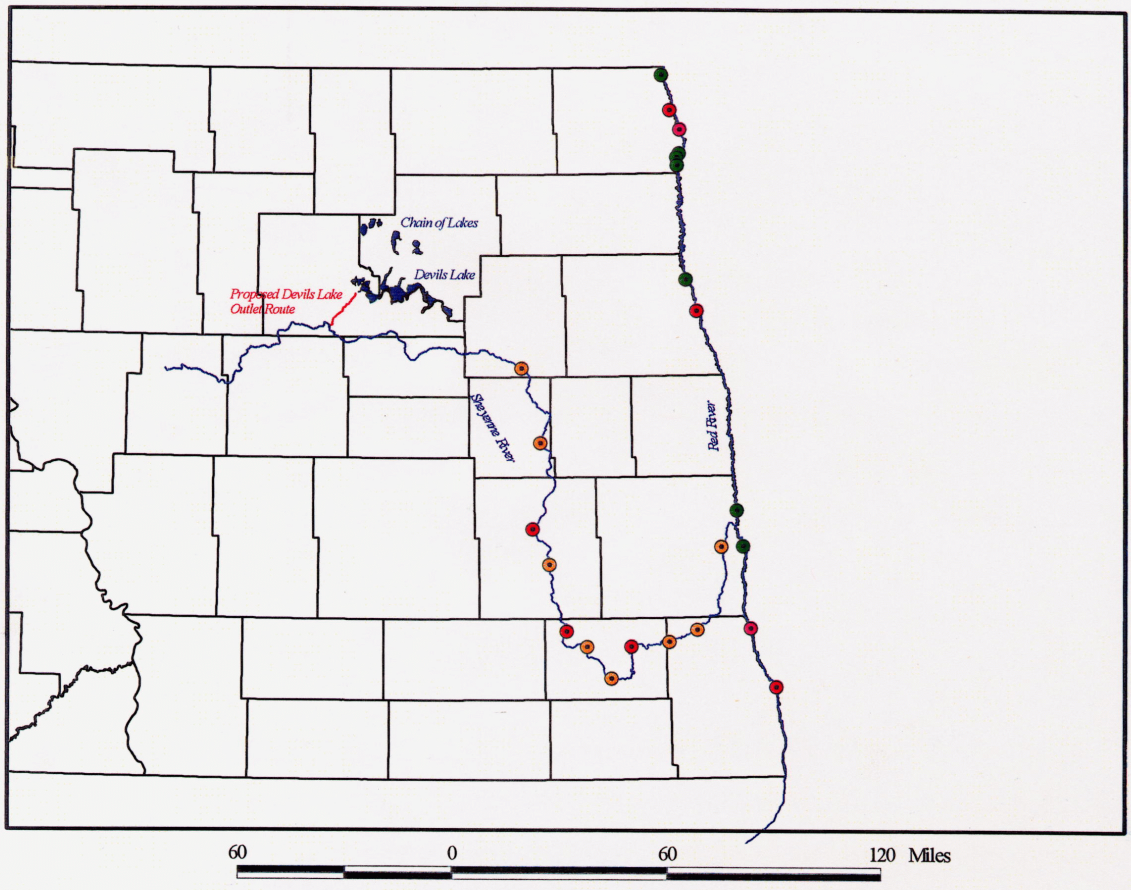
The distribution of North Dakota's rare mussel and fish species are indicated on Maps 1 and 2, respectively. (Natural Heritage Program database provided by the Natural Heritage Program, ND Parks and Recreation, Bismarck, ND. Digital data provided by the Corps, St Paul, Minnesota).

8.1.4 Special Resource Areas

There are a number of public wildlife lands within the basin that are managed for the benefit of fish and wildlife resources. The North Dakota Game and Fish Department manages seven Wildlife Management Areas (Black Swan, Crary, Minnewaukan, Nesvig, Pelican Township, C.C. Underwood, and Kenner Marsh) within the Devils Lake basin, totaling 2,513 acres.

The Service administers fee title National Wildlife Refuges (NWR) and Waterfowl Production Areas (WPA), as well as wetland easement tracts and easement refuges throughout the State of North Dakota. Wetland easements, while still in private ownership, are protected from all drainage, filling, and burning activities. The Service requires that all practical actions be taken to avoid impacts to wetlands under its jurisdiction during project construction. Although permits for activities are generally not required on these lands if facilities are placed in the existing rights -of-way, Special Use or right-of-way permits will be necessary for any construction activities on fee lands or easements where wetland are impacted.

North Dakota Rare Mussel Species



LEGEND

North Dakota Rare Mussel Species
- Ligumia recta (black sandshell)
- Quadrula quadrula (mapleleaf)
- Potamilus alatus (pink heelsplitter)
- Fusconaia flava (Wabash pigtoe)

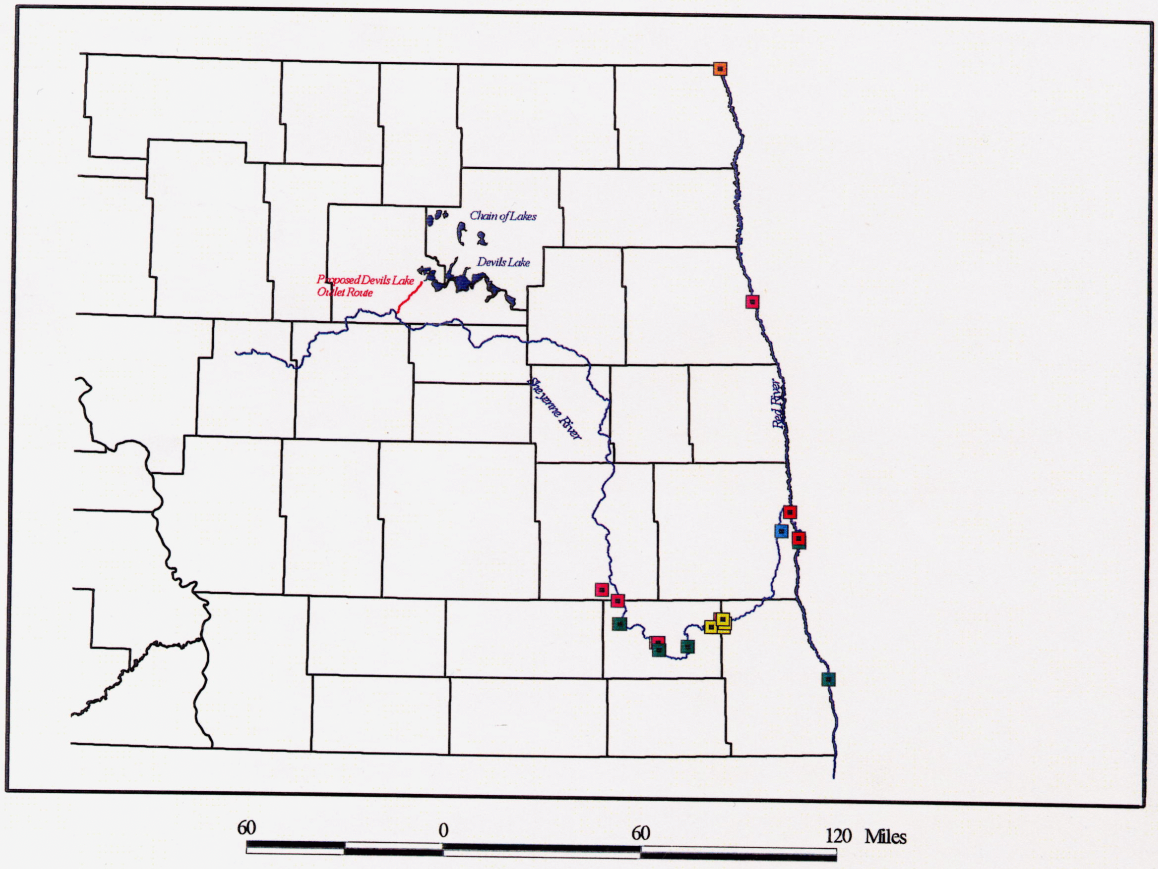
Sheyenne and Red Rivers
ND Counties
Devils Lake
Chain of Lakes
Devils Lake Outlet

N
W E
S

Map produced by the U.S. Fish and Wildlife Service, Ecological Services, Bismarck, North Dakota, 1999.
Natural Heritage Program database provided by the North Dakota Natural Heritage Program, North Dakota Parks and Recreation Department, Bismarck, North Dakota.
Digital database provided by the Corps of Engineers, St. Paul, Minnesota.

Map 1.

North Dakota Rare Fish Species



LEGEND

North Dakota Rare Fish Species
- Fundulus diaphanus (banded killifish)
- Percina caprodes (logperch)
- Notropis heterolepis (blacknose shiner)
- N. anogenus (pugnose shiner)
- N. blennius (river shiner)
- N. rubellus (rosyface shiner)
- Phoxinus eos (northern redbelly dace)
- Moxostoma valenciennesi (greater redhorse)
- Ictalurus natalis (yellow bullhead)

Sheyenne and Red Rivers
ND Counties
Devils Lake
Chain of Lakes
Devils Lake Outlet

N
W E
S

Map produced by the U.S. Fish and Wildlife Service, Ecological Services, Bismarck, North Dakota, 1999.
Natural Heritage Program database provided by the North Dakota Natural Heritage Program, North Dakota Parks and Recreation Department, Bismarck, North Dakota.
Digital database provided by the Corps of Engineers, St. Paul, Minnesota.

Map 2.

Within the Devils Lake Wetland Management District, the Service administers 14,786 acres of fee title refuge lands, 48,065 acres of WPA's, 154,748 acres of wetland easements, and 18,868 acres of refuge easement. All Service administered properties contain intact wetlands currently functioning to store water and preventing additional inflows to Devils Lake.

The Service has developed a digital database that depicts all Service fee title and wetland easement tracts for the Devils Lake basin. This database has previously been distributed to the Corps in a digital format. It is important to understand that the areas depicted as fee title lands are for illustrative purposes only and do not represent legal boundaries of owned units. Additionally, wetlands displayed on the map are derived from the Service's NWI and may not represent the actual size, location, shape, or existence of wetlands protected by individual easement agreements. For more detailed information on the boundaries of fee title land or easement areas, please contact the Service's Wetlands Acquisition Office, Bismarck, North Dakota.

8.2 FUTURE WITHOUT THE PROJECT

8.2.1 Aquatic Resources

When analyzing the future without project conditions, both the stochastic and wet future scenarios must be taken into account. The wet future scenario assumes the lake to rise to its overflow elevation of 1459 msl, and in the process the lake would cover approximately 330,000 acres in the Devils Lake basin. In the event of a spill out of the basin, the overall water quality of the lake would improve while the water quality of the Sheyenne River will be degraded with poorer Devils Lake water quality.

For evaluating the future without project aquatic resources conditions, four locations along the Sheyenne and Red Rivers were selected to review chloride and TDS impacts associated with a spill from Devils Lake to the Sheyenne River. The wet future model assumes that a spill will occur between 2014-2024. All traces show the spill along with the chloride impacts occurring from the West Bay and Pelican Lake outlet alternatives.

The results of the HEC5Q water model suggest a variety of chloride and TDS impacts associated with an overflow from Devils Lake to the Sheyenne River. The four locations are based on the HEC5Q map editor, naming convention and its corresponding river mile identifier (Figure 8.1). In order to determine the impacts along the entire Sheyenne and Red Rivers, sites were chosen on the upper Sheyenne River, upper end of Lake Ashtabula, lower Sheyenne, and the Red River. They are:

1. Cooperstown, river mile 406.4, upper Sheyenne River near Warwick.

2. Baldhill, river mile 296.9, upper end of Lake Ashtabula.
3. Valley City, river mile 261.8, in the Valley City vicinity.
4. Grand Forks, river mile 297.5, in the Grand Forks vicinity.

Wetlands

Wetlands would continue to be inundated by a rising Devils Lake to approximately 1459 msl, which is the natural overflow out of the basin. This occurrence will result in the conversions of temporary, seasonal, and semipermanent palustrine (PEMA, PEMC, and PEMF) wetlands to lacustrine wetlands (L1 or L2). Under the stochastic method, the probability of a natural overflow is about 10 percent, rendering the likelihood of this occurring remote. The acres of wetlands converted from emergent to lacustrine is dependent of the eventual lake level.

The natural transition of palustrine to lacustrine wetlands is not viewed as a negative impact, as it's normal for wetlands to fluctuate between open water, emergent, or dry depending on hydrologic conditions. Although the lake rise would result in a loss of emergent wetlands, used by waterfowl and shorebirds as nesting and brood habitat, to more open water habitat, the change would be temporary in nature. The inundated palustrine wetlands will eventually re-emerge once lake levels decline.

Along the Sheyenne and Red Rivers, wetlands will generally not be affected under the stochastic scenario, as the chance of an overflow is only about 10 percent. However, under the wet future scenario, an overflow is expected that will have significant impacts to the wetland resources along the Sheyenne River. The major impact will occur to the floodplain wetlands along the river corridors. This flooding will likely change the water regime and permanency of the wetland. Degraded water quality will alter the water chemistry of the wetland.

Fishery

With the rising lake levels under the wet future scenario, it is expected that the lake's fishery will continue to improve as newly flooded habitat becomes productive spawning habitat for the lake's fish species. Similar gains in fish habitat will be seen in the stochastic scenario to whatever lake level the lake eventually stabilizes at. In time, however, Devils Lake will begin to recede, as all prairie lake do. And when it does, the fishery will be adversely affected by the loss of habitat, significantly degraded water quality, and the concentration of fish in a receding lake. Natural reproduction of the lake's fish species will cease when water quality reaches approximately 2500 mg/l TDS.

In the event of an overflow from Devils Lake to the Sheyenne River, TDS impacts will likely suppress natural reproduction in fish species. At the Cooperstown river mile 406.4, TDS will reach a peak of 3630 mg/l in the second year of the 10-year spill

sequence, and remain above 2500 mg/l for a total of 5 years (Figure 8.3). At Baldhill, river mile 296.9, TDS will peak at 3347 mg/l in the second year of the spill, and remain above 2500 mg/l for 4 years (Figure 8.5). At the Valley City river mile 261.8 site, TDS will peak in the second year at 2700 mg/l, fall below 2160 mg/l the third and fourth years, and rise again to approximately 2500 mg/l the fifth year, before falling well below 2500 mg/l for the remainder of the spill (Figure 8.7). TDS levels will not be a factor for fish reproduction at the Grand Forks river mile 297.5 site, as TDS rises to approximately 950 mg/l. (Figure 8.9).

In a natural overflow event predicted under the wet future, it's possible that Devils Lake fish species could be introduced to the Sheyenne and Red Rivers through the Tolna Coulee. Under the stochastic method, the lake's chance of overflowing out of the basin is approximately 10 percent. Striped bass were stocked in Devils Lake in 1977. No reproduction or hybridization is known to have occurred. The striped bass is the only species recorded in Devils Lake that's not in the Sheyenne and Red Rivers. If the striped bass exists in Devils Lake, they are in very low numbers and is not likely that this fish would be introduced downstream.

Continued infrastructure protection measures will increase disturbance and turbidity that will affect a temporary impact to aquatic species in Devils Lake.

Aquatic Mollusks

Chloride impacts of a natural overflow under the wet future scenario would be catastrophic to the aquatic mollusks of the Sheyenne River. Chloride levels would exceed 300 mg/l, likely eliminating most mussel species from the Sheyenne River. Under a stochastic method, however, there is a 90 percent chance the lake would not overflow. In the 10 percent chance that it would, similar results are expected to occur as in the wet future.

In the event of an overflow to the Sheyenne River, chloride levels are expected to attain lethal levels, with chloride concentrations at the Cooperstown river mile 406.4 site ranging from approximately 360 mg/l at the beginning of the spill to 150 mg/l by the tenth and final year of the spill (Figure 8.2). At the Baldhill river mile 296.9 site, chloride levels would range from a high of 330 mg/l in the second year of the spill, and gradually decline to 100 mg/l in the tenth year of the spill (Figure 8.4). Chloride concentrations at the Valley City river mile 261.8, range from a high of 250 mg/l in the second year to approximately 100 mg/l in the eighth year of the spill (Figure 8.6). Chloride levels are not expected to reach lethal limits at the Grand Forks river mile 297.5 site, as levels generally stay below 50 mg/l, rising to a peak of approximately 65 mg/l in the sixth year of the spill (Figure 8.8).

Water Quality

Using the wet future approach, the effects of a spill of Devils Lake water into the Sheyenne would be very serious (Table 8-5).

Table 8.5. Peak constituents of a Devils Lake overflow using the wet future approach.

Location / River Mile	River	Chloride (mg/l)	TDS (mg/l)	Sulfate (mg/l)
Cooperstown / 406.4	Sheyenne	360	3630	1773
Baldhill / 296.9	Sheyenne	330	3347	1610
Valley City / 261.8	Sheyenne	250	2700	1258
Grand Forks / 297.5	Red	65	950	350

Using the HEC5Q water model, all constituents peak within the first 2 to 3 years following the spill (generally 2014-2016). After 2016, the constituent levels gradually decline back to the base pre-spill levels, coinciding with the end of the spill in the year 2024. The effects are less pronounced as the water moves downstream in the Sheyenne and Red Rivers, and into Canada. Clearly, the impact of a natural spill would be devastating. Natural reproduction of fish would cease, with TDS levels above 2500 mg/l. This would mean that the upper Sheyenne, Lake Ashtabula, and the lower Sheyenne would be severely impacted, and face a loss of natural fish reproduction. Although TDS and sulfate levels on the Red River are well below that seen on the Sheyenne River, they are still above the State standard of 500 mg/l and 250 mg/l, respectively. Chloride levels above 100 mg/l have been shown to have detrimental impacts to mussel populations. Chloride levels at 65 mg/l in the Red River are not likely to have a dramatic effect to aquatic species.

8.2.2 Terrestrial Resources

Wildlife, grasslands, woodlands, and riparian habitats within the basin will be impacted as the lake rises. Wildlife in the basin will generally be expected to relocate and adapt to the gradual loss of habitat due to the rise of lake levels. Inundated grasslands will be converted to aquatic habitat and will provide excellent spawning and nursery habitat for the fishery. Woodlands are perhaps the terrestrial resources at greatest risk, as they will be negatively impacted as inundated tree species are flooded and subsequently killed.

Terrestrial resources along the Sheyenne and Red Rivers will be affected to varying degrees. The wildlife along the river corridors will relocate and adapt to the overbank flooding associated with the increase of water due to the outlet. Grasslands and the riparian habitats may be impacted by overbank flooding. Grasslands would likely transition into wetlands and riparian habitats may be negatively impacted if flooding is persistent.

Under the stochastic approach, there is a 90 percent chance that no flooding would occur on the Sheyenne or Red Rivers due to an overflow event. If an overflow event were to occur, the impacts would likely be similar to that under the wet future scenario.

8.2.3 Threatened or Endangered Species and Rare Species

Federally listed threatened or endangered species are not expected to be impacted. State listed rare mussel and fish species that occur in the Sheyenne River will likely be impacted by the wet future scenario's prediction of an overflow from the Devils Lake basin into the Sheyenne River. The degradation of water quality will eliminate many mussel species due to high chloride levels, and natural reproduction of fish species will likely be restricted by high TDS levels.

8.2.4 Special Resource Areas

Pigeon Point, along the lower Sheyenne River, could be adversely impacted due to bank-full conditions and overbank flooding. The riparian community along the river contains many State listed rare species that could potentially be adversely impacted.

9.0 SUMMARY OF PLAN SELECTION PROCESS AND IDENTIFICATION OF EVALUATED ALTERNATIVES

As of this draft, the Corps has not identified a preferred alternative. The Draft EIS, reviewed by the Service, describes all the alternatives and their anticipated impacts. The intent of the Draft EIS, and eventually the Final EIS, is to provide the decision makers in Congress the information with which to make a decision of whether or not to authorize this project.

Based on reviewing the data, all alternatives will have environmental impacts, are not effective at preventing future flood damages or lowering the lake, and do not meet a favorable cost/benefit ratio using standard Corps procedures. At this time, there is no monitoring plan to determine future natural resource impacts, or a mitigation plan to offset resource impacts resulting from the project.

10.0 DESCRIPTION OF PROPOSED ACTION AND EVALUATED ALTERNATIVES

10.1 Future Without the Proposed Project (No Action Alternative)

The Future Without the Proposed Project (No Action Alternative) assumes that the various types of emergency measures that are currently being implemented in the project area will continue to be implemented if the lake rises. The emergency measures include continued levee raises to protect the city of Devils Lake and the relocation of homes in danger of being flooded due to lake level rises. Measures may also include temporary levees and the selected raising of transportation routes (roads and railroads), and the protection or relocation of utilities structures or features. All of these additional measures will be subject to technical and economic feasibility. This alternative also assumes the current level of upper basin storage and precaution taken to minimize the risk of erosion at the natural outlet.

The Corps should include the proposed construction of a west end outlet by the State of North Dakota as part of the future without the proposed project. This position is reinforced by the State's repeated public assurances that they will construct an outlet if the Corps does not build the Federal project. To that end, the State has hired a contractor to design a west end outlet.

10.2 Upper Basin Management

The Service has long maintained that reducing the inflows into Devils Lake is a positive action that can help slow the rise of the lake. In response to the Service and other agencies' requests to study this alternative, the Corps initiated an upper basin storage evaluation in the fall of 1999. The evaluation was conducted by WEST Consultants, Inc., a San Diego, California, engineering firm specializing in the development of hydrologic models. The primary goal of the study was to identify and delineate topographic depressions as either "intact" or "drained" using DEM topographic information. Following the DEM depression classification, a physically based hydrologic model was developed to simulate the hydrologic functions of the depressions in order to calculate the amount of potential storage within the upper basin's drained depressions. WEST's final report, "Devils Lake Upper Basin Storage Evaluation," was issued April 30, 2001.

When evaluating this report, it is important to remember that only 68 percent of the Devils Lake basin is included in this study (Table 10.1). WEST's report includes modeling for Edmore, Starkweather, St. Joe, Calio, Mauvais Coulee, Hurricane Lake, and Comstock subwatersheds. The Devils Lake and Stump Lake subwatersheds (20 percent and 12 percent of the basin, respectively) were excluded from the study. The exclusion of 32 percent of the basin means that the numbers and acres of intact and drained depressions are lower than what really exists in the entire basin.

Table 10.1. Drainage areas for the Devils Lake subwatersheds.

Subwatershed	Drainage Area (mi2)	Percent of Basin	Cumulative Subwatershed Percent
Edmore	595	15.4	68
Starkweather	320	8.3	
St. Joe	125	3.3	
Calio	129	3.3	
Mauvais Coulee	1,010	26	
Hurricane Lake	372	10	
Comstock	65	1.7	
Devils Lake*	757	20	32
Stump Lake*	485	12	
Total	3,858	100	100

*Subwatersheds not included in the WEST study.

The DEM grid for Devils Lake was based on a 5-foot contour interval data for 65 percent of the upper basin, with 10-foot contour data covering the western 35 percent of the basin (Comstock, Hurricane Lake, and western Mauvais Coulee subwatersheds). Because many DEM depressions were not identified with both the 5-foot and 10-foot contour data, the DEM derived depressions were supplemented with digital NWI wetland data and aerial photography.

While the use of NWI data would be acceptable for including *wetland* basin delineations, it does not assist in the identification and location of *drained* depressions, which is the most important part of the data set in the study. The use of NWI also does not provide wetland depressions that were drained after the date of NWI aerial photography used to make the maps, which in most cases is 1979, with some 1983 photography. As a result, it's likely that a significant number of drained depressions were never included in this study due to the limitations of the DEM data, a fact that WEST acknowledges.

The WEST report identified approximately 200,000 acres of intact depressions and 92,000 acres of drained depressions (see Table 10.2). The Service believes the estimate of drained depressions has been underestimated by at least 50 percent. In agreement with the Service,

WEST provided three reasons why they believe the numbers of intact and drained depressions are likely underestimated. They are:

1.01 The use of the NWI digital data represents only wetland boundaries, not the full capacity of the depression within which the wetland is situated.

1.02
A number of DEM depression polygons appeared to be smaller in area than the corresponding depressions when compared to aerial photos.

1.03
Both intact and drained depressions were likely missed by the DEM, especially in the 10-foot contour interval data, and the NWI data likely contains some error of wetland omission.

For the above stated reasons, WEST recommends that more intensive analysis be completed, along with a field verification, to refine the numbers.

Table10.2. Intact and drained depressions as determined by the WEST study.

Depression Type	Count	Area (acres)	Volume (ac-ft)
Intact	63,458	201,990	481,604
Drained	52,210	92,429	132,729
Total	115,668	294,419	614,333

WEST used drained depressions having an average depth of greater than or equal to 0.5 foot as candidates for restoration. There were a total of 13,464 drained depressions (26 percent of the total number of possibly drained depressions) having a surface area of 79,762 acres (86 percent of the total drained depression surface area) and a total volume of 127,835 acre-feet (96 percent of the total drained depression volume). Various levels of restoration were analyzed (25, 50, 75, and 100 percent by volume of the restoration candidates). The selection process was not optimized by drainage area or location. Table 10.3 summarizes the surface area and volume of the restored depressions for the different restoration levels.

Table 10.3. Surface area and volume of restored depressions.

Restoration Level	25%	50%	75%	100%
Area Restored, acres	19,472	39,681	59,872	79,762
Volume Restored, acre-ft.	31,431	63,608	94,850	127,835

The effect of the missed depressions on the total depression count, as indicated in number 3 above, cannot be underestimated. A recent study using DEM data has concluded that the

use of DEM's for the identification of depressions is an inaccurate method of delineation (Johnson 2001). This is certainly true of the WEST study, as the DEM data did not accurately identify the presence of depressions on the data, especially the 10-foot contour data. This fact is supported with WEST's data, which shows that 65 percent of the total depression count was added using NWI digital wetland data (Table 10.4).

Table 10.4. DEM and non-DEM WEST depressions in the Devils Lake basin.

Depression Source	Count (% of total)	Area (acres)	Volume (ac-ft)
DEM	39,723 (34%)	252,310	567,303
Non-DEM: Added from NWI: Added manually based on aerial photos:	 75,117 (65%) 828 (1%)	 35,242 6,867	 29,028 18,002
Total	115,668	294,419	614,333

Johnson (2001) evaluated three techniques to identify and delineate drained wetland depressions in four Minnesota counties. The evaluated techniques were: 1) photo interpretation of stereoscopic aerial photography; 2) the use of digital hydric soils data; and 3) DEM data. Johnson concludes that all techniques evaluated for identifying drained depressional wetlands in agricultural settings performed the best when applied to large drained wetlands (generally <10 acres). The photo interpretation method proved to be the most accurate and reliable method of delineating regardless of size.

A total of 1,482 drained wetlands were field verified in Jackson, Grant, and Rice Counties. Of the 1,228 basins that were 5 acres or less in size, the photo interpretation method delineated 1,157, or 94 percent, while DEM's only identified 69, or 5.6 percent (Table 10.5).

Table 10.5. Number of wetlands observed in the field and correct delineations by drained wetland size (Johnson 2001).

Size (acres)	Wetlands	PI	DEM
0-2	984	915	36
2-5	244	242	33
5-10	120	120	19
>10	133	133	33
Total	1,482	1,410	121

The percent commission and omission error rates by county and technique are shown in Table 10.6. The photo interpretation method has commission error rates of less than 2.9 percent, with omission of wetlands no greater than 6.3 percent. The DEM data performed miserably by comparison, with commission rates ranging from 7.7 to 23.1 percent. Omission rates ranged from 89.1 to 96.8 percent. With these types of omission rates, using this DEM data is ineffective for identifying depressional basins on any consistent basis.

Table 10.6. Percent commission/omission error rates by county and technique (Johnson 2001).

	PI	DEM
Jackson	2.9/6.3	18.2/96.8
Grant	0.6/3.3	7.7/90.3
Rice	1.2/6.2	23.1/89.1

Table 10.7 provides the mean commission/omission error rates and the 95 percent confidence interval by technique for the prairie pothole wetland counties of the study area. This table clearly shows the superior performance of the photo interpretation technique over the DEM method. An omission rate of 4.9 percent versus 91.9 percent for photo interpretation over DEM proves that the reliability is not there with respect to the DEM data, and that the only effective way to delineate depressional data is through the use of photo interpretation techniques.

Table 10.7. Mean commission/omission error rates and 95 percent confidence intervals by technique for prairie pothole region of Jackson and Grant Counties (Johnson 2001).

Technique	Commission	95% CI	Omission	95% CI
PI	1.4	0-3.471	4.9	1.052-8.892
DEM	8.0	0-19.608	91.9	81.732-100

Table 10.8 reflects the commission/omission error rates by technique and size for the pothole counties. Not surprisingly, the greatest error rate is associated with the smallest wetland size.

Table 10.8. Percent commission/omission error rates by technique and drained wetland size class in Jackson and Grant Counties (Johnson 2001).

Size (acres)	PI	DEM
0-2	2.7/7.0	23.3/97.1
2-5	0.5/0.5	4.8/89.8
5-10	0/0	0/84.5
>10	0/0	4.3/78.7
All sizes	1.8/4.7	9.9/93.2

While the WEST study is an informative product, given the techniques used and the short timeframe allotted for the study, it should not be viewed as the definitive study to determine depressional storage, but as one which identifies a minimum of drained wetland depressions. WEST was forthcoming about the shortcomings of the study and recommended further refinement and field verification of depressions be completed. To date, these have not been completed.

10.3 Expanded Infrastructure Measures

This alternative addresses the fact that portions of North Dakota Highways 20 and 57 and Bureau of Indian Affairs (BIA) Roads 1, 4, and 5 on the Spirit Lake Indian Reservation are serving as dams against the rise of Devils Lake, when they were not constructed to serve as such.

10.4 Devils Lake Outlet Alternatives

The following discussion focuses on the various outlet alternatives for Devils Lake. Table 10.9 presents the alternatives as they are currently designed. All outlet alternatives use the Corps' alternative number as indicated in the Draft Devils Lake, North Dakota Comparison of Outlet/Bypass Alternatives table. The outlet alternatives are numbered 1, 5, 8, 6, 7, and 12. At this time, numbers 1, 5, and 8 are considered to be the only viable outlet options, while numbers 6, 7, and 12 have been screened from further review at this time. However, due to the commonality between the outlet configurations and the fact that many outlet alternatives thought to be screened from consideration in the past have resurfaced for evaluation, outlet numbers 6, 7, and 12 will be discussed.

At this time, outlet number 8, the Pelican Lake 300 cfs outlet, is a likely preferred alternative based on cost and downstream water quality considerations. Number 5, the Pelican Lake 480 cfs outlet, generally has a lesser degree of impact on downstream water quality, but is not considered the preferred alternative due to its high cost.

Table 10.9. Comparison of Devils Lake Outlet/Bypass Alternatives.

	1	5 (PL2)	8 (PL1)	6	7	12
	WB480	PelBypass480	PelOut300	WB300	WB480	EastDL
Sulfate Constraint (mg/l)	450	250	450	450	None	None
Construction Costs	81	149	74	51.2	81.3	42.6
Total First Costs	105	191	97.7	71.4	147.9	138.1
Stochastic						
BCR		0.14	0.37	0.28	0.01	0.02
Lake Stage (base 1459.0 msl) [1]		1455	1455	1456	1453	1453
Wet Future						
BCR		1.38	2.62	3.09	2.37	2.85
Lake Stage (base 1460.6 msl)	1454	1455	1457	1457	1452	1452
%Ex. VC-Sulfate 250 mg/l (base 0)	71	0	13	55	73	84
%Ex. VC- Sulfate 450 mg/l (base 0)	0	0	0	0	3	58
%Ex. VC TDS (base 52-57%) [2]	89	76	77	88	90	92
%Ex. Hlsd. (base 3-4%) [2]	37	7	11	27	44	59
%Ex. Ems. (base 8-10%) [2]	29	14	12	20	33	48
Moderate Future 1455 msl						
BCR		0.67	1.38	0.92	0.76	
Lake Stage (base 1455.0 msl)		1450	1450	1453	1448	
%Ex. VC (base 27-34%) [2]		72	86	84	94	
%Ex. Hlsd. (base 3-4%) [2]		7	23	14	63	
%Ex. Ems. (base 10-11%) [2]		12	16	14	40	
Moderate Future 1450 msl						
BCR		0.11	0.38	0.1	-0.06	
Lake Stage (base 1450 msl)		1449	1447	1450	1447	
%Ex. VC (base 39-43%) [2]		82	91	89	65	
%Ex. Hlsd. (base 2%) [2]		3	18	9	35	
%Ex. Ems. (base 9-11%) [2]		14	16	13	34	

Notes:

Alternatives are numbered according to the Draft Devils Lake, North Dakota Comparison of Outlet/Bypass Alternatives table.

Costs expressed in $000's.

[1] - 10% Probability lake level.

[2] - Percentage of time exceeding 500 mg/l TDS at Valley City, Hallstad, and Emerson during the first 10 years of operation. Range of base conditions is dependent on the date of starting operation of an outlet.

WB480 - West Bay 480 cfs outlet constrained to 450 mg/l sulfates and 600 cfs channel capacity.

PelBypass480 - Pelican Lake Bypass constrained to 250 mg/l sulfates and 600 cfs channel capacity.

PelOut300 - Pelican Lake Outlet (300 cfs max. discharge) constrained to 450 mg/l sulfates and 600 cfs channel capacity.

WB300 - West Bay 300 cfs outlet constrained to 450 mg/l sulfates and 600 cfs channel capacity.

WB480 - West Bay 480 cfs outlet unconstrained for water quality and quantity.

EastDL - East end outlet unconstrained for water quality.

All the outlet alternatives under consideration have negative downstream water quality impacts on the Sheyenne and Red Rivers. Furthermore, using the wet future scenario, no outlet can prevent the rise of Devils Lake or subsequent infrastructure protection measures necessary to protect the town of Devils Lake and the local area infrastructure. In every outlet alternative, the lake rises at least 5 feet; and in the preferred alternative, the lake rises 10 feet to elevation 1457 msl.

While the outlets may be shown to prevent a spill from the Devils Lake basin, it remains to be determined what impact a lake at 1457 msl will have on the basin.

10.4.1 Alternatives 1, 6, and 7: West Bay Outlet from Devils Lake south of Minnewaukan

Due to the poor water quality concerns in Devils Lake, most outlet alternatives that have been studied originate on the west end of the lake where the best water quality exists. In 1998, the Corps designed a 14-mile, 300 cfs capacity buried pipeline to transport water from Devils Lake to the Sheyenne River. In 1999, the Corps discovered that a 480 cfs pump operating without water quality or channel capacity would be needed to stabilize the lake at elevation 1447 msl, provided that the future precipitation continued at the same rate as the previous 7 years.

To convey water through the pipeline, a high head pump station is needed. The pump station will be constructed east of Round Lake and Highway 281. The buried pipeline would then extend the 13.3 miles from the pump station to the outlet structure on the Sheyenne River.

The first 2.6 miles of high pressure pipeline would be either ductile iron or steel pipe, with the remainder being reinforced concrete pipe. The section of pipeline that runs from the divide down to the Sheyenne River could be replaced by an open channel over a series of drop structures. Previous evaluations of this project have concluded that a buried pipeline is preferred over the open channel configuration. However, as a cost cutting measure, an open channel configuration may be further evaluated. Current cost estimates for numbers 1, 6, and 7 are $105, $71.4, and $147.9 million, respectively.

Recent analysis, however, concludes that the number 7 unconstrained outlet, pumping 480 cfs could not keep the lake below 1452 msl, and in the case of alternative numbers 1 and 6 the lake still rise to 1454 msl and 1457 msl, respectively, when using the wet future scenario. All pumping would be conducted during a 7-month timeframe from May through November. Devils Lake water will be pumped into the Sheyenne River at a rate not to exceed the Sheyenne's 450 mg/l sulfate constraint and its 600 cfs bank-full capacity at the insertion point. The 450 mg/l threshold is the

North Dakota State water quality standard for Class IA waters such as the Sheyenne River.

Of the West Bay alternatives, number 7 would have the most environmental impact because it has no sulfate constraints, which means that it would pump at full capacity regardless of the water quality. This fact is seen in the percent of time that water quality would be severely degraded. When looking at the wet future, the pump operation would still allow the lake to rise to 1452 msl, 5 feet higher than is currently is (1447.1). This outlet would result in severe water quality degradation in the Sheyenne and Red Rivers. Currently the Sheyenne does not exceed 250 mg/l sulfate at any time. Under this alternate at Valley City, North Dakota, the Sheyenne River would exceed 250 mg/l, 73 percent, and 450 mg/l, 3 percent, of the time, with TDS exceeding 500 mg/l, 90 percent, in a stretch of the river that has base exceedences of between 52-57 percent.

Numbers 1 and 6 are 480 and 300 cfs outlets, respectively. They are both constrained to not exceed 450 mg/l sulfates in the Sheyenne River. Neither one is effective at lowering the lake level, as the lake rises to 1454 msl with number 1, and to 1457 with number 6 under the wet future. At Valley City, the number 1 alternative exceeds 450 mg/l sulfate 71 percent, and 500 TDS 89 percent of the time. Perhaps the greatest degradation occurs at Halstad, Minnesota, and Emerson, Manitoba, Canada where TDS exceeds 500 mg/l, 37 percent, and 29 percent, respectively, when current exceedences are 3-4 percent and 8-10 percent, respectively. Number 6 is slightly less but still represents a several fold increase to 27 percent and 20 percent exceedence at Halstad and Emerson for TDS, and 55 percent exceedence of 250 mg/l of sulfate at Valley City.

10.4.2 Alternatives 5 (PL2), and 8 (PL1): Pelican Lake Outlet from West Bay Devils Lake.

Early analysis of the West Bay, Peterson Coulee outlet route indicates that the anticipated effectiveness of a west end outlet is less than desired largely due to water quality concerns. As a result, the Pelican Lake outlet alternatives have been proposed. The Pelican Lake alternatives are attractive because water flowing from the Mauvais Coulee to Pelican Lake is fresher than that in Devils Lake. Exporting water from Pelican Lake would be more effective than the West Bay outlet because more water could be pumped due to greatly improved water quality.

The Pelican Lake outlet is designed to be approximately 22 miles long. The first 6.1 mile section of the outlet would be an open channel, transporting water from Pelican Lake north of Devils Lake to just north of the town of Minnewaukan on the west end of Devils Lake. From the end of the open channel on the north side of Minnewaukan, water would be pumped through a 16.1-mile pipeline to the Sheyenne River. This

part of the pipeline would be similar to the West Bay outlet, following Peterson Coulee. In fact, an alternate configuration assumes the West Bay outlet is fully constructed and the Pelican Lake water is brought to the pump station via the open channel described above.

In an effort to obtain more fresh water from the Mauvais Coulee, the historical drainage route from Dry Lake to the Mauvais Coulee would be restored, as drainage from Dry Lake was diverted directly to Devils Lake through Channel A in 1979. A control structure will be built at the head of Channel A to re-direct flow west through the chain of lakes. A new channel could be constructed west of Dry Lake to allow flow to reach Mauvais Coulee.

There are currently two Pelican Lake alternatives, numbers 5 and 8, ranging in cost from $97.7 million for number 8 to $191 million for number 5. Both outlets are constrained to operate within a 600 cfs Sheyenne River channel capacity. Number 5 is designed not to exceed 250 mg/l sulfate concentration, with number 8 being constrained to a 450 mg/l sulfate concentration. Both alternatives operate with Channel A being diverted through the Chain of Lakes. If the combined flow of Big Coulee and Channel A exceeds 2,000 cfs, the excess is allowed to flow though Channel A and into Devils Lake. Highway 19 is used as a control structure, with all pumped water coming from the area north of Highway 19 known as Pelican Lake. Number 5 has the best water quality, due to the fact it's prevented from mixing with Devils Lake. This alternative pumps exclusively Pelican Lake water, and allows Pelican Lake to be drawn down below the level of the west bay of Devils Lake. However, if inflows to Pelican Lake exceed its capacity, excess flow will be allowed into Devils Lake. Number 8, on the other hand, does allow mixing of the water, as both Pelican Lake and Devils Lake will be maintained at the same elevation by a culvert in Highway 19.

Number 5 is a 480 cfs outlet constrained to 250 mg/l sulfate. It is the best alternative with respect to water quality, but has a $191 million cost, making it less attractive to the project sponsors. Under a wet future scenario, the lake still reaches 1455 msl. However, with respect to water quality, this alternative doesn't exceed 250 mg/l or 450 mg/l sulfate at Valley City. With respect to TDS, it is the best performing of any alternative by exceeding the Valley City base of 52-57 percent exceedence 76 percent of the time. At Halstad and Emerson, this alternative exceeds the TDS standard 7 and 14 percent of the time respectively, as compared to a base exceedence of 3-4 percent and 8-10 percent, respectively. It is clearly the most desirable of any alterative, with respect to water quality.

The number 8 alternative is a likely preferred Corps outlet at this time. It is a 300 cfs outlet constrained to 450 mg/l sulfate. The outlet is not effective at lowering the lake, as the wet future scenario expects the lake to rise another 10 feet above current lake

levels to 1457 msl. The outlet performs somewhat poorer than number 5 in terms of water quality. It does not exceed 450 mg/l sulfate at Valley City, but exceeds TDS 77 percent of the time over the base exceedence of 52-57 percent. At Halstad and Emerson, the TDS standard is exceeded 11 and 12 percent, up from 3-4 percent and 8-10 percent, respectively.

10.4.3 Alternative 12: East Devils Lake Outlet

The East Devils Lake outlet would follow existing contours, allowing for a gravity flow outlet from Stump Lake to the Sheyenne River. The construction of an east end outlet has been the topic of much discussion among the local residents, who would prefer to see it built because it is perceived to be the quickest way to move water to the Sheyenne River and keeps the best water quality in the lake.

The water quality at the east end of Devils Lake and Stump Lake is very poor. Further complicating the design of an east end outlet is that water models have not shown an outlet to be effective at reducing Devils Lake levels. Due to these factors, an east end outlet is not being considered by the Corps at this time.

Current estimates place the construction cost at $42.6 million. Although it is the most inexpensive outlet to construct, its benefits are few when calculating the benefit/cost ratio using traditional Corps methods. Using this traditional method, the B/C ratio is 0.02, and suggests the lake will rise to elevation 1453 msl. Using the wet future scenario, a B/C of 2.85 can be generated, however, the lake still goes to elevation 1452 msl.

The severe water quality impacts this alternative creates make it an unacceptable alternative. Currently at Valley City the sulfates levels in the Sheyenne River do not go above 250 mg/l. When modeling sulfates thresholds of 250 mg/l and 450 mg/l, an east end outlet would exceed these levels 84 percent and 58 percent of the time. As for TDS, the Sheyenne currently exceeds 500 mg/l between 52 percent and 57 percent of the time. The east end outlet would raise that to 92 percent exceedence.

10.4.4 Combination 1

This alternative combines the Upper Basin Storage alternative with the Expanded Infrastructure Measures alternative instead of an outlet. This alternative is relatively low cost and risk, as compared to other outlet alternatives that result in a variety of impacts on both the Sheyenne and Red Rivers.

10.4.5 Combination 2

This alternative combines the Upper Basin Storage, Expanded Infrastructure Measures, and a 300 cfs West Bay Outlet. This alternative is essentially Combination 1, with a 300 cfs west end outlet. The driving assumption behind the development of this alternative is that a less efficient and inexpensive outlet could be developed with the help of upper basin storage and infrastructure measures making up for the outlet.

10.5 Devils Lake Sensitivity Analysis

10.5.1 Moderate Futures

To better understand the sensitivity of assumptions used for future lake conditions, both with and without a project, the alternatives were evaluated in comparison to other conditions, such as a more moderate future where the lake only rises to elevations 1450 msl and 1455 msl.

10.5.1.1 1450 msl lake level.

This moderate future trace is one of the 10,000 stochastic traces and is representative of about 30 percent of all traces. In this future, the lake rises to 1450 msl about year 2014, and then recedes for the remaining 50 years. It rises to a second peak near the end of the 50-year period, but the maximum lake level during the second peak is much lower than 1450 msl.

10.5.1.2 1455 msl lake level.

This moderate future is one of the 10,000 stochastic traces and is representative of about 25 percent of those traces. In this future, the lake level rises to 1455 msl about year 2014, and then recedes for the remaining 50 years.

10.6 Raise the Natural Outlet at Tolna Coulee

The prevention of a natural overflow of Devils Lake water into the Sheyenne River through the Tolna Coulee is identified in the Corps' Purpose and Need as the basis for the project. Subsequently, preventing the overflow with a structure at the Tolna Coulee would achieve this goal. If constructed, a dam/weir would be designed at elevation 1463 msl. The structure would be a 380-foot wide concrete drop structure across the natural outlet, which would prevent any erosion of the channel.

11.0 DESCRIPTION OF IMPACTS

1.01 Chloride concentrations in the Sheyenne River and Red River as a result of outlet operations and its impact on aquatic mussels. The Service is concerned about the impact of elevated chloride concentrations in the Sheyenne River as a result of outlet operations and its effects to aquatic mussels. While documenting the distribution and ecology of mussels in the Turtle River, North Dakota, Cvancara and Harrison (1965) discovered that no mussels were recorded from a station where chloride levels were 87 parts per million (1 ppm = 1 mg/l), to the mouth of the river where levels reached 2000 ppm. Ironically, the chloride levels in the Turtle River were accompanied by unusually high dissolved oxygen and low turbidity, leading researchers to conclude that a correlation exists between high chloride and mussel absence.

The high chloride concentration of a water body presumably produces an osmoregulation problem for mollusks, wherein they lose water and necessary salts to a hypersaline surrounding medium (Cvancara 1983). The problem of high chlorides and mussel survival is complicated in that we don't know, at this time, what the critical threshold is, or how mollusks react to the sudden shock of high chloride concentrations.

Cvancara, Norby, and Alstine (1976) cited M.J. Imlay's research on the Park River, North Dakota, where he studied the correlation between high chloride levels and mussel absence. Imlay (1973) found that where chloride levels were high and mussels were absent, the potassium content was also high. Imlay also demonstrated that dissolved potassium at low levels is toxic to mussels, and suggests that the potassium ion may be more toxic to mussels than chloride. His predictive hypothesis suggests rivers with potassium concentrations of 4-7 mg/l would be marginal for mussels, and concentrations greater than 7 mg/l would have no mussels. Sheyenne River mussels were nonetheless found in mean concentrations of 6.7-11 mg/l potassium, somewhat eroding his hypothesis. However, the point is valid that high chloride levels may have a correlation with high potassium concentrations, which may combine to create habitats unsuitable for mussels. Cvancara, Norby, and Alstine (1976) found that "high chloride values (up to 86 mg/l) do not necessarily correspond to high potassium values in the Sheyenne River." However, it appears that all researchers agreed that more work was needed to evaluate the effects of potassium and chloride on mussels.

Cvancara (1965, 1970, 1972, 1974, 1975a, 1975b, 1976, 1983) repeatedly indicates that high chloride levels (about 100 mg/l or more) are associated with the absence of mussels.

The location of the North Dakota rare mussel species and their distribution in the Sheyenne and Red Rivers are presented on Map 1. Table 11-1 lists the known mussel species in North Dakota, their status, known host fish, and observed ranges of chlorides and sulfates.

	Table 11.1. North Dakota Mussel Species							
No.	Genus and Species (Author, date)	Common Name	AFS Ranking [a]	ND List [b]	Known Host Fish [c]	Total Chlorides (mg/l) [d]	Total Sulfates (mg/l) [e]	
1	Alasmidonta marginata (Say, 1818) [f]	elktoe	SC	No	WHS, NHS, SHR, ROB, WAM	n/a	n/a	
2	Amblema plicata plicata (Say, 1817)	threeridge	CS	No	SNG, WHC, BLC, YEP, ROB, GSF, BLG, PSD, NOP, CCF, WHB, WAM, LMB, SAR	7-36	n/a	
3	Anodontoides ferussacianus (I. Lea, 1834)	cylindrical papershell	CS	No	CMS, BNS, BLM, FHM, WHS, BSB, IOD,	4-107	47-1300	
4	Fusconaia flava (Rafinesque, 1820)	Wabash pigtoe	CS	Yes	BLC, WHC, BLG	23-37	n/a	
5	Lampsilis ovata (Say, 1817) [g]	pocketbook	SC	No	BLG, LMB, SMB, WHC, YEP, SAR	7-37	370 [h]	
6	L. siliquoidea (Barnes, 1823) [i]	fatmucket	CS	No	LMB, CMS, WHS, TMT, WHB, ROB, BLG, SMB, WHC, BLC, YEP, SAR, WAE	4-58	47-1100	
7	Lasmigona complanata complanata (Barnes, 1823)	white heelsplitter	CS	No	CAP, GSF, LMB, WHC	4-95	47-680	
8	L. compressa (I. Lea, 1829)	creek heelsplitter	CS	No	Unknown (poss. CAP)	10-28	47 [j]	
9	L. costata (Rafinesque, 1820) [k]	fluted-shell	CS	No	CAP	n/a	n/a	
10	Ligumia recta (Lamarck, 1819)	black sandshell	SC	Yes	BLG, LMB, WHC,	20-37	n/a	
11	Potamilus alatus (Say, 1817) [l]	pink heelsplitter	CS	Yes	FWD	n/a	n/a	
12	P. ohiensis (Rafinesque, 1820) [m]	pink papershell	CS	No	FWD, WHC	7-35	250-725	
13	Pyganodon grandis (Say, 1829) [n]	giant floater	CS	No	CAP, YEP, FLG, ROB, WHC, SKH, GIS, GOS, CMS, CRC, WHS, YEB, BSB, WHB, GSF, LMB, BLC, IOD, JOD, FWD, RCS, BLG	2-160	47-1300	
14	Quadrula quadrula (Rafinesque, 1820)	mapleleaf	CS	Yes	FCF, BLG, SAR	18-38	n/a	
15	Strophitus undulatus (Say, 1817)	squawfoot	CS	No	May complete its life cycle without being parasitic on fish. Artificially infected by CRC, GSF, LMB	14-28	n/a	

The following are explanations for annotated portions of the mussel chart.

[a] The American Fisheries Society ranking is derived from Williams et.al. (1993).

[b] The North Dakota State Heritage Program's rare species list for the Sheyenne and Red Rivers, derived from Corps of Engineers, St. Paul District, Geographic Information Systems (GIS) section 1999.

[c] Derived from Cvancara (1983), Oesch (1984), and Hart and Fuller (1974).

[d] Derived from Cvancara (1983), appendix B.

[e] Derived from Cvancara (1983), appendix B.

[f] Listed by Williams et. al. (1993), as occurring in North Dakota. No other mention of this species occurring in North Dakota has been found to date.

[g] Listed by Cvancara (1983), and Kreil et. al. (No Date). Williams, et. al. (1993) does not list this species as occurring in North Dakota.

[h] Cvancara (1983) recorded this data from a single site.

[I] Named in accordance with Turgeon, et. al. (1988). Cvancara uses the species radiata.

[j] Cvancara (1983) recorded this data from a single site.

[k] Listed by Williams et. al. (1993), as occurring in North Dakota. No other mention of this species occurring in North Dakota has been found to date.

[l] Named in accordance with Turgeon et. al. (1988). Cvancara (1983) uses the name Proptera alata.

[m] Named in accordance with Turgeon et. al. (1988), Oesch (1988), and Cummings and Mayer (1992). Cvancara (1983) uses the name Proptera laevissima.

[n] Named in accordance with Williams et.al. (1993).

The three letter codes used for the host fish listed in Appendix 1 were developed by the U.S. Fish and Wildlife Service, Fisheries Division, for use throughout the country. Also enclosed is a listing of North Dakota fish species (Appendix 2).

Larval mussels, called glochidia, undergo a metamorphosis after being released by the female. Newly released glochidia must attach themselves to a host fish, which they parasitize in order to develop into an adult mussel. It is important to recognize that not just any fish will serve as a host, since a glochidium of a particular species usually can parasitize only certain species of fish (Oesch 1984). Successful parasitization of a host fish induces in the fish an immunity which strengthens with repeated glochidial infections, and in certain cases, can provide additional immunity to other infections (Hart and Fuller, ed., 1974). Hart and Fuller (1974) state that the disruption of the relationship between mussels and host fish is generally a result of habitat destruction or elimination of the host fish.

Moderate and Wet Future chloride impacts by alternative

The Service selected four locations along the Sheyenne and Red Rivers to review chloride impacts associated with the West Bay 300 cfs and 480 cfs, and the Pelican Lake 300 cfs and 480 cfs outlet alternatives, using the moderate and wet futures. A future without the project trace was also reviewed to determine the chloride impacts associated with a spill from Devils Lake to the Sheyenne River. The wet future model assumes that a spill will occur between 2014-2024. All traces show the spill along with the chloride impacts occurring from the West Bay and Pelican Lake outlet alternatives.

The results of the HEC5Q water model suggest a variety of chloride impacts associated with the various outlet alternatives. The four locations are based on the HEC5Q map

editor, naming convention and its corresponding river mile identifier (Figure 11.1). In order to determine the impacts along the entire Sheyenne and Red Rivers, sites were chosen on the upper Sheyenne River, upper end of Lake Ashtabula, lower Sheyenne, and the Red River. They are:

1.01	Cooperstown, river mile 406.4, upper Sheyenne River near Warwick.
1.02	Baldhill, river mile 296.9, upper end of Lake Ashtabula.
1.03	Valley City, river mile 261.8, in the Valley City vicinity.
1.04	Grand Forks, river mile 297.5, in the Grand Forks vicinity.

Cooperstown:

Wet Future, West Bay 300 cfs and 480 cfs outlets (Figure 11.2): For the most part, the West Bay 300 and 480 cfs outlets tend to mirror one another. The West Bay 300 cfs outlet generally remains at about 80 mg/l. This is a concern based on Cvancara's Turtle River finding that mussels were absent in waters above 87 ppm (parts per million = mg/l). It is unknown how mussels would react in waters containing approximately 80 mg/l for the life of the project.

The 480 cfs has exceedences greater than 100 mg/l, for a 4-year cycle from 2025-2029. In the years 2005-2006 and 2036-2037, chloride concentrations approach 90 mg/l. The rest of the time, they tend to fall along the 300 cfs outlet trace.

Both the West Bay 300 and 480 cfs outlets cause concern over the elevated levels of chloride they produce and its impact to mussel populations. Chloride levels at approximately 80 mg/l for most of the life of the project represents a four-fold increase over the Sheyenne River's long-term base concentration of about 20 mg/l.

Wet Future, Pelican Lake 300 cfs and 480 cfs outlets (Figure 11.4): The Pelican Lake 300 cfs outlet produces chloride levels of about 50 mg/l, up from a base average of about 20 mg/l. In the year 2024, the levels take a dramatic rise to approximately 70-80 mg/l range, and remain there for the life of the project. While this represents an improvement over the West Bay outlets, it remains unclear what elevated chloride concentrations will do to the mussels and how they will react. The 480 cfs outlet is somewhat better, with levels below 50 mg/l, with a range of 40-45 mg/l. These levels represent a two-fold increase in chloride concentrations and remain fairly constant throughout the life of the project.

Moderate Future, 1450 msl and 1455 msl (Figures 11.26 and 11.27): The moderate future traces show that the outlet will operate from the year 2005 to 2024. For both the 1450 msl and 1455 msl futures, the 300 cfs West Bay outlet results in chloride levels of approximately 80 mg/l. Chloride levels in this range represent a four-fold increase over baseline conditions, and will be a cause of concern. Under the 1450 msl future, the 480 cfs West Bay outlet produces levels at 150 mg/l for the first 3 years, with levels remaining at

this level 4 out of the first 5 years of outlet operation. A second spike is seen for 3 years between 2014-2016, where levels range from approximately 110 to 140 mg/l. The 1455 msl future, 480 cfs outlet shows chloride levels above 100 mg/l for the first 8 years of operation (2005-2012), with concentrations ranging from a high of 140 mg/l in 2005 to a low of 110 mg/l in 2012. A second smaller spike is seen in year 2016, with levels at 100 mg/l.

Future without the project (Figure 11.6): The future without the project trace generates an environmentally damaging spill of Devils Lake water into the Sheyenne River. The chloride levels exceed 350 mg/l in the second year of the spill (2014-2024). They range from a high of 350 mg/l to a low of 140 mg/l in the last year of the spill in 2024.

Baldhill:

West Bay 300 cfs and 480 cfs outlets (Figure 11.8): It's difficult to see the surface traces on this hydrograph, as the lake bottom traces mask the surface traces. For the 300 and 480 cfs outlets, the chloride levels in the bottom traces tend to range from 60-80 mg/l. The 480 cfs outlet results in concentrations of approximately 80 mg/l for the first 2 years of operations (2005-2006), and 110 mg/l from the years 2025-2029. They are 80-90 mg/l from 2037-2038.

Pelican Lake 300 cfs and 480 cfs outlets (Figure 11.10): Again, the bottom traces mask the surface traces on this alternative, however, the 300 cfs outlet is worse than the 480 cfs, with a range of 40-60 mg/l. The better of the two is the 480 cfs outlet, which is generally less than 50 mg/l in a range of approximately 30-40 mg/l.

Moderate Future 1450 msl and 1455 msl (Figures 11.28 and 11.29): The 1450 msl moderate future trace show that the outlet will operate from the year 2005 to 2024. The 1455 msl moderate future trace will run from 2005 to 2031. For the 1450 msl future, the 300 cfs West Bay outlet results in chloride levels ranging from approximately 50 to 70 mg/l. The 1455 msl future, the levels are about the same, but are longer in duration, running out to year 2031. Chloride levels in this range will be a cause of concern. Under the 1450 msl future, the 480 cfs West Bay outlet produces levels at 150 mg/l for the first 3 years, with levels remaining at this level 4 out of the first 5 years of outlet operation. A second spike is seen for 3 years between 2014-2016, where levels range from approximately 100 to 130 mg/l. The 1455 msl future, 480 cfs outlet shows chloride levels above 100 mg/l for the first 8 years of operation (2005-2012), with concentrations ranging from a high of 130 mg/l in 2005 to a low of 100 mg/l in 2012. A second smaller spike is seen in year 2016, with levels at 100 mg/l.

Future without the project (Figure 11.12): From the second year of the spill in 2015, chloride spikes to a high of 330 mg/l, then gradually recedes to about 100 mg/l at the end of the spill in 2024. As shown in the Cooperstown traces, this event would be disastrous.

Valley City:

West Bay 300 cfs and 480 cfs outlets (Figure 11.14): The 480 cfs outlet reaches a maximum chloride level of 100 mg/l for 3 years, from 2025-2027. The 300 cfs outlet performs slightly better across the life of the project, with levels consistently lower that the 480 cfs outlet. The 480 cfs plan appears to be in the 60-80 mg/l range, with concentrations correlating with the baseline in years 2032-2036, then rising again in 2037-2043 to about 60-80 mg/l before decreasing to the base condition. The 300 cfs outlet doesn't show that much variability, remaining above 50 mg/l, but below 70 mg/l for most of the 50-year life of the project. It shows the same drop in years 2032-2036, but not as low, staying less than 50 mg/l, but approximately 30 mg/l.

Pelican Lake 300 cfs and 480 cfs outlets (Figure 11.16): The 300 cfs outlet has the higher concentrations remaining about 40 mg/l for most of the life of the project. The 480 cfs plan rises above 50 mg/l to about 70 mg/l for the years between 2037-2043, and remains in the range of 45-50 mg/l for the life of the project.

Moderate Future 1450 msl and 1455 msl (Figures 11.30 and 11.31): The 1450 msl moderate future trace show that the outlet will operate from the year 2005 to 2024. The 1455 msl moderate future trace will run from 2005 to 2033. For the 1450 msl future, the 300 cfs West Bay outlet results in chloride levels ranging from approximately 30 to 55 mg/l. The 1455 msl future shows levels ranging between 30 and 60 mg/l, for a longer duration, running out to year 2033. Chloride levels in this range will not likely create problems for mussels. Under the 1450 msl future, the 480 cfs West Bay outlet produces levels from 130 to 140 mg/l for the first 4 years. A second spike is seen for 3 years between 2014-2016, where levels range from approximately 100 to 130 mg/l. The 1455 msl future, 480 cfs outlet shows chloride levels above 100 mg/l for the first 5 years of operation (2005-2009), and at 100 mg/l from 2010 to 2011. A second smaller spike is seen in the years 2015-2016, with levels at approximately 90 mg/l.

Future without the project (Figure 11.18): Chloride concentrations reach a high of 250 mg/l the second year of the spill in 2015. The levels gradually recede to a high of 55 mg/l in 2024. Concentrations above 100 mg/l for 2015-2022. These levels would be damaging to the mussel populations in the Sheyenne River.

Grand Forks:

West Bay 300 cfs and 480 cfs outlets and the Pelican Lake 300 cfs and 480 cfs outlets (Figures 11.20 and 11.22): All outlet alternatives tend to mirror the base chloride concentration of about 20 mg/l and do not rise above 50 mg/l. Chloride effects are not expected to be a problem at this location.

Moderate Future 1450 msl and 1455 msl. The 1450 msl and 1455 msl moderate future traces show elevated chloride levels from the beginning of outlet operations in year 2005 to about year 2014. For the 300 cfs West Bay outlet, chloride concentrations are at or near baseline levels at about 30 mg/l. For the 480 cfs outlet, chloride concentrations for both futures rise to a peak of approximately 60 mg/l, and are not expected to result in any impacts to mussel populations.

Future without the project (Figure 11.24): The spill results in chloride concentrations at a high of 70 mg/l to a low of 30 mg/l during the spill of 2014-2024. Chloride concentrations at this level are not likely to negatively impact mussel populations or other aquatic species.

1.02 Impacts to Lake Ashtabula. Cvancara and Freeman (1978) found four species of mussels in Lake Ashtabula. This is far fewer than the eight species found above the lake and eleven species found below Baldhill Dam. It is well known that dams have a negative impact on mussel populations (both in lake and upstream by eliminating or reducing host fish populations) due to the degradation of habitat and alteration of the river's chemical and biological properties.

The possible causes cited by Cvancara and Freeman (1978) for the fewer species are likely the alteration of reproductive processes and periodic low levels of oxygen found in Lake Ashtabula. It is unclear at this time what effects Devils Lake water will have on the remaining mussel species in Lake Ashtabula. Reviews thus far suggest that mollusk species may tolerate the higher TDS and sulfate concentrations than might be experienced in the Sheyenne River and Lake Ashtabula as a result of the outlet.

The North Dakota Game and Fish Department (Department) has raised concerns about the chronically low dissolved oxygen levels recorded in the upper end of Lake Ashtabula during the winter and summer months. The Department is concerned about the effects to the lake from potentially higher phosphate levels attributable to Devils Lake water. Higher phosphate concentrations and continued nutrient loading of Lake Ashtabula could lead to lower dissolved oxygen levels resulting in fish and mollusk kills.

A change in the hydraulic storage ratio of the lake could result in a loss of young and adult fish, as well as a shift in algal composition and invertebrate populations due to the flushing aspect of the additional water.

In addition, erosion rates will undoubtedly increase in the upper Sheyenne River, which will ultimately magnify deposition in the upper end of Lake Ashtabula further exacerbating the problems mentioned, e.g. nutrient loading, loss of volume, increasing turnover rate, and loss of fish through the dam.

1.03 Impacts to Valley City National Fish Hatchery. Concerns have been expressed by the Service about the higher levels of sulfate, TDS, and turbidity having a negative impact on the operation of the hatchery. The hatchery takes 100 percent of its water supply for hatchery operations directly from the Sheyenne River. Higher sulfates present a known corrosive problem to hatchery equipment. High TDS levels slow the growth of juvenile fish and limit natural fish reproduction. Increased turbidity (with silts 0.5 microns and below) are likely to hinder fish production at the hatchery as suspended silts create operational problems. The transport of blue-green algae may decrease available zooplankton and phytoplankton for juvenile fish in the Sheyenne River and Lake Ashtabula. Additionally, when the algae expire, they may release algal toxins into the lake resulting in fish kills.

Extended high flows from Baldhill Dam may result in serious problems, with ability to drain the fish ponds at Baldhill Dam and Valley City National Fish Hatcheries. Flows around 700-800 cfs will prevent the ponds from being drained. In a typical year, juvenile fish are removed and ponds drained in the May to June timeframe coinciding with daphnia (a zooplankton which provides a primary forage base for the fish) depletions. If high flows prevent this procedure, the fish will consume one another as a primary food source, resulting in a lower production.

1.04 Impacts to fish and sensitive fish species in the Sheyenne and Red Rivers. The outlet's effects to the fishery resource within the Sheyenne and Red Rivers will largely be connected to the rivers' higher, prolonged flows. The resulting loss of riffle and pool habitat from higher annual flows in the Sheyenne and Red Rivers is a concern for aquatic species. Riffle and pool habitats are important during low-flow periods, as they provide wintering, rearing and forage areas for fish. Higher, prolonged flood water in the river systems could destroy riparian habitat located along the bank of the river, which in turn can impact fish species. Additionally, the Service is concerned with the fragile connection between mussels and their host fish in the Sheyenne. If a host fish is reduced or eliminated by poor water quality, a loss of associated mussel species may occur.

Upper Sheyenne River: There are 16 fish species that could be impacted due to the loss of habitat types in the Sheyenne River (Table 11.2). Of these species, six are located in the upper Sheyenne River and utilize the slow riffle habitat type for some part of their life stage (Earth Tech. Inc., 2001). Recent modeling data indicates that outlet operations may result in a decline of the slow riffle habitat on the upper Sheyenne River. The fish species potentially effected by the decline of this habitat are: the bluntnose minnow, channel catfish, common shiner, shorthead redhorse, white sucker, and yellow perch.

Table 11.2. Known host fish for North Dakota mussel species.

		Potential Loss of Habitat Type					
Known host fish species for ND mussels	**Mussel species (ND State listed=Y)**	**Upper Sheyenne - Slow riffle**	**Life stage**	**Lower Sheyenne - Shallow pool**	**Life stage**	**Lower Sheyenne - Medium pool**	**Life stage**
black crappie	threeridge, wabash pigtoe (Y), giant floater, fatmucket					X	juvenile
bluegill	wabash pigtoe (Y), pocketbook, fatmucket, black sandshell (Y), giant floater, mapleleaf (Y), threeridge			X	young of the year & juvenile		
bluntnose minnow	cylindrical papershell	X	adult	X	young of the year		
bluntnose shiner	cylindrical papershell						
brook stickleback	giant floater, cylindrical papershell						
carp	white heelsplitter, creek heelsplitter (possible), fluted-shell, giant floater						
channel catfish	threeridge	X	young of the year			X	adult
common shiner	cylindrical papershell, fatmucket, giant floater,	X	spawning			X	adult & juvenile
creek chub	giant floater, squawfoot						
fathead minnow	cylindrical papershell						
flathead catfish	mapleleaf (Y)						
flathead chub	giant floater						
freshwater drum	pink heelsplitter (Y), pink papershell, giant floater						
gizzard shad	giant floater						
golden shiner	giant floater						
green sunfish	threeridge, white heelsplitter, giant floater, squawfoot			X	young of the year & adult		
iowa darter	giant floater, cylindrical papershell						
johnny darter	giant floater						
largemouth bass	threeridge, pocketbook, fatmucket, white heelsplitter, black sandshell (Y), giant floater, squawfoot					X	juvenile
northern hogsucker	elktoe						
northern pike	threeridge					X	adult
pumpkinseed	threeridge						
river carpsucker	giant floater						
rock bass	elktoe, threeridge, giant floater, fatmucket						
sauger	threeridge, pocketbook, fatmucket, mapleleaf (Y)						
shorthead redhorse	elktoe	X	young of the year				
shortnose gar	threeridge						
skipjack herring	giant floater						
smallmouth bass	pocketbook, fatmucket			X	young of the year		
tadpole madtom	fatmucket					X	young of the year
walleye	fatmucket					X	young of the year & juvenile
warmouth	elktoe, threeridge						
white bass	threeridge, fatmucket, giant floater					X	juvenile
white crappie	threeridge, wabash pigtoe (Y), pocketbook, fatmucket, white heelsplitter, black sandshell (Y), pink papershell, giant floater,					X	adult & juvenile
white sucker	elktoe, cylindrical papershell, fatmucket, giant floater	X	juvenile				
yellow bullhead	giant floater						
yellow perch	threeridge, pocketbook, fatmucket, giant floater	X	adult			X	juvenile

The possible decline of these fish species in the Sheyenne River may be significant, as they are known host fish for the cylindrical papershell, threeridge, fatmucket, giant floater, elktoe, and pocketbook mussel species. With the exception of the elktoe, the other five mussel species have been recorded in the Sheyenne River. Although these are not the only known host fish for these mussel species, the general decline or loss of host fish could still have an impact on mussel populations, depending on the distribution and abundance of other suitable host fish in the upper Sheyenne River. None of the six fish species are known host fish for the Wabash pigtoe, a North Dakota state listed rare species that occurs in the upper Sheyenne River.

The Department is concerned because the Upper Sheyenne River can be a locally important recreational fishery at times. The predicted flow rate of up to 600 cfs will likely result in high energy expenditure by fish if pool habitat is not available. It is likely that these fish will vacate that habitat in favor of more hospitable flows. Re-colonization will likely occur but will take time and assumes downstream habitat is available. With sustained flows of approximately 600 cfs, a monotypic aquatic habitat will be created, reducing habitat diversity, thereby leading to a lesser diversity of fish species.

Lower Sheyenne River: There are 14 known host fish species dependent on the shallow and medium pool habitats in the lower Sheyenne River (Earth Tech Inc., 2001). Recent modeling data indicates that outlet operations may result in a decline of the shallow and medium pool habitats on the lower Sheyenne River. Of the 14 fish species, four of them, the black crappie, bluegill, largemouth bass, and white crappie, are known host fish species for the Wabash pigtoe and the black sandshell, both of which are state listed rare mussel species.

There are three known host fish for the Wabash pigtoe; the black crappie, white crappie, and the bluegill. The decline or loss of these species may be significant, as all three are known host fish for the Wabash pigtoe. There are three species that are known host fish for the black sandshell, they are: the bluegill, largemouth bass, and the white crappie. As with the Wabash pigtoe, the decline or loss of these host fish would impact all of the known host fish for the black sandshell.

Red River: The Red River supports an internationally renowned trophy catfish fishery. It is among the best places in the United States for anglers to catch trophy catfish. Concerns have recently been expressed over the decline of large fish, angling pressure and loss of habitat quality in the main stem Red River. At this time, it is uncertain as to what effect Devils Lake water will have on this valuable fishery.

Increased flows downstream in the Red River may also amplify the demand for clearing and snagging along the river. Snagging and clearing of trees from the river channel is a normal practice when water managers attempt to efficiently convey water. Snags are

important habitat in all riverine systems, but are especially important in the Red River for the channel catfish population.

The reintroduction of Lake sturgeon (*Acipenser fulvescens*) to the Red River by the Minnesota Department of Natural Resources should be monitored by the Corps for possible impacts due to degraded water quality. Currently Lake sturgeon are a Minnesota State listed species. At this time, it is unclear what, if any, effects Devils Lake water will have on this project.

Map 2 shows the location of the North Dakota rare fish species and distribution in the Sheyenne and Red Rivers.

1.05 Impact of outlet alternatives on Devils Lake aquatic habitat and lake levels. The Service is concerned with TDS concentrations greater than 2500 mg/l, as natural reproduction is inhibited through disturbances to the fertilization process of fish eggs. With the exception of Pelican Lake, no outlet draws enough water out of the lake to concentrate TDS levels above 2500 mg/l. East Devils Lake concentrations actually go down after the years 2004-2005, because the wet scenario assumes the lake continues to rise to an elevation range of between 1452 to 1457 msl (depending on outlet alternative, see Table 11.3).

In Pelican Lake, the TDS levels rise above 2500 mg/l between the years 2029-2031 on all outlet alternatives and remain above 2500 mg/l for up to 5 years. Because the wet future predicts a Devils Lake overflow lasting from years 2014-2025, the higher TDS levels in the years 2029-2031 are likely the result of a declining lake level and subsequent concentration of dissolved solids in the lake. This appears to be driven by a switch from the wet future water model ("wet seven" hydrologic cycle of 1993-1999, used back-to-back from 2001 forward to create the overflow of Devils Lake in the year 2014) to the long-term 1980-1999 hydrologic cycle after 2025. The long-term 1980-1999 cycle, which contains the drought years in the mid-to-late 1980's, will be repeated after 2025 and will draw the lake down.

The Service is concerned that the Pelican Lake area will not support natural reproduction of fish with TDS concentrations above 2500 mg/l. An analysis of TDS data from 1993-1999 showed that Big Coulee concentrations averaged 455 mg/l. With Big Coulee emptying into the Pelican Lake area and TDS concentrations above 2500 mg/l produced from a declining lake level, it's unlikely that the Pelican Lake area will remain a viable spawning area for the Devils Lake fishery. With the exception of the East Devils Lake numbers going down from the beginning of pump operations, the remainder of Devils Lake will not likely be affected by TDS concentrations that will negatively impact the long-term fishery of the lake.

Table 11-3. Wet scenario in-lake effects by outlet alternative that exceed 2500 mg/l or meet lake target elevation.

Corps Alternative Number		**1**	**5 (PL2)**	**8 (PL1)**	**6**	**12**
Alternative Description	No Pump	WB480	PelBypass480	PelOut300	WB300	EastDL
Year TDS >2500 mg/l [1]						
at Pelican Lake	2030-31	2029-30	2029-30	2030-31	2030-31	2030
at West Bay	NA	NA	NA	NA	NA	NA
at Main Bay	NA	NA	NA	NA	NA	NA
at East Bay	NA	NA	2033	2050	NA	NA
at East Devils Lake	2004	2004	2004-05	2004-05	2004-05	2004-05
Year lake level reaches 1443 msl. [2]	NA	2027	2027	NA	NA	2027

[1] TDS > 2500 mg/l will impact fertilization process in fish.
[2] 1443 msl is the recommended target elevation for long-term lake management.
NA indicates that TDS or lake elevation does not reach target goals.

1.06 **Wetland impacts resulting from Devils Lake outlet alignment.** The outlet's pipeline alignment is generally well placed to avoid wetland impacts. There are relatively few impacts to wetland resources along the original West Bay 300 cfs outlet alternative. A total of 6.3 acres of wetland will be temporarily affected by construction (Table 11.4). Generally, projects which involve the burying of a pipeline should not significantly affect wetland basins, provided precautions are taken to restore natural wetland contours. Caution should be taken during installation of underground facilities to restore the existing basin contours and to compact trenches sufficiently through wetlands to prevent any drainage along the trench or through bottom seepage.

1.07 **Impacts to wetlands along outlet alignments, including an open channel used in combination with a buried pipeline outlet design.** The Service is concerned about the extent of erosion and sedimentation of Peterson Coulee due to the volume of water in the coulee as a result of pumping operations in an open channel configuration. The open channel outlet operating criteria may significantly alter the way project features impact the environment. To date, no specific details are available to assist in a thorough analysis of the various options. As these details are made available, the Service will be in a better position to provide a more accurate analysis of potential impacts.

Table 11-4. Wetland impacts along the Peterson Coulee 300 cfs outlet route.

Station	Twn/rng/sec	Wetland type	Wetland acres directly affected pipeline alignment	Wetland acres within rights-of-way, likely to be affected.
147+00	15106804	PEMC	0.20	
195+50	15206834	PEMC	0.15	
248+25	15206835	PEMA (pt)*		0.10
265+00	15206835	PEMC	0.82	
268+00	15206826	PEMA		0.26
365+50	15206824	PEMC	0.19	
406+00	15206719	PEMC (pt)*		0.10
447+50	15206718	PEMC (pt)*		0.10
504+00	15206717	PEMA	0.50	
539+50	15206709	PEMA		0.10
542+00	15206709	PEMA		0.18
605+00	15206704	PABF		2.80
659+00	15306735	PEMA	0.20	
664+50	15306735	PEMC	0.36	
671+50	15306735	PEMA	0.14	
679+75	15306735	PEMA (pt)*		0.10
TOTAL			2.56	3.74

*These wetlands are point wetlands. The digital data does not reflect an acreage size for point delineations. For the purposes of calculating acreage, the NWI assigns point polygons an area of 0.10 acres.

The Service administers wetland easement tracts throughout the State of North Dakota. A review of wetland easements within the project area indicates that several wetland easements are located along the various outlet alternatives. If wetlands protected by easements are impacted by construction activity, special use or right-of-way permits will be necessary. Wetlands under easement are protected from all drain, fill, burn, and leveling activities (individual wetland watershed cannot be altered, which reduces the inflow into the wetland). For additional details and permit requirements, please contact Mr. Roger

Hollevoet, Project Leader, Devils Lake Wetland Management District Complex, P.O. Box 908, Devils Lake, North Dakota 58301 (701-662-8611).

In most cases, pipeline projects do not result in lasting environmental impacts on wetland basins and upland sites. The Service will recommend mitigation to offset the temporary loss of habitat for aquatic birds associated with the all pipeline alternative. Our primary concern focuses on maintaining the integrity of Peterson Coulee and impacts to the linear wetland habitat associated with trenching a pipeline route within the channel. Peterson Coulee displays a beaded channel characteristic, which can provide valuable habitat for aquatic species.

Potential impacts with an open channel configuration would generally be the same as those discussed above. However, the open channel segment presents additional concerns for the extent of erosion and sedimentation on Peterson Coulee due to the volume of water, as well as the potential effects on the coulee through the open channel modifications. Mitigation for the loss of emergent habitat could be an issue for discussion. A 200-300 cubic feet per second (cfs) flow would likely result in the loss of emergent wetlands located in the channel.

8. **Threatened or Endangered Species and Rare Species.** Impacts to federally listed threatened or endangered species is not expected to occur from an outlet project. State listed rare species could be adversely impacted due to degraded water quality, continuous bank-full conditions and or over-bank flooding. Locations of State listed mussel and fish species are provided in Maps 1 and 2, located in section 8.1.3.

1.9 **Sheyenne River morphology impacts and accelerated sedimentation and erosion.** The Service is concerned about the higher sustained flows and its effect on the geomorphology of the Sheyenne River. Recent studies indicate that a 7-month outlet operation would convert much of the Sheyenne River into deep pool habitat. Although increased flows may be beneficial to aquatic life in the upper Sheyenne River, the resultant changes in channel morphology and water quality may impact the availability of necessary habitat required for various life stages of aquatic species. The net result of this will likely be the reduction of diversity and abundance of aquatic species in the Sheyenne River. Those species that can withstand the impacts could eventually dominate the system (Earth Tech Inc., 2001).

Furthermore, Earth Tech documented the results of several studies which discuss the impact that erosion and sedimentation have on mollusks. Research indicates that erosion and sedimentation resulting from a change in channel geomorphology can render a substrate unsuitable for mussels. Substrate disturbance can dislodge mussels, alter currents, and resuspend sediment and increase turbulence and turbidity, all of which negatively impact mussels by reducing growth feeding rates, oxygen consumption, and nitrogen excretion. Siltation results in the clogging of the mussel's gills and filtration systems,

preventing respiration and causing nutritive stress. Studies show that most mussels die when covered by as little as 1.3 to 5.1 centimeters of silt.

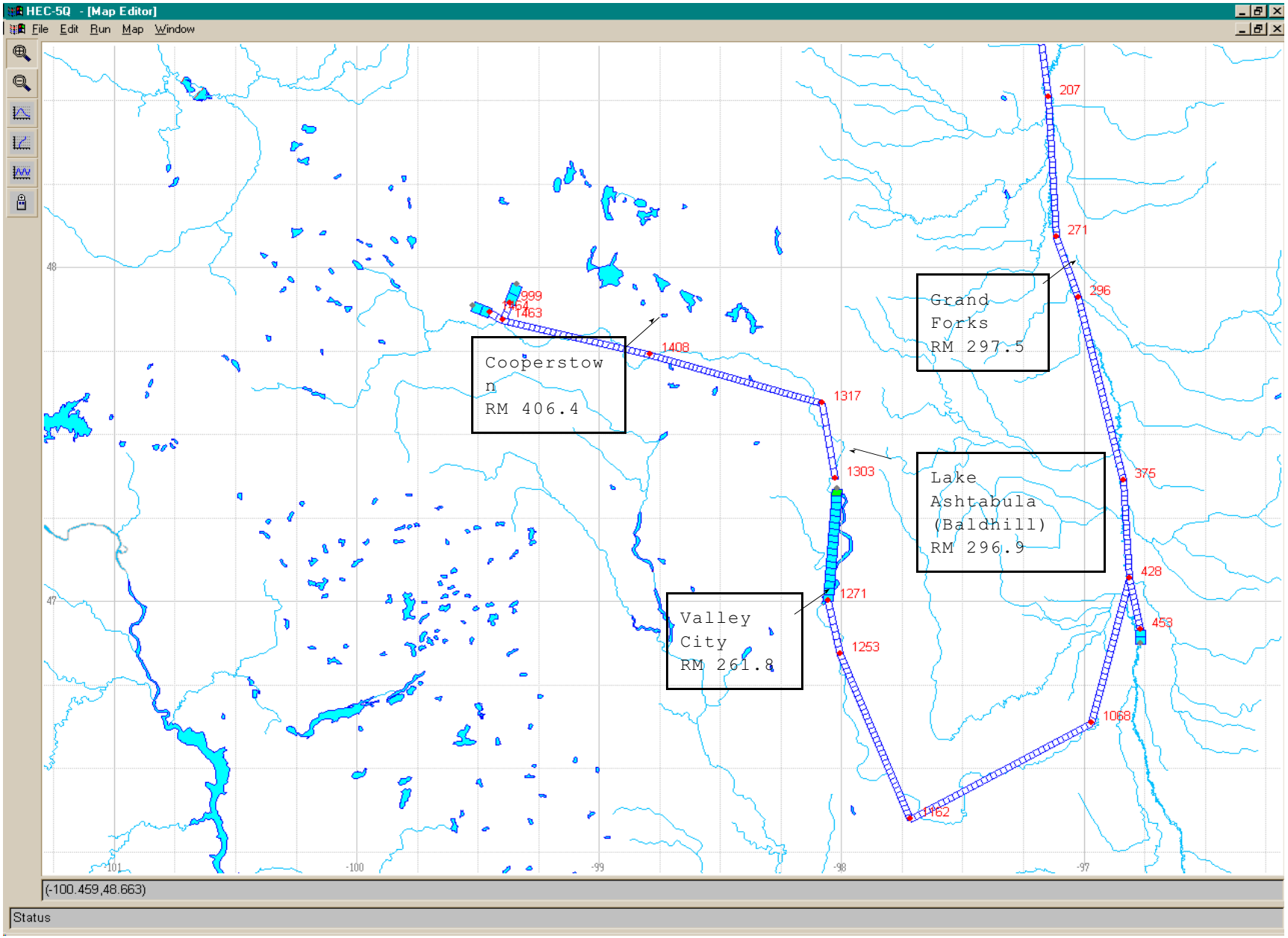
The changes in flow duration, stage, and frequency will increase erosion and sedimentation on the Sheyenne River. Studies to date indicate that the operation of the outlet could result in changes in channel width and in meander length and amplitude. Depending on location, channel widths on the Sheyenne River could change by as much as 3 feet on reaches below Baldhill Dam, to as much as 9 feet at some locations on the Sheyenne River above Baldhill Dam. Modeling results have indicated that there would be no change in stream meander length or amplitude downstream of Lake Ashtabula. On the upper Sheyenne River, meander length could decrease in some reaches by as much as 44 feet and meander amplitude by as much as 14 feet (Earth Tech Inc., 2001).

1.10 Accelerated wetland drainage in the upper basin as a result of the outlet. The Service is concerned about the accelerated loss of wetland habitat in the upper basin as a result of this project. A private drainage survey conducted from 1965 to 1980 documented a 2.5 percent drainage rate of wetlands per year in the Devils Lake basin. The Service believes that the pressure to drain remaining unprotected wetlands for agricultural and other purposes has not diminished over time. Within the basin, there is continuing legal action by lower basin landowners who claim that they have been adversely affected by the rise of Devils Lake, due in part to decades of wetland drainage by upper basin landowners. In the recent wet cycle, the practice of wetland drainage, including pumping, has shown itself to be a contributing factor in the rise of the lake. The Service is concerned that the construction of an outlet, without control on additional inflow to the lake from drainage, will provide the supporters of wetland drainage a way to export water out of the basin.

1.11 Impacts to the riparian habitat along the Sheyenne River.

Over-bank flooding and elevated groundwater levels are expected to occur as a result of the operation of an outlet. It is expected that a species shift in composition will be the result of a hydrological change, as species abundance and composition can be expected to decline. Loss or alteration of habitat, erosion, invertebrate impacts due to sedimentation and erosion, loss of riparian vegetation, decreased shading and loss of detritus in the channel remain Service concerns.

Figure 11.1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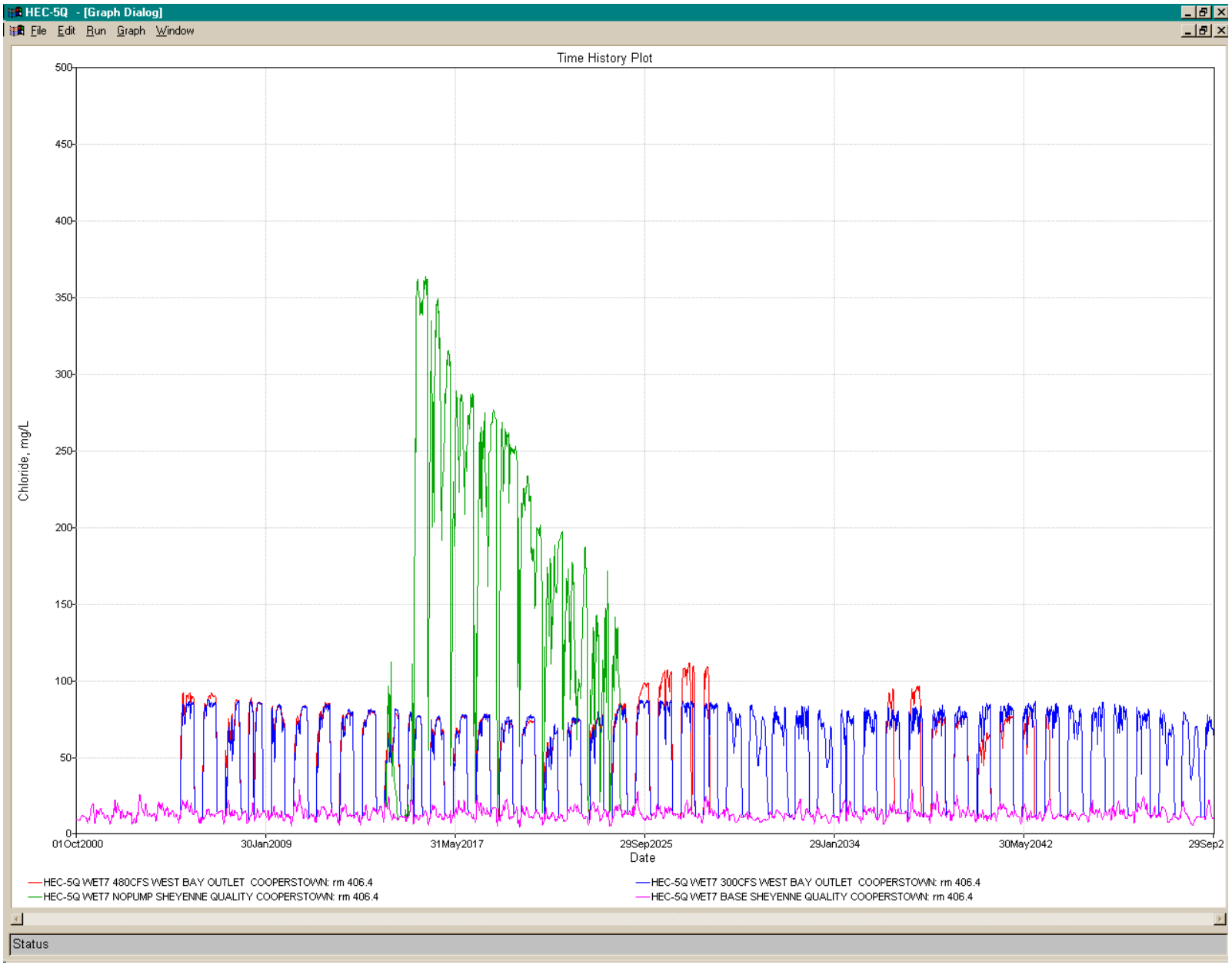
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Chloride, mg/L
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50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 300CFS WEST BAY OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

Figure 11.2

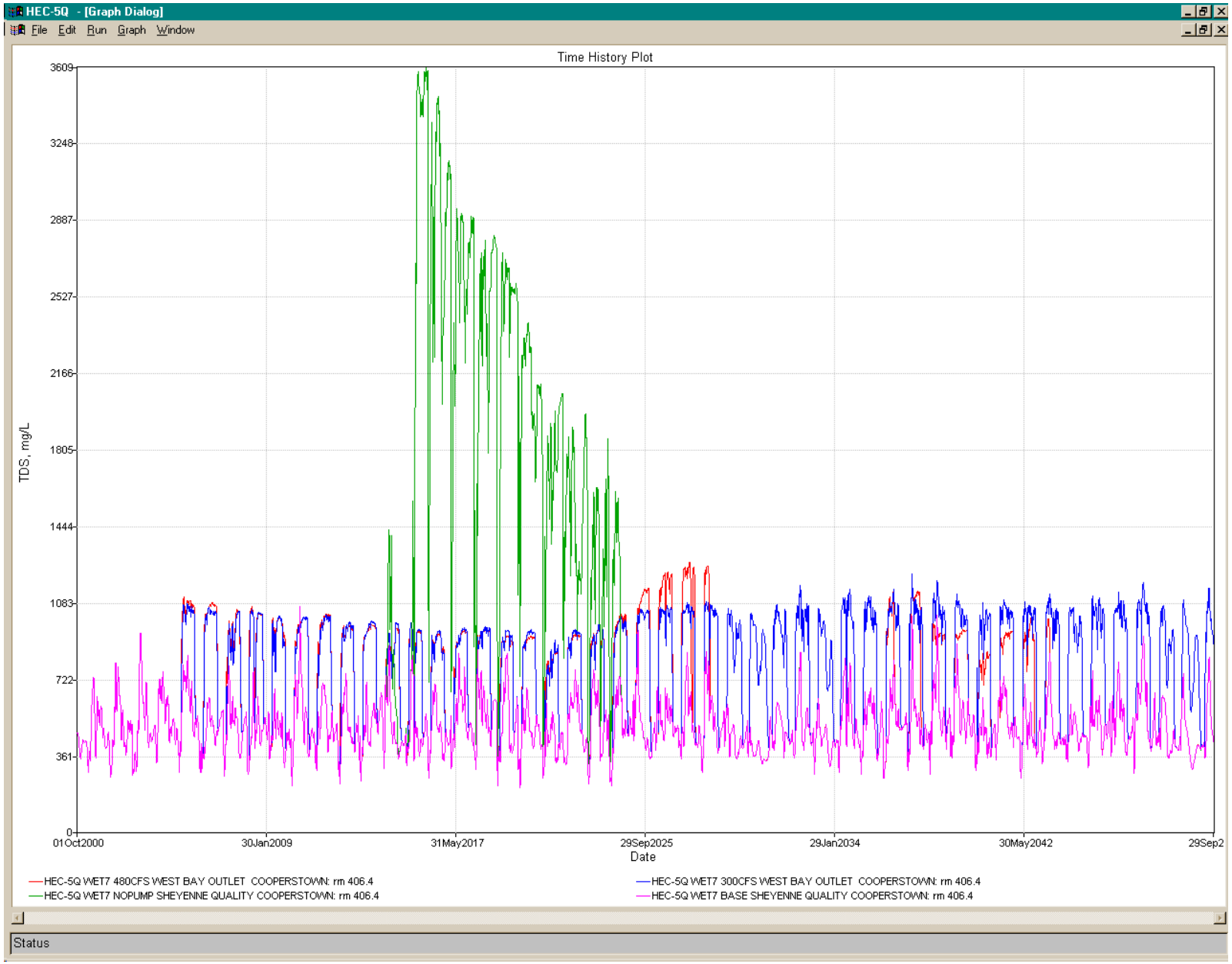

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
3609
3248
2887
2527
2166
1805
1444
1083
722
361
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 300CFS WEST BAY OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

Figure 11.3

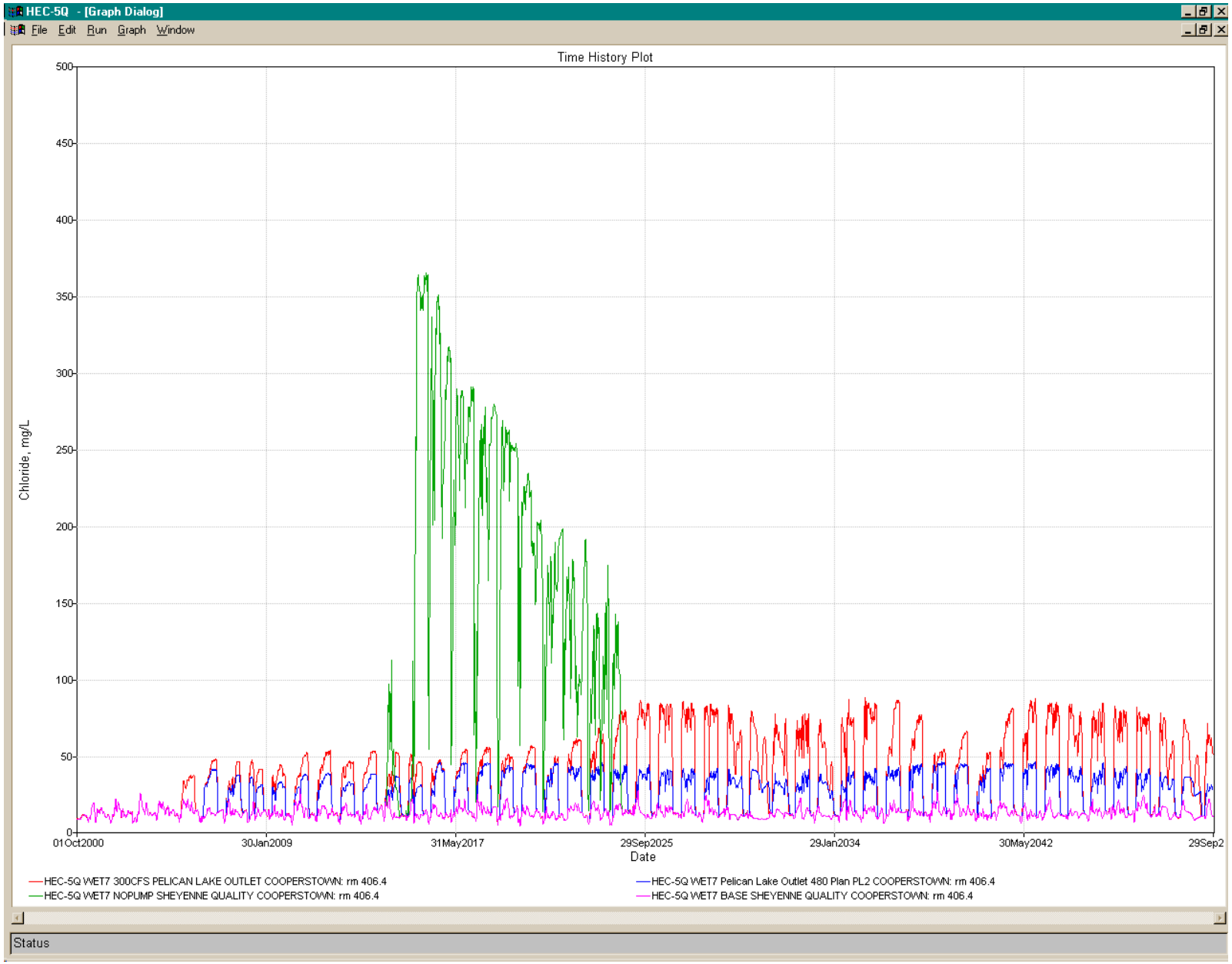

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

Figure 11.4

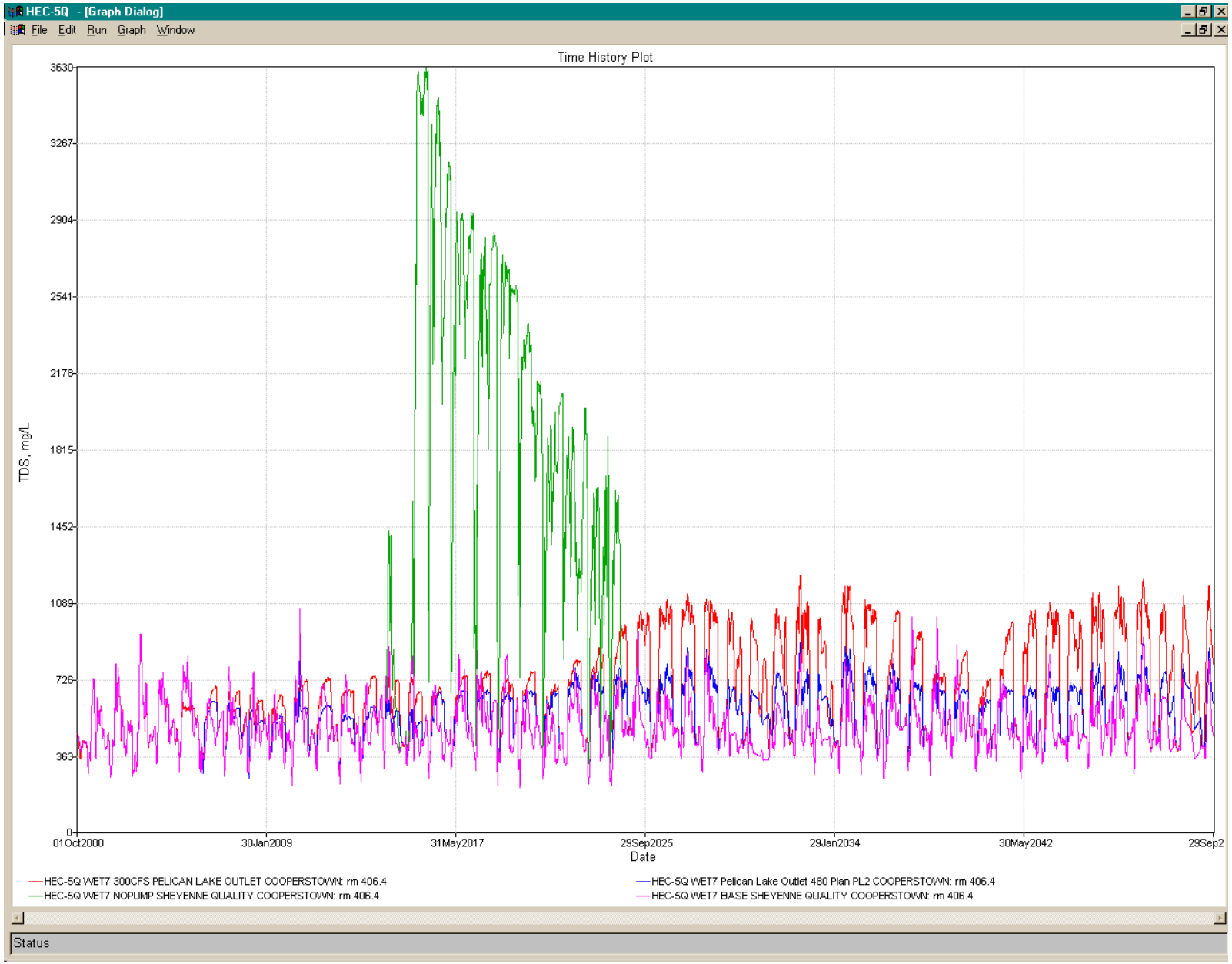
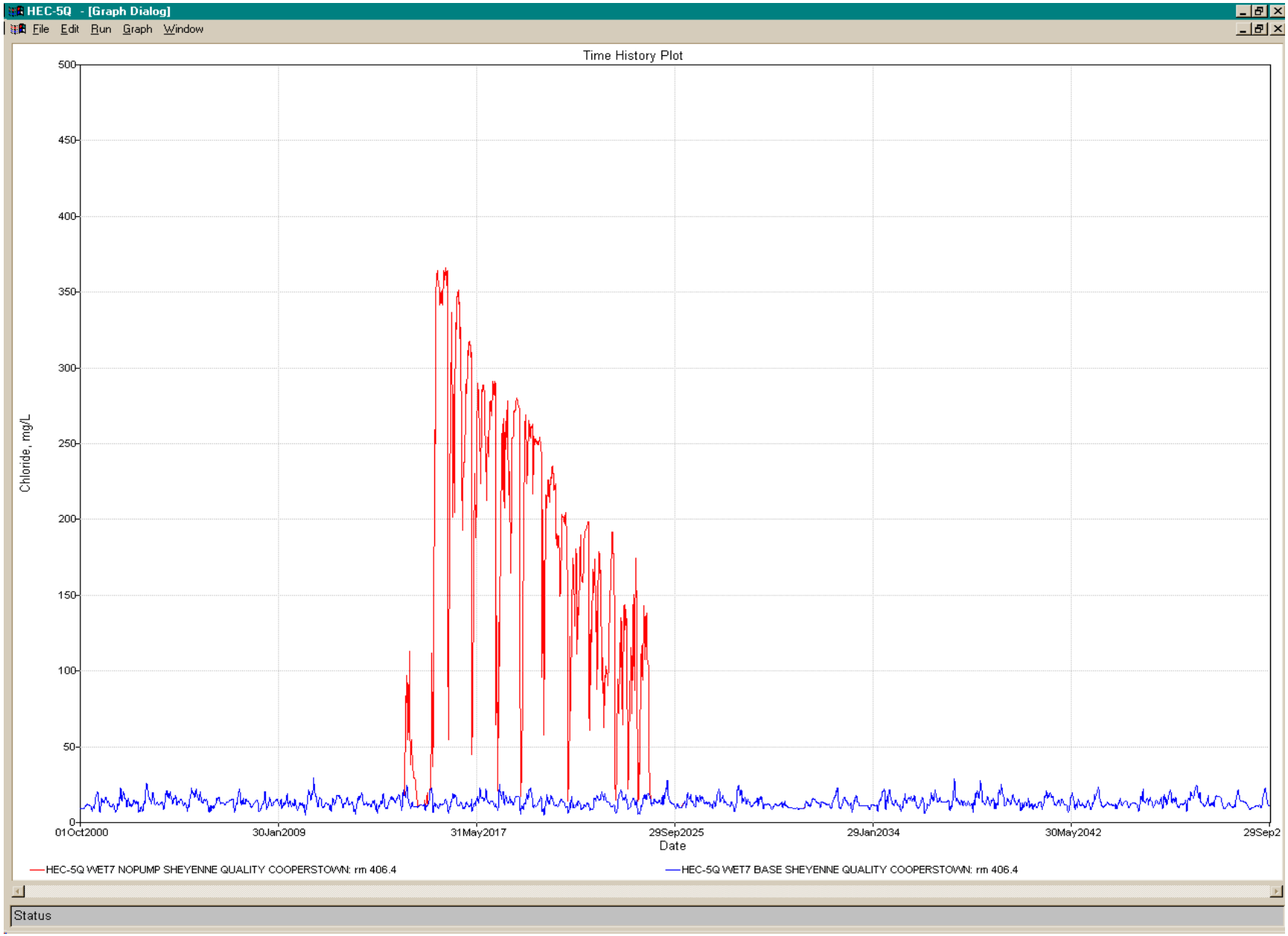

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
3630
3267
2904
2541
2178
1815
1452
1089
726
363
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET COOPERSTOWN: rm 406.4
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

Figure 11.5

Figure 11.6


HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

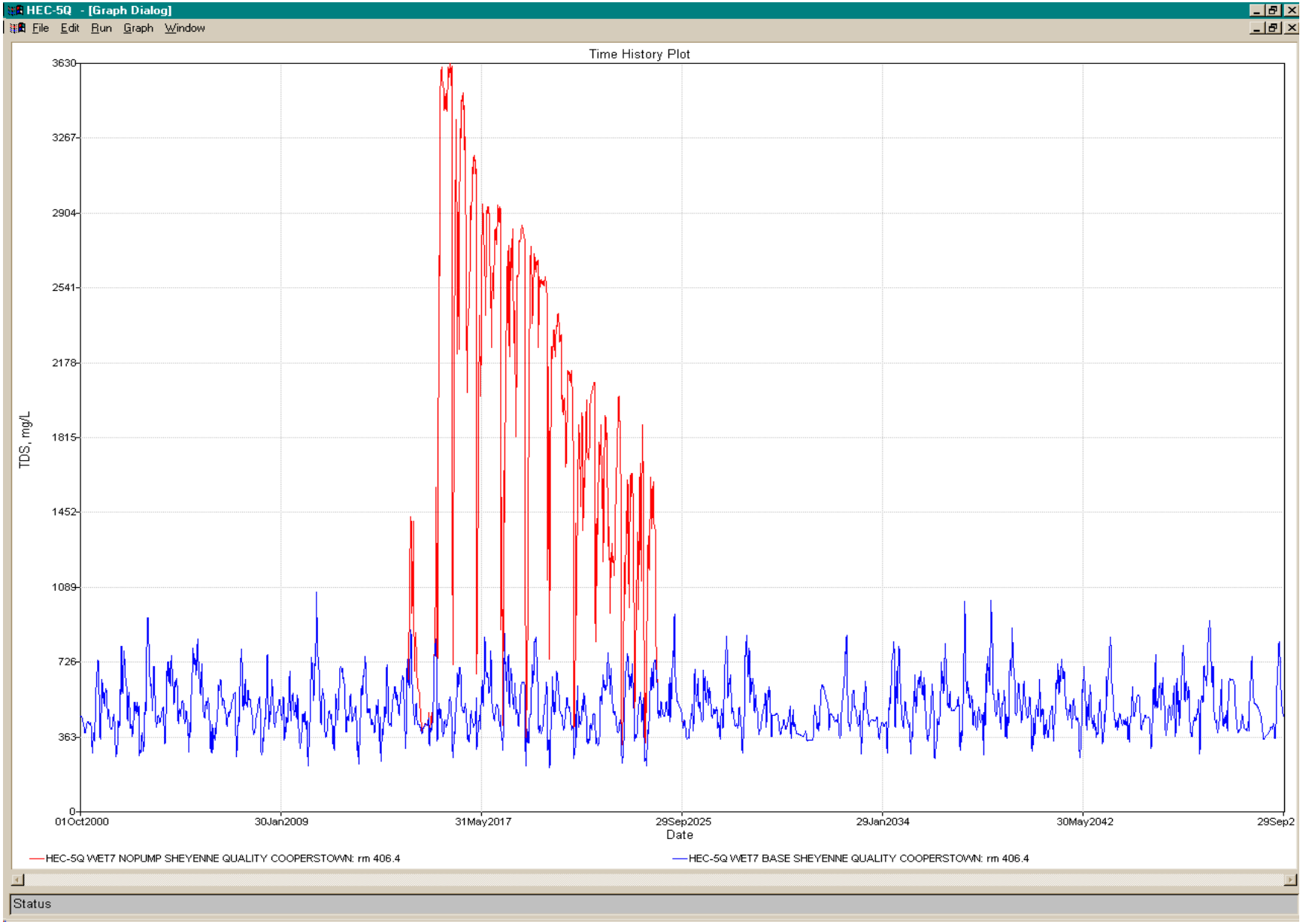

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
3630
3267
2904
2541
2178
1815
1452
1089
726
363
0
TDS, mg/L
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY COOPERSTOWN: rm 406.4
HEC-5Q WET7 BASE SHEYENNE QUALITY COOPERSTOWN: rm 406.4
Status

Figure 11.7

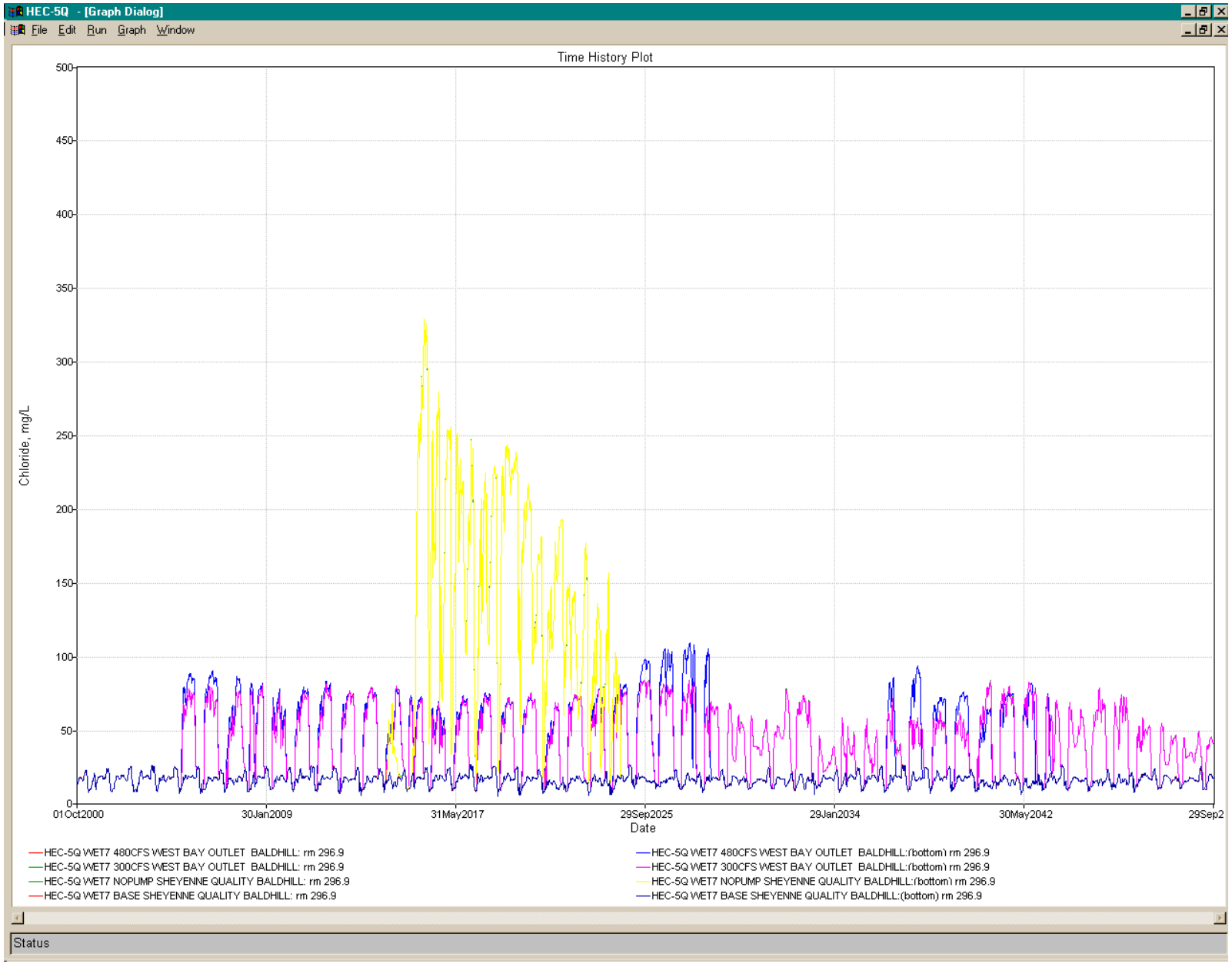

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 300CFS WEST BAY OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 480CFS WEST BAY OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 300CFS WEST BAY OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

Figure 11.8

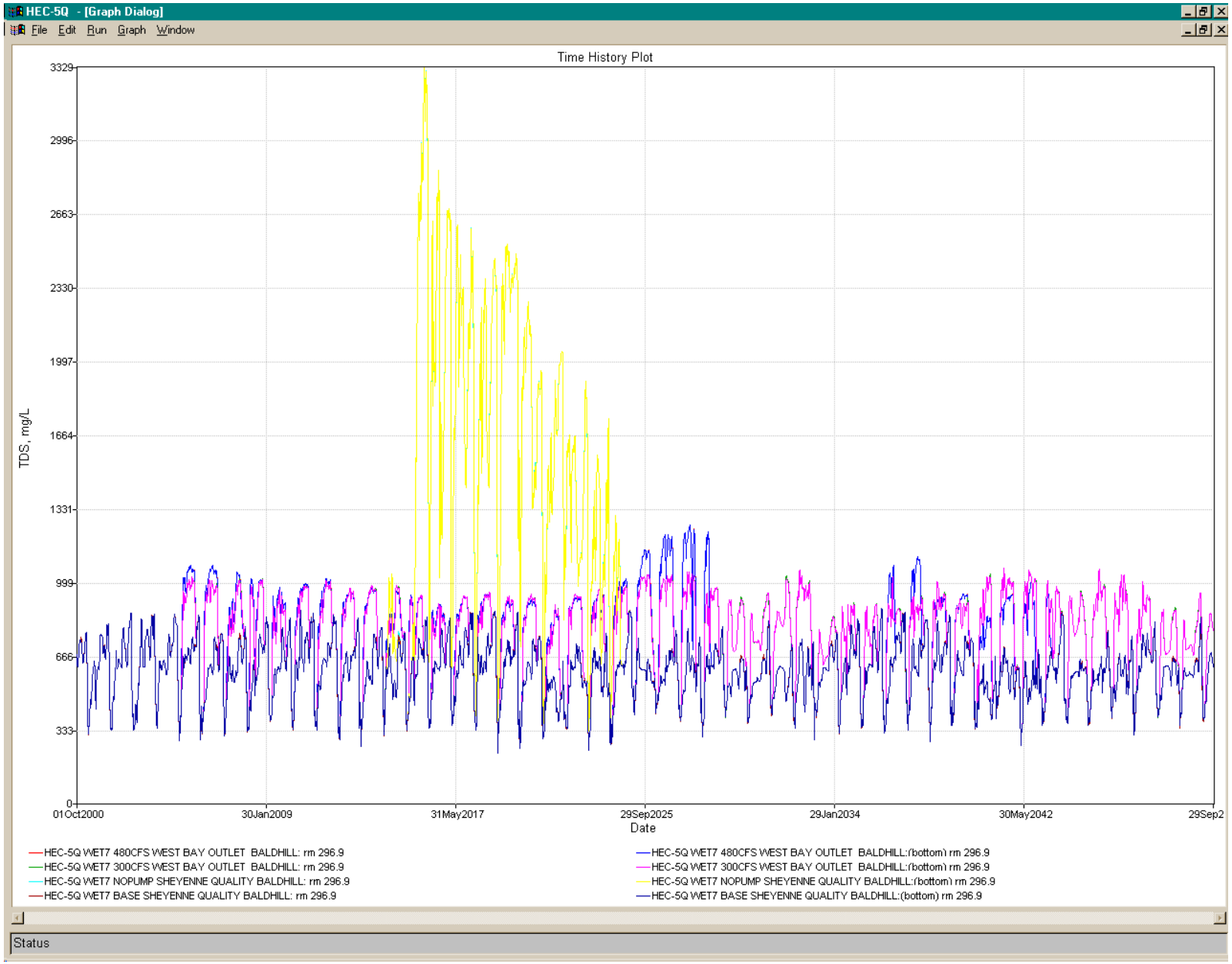

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
3329
2996
2663
2330
1997
1664
1331
999
666
333
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 300CFS WEST BAY OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 480CFS WEST BAY OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 300CFS WEST BAY OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

Figure 11.9

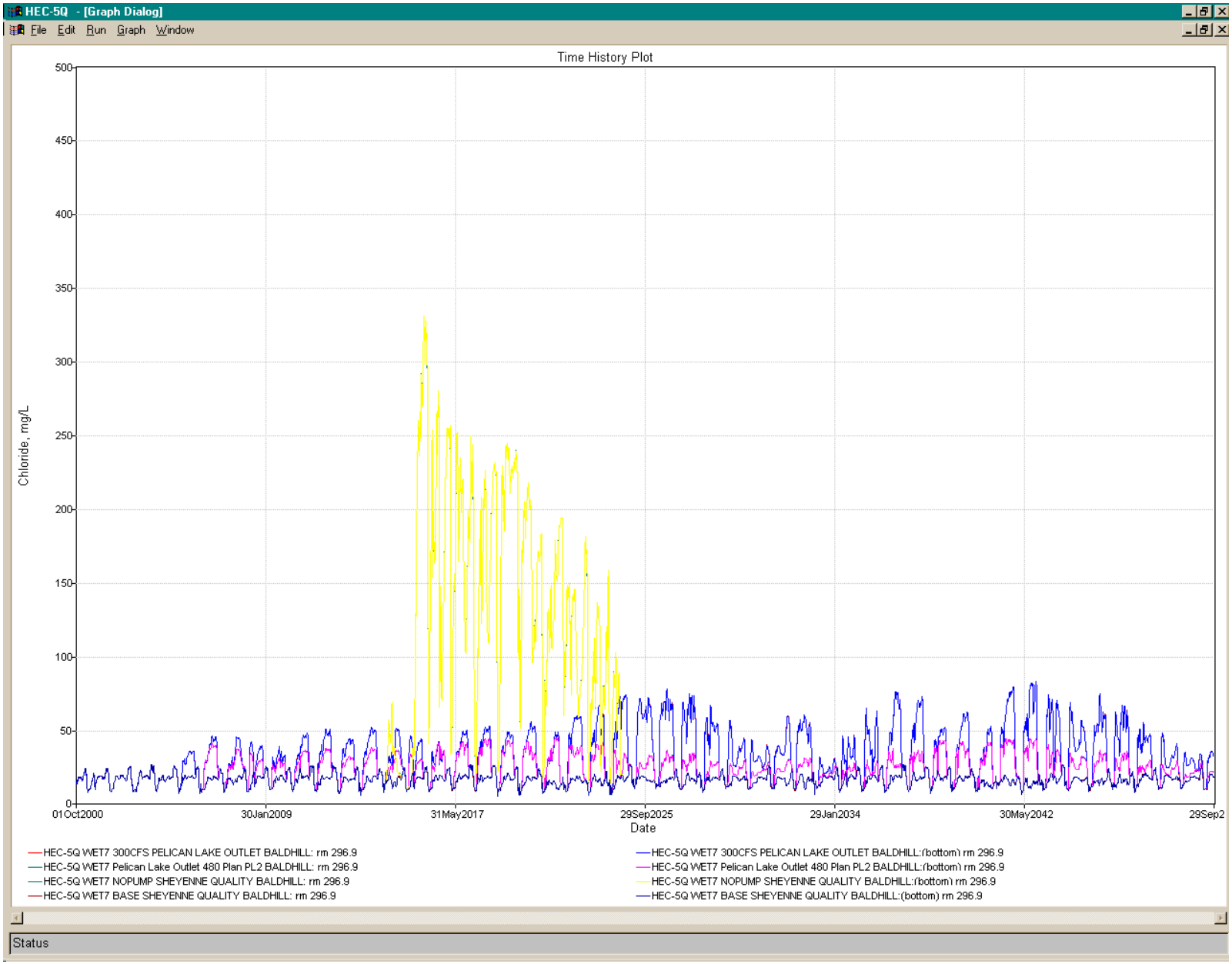

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

Figure 11.10

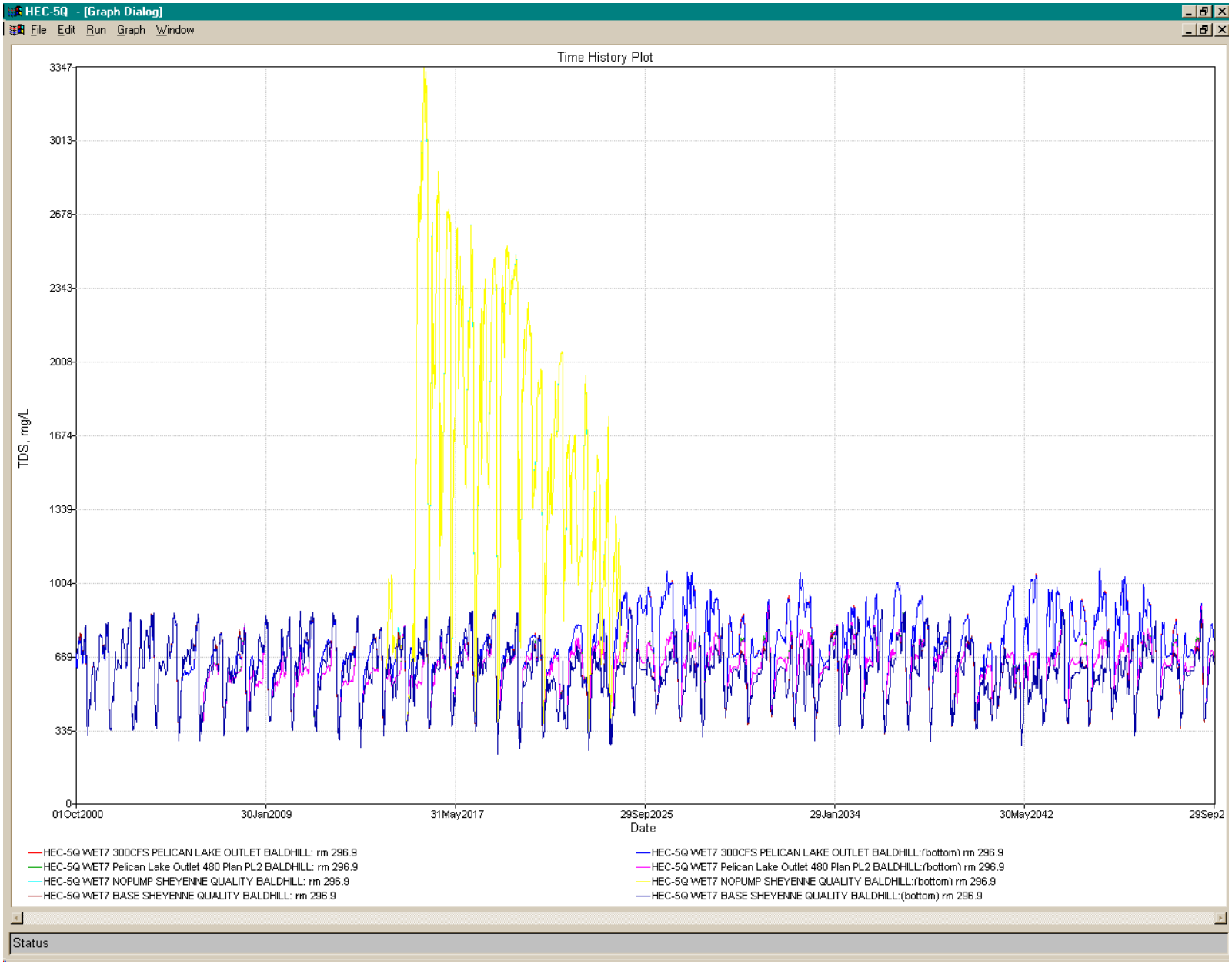

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
3347
3013
2678
2343
2008
1674
1339
1004
669
335
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET BALDHILL: rm 296.9
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

Figure 11.11

Figure 11.12

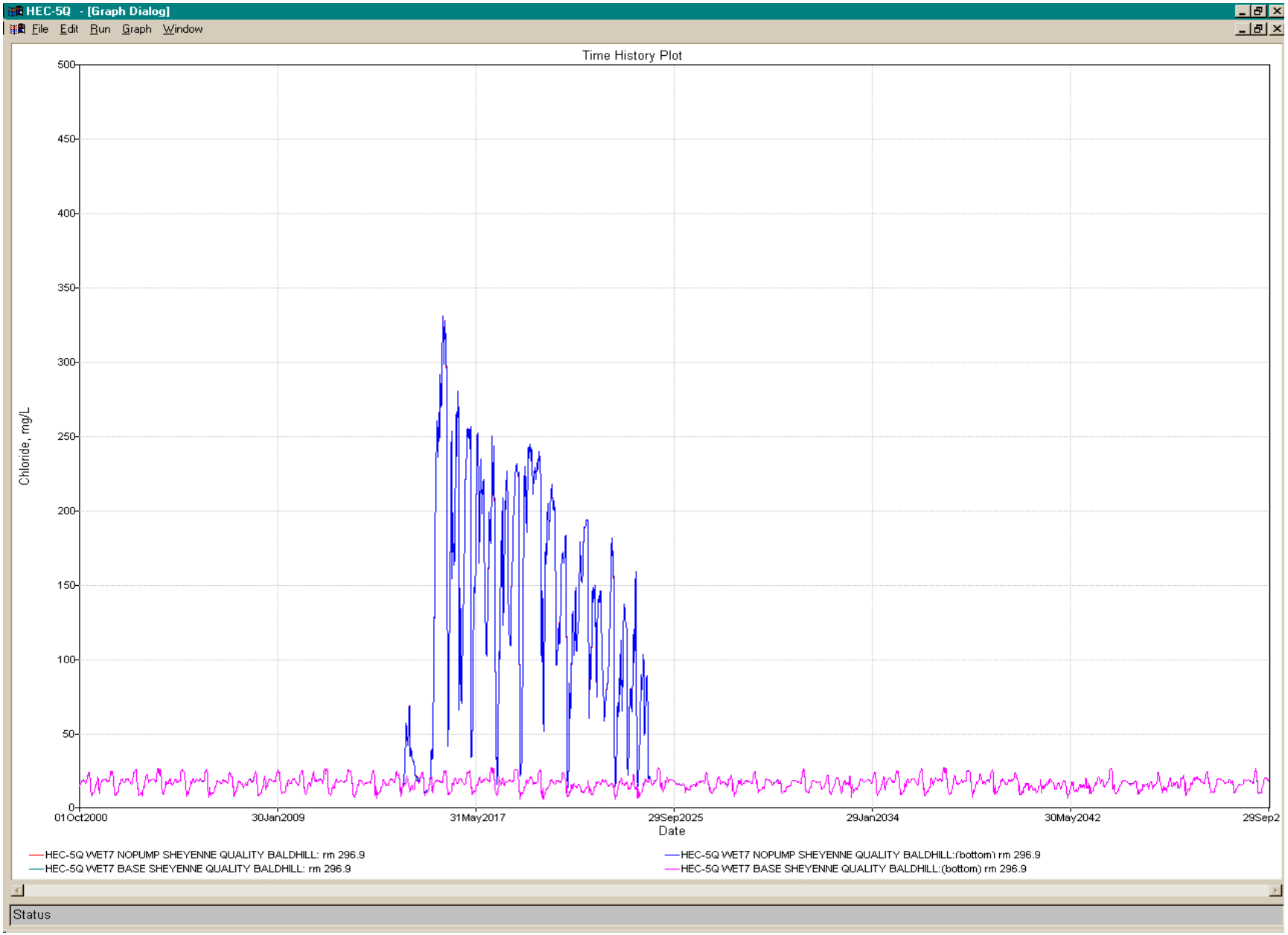
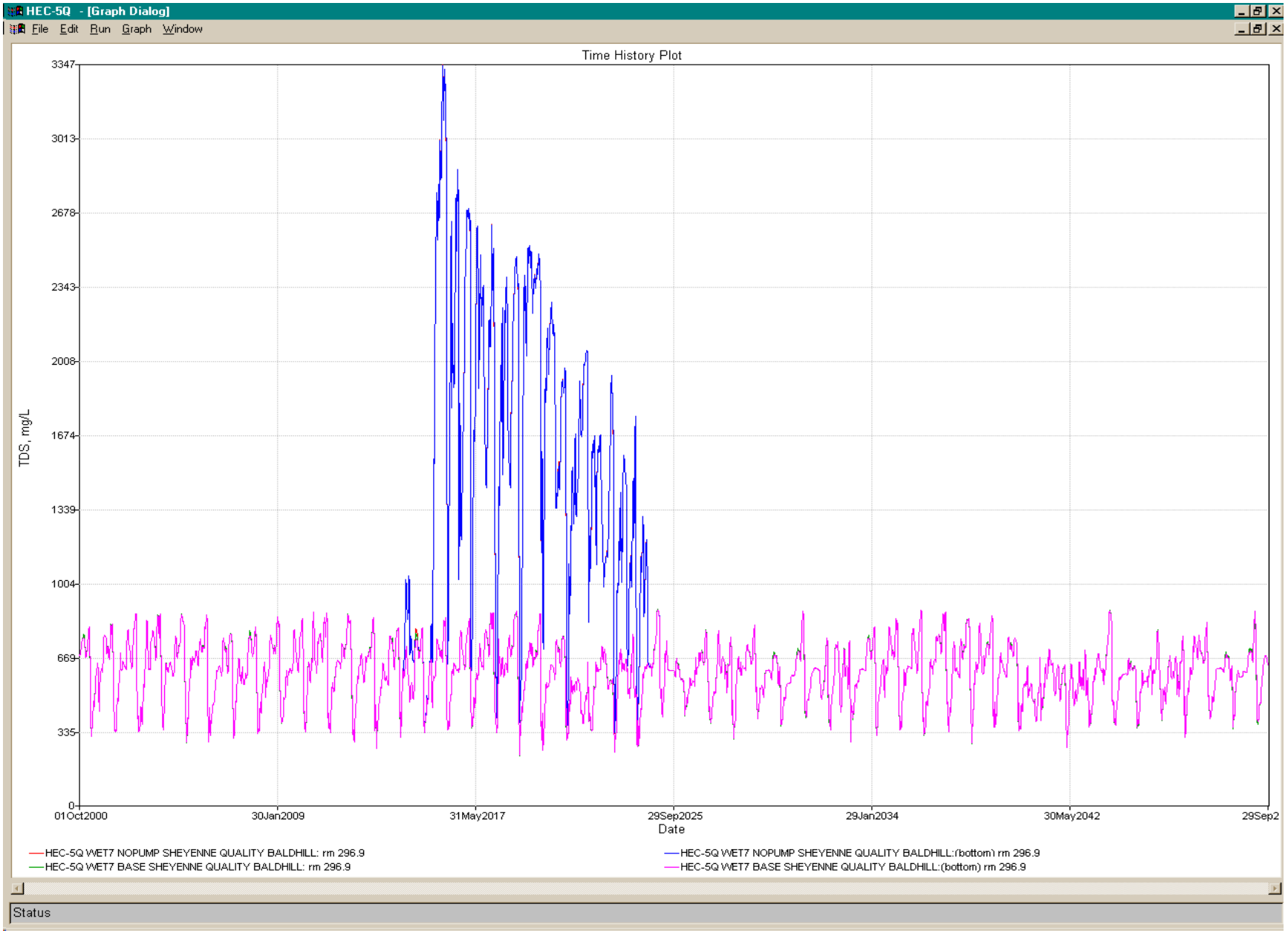

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

Figure 11.13


HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
3347
3013
2678
2343
2008
1674
1339
1004
669
335
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL: rm 296.9
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
HEC-5Q WET7 BASE SHEYENNE QUALITY BALDHILL:(bottom) rm 296.9
Status

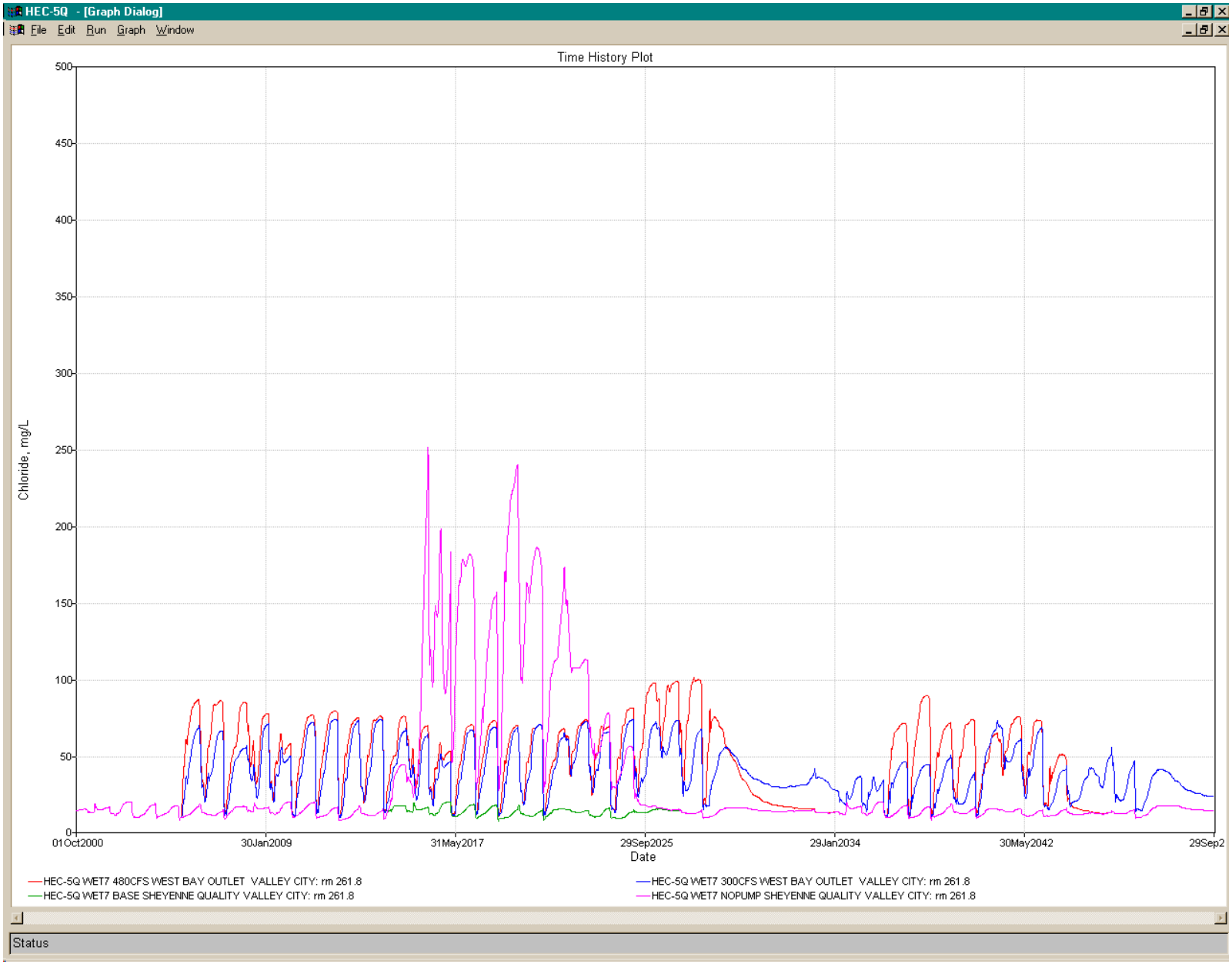

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 300CFS WEST BAY OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

Figure 11.14

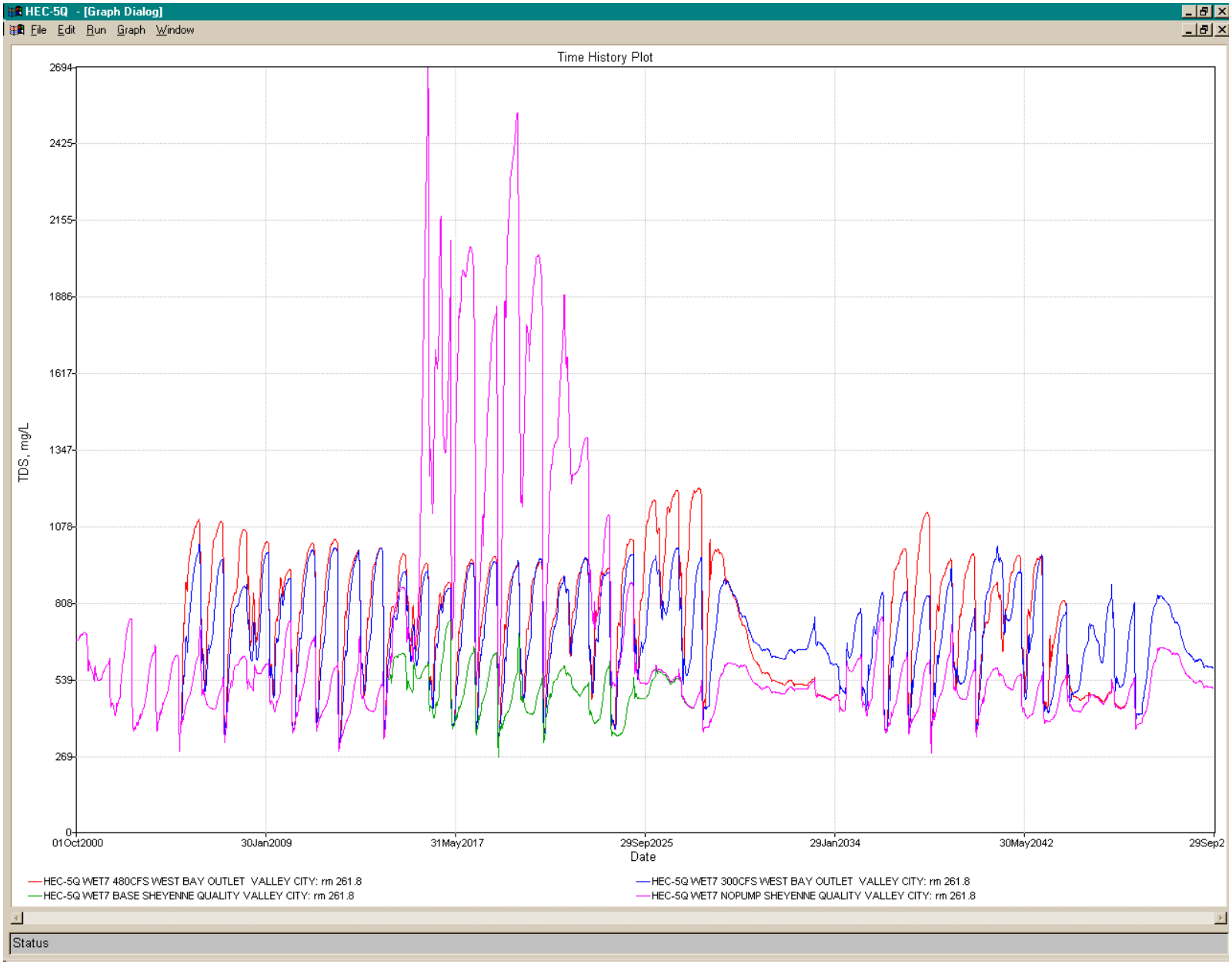

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
2694
2425
2155
1886
1617
1347
1078
808
539
269
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 300CFS WEST BAY OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

Figure 11.15

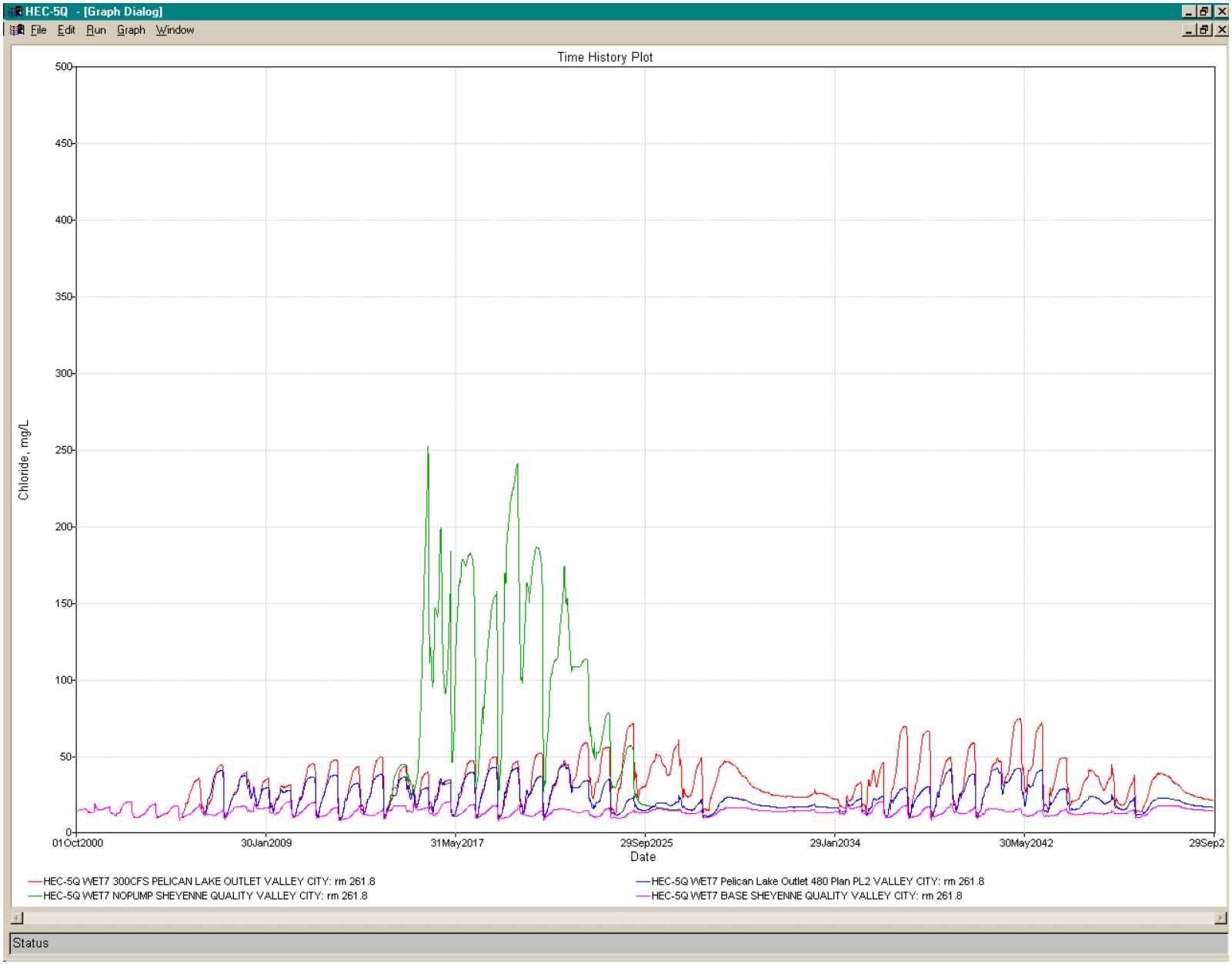

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

Figure 11.16

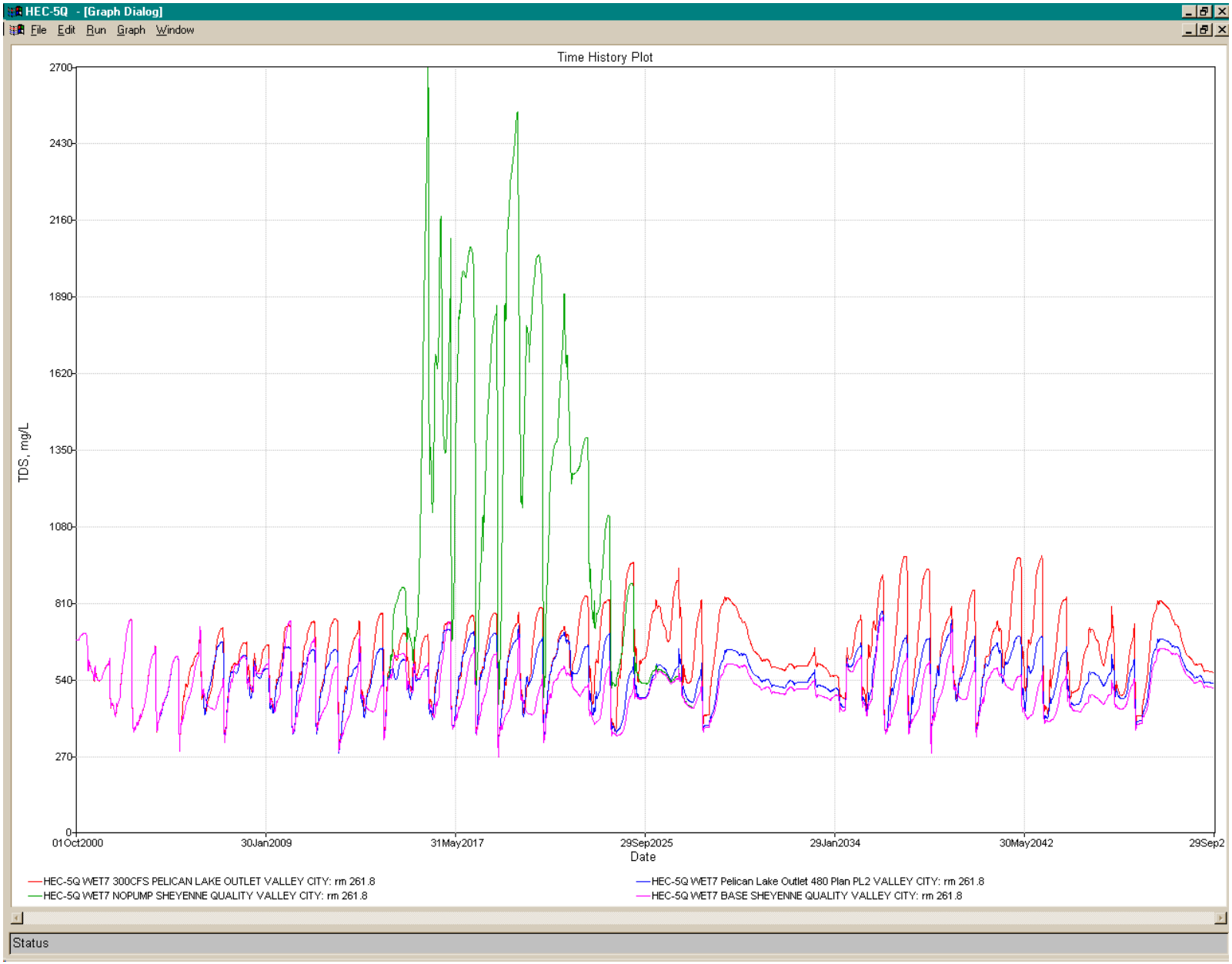
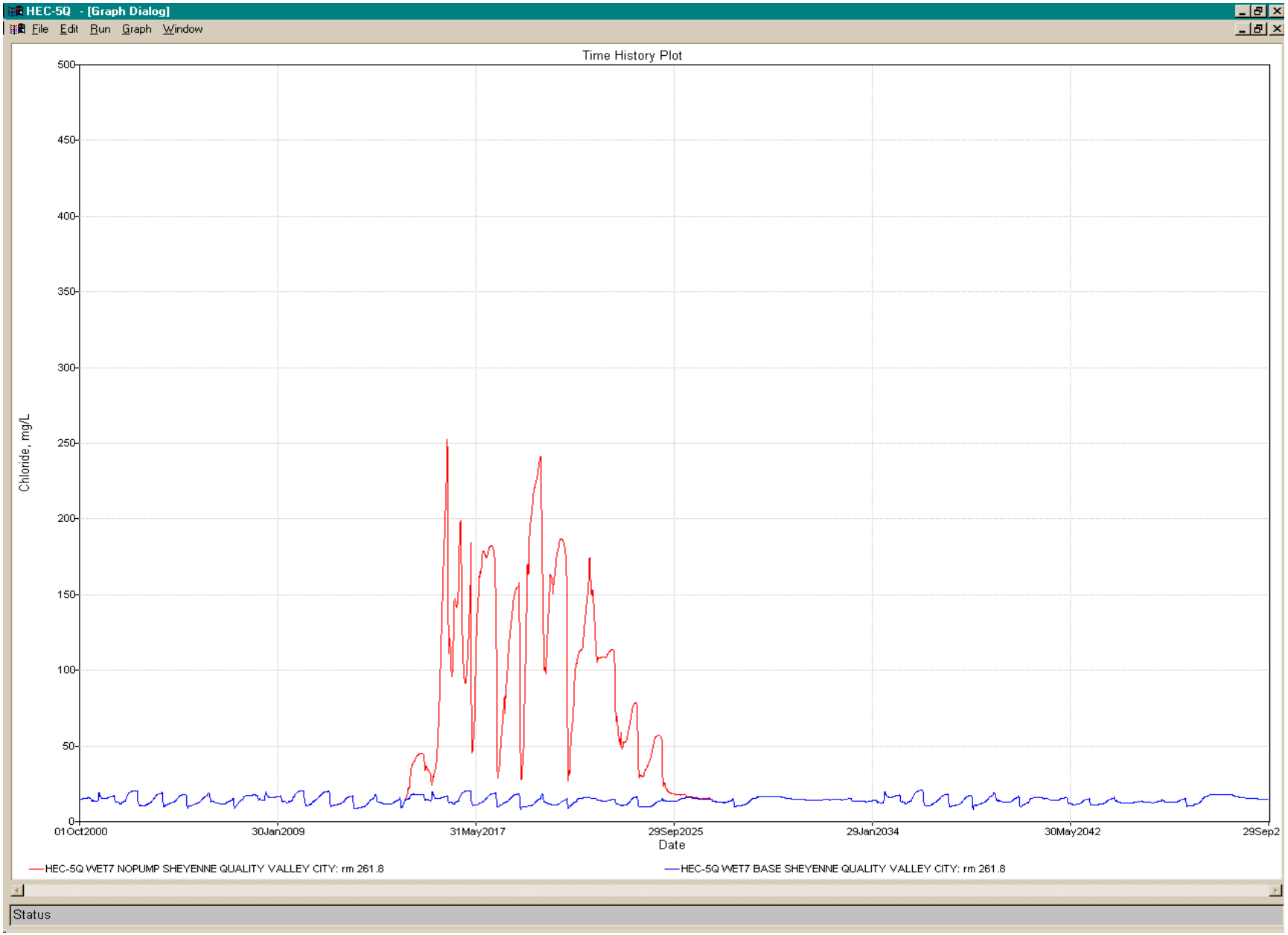

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
2700
2430
2160
1890
1620
1350
1080
810
540
270
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET VALLEY CITY: rm 261.8
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

Figure 11.17

Figure 11.18


HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

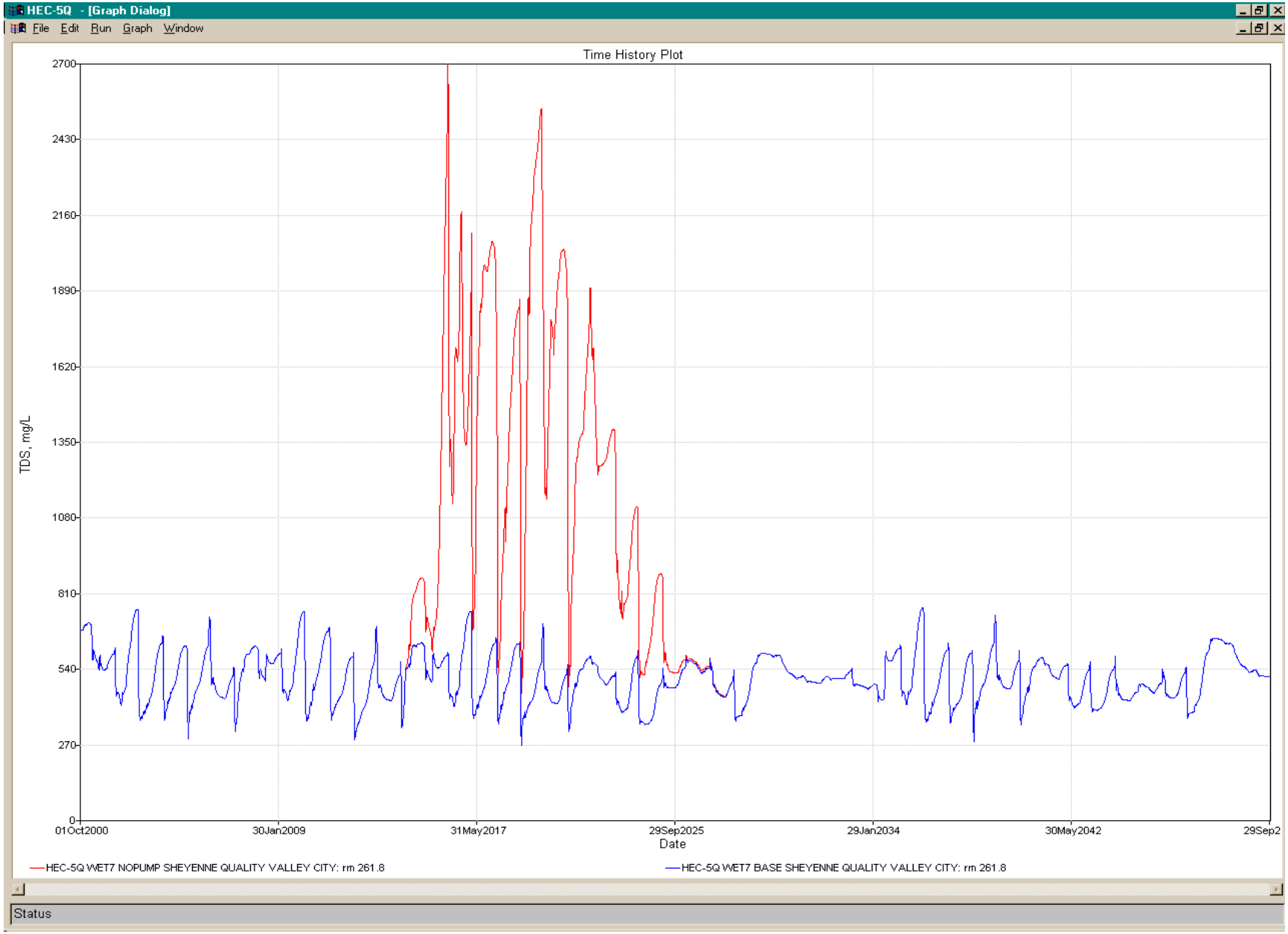

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
2700
2430
2160
1890
1620
1350
1080
810
540
270
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY VALLEY CITY: rm 261.8
HEC-5Q WET7 BASE SHEYENNE QUALITY VALLEY CITY: rm 261.8
Status

Figure 11.19

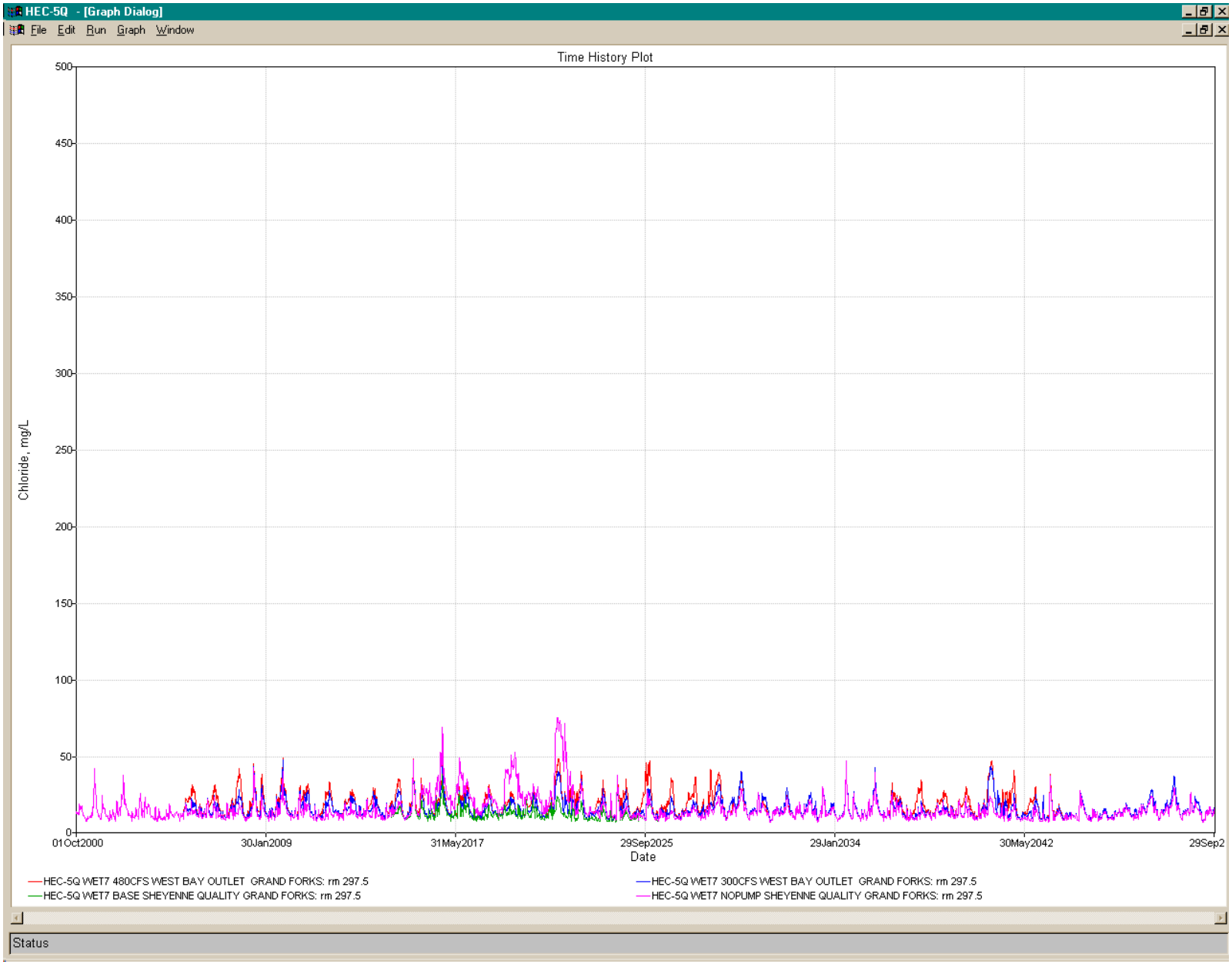

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 300CFS WEST BAY OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 BASE SHEYENNE QUALITY GRAND FORKS: rm 297.5
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY GRAND FORKS: rm 297.5
Status

Figure 11.20

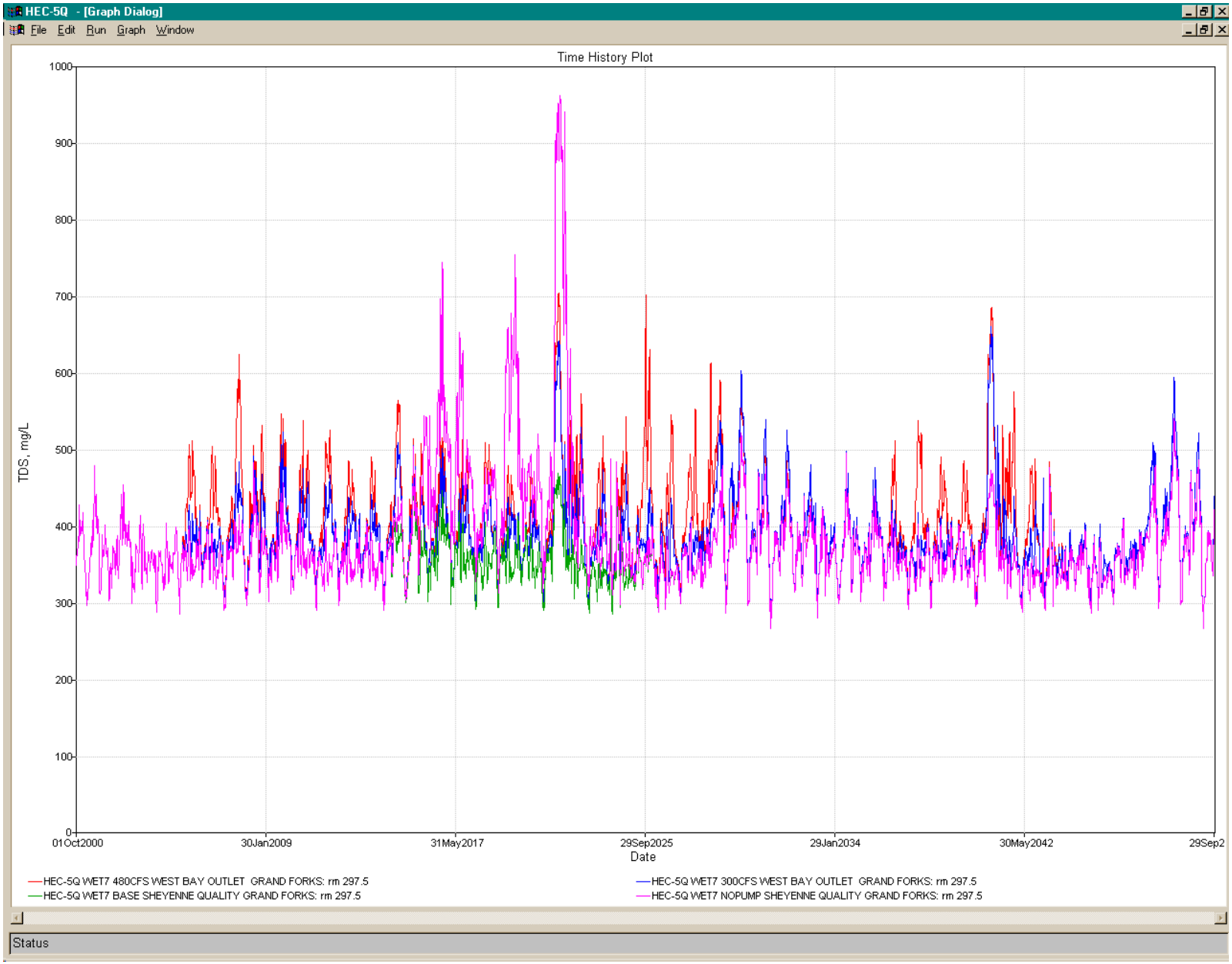

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
1000
900
800
700
600
500
400
300
200
100
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 480CFS WEST BAY OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 300CFS WEST BAY OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 BASE SHEYENNE QUALITY GRAND FORKS: rm 297.5
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY GRAND FORKS: rm 297.5
Status

Figure 11.21

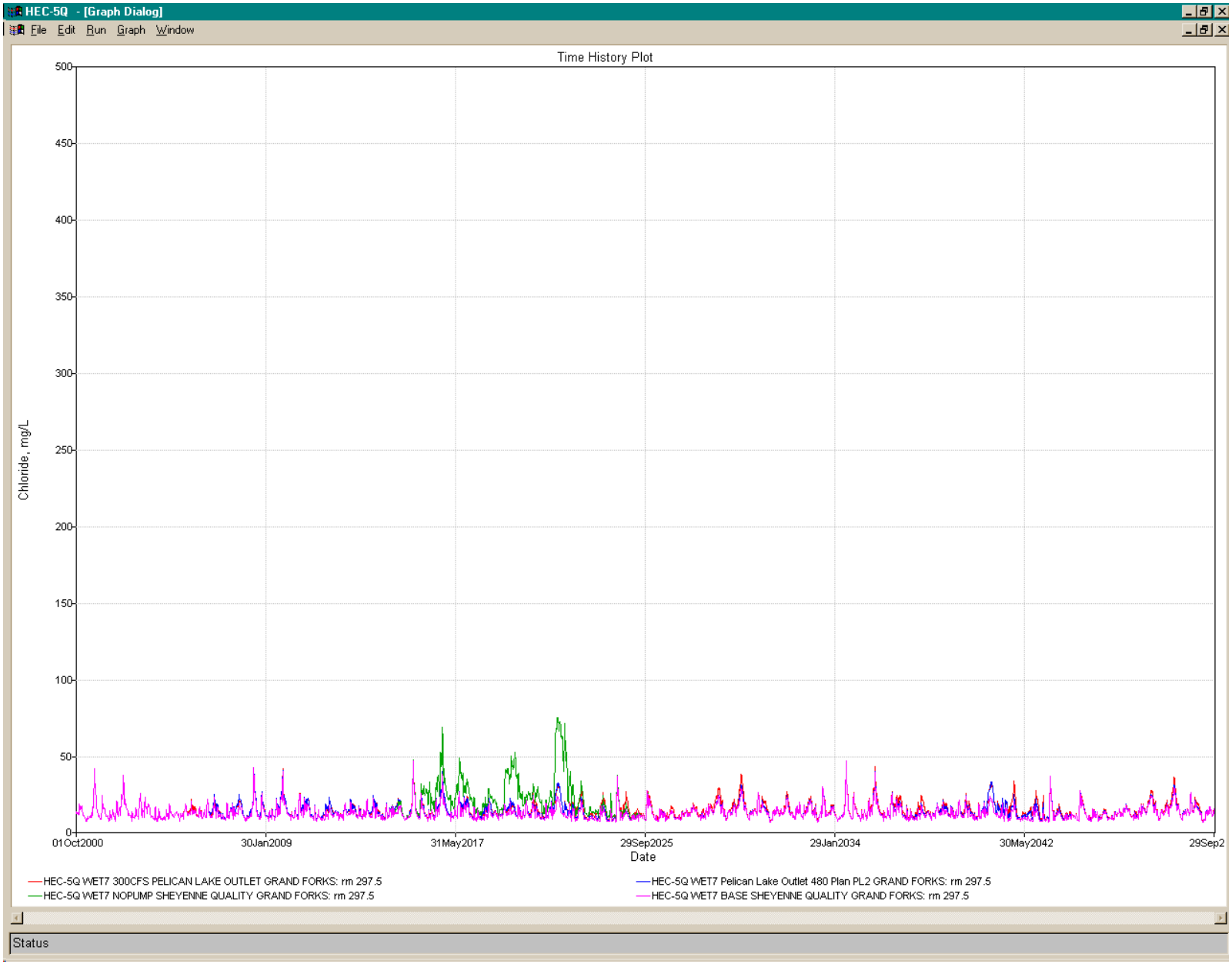

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY GRAND FORKS: rm 297.5
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 GRAND FORKS: rm 297.5
HEC-5Q WET7 BASE SHEYENNE QUALITY GRAND FORKS: rm 297.5
Status

Figure 11.22

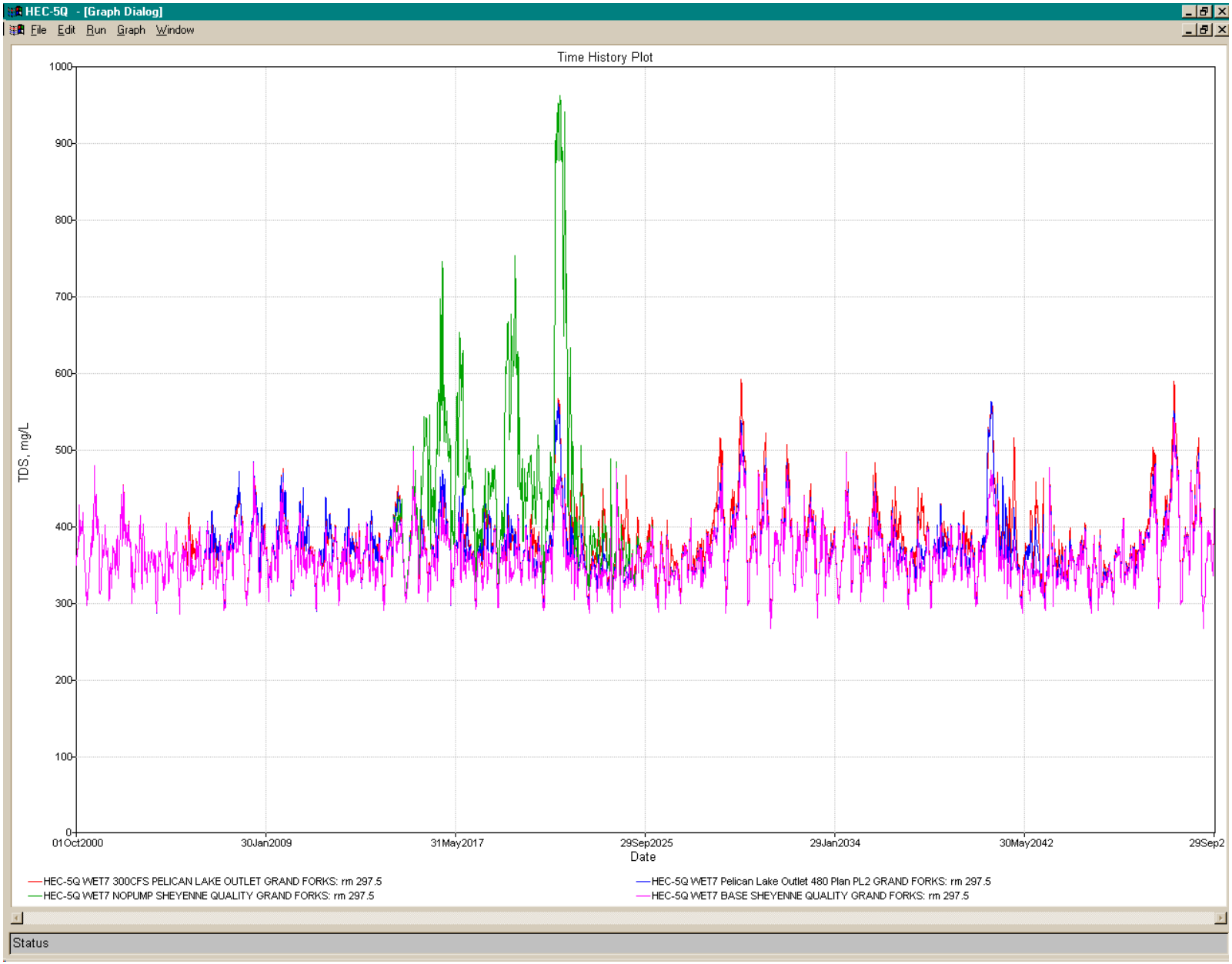
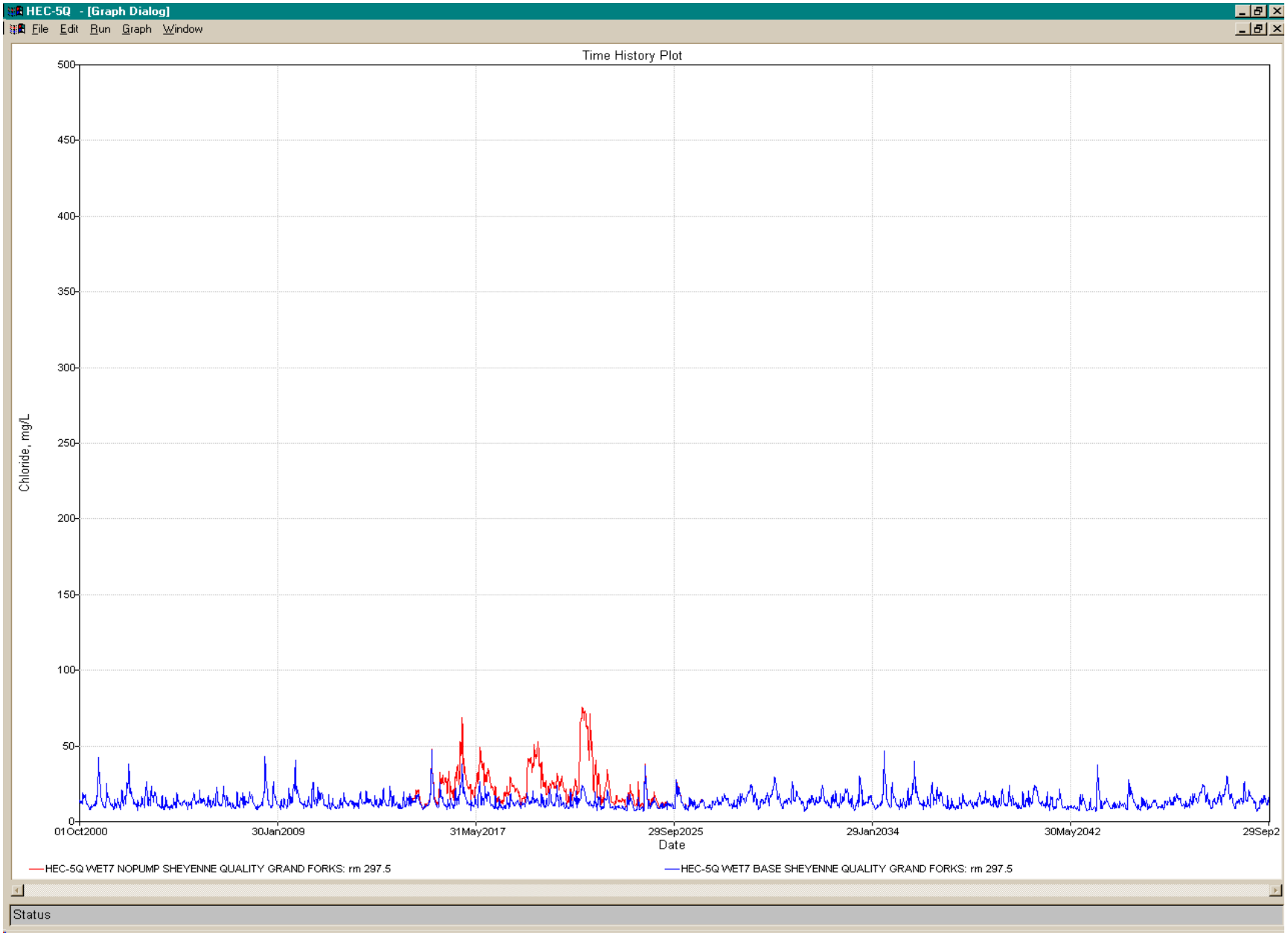

HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
TDS, mg/L
1000
900
800
700
600
500
400
300
200
100
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
30May2042
29Sep2
Date
HEC-5Q WET7 300CFS PELICAN LAKE OUTLET GRAND FORKS: rm 297.5
HEC-5Q WET7 NOPUMP SHEYENNE QUALITY GRAND FORKS: rm 297.5
HEC-5Q WET7 Pelican Lake Outlet 480 Plan PL2 GRAND FORKS: rm 297.5
HEC-5Q WET7 BASE SHEYENNE QUALITY GRAND FORKS: rm 297.5
Status

Figure 11.23

Figure 11.24


HEC-5Q - [Graph Dialog]
File Edit Run Graph Window
Time History Plot
Chloride, mg/L
500
450
400
350
300
250
200
150
100
50
0
01Oct2000
30Jan2009
31May2017
29Sep2025
29Jan2034
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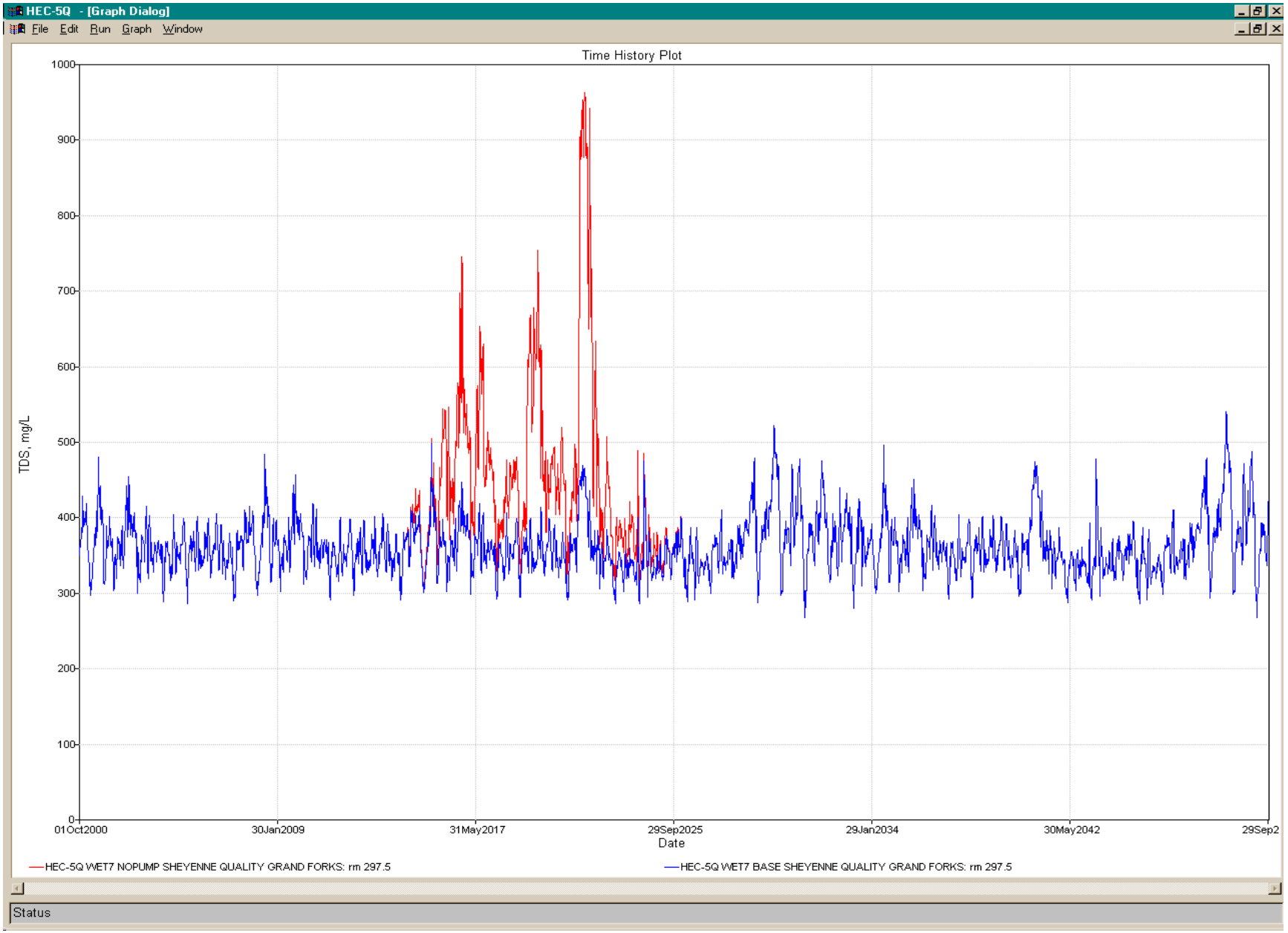
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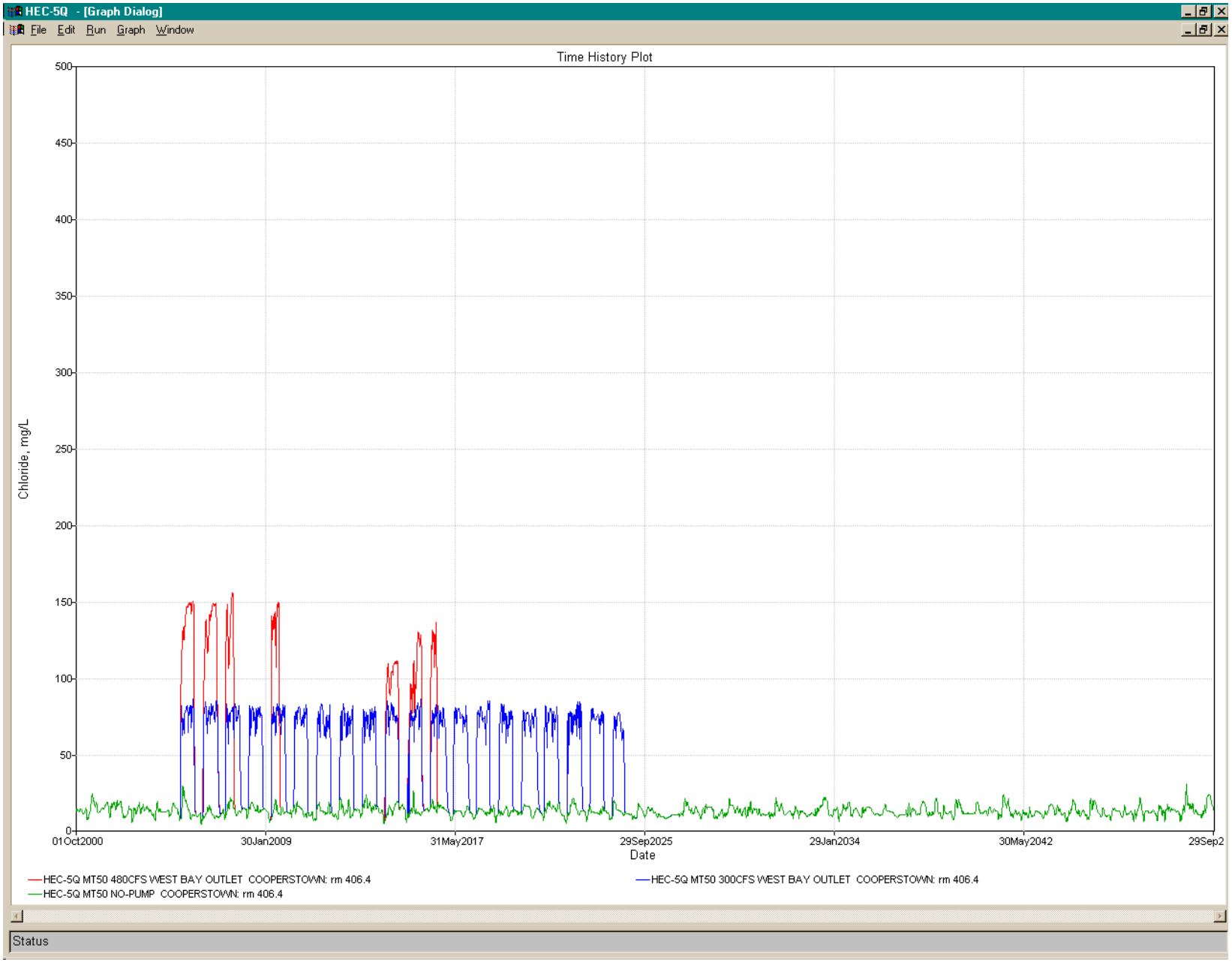
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Figure 11.26

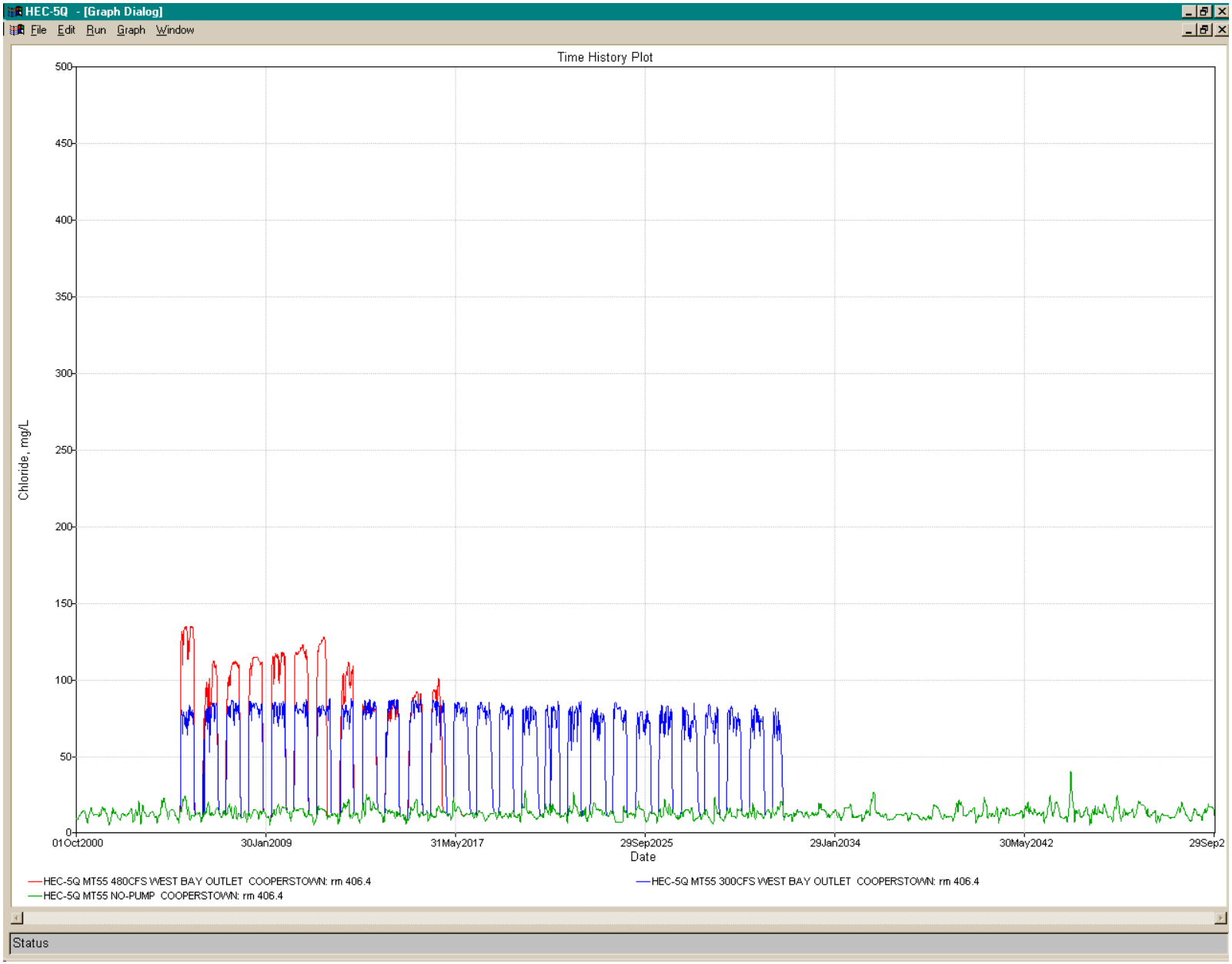
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Figure 11.27

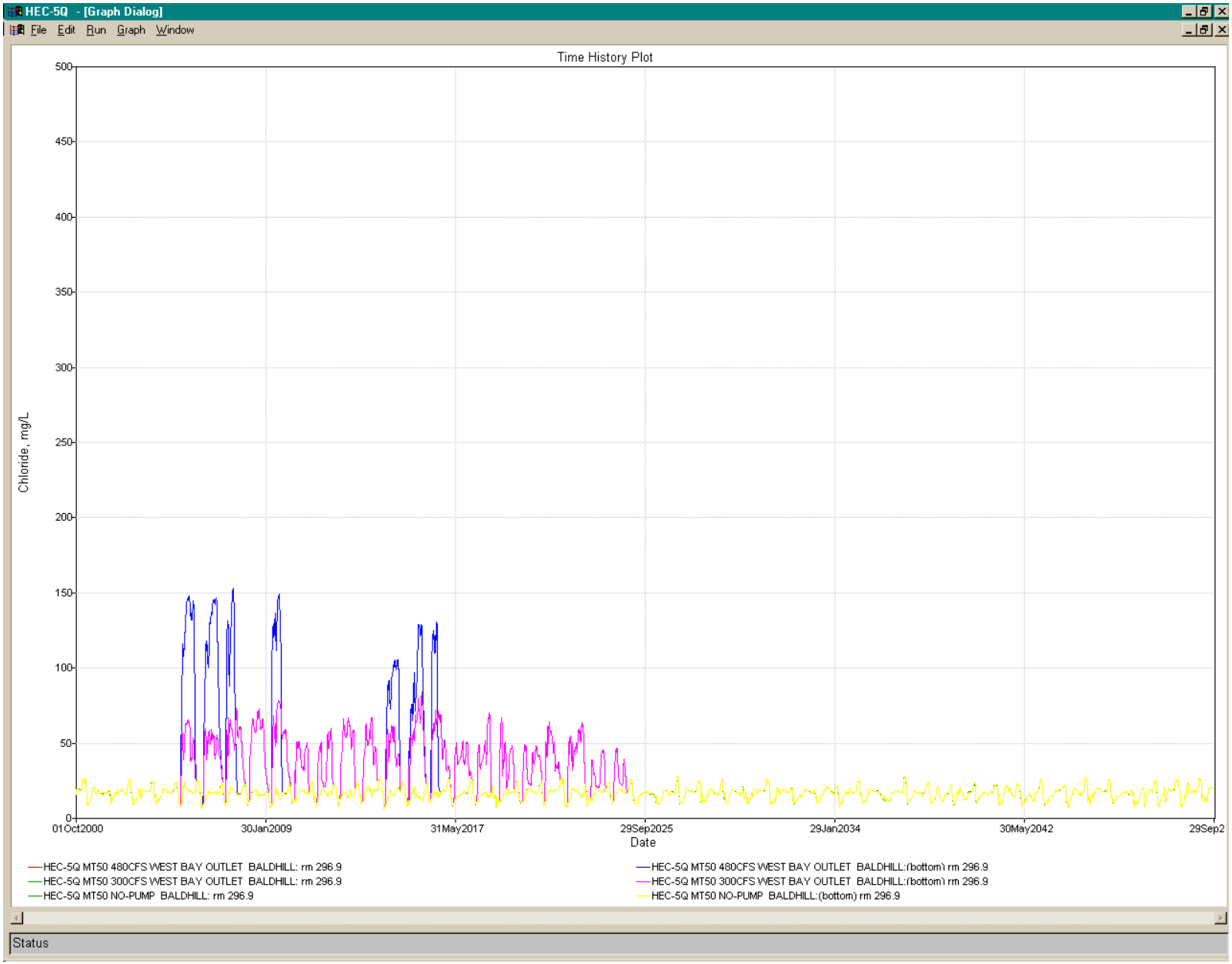
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Figure 11.28

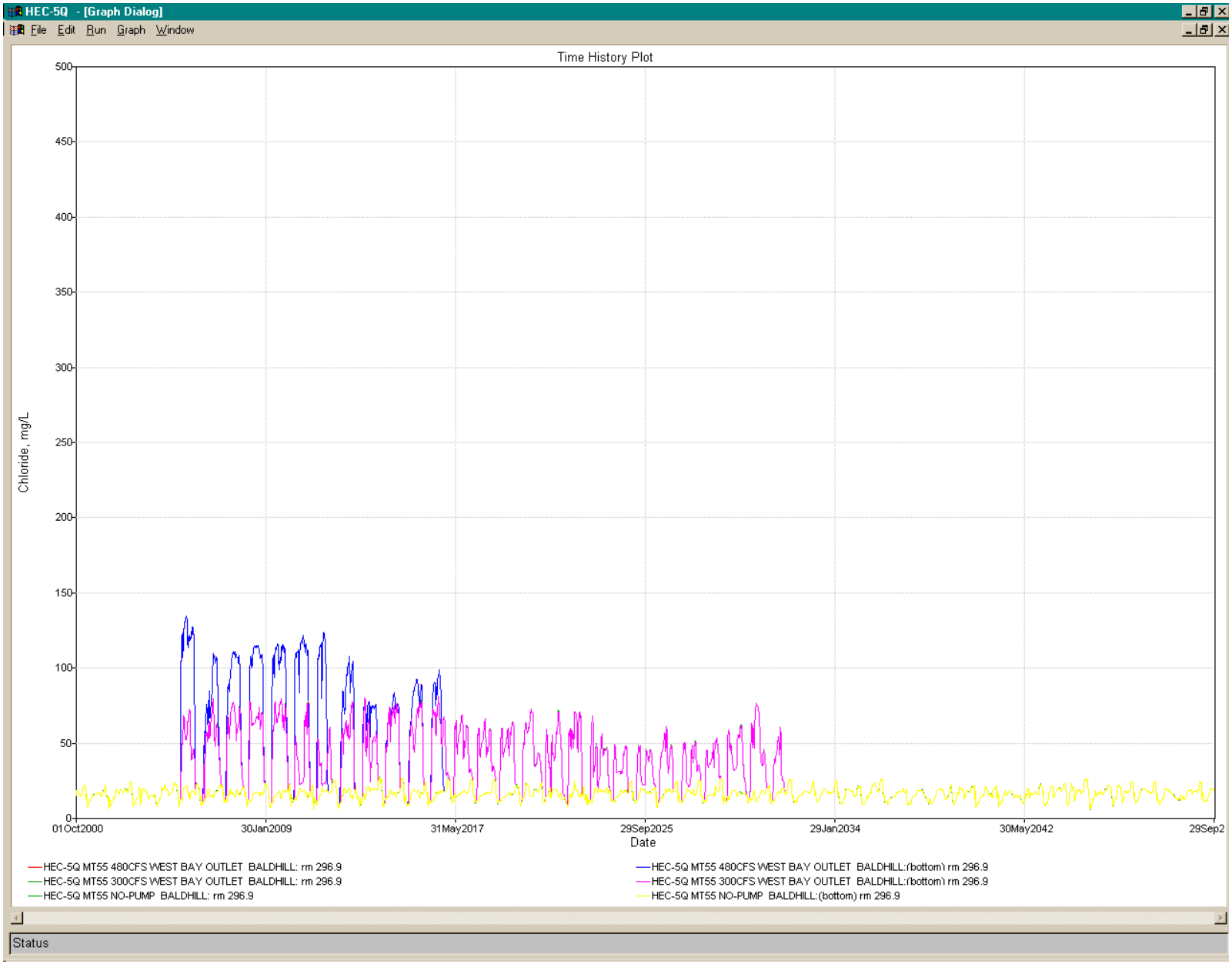
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Figure 11.29

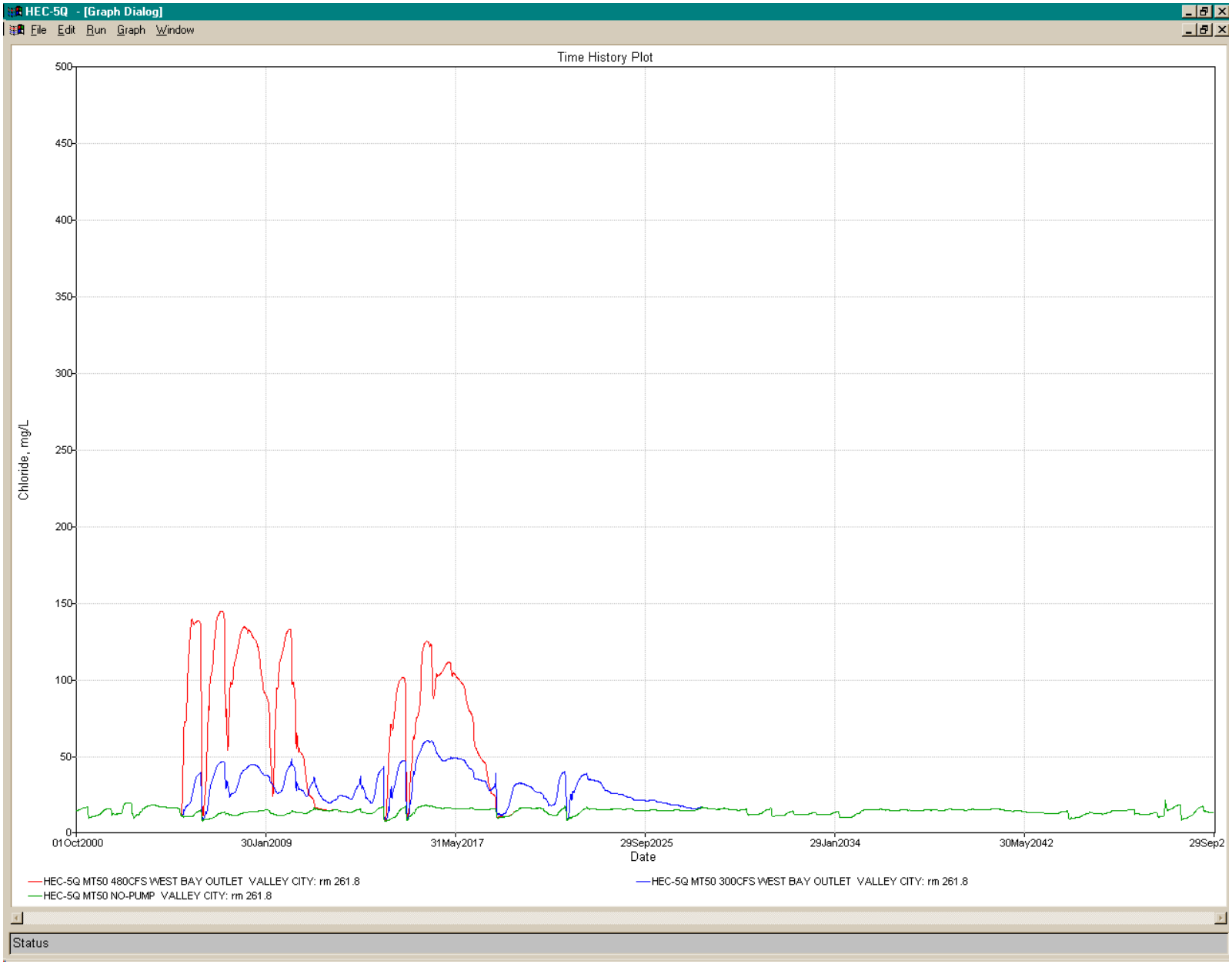
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Figure 11.30

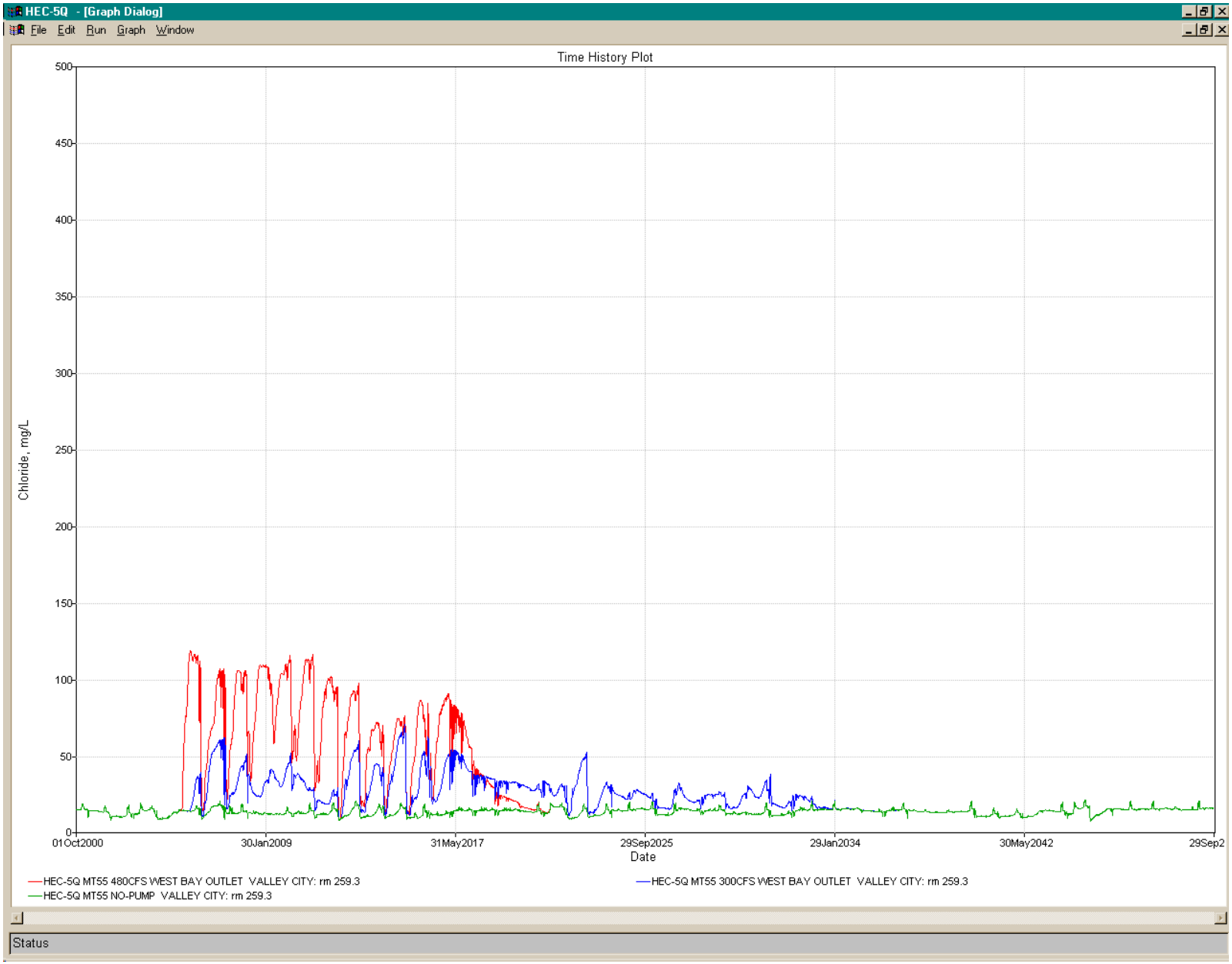
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Figure 11.31

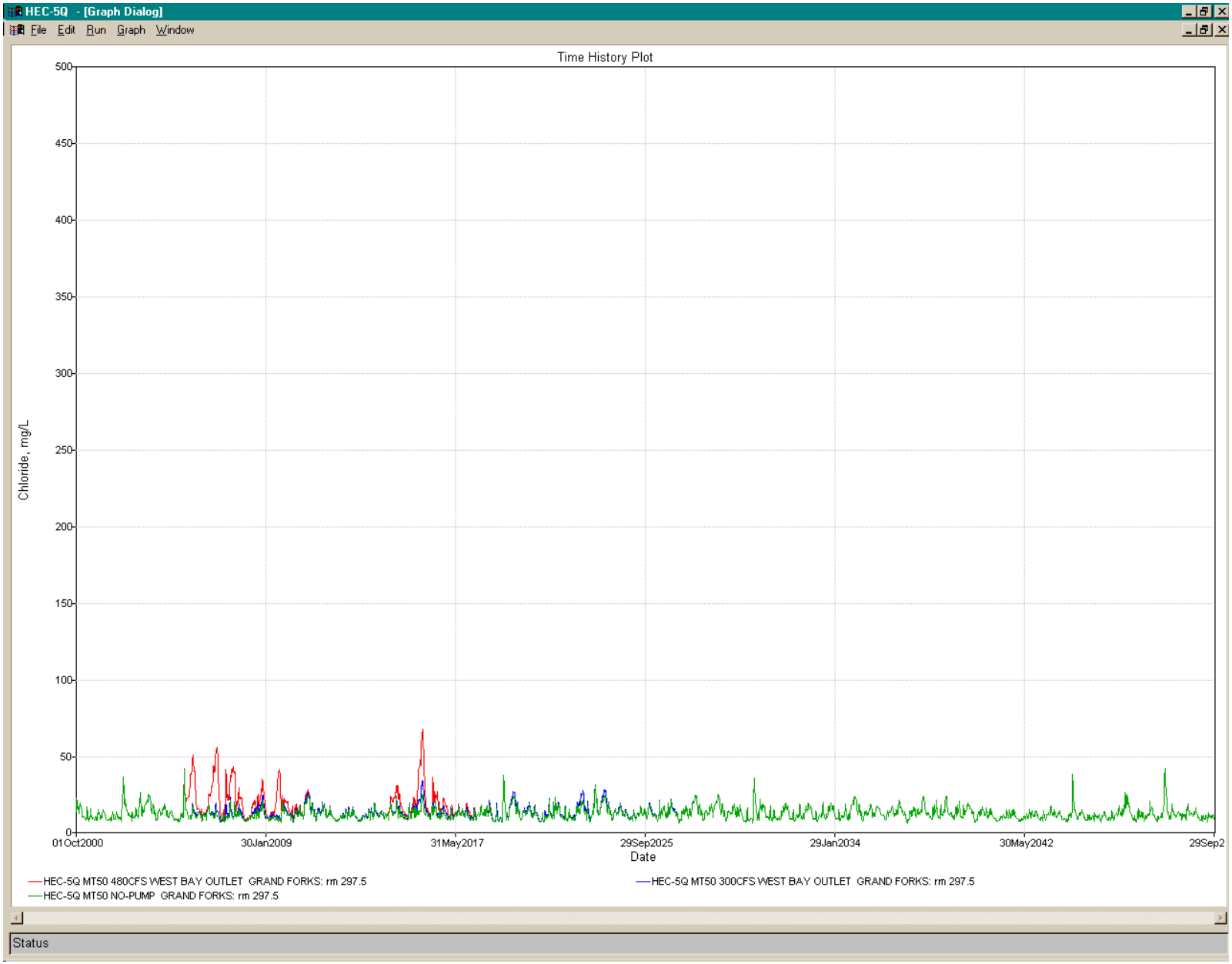
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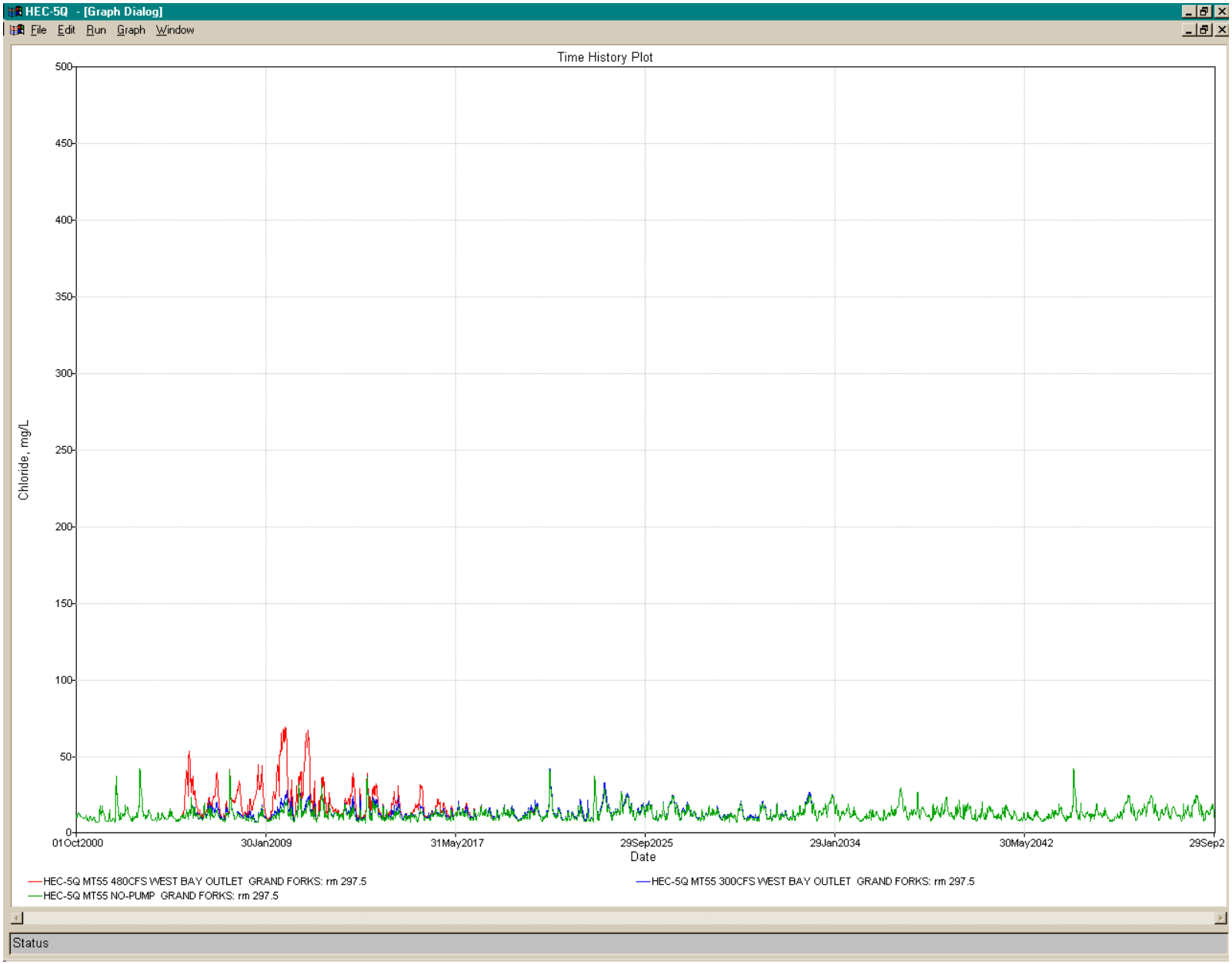
Figure 11.32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Status

Figure 11.33

12.0 EVALUATION AND COMPARISON OF THE SELECTED PLAN AND EVALUATED ALTERNATIVES

The February 2002 Draft EIS does not contain a recommended outlet plan for implementation, provide a detailed analysis of all alternatives, or contain a complete analysis of project impacts or mitigation needs. As stated in the Draft EIS, the intent of the report is to provide the decision makers in Congress the available information with which to make a decision to fund a project.

All the proposed alternatives will have negative impacts to natural resources, are ineffective at lowering the lake or preventing future flood damages, and do not meet a favorable cost/benefit ratio using the standard Corps process. Furthermore, the full extent of the environmental damage to natural resources is currently incomplete, and there are no mitigation or monitoring plans designed to identify and offset natural resource impacts resulting from the project.

Significance of fish and wildlife resources losses: The Service is concerned that due to the compressed timeframe for review, the pertinent results and recommendations from the many environmental studies competed to date will not be adequately reviewed and thoroughly implemented or incorporated into project planning. Recent studies, such as the Draft Aquatic Impact Analysis Report and the fluvial geomorphology report, contain information that indicates fish and wildlife resource damages may occur as a result of outlet operations. The upper basin water storage report contained recommendations for data refinement that, if implemented, may have lead to a different economic outcome relative to upper basin water storage.

Responsiveness to stated fish and wildlife planning objectives: Early Service concerns over exceeding state water quality standards in the Sheyenne and Red Rivers have largely been alleviated with the design of the Pelican Lake 300 cfs outlet. Although water quality may not exceed state standards on the Sheyenne River, it should be recognized that the project will result in an overall degradation of water quality in the Sheyenne and Red Rivers, with some exceedences of state standards for TDS occurring on the Red River. Erosion studies to date indicate serious erosion problems may occur as a result of yet unidentified outlet operations. Earlier Service concerns centered on water quality impacts to the freshwater mussel populations in the Sheyenne and Red River. With the design of the Pelican Lake outlet, water quality degradation in the Sheyenne and Red Rivers may not be serious enough to destroy mussel populations. However, results of the erosion study indicates that erosion and sedimentation problems may be serous enough to eliminate life stage habitat in the Sheyenne River, which may affect known host fish species for several mussel species. The synergistic effect of all the changes on the Sheyenne River will determine the resulting impacts to fish and wildlife populations and their habitats.

The Service's remaining planning objectives (Chapter 6) have not been met thus far in the Corps planning process and Draft EIS.

Extent to which impacts have been or can be avoided and/or reduced: It is unclear at this time to what extent natural resource impacts will be avoided or reduced. Environmental problems associated with the project have not been totally identified or discussed in terms of avoidance or

reduction. The Service is concerned that relevant environmental studies will not be incorporated into the final project planning process, as an outlet had been determined to be part of the solution before natural resource impacts were quantified. With the compressed timeframe for EIS completion, it is doubtful that significant changes will be made to identify and alleviate suspected or known environmental damage.

Extent to which unavoidable impacts have been or can be compensated: At this time, all the unavoidable impacts to natural resources have not been determined. Serious questions remain over how to mitigate the loss of aquatic habitat in the Sheyenne River due to the alteration of flow patterns in the river. Much more research needs to be done to determine how to mitigate the loss of stream habitat and subsequent aquatic life.

13.0 FISH AND WILDLIFE CONSERVATION MEASURES

The construction and operation of a Devils Lake outlet will require that a mitigation plan be developed and implemented to offset impacts to natural resources. It is likely that the greatest potential for natural resource impacts will be located on the Sheyenne River, downstream from the outlet's insertion point and consist primarily of water quality degradation, erosion and sedimentation and its associated effects to the aquatic habitat and biota. Lesser impacts to wetlands are expected to occur as a result of the construction of the pipeline between Devils Lake and the Sheyenne River.

Long-term monitoring will be required to fully identify the impacts that may occur as a result of the outlet operation. Based on recent studies and previous Service recommendations, the issues that require monitoring include erosion and sedimentation, channel morphology, fish and mussel surveys, aquatic habitat, water quality, riparian vegetation surveys, soil salinity, endangered species, and groundwater monitoring. All of these issues are pertinent to the downstream habitats of the Sheyenne and Red Rivers, as well as Lake Ashtabula.

Mitigation features include increased upper basin water storage to reduce the inflow into Devils Lake in an effort to reduce the need to operate the outlet, establishing or enhancing the riparian habitat along the Sheyenne River, the acquisition of key riparian blocks, planting, erosion control, fish structures, fish stocking, mussel reintroduction, and vegetation management.

The impact on mussel species in the upper Sheyenne River resulting from a 480 cfs unconstrained outlet or a natural overflow is problematic. Earth Tech, Inc., in their recently completed "Draft Aquatic Impact Analysis Report", states that the loss of mussels in the upper reach of the Sheyenne River due to water quality or erosion and sedimentation, would be difficult to mitigate for, as the upper reach is essentially isolated from recolonization sources. However, they report that research is currently underway to study the holding and propagation of mussels, which may provide the information necessary to prepare a relocation and holding plan for mussels. Mussels have been successfully reintroduced into locations where they were extirpated due to poor water quality once the quality had been improved. As for fish species, fish stocking has proven to be a successful method of introducing species into waters where habitat and water quality have been improved sufficiently enough to allow for survival (Earth Tech, Inc., 2001).

Recent studies indicate that outlet operations will result in changes in river stage and flow, and would affect the amount and distribution of aquatic habitat types on the river. Modeling results show that on the upper Sheyenne River, slow riffle habitat may decline. Slow riffle habitat is utilized by a wide variety of species and is important as spawning habitat. Downstream of Lake Ashtabula, in the lower Sheyenne, shallow and medium pool habitats would generally decrease. Shallow pool habitat is particularity important as it is inhabited primarily by young-of-the-year and juvenile fishes. Medium pool habitat is utilized by a variety of species during their life stages.

The loss of habitat on the Sheyenne River could affect not only the fish species dependent on them, but also a wide array of other aquatic life, such as mussels. A complete mitigation plan for potential impacts cannot be developed until all environmental issues are fully identified and impacts analyzed.

14.0 LIST OF RECOMMENDATIONS

The Service advises that the Corps implement the following recommendations in order to protect fish and wildlife resources in the project area.

Operating Recommendations

1. **Develop an outlet operation plan with interagency involvement.** To date, no operational plan has been developed for an outlet. Before an outlet is constructed, an interagency advisory team should develop and approve an operational plan.

2. **Configure an operational plan that addresses the future viability of Devils Lake's natural resources and minimizes downstream environmental impacts.** The Pelican Lake outlet plan, operating at 300 cfs, will pump the lake's freshest inflow to the Sheyenne River in an effort to minimize water quality impacts. However, this will increase the water quality degradation in Devils Lake, thereby hastening the decline of the lake's resources due to water quality degradation. While the Pelican Lake plan minimizes downstream water quality impacts, recent studies show that increased erosion and sedimentation is likely to occur downstream on the Sheyenne River.

3. **Establish an operational Devils Lake level at or above 1443.0 msl.** The Service recommends that elevation 1443 msl be established as a target elevation for Devils Lake to minimize effects to the lake and impacts to the Sheyenne River. Once pumping or natural draw down brings the lake to this elevation, all pumping would cease. This provides approximately 380,000 acre-feet of storage between 1443 msl and 1446.5 msl (the overflow to Stump Lake). With Stump Lake at approximately 1411.0 msl, there is approximately 371,155 acre-feet of storage to elevation 1446.5 msl. Therefore, with the lake at 1443 msl, there would be approximately 751,155 acre-feet of storage below 1446.5 msl, in both Devils Lake and Stump Lakes. Additionally, this elevation is consistent with the Service's State approved water right for Lake Alice National Wildlife Refuge, and allows for some measure of wildlife management at the refuge. Establishing the operating level at or above 1443 msl also provides for the long-term health of the Devils Lake fishery.

Minimize Inflow to the Lake while Maximizing Upper Basin Storage Potential

4. **Include in the project plan the sponsors proposal for restoration and creation of storage in the watershed as part of the three-legged stool solution to managing the rise of Devils Lake.** Along with an outlet and infrastructure protection, wetland restoration, and other means of holding water on the landscape are essential to resolving the effects of the rising water level in Devils Lake. The Corps should identify all agencies that have authority to work on water storage and assist them in

   seeking ways to increase water storage. The Service recommends establishing at least 50,000 acre-feet of new storage in the Devils Lake upper basin.

5. **Moratorium on new wetland drainage and pumping within the basin for the life of the project.** The Service recommends that the Corps coordinate with the State to insure that any plans to remove water from the landscape and place it into the lake through wetland drainage or pumping be postponed during the life of the project to avoid the need to move additional water downstream. Taking precautions to prevent further aggravating factors, such as wetland drainage and pumping from increasing lake levels is consistent with the goal of the outlet to reduce lake levels and prevent a natural overflow of Devils Lake to the Sheyenne River.

6. **Continued work on the WEST study.** The Service recommends the Corps conduct additional work on the WEST study, as suggested and supported by WEST's conclusions, before selecting any outlet plan as the preferred alterative. The additional work is necessary to refine this important data for use in the proper development of the upper basin storage portion of the project. In order to obtain the best possible information to use for depressional storage modeling, the Service recommends that a complete re-photo interpretation of the Devils Lake basin be completed. Numerous studies have consistently concluded that the most accurate and reliable way to obtain drained wetland data is to photo interpret it from high altitude, color infrared aerial photography. The new delineations could then be digitized and made available for subsequent modeling efforts.

7. **Moratorium on all existing drainage maintenance that increases volume, peak or duration of flow.** Management of existing projects which seek to add more water to Devils Lake faster should be postponed or minimized during the life of the project. A basin-wide water management plan should be developed in order to effectively manage the flow of water to Devils Lake. An operational procedure to hold water on the landscape, much like the "waffle plan" designed by the Energy & Environmental Research Center's approach to attenuate flood peaks, should be explored and implemented as part of a holistic approach to basin water management.

8. **Close all unauthorized drainage and cease all unauthorized pumping.** The State Engineer has estimated approximately 3 percent of all wetland drains in the basin are operating illegally. The Service recommends that these drains are closed to prevent the unauthorized drainage of wetlands adding to the problem of high lake levels in Devils Lake.

9. **Monitor wetland loss within the basin.** The Service is concerned that with an operational outlet comes the social demand to use it to its maximum capacity. With this in mind, the Service is concerned that additional pressure to drain wetlands will be

placed on the existing wetland base within the basin. Therefore, a monitoring plan should be established to track the security of water storage.

10. **Maximize the use of public lands in the upper basin for multi-purpose functions.** The Corps and State should assist agencies and organizations in obtaining necessary permits for storage projects that include public lands.

General Recommendations

11. **Develop monitoring plans for environmental impacts associated with the operation of the Devils Lake outlet.** The plans should include the monitoring of impacts to fish and wildlife resources and habitats within the Devils Lake basin, Devils Lake, and the Sheyenne and Red Rivers and their associated habitats. Specifically, monitoring plans should include, but not be limited to water quality, riparian vegetation, fish and mussel surveys, erosion and sedimentation, in-lake effects to the fishery of Devils Lake, and monitoring the progress of upper basin storage of water.

12. **If the Corps proceeds with an outlet project, the Service recommends that the Corps select an alternative that results in the least amount of environmental damage to the Sheyenne and Red Rivers, Devils Lake, and their habitats.** The Corps should apply an environmentally sensitive operational plan to the Pelican Lake 300 cfs outlet plan to pump the freshest water to the Sheyenne River, while maximizing Devils Lake's resources, and making maximum usage of upper basin storage opportunities to reduce inflow to the lake.

13. **Obtain Service permits and establish wetland exchange and mitigation prior to the start of construction.** All wetland easements and fee-title land interests administered by the Service have been provided to the Corps in a digital format. If easement wetlands or fee-title property are impacted, please contact Mr. Roger Hollevoet, Project Leader, Devils Lake Wetland Management District at 701-662-8611, to determine appropriate permit and conditions. The Service recommends that all wetland impacts should be mitigated on an acre-for-acre basis. Unavoidable impacts to woody vegetation should be replaced on a 2:1 basis.

14. **Include the State of North Dakota's stated intent to construct an outlet to the "Future Without the Project" conditions.** The State has started this process in the contracting of the design phase of their outlet to an engineering firm in Bismarck. They have stated their intent to move ahead in the construction phase of their outlet in the event that a Corps outlet project is not forthcoming. Including this commitment is needed to accurately reflect the future without condition.

15. **Post project monitoring of the Sheyenne River for western prairie fringed orchid impacts if an outlet greater than 300 cfs is constructed.** The Service recommends a plan be established to monitor the Devils Lake outlet operations and its impact on the watertable of the Sheyenne River and western prairie fringed orchid habitat on the Sheyenne National Grasslands and Richland and Ransom Counties if an outlet greater than 300 cfs is constructed. The Service previously raised concerns over a 300 cfs outlet and its impact on the water table in orchid habitat. Upon completion of a Barr Engineering study, the Service concurred with the Corps' determination that the proposed 300 cfs outlet is not likely to adversely affect listed species. However, if an outlet with a greater pumping capacity (e.g. one of the several 480 cfs alternatives) is selected, the Service will request a study be conducted to determine the potential impact that alternative will have on the western prairie fringed orchid.

16. **The Corps should dismiss the "wall of water" theory surrounding an overflow event from Devils Lake to the Sheyenne River.** The Corps should dismiss the popular notion that there will be a wall of water cascading down the Tolna Coulee in the event Devils Lake should ever rise to its overflow of 1460 msl. There is no scientific data that suggests a "wall of water" will downcut the Tolna Coulee in the case the lake ever overflowed. Furthermore, the Federal Register notice of December 22, 2000, stated that measures at the natural overflow point would be taken to minimize erosion.

    The Service wrote a Planning Aid Letter, dated May 24, 1999, providing input on the potential natural resource impacts of an overflow from Devils Lake to the Sheyenne River through the Tolna Coulee. The report evaluated Corps data that documented predicted flow projections for the 6-year and SPF outflows. It was shown that despite the significant inflow to the lake, the flow projections demonstrate that evaporation from the lake's surface area will have a dramatic effect in limiting the amount and peak flow of water that could outflow from the basin.

    The 6-year outflow showed that the maximum flow out of the basin within the first 24 months was in month 18, with a maximum outflow of 80 cfs, with a 24-month average of 61 cfs. The SPF outflow showed a maximum of 1196 cfs in month 6, with a 24-month average of 463 cfs.

17. **Fish entrainment and fish screen.** The Service recommends that any pump intake be designed to pump at or less than 0.5 foot per second, with a 0.25 inch mesh fish screen to minimize concerns for impingement and entrainment of fish into the intake.

18. **The Service recommends that the Corps use the stochastic method, as outlined in the Corps of Engineers Principles and Guidelines, to determine project effectiveness as this method provides the most defensible analysis.** All outlet alternatives should use the standard stochastic approach to evaluating the economic

feasibility of the project. Creating hydrologic data, as in the "wet future" scenario, does not seem to comply with the standard Corps guidelines. Repeating the wettest 7 years in recorded history back-to-back until the lake spills out of the basin seems to be a manufactured attempt to create a disaster large enough to justify the project. If a "what if" scenario is desirable, perhaps the moderate futures of 1450 msl or 1455 msl would be more likely.

15.0 SUMMARY OF FINDINGS AND SERVICE POSITION

The purpose and need for the outlet project, as defined in the December 22, 2000, Federal Register notice, is to *"reduce the flood damages related to the rising lake levels in the flood-prone areas around Devils Lake and to reduce the potential for a natural overflow event."* Based on the review of the project, the Service is concerned that the proposed alternatives will not fully accomplish the two-fold purpose of the project.

By using the wet future scenario, the hydrology necessary to produce an overflow to the Sheyenne River can be created with all outlet alternatives shown to prevent the lake from overflowing the basin, thus fulfilling the second project purpose of reducing the potential for a natural overflow. However, it's apparent that all outlet alternatives, using the wet and moderate 1450 msl and 1455 msl futures, fail to fully meet the first stated project purpose of reducing flood damages around the lake. Despite the operation of a 300 cfs outlet, the HEC5Q water model concludes that lake levels will continue to rise with an outlet, albeit more slowly, and the continual rise of lake elevations will require additional infrastructure protection. The inevitable expenditure of money and construction of infrastructure protection measures is still likely.

All of the outlet alternatives studied to date fail to prevent the rise of the lake, lower lake levels, or prevent the flood damages related to rising lake levels. All outlet alternatives result in a rise of anywhere from 5 to 10 feet in elevation (1452 msl to 1457 msl) above the current lake elevation of 1447 msl. Lake level rises to these elevations will still require levee and road raises, as well as other infrastructure measures. Complicating the analysis is the prediction that all alternatives result in a general degradation of the downstream water quality of the Sheyenne and Red Rivers, increased erosion and sedimentation, the loss of stream habitat and the potential impacts to fish and mussel species. The Pelican Lake plan will result in the removal of the freshest inflow to the lake, thereby reducing the lake's overall water quality and hastening the impact that poor water quality will have on the aquatic biota. Furthermore, all outlet alternatives do not meet a favorable cost/benefit ratio using the standard Corps methodology.

The Service is concerned that the public's expectation that an outlet will solve their flood problems is not met with the current alternatives. An outlet that fails to perform to the public's expectation may create future pressure to operate the outlet in a way inconsistent with its original intent by increasing its pumping duration and capacity. Increasing the pumping duration or capacity will likely create additional downstream water quality degradation, erosion and sedimentation on the Sheyenne and Red Rivers, as well as other environmental problems.

In passing the FWCA, Congress established two basic premises upon which the Act is founded: 1) to recognize *"the vital contribution of our wildlife resources to the Nation, the increasing public interest and significance thereof due to expansion of our national economy and other factors,"* and 2) *"to provide that wildlife conservation shall receive equal consideration and be coordinated with other features of water-resource development programs through effectual and*

harmonious planning, development, maintenance, and coordination of wildlife conservation and rehabilitation".

Based on the Service's review of the Draft EIS, the Service believes that the Corps has not met the intent of the FWCA by failing to provide fish and wildlife resources *"equal consideration"* during project planning. Evidence of this lies in the number of environmental reports that are incomplete due to the compressed timeframe, or their findings and recommendations have not been fully incorporated into the Draft EIS. Furthermore, a complete environmental analysis, with a monitoring and mitigation plan designed to address natural resource impacts, has not been developed.

If a project is authorized by Congress, the Service recommends the least environmentally damaging outlet alternative be selected, based on a yet-to-be-developed operational plan, that minimizes the impacts to the viability of Devils Lake and downstream on the Sheyenne and Red Rivers. A long-term monitoring plan must be developed to identify and describe natural resource impacts. Furthermore, a mitigation plan should be implemented for the impacts currently identified, and periodically updated for impacts identified through the monitoring plan.

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Appendix 1.

SPCode	Species
AMM	AMAZON MOLLY
AME	AMERICAN EEL
AMS	AMERICAN SHAD
AMP	AMUR PIKE
APT	APACHE TROUT
ARC	ARCTIC CHAR
ARG	ARCTIC GRAYLING
ATS	ATLANTIC SALMON
ASN	ATLANTIC STURGEON
BKF	BANDED KILLIFISH
BES	BEAUTIFUL SHINER
BBG	BIG BEND GAMBUSIA
BIB	BIGMOUTH BUFFALO
BIS	BIGMOUTH SHINER
BAB	BLACK BUFFALO
BLB	BLACK BULLHEAD
BLC	BLACK CRAPPIE
BCS	BLACKCHIN SHINER
BND	BLACKNOSE DACE
BNS	BLACKNOSE SHINER
BSD	BLACKSIDE DARTER
BCF	BLUE CATFISH
BLP	BLUE PIKE
BLS	BLUE SUCKER
BXC	BLUE X CHANNEL CATFISH
BLG	BLUEGILL
BLM	BLUNTNOSE MINNOW
BNS	BLUNTNOSE SHINER
BOC	BONNEVILLE CISCO
BTC	BONYTAIL CHUB
BON	BOWFIN
BRM	BRASSY MINNOW
BSB	BROOK STICKLEBACK
BKT	BROOK TROUT
BRB	BROWN BULLHEAD
BNT	BROWN TROUT
BLT	BULL TROUT

SPCode	Species
BUT	BURBOT
CAP	CARP
CMM	CENTAL MUDMINNOW
CSR	CENTRAL STONEROLLER
CCF	CHANNEL CATFISH
CCH	CHIHUAHUA CHUB
CHS	CHUM SALMON
COS	COHO SALMON
CSF	COLORADO SQUAWFISH
CSP	COMANCHE SPRINGS PUPFISH
CMS	COMMON SHINER
CRC	CREEK CHUB
CUT	CUTTHROAT TROUT
DAR	DARTERS
DEP	DESERT PUPFISH
DOV	DOLLY VARDEN
DXB	DOLLY VARDEN X BKT
DUD	DUSKY DARTER
EMS	EMERALD SHINER
FCS	FALL CHINOOK SALMON
FHM	FATHEAD MINNOW
FID	FINESCALE DACE
FCF	FLATHEAD CATFISH
FLC	FLATHEAD CHUB
FOD	FOUNTAIN DARTER
FWD	FRESHWATER DRUM
GAR	GARS
GTM	GILA TOPMINNOW
GIT	GILA TROUT
GIS	GIZZARD SHAD
GHR	GOLDEN REDHORSE
GOH	GOLDEN REDHORSE
GOS	GOLDEN SHINER
GOT	GOLDEN TROUT
GOE	GOLDEYE
GOF	GOLDFISH
GRC	GRASS CARP

SPCode	Species
GRP	GRASS PICKEREL
GRH	GREATER REDHORSE
GSF	GREEN SUNFISH
GUB	GUADALUPE BASS
GSN	GULF STURGEON
HEG	HERRING
HOC	HORNYHEAD CHUB
HBC	HUMPBACK CHUB
HSF	HYBRID SUNFISH
IOD	IOWA DARTER
JOD	JOHNNY DARTER
JUS	JUNE SUCKER
KIH	KILLIFISH
KOE	KOKANEE
LAC	LAKE CHUB
LCS	LAKE CHUBSUCKER
LAH	LAKE HERRING
LST	LAKE STURGEON
LAT	LAKE TROUT
LWS	LAKE WHITEFISH
LAW	LAKE WHITEFISH
LAS	LANDLOCKED ATLANTIC SALMON
LMB	LARGEMOUTH BASS
LSR	LARGESCALE STONEROLLER
LFS	LATE FALL CHINOOK SALMON
LSP	LEON SPRINGS PUPFISH
LED	LEOPARD DARTER
LOP	LOGPERCH
LOD	LONGNOSE DACE
LND	LONGNOSE DARTER
LNG	LONGNOSE GAR
LOS	LONGNOSE SUCKER
LRS	LOST RIVER SUCKER
MOE	MOONEYE
MOS	MOUNTAIN SUCKER
MWF	MOUNTAIN WHITEFISH
MUW	MUDMINNOW

SPCode	Species
MUE	MUSKELLUNGE
NHS	NORTHERN HOGSUCKER
NOP	NORTHERN PIKE
NRD	NORTHERN REDBELLY DACE
OHR	OCONEE REDHORSE
OHT	OHRID TROUT
OSF	ORANGE-SPOTTED SUNFISH
XXX	OTHER/UNKNOWN/NOT IDENTIFI
PAH	PADDLEFISH
PRC	PAHRANAGAT ROUNDTAIL CHUB
PLS	PALLID STURGEON
PXS	PALLID X SHOVELNOSE
SBH	PALMETTO BASS
PED	PEARL DACE
PPF	PECOS PUPFISH
PKS	PINK SALMON
PKF	PLAINS KILLIFISH
PLM	PLAINS MINNOW
PTM	PLAINS TOPMINNOW
PUS	PUGNOSE SHINER
PSD	PUMPKINSEED
PSF	PUMPKINSEED SUNFISH
QUK	QUILLBACK
QCS	QUILLBACK CARPSUCKER
RBS	RAINBOW SMELT
RBT	RAINBOW TROUT
RXS	RAINBOW X STEELHEAD
RBS	RAZORBACK SUCKER
RDM	RED DRUM
RES	RED SHINER
RDS	REDBREAST SUNFISH
RSF	REDEAR SUNFISH
RGC	RIO GRANDE CHUB
RCS	RIVER CARPSUCKER
RID	RIVER DARTER
RIS	RIVER SHINER
ROB	ROCK BASS

SPCode	Species
ROS	ROSYFACE SHINER
RTC	ROUNDTAIL CHUB
SAS	SAND SHINER
SAR	SAUGER
WXS	SAUGEYE
SHR	SHORTHEAD REDHORSE
SNG	SHORTNOSE GAR
SSN	SHORTNOSE STURGEON
SNS	SHORTNOSE SUCKER
SHS	SHOVELNOSE STURGEON
SFC	SICKLEFIN CHUB
SIC	SILVER CHUB
SRH	SILVER REDHORSE
SIS	SILVERBAND SHINER
SKH	SKIPJACK HERRING
SMT	SLENDER MADTOM
SHD	SLENDERHEAD DARTER
SMB	SMALLMOUTH BASS
SAB	SMALLMOUTH BUFFALO
SND	SNAIL DARTER
SNK	SNOOK
SOS	SOCKEYE SALMON
SPL	SPLAKE
SPS	SPOTFIN SHINER
SOS	SPOTTAIL SHINER
SPB	SPOTTED BASS
SPS	SPOTTED SUCKER
SCS	SPRING CHINOOK SALMON
STT	STEELHEAD
STE	STICKLEBACK
SOC	STONECAT
STB	STRIPED BASS
STC	STURGEON CHUB
SUM	SUCKERMOUTH MINNOW
SUS	SUMMER CHINOOK SALMON
TMT	TADPOLE MADTOM
THS	THREESPINE STICKLEBACK

SPCode	Species
MUH	TIGER MUSKELLUNGE
TIT	TIGER TROUT
TIA	TILAPIA
TOS	TOPEKA SHINER
TRP	TROUT PERCH
UNK	UNKNOWN
VRC	VIRGIN RIVER CHUB
WAE	WALLEYE
WAM	WARMOUTH
WAS	WARNER SUCKER
WEF	WEAKFISH
MOS	WESTERN MOSQUITOFISH
WSM	WESTERN SILVERY MINNOW
WHB	WHITE BASS
WEB	WHITE BULLHEAD
WCF	WHITE CATFISH
WHC	WHITE CRAPPIE
WHP	WHITE PERCH
WHS	WHITE SUCKER
WCS	WINTER CHINOOK SALMON
SXW	WIPER
WDF	WOUNDFIN
YCF	YAQUI CATFISH
YAC	YAQUI CHUB
YAS	YAQUI SUCKER
YTM	YAQUI TOPMINNOW
YLB	YELLOW BASS
YEB	YELLOW BULLHEAD
YEP	YELLOW PERCH
ZAD	ZANDER

Species Code	Species
AME	AMERICAN EEL
BAB	BLACK BUFFALO
BCS	BLACKCHIN SHINER
BIB	BIGMOUTH BUFFALO
BIS	BIGMOUTH SHINER
BKF	BANDED KILLIFISH
BLB	BLACK BULLHEAD
BLC	BLACK CRAPPIE
BLG	BLUEGILL
BLM	BLUNTNOSE MINNOW
BLS	BLUE SUCKER
BND	BLACKNOSE DACE
BNS	BLACKNOSE SHINER
BOC	BONNEVILLE CISCO
BRB	BROWN BULLHEAD
BRM	BRASSY MINNOW
BSB	BROOK STICKLEBACK
BSD	BLACKSIDE DARTER
BUT	BURBOT
CAP	CARP
CCF	CHANNEL CATFISH
CMM	CENTAL MUDMINNOW
CMS	COMMON SHINER
CRC	CREEK CHUB
CSR	CENTRAL STONEROLLER
EMS	EMERALD SHINER
FCF	FLATHEAD CATFISH
FHM	FATHEAD MINNOW
FID	FINESCALE DACE
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FWD	FRESHWATER DRUM
GIS	GIZZARD SHAD
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GOS	GOLDEN SHINER

Species Code	Species
GRH	GREATER REDHORSE
GRP	GRASS PICKEREL
GSF	GREEN SUNFISH
HOC	HORNYHEAD CHUB
HSF	HYBRID SUNFISH
IOD	IOWA DARTER
JOD	JOHNNY DARTER
LAC	LAKE CHUB
LAH	LAKE HERRING
LAW	LAKE WHITEFISH
LCS	LAKE CHUBSUCKER
LMB	LARGEMOUTH BASS
LND	LONGNOSE DARTER
LNG	LONGNOSE GAR
LOD	LONGNOSE DACE
LOP	LOGPERCH
LOS	LONGNOSE SUCKER
LSR	LARGESCALE STONEROLLER
MOE	MOONEYE
MOS	MOUNTAIN SUCKER
MUE	MUSKELLUNGE
MUH	TIGER MUSKELLUNGE
NHS	NORTHERN HOGSUCKER
NOP	NORTHERN PIKE
NRD	NORTHERN REDBELLY DACE
OSF	ORANGE-SPOTTED SUNFISH
PAH	PADDLEFISH
PED	PEARL DACE
PKF	PLAINS KILLIFISH
PLM	PLAINS MINNOW
PLS	PALLID STURGEON
PSD	PUMPKINSEED
PSF	PUMPKINSEED SUNFISH
PTM	PLAINS TOPMINNOW
PUS	PUGNOSE SHINER
PXS	PALLID X SHOVELNOSE
QCS	QUILLBACK CARPSUCKER

Species Code	Species
QUK	QUILLBACK
RBS	RAINBOW SMELT
RCS	RIVER CARPSUCKER
RES	RED SHINER
RID	RIVER DARTER
RIS	RIVER SHINER
ROB	ROCK BASS
ROS	ROSYFACE SHINER
SAB	SMALLMOUTH BUFFALO
SAR	SAUGER
SAS	SAND SHINER
SFC	SICKLEFIN CHUB
SHD	SLENDERHEAD DARTER
SHR	SHORTHEAD REDHORSE
SHS	SHOVELNOSE STURGEON
SIC	SILVER CHUB
SIS	SILVERBAND SHINER
SKH	SKIPJACK HERRING
SMB	SMALLMOUTH BASS
SMT	SLENDER MADTOM
SNG	SHORTNOSE GAR
SOC	STONECAT
SOS	SPOTTAIL SHINER
SPS	SPOTFIN SHINER
SRH	SILVER REDHORSE
STC	STURGEON CHUB
SUM	SUCKERMOUTH MINNOW
SXW	WIPER
TMT	TADPOLE MADTOM
TOS	TOPEKA SHINER
TRP	TROUT PERCH
UNK	UNKNOWN
WAE	WALLEYE
WHB	WHITE BASS
WHC	WHITE CRAPPIE
WHS	WHITE SUCKER
WSM	WESTERN SILVERY MINNOW

Species Code	Species
WXS	SAUGEYE
YEB	YELLOW BULLHEAD
YEP	YELLOW PERCH
ZAD	ZANDER

APPENDIX 3

"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT

100 NORTH BISMARCK EXPRESSWAY BISMARCK, NORTH DAKOTA 58501-5095 PHONE 701-328-6300 FAX 701-328-6352

April 11, 2002

Al Sapa, Field Supervisor
U.S. Fish and Wildlife Service
Ecological Services
3425 Miriam Avenue
Bismarck, ND 58501

Dear Mr. Sapa:

Thank you for allow us the opportunity to review and comment on your draft FWCA report for the Devils Lake Emergency Outlet. There is general concurrence with your report but as stated throughout the report there are large scale data gaps. As a result of the short time frame involved it is difficult to thoroughly predict and assess potential impacts.

Some general comments on the FWCA document are as follows:

Lake Ashtabula

Fishery impacts were mentioned but very little time was spent on what it would mean. It is suggested that this area be expanded. Also, although mentioned as it relates to the upper–Sheyenne River, the impact of erosion on habitat in Lake Ashtabula was not considered. Erosion rates will undoubtedly increase in the upper Sheyenne River and will ultimately be deposited in the upper end of Lake Ashtabula further exacerbating the problems mentioned, e.g. nutrient loading, etc. Additionally, with the loss of volume attributable to erosion the turnover rate will increase, again further exacerbating the potential for fish loss through the dam

Upper Sheyenne River

Again, there is relatively little mention on fish impacts other than how it might affect mussel populations. The Upper Sheyenne River can be a locally important recreational fishery at times. The predicted flow rate of up to 600 cfs will likely result in high energy expenditure in fish if pool habitat is not available. It is more likely they will vacate that habitat in favor of more hospitable flows. Re-colonization will likely occur but will take time and assumes downstream

habitat is available. With sustained flows of approximately 600 cfs, a monotypic aquatic habitat will be created, reducing diversity leading to lesser species diversity of fish species.

Red River

It would be valuable to predict the impact of snagging and clearing on the Red River. This is normal practice when water manager attempt to efficiently convey water. Snags are important habitat in all riverine systems but are especially important in the Red River with the channel catfish population.

Overall it is extremely important that the project sponsor commits to long-term monitoring of issues stated in your document, i.e., erosion and sedimentation, etc. Of equal importance is a commitment to mitigate for impacts not predicted but experienced as found in the long term monitoring.

Thank you again for allowing us the opportunity to comment.

Sincerely,

Dean Hildebrand
Director

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mountain-Prairie Region

IN REPLY REFER TO:
FWS/R6
ES

MAILING ADDRESS:
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225-0486

STREET LOCATION:
134 Union Blvd.
Lakewood, Colorado 80228-1807

DEC 26 2002

Colonel Robert L. Ball
District Engineer
U.S. Army Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Dear Colonel Ball:

Thank you for inviting the U.S. Fish and Wildlife Service to participate in the interagency briefing in Denver on December 18, 2002, concerning the status of the Devils Lake Outlet Integrated Planning Report and Environmental Impact Statement. We appreciate the efforts that have gone into trying to develop measures to reduce and mitigate impacts to fish and wildlife resources on this very complicated project. We understand that the people who live around Devils Lake and the State of North Dakota want to see a solution developed soon regarding the major flooding problems that have been ongoing for many years, resulting in millions of dollars of damage and many displaced homes. However, we do not believe the current proposal solves their problem, is cost effective, or comprehensively addresses the problem using a watershed approach, which we believe is critical from a fish and wildlife standpoint.

Furthermore, at the meeting we were informed that the Corps is seriously considering releasing a final Environmental Impact Statement within the next 2 months. We believe that releasing a final EIS within that short timeframe would be premature and inconsistent with the intent of National Environmental Policy Act and the associated Council on Environmental Quality Guidelines. Many modifications to the project have been proposed in the last few months, but most of those project features have not undergone detailed analyses. Thus, we have not been given the opportunity to conduct an adequate assessment of impacts to fish and wildlife resources and to recommend appropriate mitigation measures in accordance with our mutual responsibilities under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.). Without the appropriate detailed data, we cannot make a determination if the proposed use of Service lands would meet the compatibility requirements under the National Wildlife Refuge System Improvement Act of 1997 (16 U.S.C. 668dd-668ee).

If a decision is made to go ahead with the project using the highly speculative justification that the past several above average water years would continue for two decades into the future, we recommend that the necessary studies first be identified and assessed through an interagency team. Then the assessments of the study results should be described in a revised draft EIS that is circulated for public and agency review and comment. From our perspective, the following issues should be fully addressed in a revised draft EIS and incorporated into project plans.

1. Will the quality of the water pumped into the Sheyenne River adversely affect the native mussel populations? What other impacts will occur to aquatic species downstream and to the streamside wetlands and woody riparian habitat? What species will move down through the system that do not currently occur if the sand filter is not built?

2. The plan does not adequately describe the erosion protection measures that will be used to stabilize the 23 areas in the Sheyenne River that have been identified as needing additional protection because of the large amount of water that would be pumped into the river by pipeline. Will such structures cause downstream bank erosion resulting in the need to add additional protection in the future? We recommend the Corps consider alternatives that work with the natural river system and that are more environmentally compatible than traditional rock riprap. Also, we need to see an assessment of the hydrological effects (e.g., changes in velocities and shear stress) that would result from emplacement of bank stabilization and the construction of bypass channels in the Sheyenne River. Such bypass channels could significantly reduce stream meanders that nature uses to keep erosive velocities in check and to maintain ground water elevations. What steps would be taken to preclude major downcutting of the Sheyenne River with resultant sedimentation impacts downstream and loss of stream access to the cutoff oxbows?

3. The design and operational criteria of the diversion channels and their control structures need to be described in sufficient detail to enable us to evaluate all habitat impacts, including those on Service refuge lands and wetland easements. This information should include the proposed flow capacities and the anticipated maintenance activities. Specifically, additional detailed information on the proposed construction, hydrology, and operations is needed to assess the impacts to Lake Alice National Wildlife Refuge from the proposed Dry Lake Diversion feature. This information is essential for our refuges staff to make a determination of whether the project is compatible with the purposes for which Lake Alice National Wildlife Refuge was established. The National Wildlife Refuge Administration Act (16 U.S.C. 668dd) requires that any use of a National Wildlife Refuge must be compatible with the purpose for which that refuge was established. It is important to note that current Service policy, as published in the Federal Register on October 18, 2000, prohibits using compensatory mitigation as a means of converting a proposed use that would otherwise be considered incompatible into a compatible use. The proposed use must meet the compatibility requirements on its own merits.

4. In our opinion, any acceptable project from a fish and wildlife standpoint will include specific measures and funding to block hundreds of drains and restore thousands of acres of wetland in the watershed that drain into Devils Lake. At the briefing, you stated that the Corps is exploring institutional programs designed to compensate landowners for storing water on the land. While these programs have merit, they are not going to solve the problem by themselves because it is highly unlikely that a sufficient number of landowners would participate in such programs. The Service believes that decades of wetland drainage projects in the upper basin continue to play a significant role in the flooding problems in the Devils Lake Basin.

5. You indicated that the State has talked about a moratorium on additional drainage in the upper basin with some provisions for exceptions. If the project proceeds, we deem it vital that an agreement be reached with the State that would establish such a moratorium, with few exceptions, in addition to the aforementioned need to plug existing drains. Otherwise, the operation of a pump to remove water from Devils Lake will encourage further drainage efforts in the basin. The agreement should commit the State to ensuring all illegal drains are closed. We would appreciate the opportunity to comment on a draft agreement.

We appreciate the Corps' ongoing coordination efforts concerning the Devils Lake Outlet Planning Report and Environmental Impact Statement. As you noted in the briefing, future coordination efforts could be enhanced through establishment of an interagency working group, as was suggested by our Washington Office in a meeting the previous week. We believe that an interagency planning approach would be more effective than submitting preliminary draft ideas to the various agencies and soliciting their opinions. If invited, we would be pleased to participate in such an effort. However, we do ask that you forward our concerns to General Flowers for his consideration when making his decision on how to proceed with this project, which we understand is currently slated for early January. We also would appreciate a written response on how you intend to address the above issues should project planning continue.

Sincerely,

Ralph O. Morgenweck

Regional Director

cc: Assistant Director, Fisheries and Habitat
Conservation and National Chief,
National Wildlife Refuge System
U.S. Fish and Wildlife Service
1849 C Street, N.W.
Washington, D.C. 20240

DEPARTMENT OF THE ARMY
ST. PAUL DISTRICT, CORPS OF ENGINEERS
190 FIFTH STREET EAST
ST. PAUL, MN 55101-1638

REPLY TO
ATTENTION OF

MAR 17 2003

Project Management Branch
Planning, Programs and Project Management Division

Mr. Ralph Morgenweck
Regional Director
U.S. Fish and Wildlife Service
Post Office Box 25486
Denver Federal Center
Denver, Colorado 80225-0486

Dear Mr. Morgenweck:

We are responding to your letter of December 26, 2002, regarding the Devils Lake Outlet Study. Your general comments concerned coordinating the results through an interagency team and issuing a revised draft Integrated Planning Report and Environmental Impact Statement.

Although the final Report itself has not gone through an interagency team review, the scopes of work and contractor products have been placed on the District FTP site for agencies to review. In addition, interagency meetings have been held in Bismarck, Devils Lake, and Denver to discuss the results of the studies, and numerous telephone conversations have taken place. The Corps of Engineers feels that the acquisition of additional information since the preparation of the Draft Environmental Impact Statement (EIS) in February 2002 refined the analysis and, as such, the information available is adequate to make reasoned decisions. Therefore, a revised draft Report will not be issued. The entire study has been developed using an interagency team approach. This will continue if additional study and construction are funded. The final Integrated Planning Report/EIS identifies that an interagency team would be needed to further develop and implement the long-term monitoring program.

We agree that at this time there is not adequate information for you to make a determination regarding compatibility requirements. As the study progresses, we will work with the Service to identify your concerns, further design the Dry Lake Diversion feature of the project, and request a compatibility determination. That work may be initiated this summer, depending on funding. As the study progresses, the design will be coordinated through the technical work group and interagency meetings.

Responses to your specific comments are addressed below.

1. Water quality effects on aquatic resources and impacts to riparian habitat: Studies indicate little, if any, water quality effects on the mussel populations with a 300 mg/l sulfate

constraint. The potential effects on aquatic species on the Sheyenne River that would be associated with increased flows are described in the Report. Generally, it is anticipated that the changes in water quality and increased flows associated with outlet operation would result in long-term subtle changes in species composition, density, and distribution. The information your agency provided in the Coordination Act Report is included in the analysis of effects. Ramping of flows during operation is proposed to help alleviate some effects. Groundwater effects to the riparian community are also identified in the report, and acquisition of 6,000 acres of mitigation lands is identified as a project feature. In the absence of a comprehensive survey of the Devils Lake and Sheyenne River basins, it is impossible to definitively identify species that may be transferred to the Sheyenne River with outlet operation. In the absence of a water treatment plant to treat all Devils Lake outlet water, it would be impossible to eliminate all levels of biota, such as viruses or bacteria, from an outlet discharge. A sand filter, coupled with implementation of a monitoring and rapid response plan, is included as a project feature to address, to the extent practicable, biota transfer concerns associated with the operation of an outlet. Long-term monitoring is included to assess the effectiveness of implemented mitigation features and to help identify any future mitigation needs.

2. Design and type of erosion protection features to be employed: The design of the erosion protection features would be dependent on site-specific conditions. Sites located in urban areas may require the use of sheet pile or crib walls, while sites located in rural areas could incorporate approaches ranging from riprap to bioengineering techniques. The need for additional erosion protection would be determined through the long-term monitoring program. The aquatic mitigation high flow bypass channels and their hydrologic effects would be coordinated with the agencies as the design is undertaken. It is our intent to establish an interagency team to provide input into the final design of the proposed aquatic mitigation features, and we look forward to your agency's participation. The geomorphologic modeling has indicated there would be little change in the channel depth. Therefore, no mitigation is proposed at this time.

3. Dry Lake design and refuge compatibility: The design of the Dry Lake Diversion features would be coordinated with the Service to identify your concerns and develop a plan that is mutually acceptable. A determination of compatibility would be requested after the design is completed.

4. Wetland restoration in the Upper Basin as a project component: The Integrated Planning Report/EIS evaluated upper basin storage and showed it may have some merit under certain conditions. The Report concludes that, on the basis of the stochastic analysis, upper basin storage is not economically justified, while net benefits result under the wet future scenario. The Report indicates that further analysis to optimize the most cost-effective plan for upper basin storage, as a complementary project feature, along with further evaluation of associated social, economic, and environmental effects, appears warranted. As of now, the Corps is not authorized to conduct further studies on upper basin storage.

5. Upper basin drainage, moratorium on additional drainage, and blocking existing and illegal drains: The Corps concurs that controls on future wetland drainage in the upper basin would improve the effectiveness of other features. The PCA stipulates that the non-Federal

sponsor comply with requirements of Section 402c of the Water Resources Development Act of 1986. Whether the sponsor is to maintain the level of protection provided by the project to include a moratorium on any new drainage permits in the upper basin will be determined during development of the PCA. It is the Corps' understanding that the State has reevaluated the drains in the basin and has determined there are no illegal drains.

Finally, you expressed concerns regarding the establishment of an interagency work group. As you are aware, a technical work group composed of various Federal, State, Tribal, Canadian, and local representatives was established to review study plans, identify issues and concerns, and provide review and comment on various contractor reports. Coordination with this work group occurred throughout the study process. Should funding be provided for the project to proceed, please be assured that the Corps will make every effort to ensure that agencies have the opportunity to be involved in the design, implementation, operation, or evaluation of the proposed features.

As requested, your letter was forwarded to our Headquarters staff in Washington, D.C. If you have additional concerns, please contact me at 651-290-5300 or the project manager, Dave Loss, at 651-290-5435.

Sincerely,

Robert L. Ball
Colonel, Corps of Engineers
District Engineer

Copy furnished:

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Roger Hollevoet
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United States Department of the Interior

FISH AND WILDLIFE SERVICE
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3425 Miriam Avenue
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MAR 17 2003

Ms. Jody DesHarnais, Chief, Planning Division
Department of the Army
St. Paul District, Corps of Engineers
Attn: Mr. David Loss, Devils Lake Project Manager
190 Fifth Street East
St. Paul, Minnesota 55101-1638

Dear Ms. DesHarnais:

Enclosed with this letter is a Supplemental Fish and Wildlife Coordination Act Report (SCAR), pursuant to the negotiated Scope of Work (fiscal year 2003) for Fish and Wildlife Coordination Act activities to be provided by the Fish and Wildlife Service (Service), North Dakota Field Office. This SCAR is provided to assist the Corps of Engineers (Corps) in their Devils Lake Emergency Outlet alternative evaluation, and to supplement the Service's June 2002 Final Coordination Act Report for the Devils Lake Emergency Outlet, Devils Lake, North Dakota.

The Service has coordinated this report with the North Dakota Game and Fish Department (Department). The Department's comments are incorporated in this report and we have enclosed their March 13, 2003, letter stating their general concurrence with the context and content of the report.

The Service has not as yet had the opportunity to review a comprehensive plan for the Corps' preferred alternative. By this letter, we are requesting that the Corps provide the Service with a comprehensive package for review, as well as a copy of the Final EIS as soon as it becomes available. We reserve the right to provide further comments and recommendations to the Corps after we have had sufficient time for a thorough review of the preferred alternative presented in the Final EIS.

Thank you for this opportunity to provide comments. If additional information is needed, please contact Terry Ellsworth of my staff at (701) 250-4481, or at the letterhead address.

Sincerely,

Jeffrey K. Towner

Jeffrey K. Towner
Field Supervisor
North Dakota Field Office

Enclosure

cc/enc: NEPA Coordinator, Denver
Project Leader, Devils Lake WMD
Director, ND Game & Fish Department, Bismarck
(Attn: M. McKenna)

Supplemental Fish and Wildlife Coordination Act Report for the Devils Lake Outlet Flood Control Project

INTRODUCTION

This Supplemental Fish and Wildlife Coordination Act Report (SCAR) has been written to assess anticipated impacts and provide recommendations to the Corps of Engineers' (Corps) Devils Lake, North Dakota, Integrated Planning Report/Environmental Impact Statement (EIS). The SCAR addresses the infrastructure protection features described as the no-action alternative, the Dry Lake Diversion, and the proposed mitigation for downstream impacts resulting from operation of an outlet. The information contained in this report is intended to provide supplemental information to the U.S. Fish and Wildlife Service's (Service) June 2002, Final Fish and Wildlife Coordination Act Report for the Devils Lake Emergency Outlet, Devils Lake, North Dakota. It is prepared under the authority of and in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e), and in accordance with the provisions of the Endangered Species Act (16 U.S.C. 1531 et seq.). This report constitutes the report of the Secretary of Interior as required by Section 2(b) of the FWCA.

The Service utilized reports and study material supplied by consultants retained by the Corps' St. Paul District Office in the preparation of this SCAR. The materials provided to the Service contained detailed information on various aspects of the proposed project (infrastructure protection, Dry Lake Diversion, mitigation and monitoring plan, and sand filtration system). While this information was useful in our analysis of the project and some of the resource impacts, downstream impacts to fish and wildlife resources in the project area are complex and many unknowns have yet to be answered.

The Service has not had the opportunity to review a comprehensive plan for the Corps' preferred alternative. The Service requests that the Corps provide a complete Integrated Planning Report for our review. This SCAR should be considered an interim report until such time as we receive the Corps' plan. We also request an opportunity to review the Corps' Final EIS prior to its publication. We reserve the right to provide further comments and recommendations, in addition to this SCAR, to the Corps after we have had sufficient time for a thorough review of the preferred alternative presented in the Corps' Integrated Report.

EXECUTIVE SUMMARY

Devils Lake has a lengthy history of fluctuation. Current lake levels are at unrecorded high levels, primarily as a result of several years of above-average precipitation and historic-high runoff into the lake. Lake levels are further increased by aggressive wetland drainage throughout the Devils Lake basin.

As Devils Lake continues to rise, it has reclaimed thousands of acres of lake plain that have, in drier years, been encroached upon by agricultural, recreational, commercial and residential interests. Increasing infrastructure costs associated with levee and highway raises, home

relocation, and city and county infrastructure alterations has created significant pressure on Federal, State, and local agencies to seek a solution to the rising water levels in Devils Lake.

One such proposed action consists of an outlet from Devils Lake to the Sheyenne River. Of the many possible alternatives, a 300 cubic feet per second (cfs) buried pipeline outlet from the Pelican Lake area using the Peterson Coulee alignment has been selected as the preferred alternative. The alignment may also be constructed as an open channel for part of its length. The Corps of Engineers is currently evaluating an outlet alternative using a Dry Lake Diversion. Outlet discharges of 300 cfs, constrained to a 600 cfs Sheyenne River channel capacity and 300 milligrams per liter (mg/l) sulfate constraint, will be evaluated. The outlet will be limited to a 7-month operation beginning in May and running through November. The life of the project is 50 years, running from 2004 to 2054. In addition to the outlet, a future without the proposed project, expanded infrastructure measures, has been studied.

The Pelican Lake outlet plan will remove the freshest of the lake inflow to the Sheyenne River, thereby reducing the freshening effect the inflow has on the lake. The result will be a general decline of the water quality of the lake, and a hastening of the impact poor water quality has on the lake's aquatic biota. The riparian habitat along the Sheyenne River will suffer from an increase in overbank flooding for prolonged periods of time, resulting in a change in species composition and or loss of streambank vegetation along the riparian corridor.

Rising lake levels have affected communities, transportation routes, and rural lands. Federal, State, and local agencies have been studying a three-part integrated approach to flood damage reduction in response to the rising lake levels. This three-part approach includes: upper basin water management to reduce the amount of water reaching the lake, protection of structures and infrastructure if the lake continues to rise, and an outlet to move water out of the Devils Lake basin into the Sheyenne River.

The U.S. Fish and Wildlife Service (Service) is concerned about the impacts to both wetlands protected by easements and non-easement wetlands from the various infrastructure protection measures. The Service mitigation policy uses a step-wise approach to mitigation. First and foremost, avoid wetland impacts. If wetland impacts are unavoidable, keep them to a minimum and fully mitigate for all unavoidable wetland impacts. In the case of easement wetlands, Service policy requires impacted easement wetlands must be exchanged for easements of equal value, prior to construction.

The Service's planning objectives recommend establishing a target elevation of 1443 mean sea level (msl) for Devils Lake, to operate any outlet within State water quality standards, and to develop an adequate monitoring and mitigation plan to offset the loss of natural resource habitat and biota. The Service strongly encourages the management of the upper basin for the benefit of the lake in an effort to reduce inflow to the lake as much as possible. This includes effective upper basin water storage and the increase of water storage on public lands.

The Corps indicated in their response to Service recommendations that a Devils Lake operational level of 1443 msl is acceptable. At this level, the Service will be able to meet its water level

management goals for Lake Alice National Wildlife Refuge. If 1443 msl is the selected level in the operation plan, the plan should affirm that when Devils Lake reaches an elevation of 1443 msl, outlet operations will stop. In addition, if the lake begins to rise, the operating plan should specify at what elevation the outlet will resume pumping. The goal of the operating plan should be to prevent additional flooding, while minimizing outlet operation and the resultant impact to downstream receiving waters.

Because of the inability to accurately quantify all of the project impacts associated with operation, the Corps has included mitigation measures to alleviate effects and attempt to maintain some existing critical aquatic habitats to facilitate recovery following project operation. An adaptive mitigation approach is also recommended. This approach would include modification to the mitigation measures, as needed. Monitoring is a major component of the proposed mitigation plan. Areas requiring monitoring include, but may not be limited to: groundwater, erosion, sedimentation, aquatic habitat, biota transfer, water quality, riparian vegetation, cultural resources, soil salinity, downstream water users, and endangered species. Monitoring would be used to modify mitigation during and after project operation, as necessary. An interagency task force would have to be established to manage and coordinate the long-term monitoring program. It is assumed that monitoring would be required for the life of the project or until agency coordination determines it is no longer necessary.

ACKNOWLEDGEMENT OF INPUT, COORDINATION AND CONCURRENCE OF STATE FISH AND WILDLIFE AGENCY

A copy of the Supplemental Fish and Wildlife Coordination Act Report (SCAR) for the Devils Lake Emergency Outlet was presented to the North Dakota Game & Fish Department (Department) for their review and comment. The Department provided the Service with general concurrence on the SCAR Report in their letter of March 13, 2003. Comments offered by the Department have been incorporated into the SCAR Report.

BACKGROUND

Since 1980, several studies and reports on Devils Lake have been published. The Corps has produced the following studies: 1996 Emergency Outlet Plan; 1996 Environmental Assessment and Plans and Specifications for Raise of Existing Levee; 1996 Contingency Plan; 1992 Reconnaissance Report for Flood Control, Lake Stabilization, and Comprehensive Purposes; 1988 Devils Lake Basin Integrated Draft Feasibility Report and Environmental Impact Statement; 1983 Section 205 Detailed Project Report for Flood Control. These reports provide a significant background of information on the basin.

Consultants produced the following publications used in the preparation of this Supplemental Fish and Wildlife Coordination Act Report. Barr Engineering Company produced a Devils Lake Infrastructure Protection Study, November 8, 2002, and the Dry Lake Diversion Feature Development Report, April 19, 2002. Peterson Environmental Consulting, Inc. produced a Devils Lake Flood Control Project, 300 cfs Outlet Interim Mitigation Plan, December 17, 2002.

The Service has published the 1988 Draft Fish and Wildlife Coordination Act Report for Fish and Wildlife Resources in Relation to the Devils Lake Basin Flood Control Project; 1992 Substantiating Report; Planning Aid Letter, Devils Lake Emergency Outlet Study providing input on various outlet alignment alternatives, September 3, 1997; Planning Aid Letter and Substantiating Report, Devils Lake Feasibility Study, Lake Stabilization, Devils Lake, North Dakota, October 3, 1997; Fish and Wildlife Service letter to the Corps providing wetland drainage, restoration, and storage information for the Devils Lake basin, August 18, 1998; Devils Lake Emergency Outlet Study, Devils Lake, North Dakota, Planning Aid Letter and Substantiating Report, April 1, 1999; Planning Aid Letter providing Fish and Wildlife Service input on the potential natural resource impacts of an overflow from Devils Lake basin to the Sheyenne River through the Tolna Coulee, May 24, 1999; Planning Aid Letter providing Fish and Wildlife Service input on the Devils Lake outlet alternative known as the Stump Lake alternative, April 7, 1999; Fish and Wildlife Coordination Act Report for the Devils Lake Emergency Outlet, Devils Lake, North Dakota, June, 2002; and Survey of Specific Fish Pathogens in Free-ranging Fish from Devils Lake and the Sheyenne and Red Rivers in North Dakota, December 2002.

DESCRIPTION OF FISH AND WILDLIFE RESOURCES

Wetlands

The wetland resources of the Prairie Pothole Region provide many functions and values. In general, wetlands follow a yearly cycle, beginning with the spring catch of snow melt runoff. Through the summer months, wetlands receive direct precipitation and runoff from the surrounding watershed, while simultaneously exporting water through evapotranspiration and losing surface water through seepage. By late summer, the wetlands are generally drawn down or dry and enter the fall and winter months in a condition that prepares them to repeat the cycle the next spring.

Historically, North Dakota had approximately 4.9 million acres of wetlands, representing about 11 percent of the land surface. Dahl (1990) estimates that North Dakota has approximately 2.5 million acres remaining. This translates into a 49 percent loss of the State's wetland base. The Service estimates that the Devils Lake basin originally had at least 400,000 acres of wetlands. The Service estimates that between 183,000-189,000 acres of drained wetlands exist in the Devils Lake basin (U.S. Fish and Wildlife Service 1997. Substantiating Report, Devils Lake Feasibility Study, Lake Stabilization, Devils Lake, North Dakota. Bismarck, North Dakota. p. 23-24). The National Wetlands Inventory (NWI) data shows that the basin has 210,000 acres of wetland. This represents a 50 percent loss of wetlands.

Wetland habitats can be grouped into broad categories, which provide several functions and values unique to wetlands such as flood water storage, habitat for wildlife, filtering of polluted water, and groundwater recharge. Using "Classification of Wetlands and Deepwater Habitats of the United States" by Cowardin et al. (1979) and the NWI, prairie pothole habitats found in the Devils Lake basin can generally be grouped into palustrine, emergent, temporarily, seasonally

and semipermanently flooded wetlands (PEMA, PEMC and PEMF, respectively). The upper basin chain of lakes can be described as a lacustrine, limnetic, unconsolidated bottom, intermittently exposed wetland (L1UBG), with a shallow ring of lacustrine, littoral, aquatic bed, semipermanently flooded habitat (L2ABF).

Temporary wetlands (PEMA) are the most common wetland type on the glaciated prairie of North Dakota. They are characterized as usually being less than 1 acre in size and less than 1 foot deep. They typically lose water rapidly during the first few weeks after spring snow melt and are dry within a month or so. Despite their fleeting existence, temporary wetlands are very important. The temporary wetlands are the first wetland type to melt in the spring, thus providing the first invertebrate food supply for migrating waterfowl. This food supply is a critical source of protein used by breeding birds during the egg laying period, as well as food for other spring migrant waterbirds.

Swanson et. al. (1985) and Krapu (1974a & b) showed that not only do temporary wetlands provide a major source of protein for nesting hens, but that poor quality diets lead to reduced clutch and egg size, laying rate, and number of nesting attempts (Eldridge and Krapu 1988). Waterfowl such as mallards, gadwall, blue-wing teal, northern shoveler, and northern pintail are heavy users of temporary wetlands.

In addition to providing invertebrate food supply, seasonal wetlands (PEMC) provide isolation for duck pairs and locations for over-water nesters. In high water years, seasonal wetlands provide good brood habitat and molting areas. They are heavily used by dabbling, diving, and stiff-tailed ducks due to their greater average depth and duration of inundation. Mallard, blue-winged teal, gadwall, northern pintail, northern shoveler, redhead, green-winged teal, ruddy duck, wigeon, lesser scaup, canvasback, and ring-necked ducks are all extensive users of seasonal wetlands.

Semipermanent wetlands (PEMF) provide nearly all the requirements of the waterfowl that nest on the North Dakota prairies. Emergent vegetation contained in these wetlands provide the primary breeding habitat for diving and stiff-tailed ducks, such as redhead, canvasback, and ruddy duck. Due to their large size, relative to temporary and seasonal wetlands, semipermanent wetlands are the last of the prairie wetlands to become ice free in the spring. As a result, they are not a source of invertebrates early in the spring for nesting dabbling hens.

The Service, through its Small Wetlands Acquisition Program, acquires wetland protection easements and fee-title and Waterfowl Production Areas (WPA) throughout the basin. These wetlands are protected from draining, filling, burning, or leveling activities. The Devils Lake Wetland Management District (WMD), which encompasses the Devils Lake basin, is comprised of eight counties. Currently, the Devils Lake WMD manages approximately 154,748 acres of wetlands protected under easement, and 48,066 acres of WPA and Wildlife Development Units. All Service administered wetlands are providing annual hydrologic benefits by reducing inflow to the lake.

Fishery

Prior to 1956, no game fishery existed in Devils Lake (U.S. Fish and Wildlife Service 1992). Game fish were first introduced into Devils Lake in 1956 and stocking continued through 1958. Declining water levels briefly curtailed stocking activities, but stocking was once again initiated in 1967 and a sport fishery has occurred since that time. During the 1980's, the fishery improved, which resulted in a dramatic increase in recreational use of the lake. Most fishing activity occurs in Devils Lake west of Highway 57.

The sport fishery of Devils Lake is a valuable resource, which has greatly improved since the 1980's with rising water levels. Devils Lake is a brackish lake, developed through lake level fluctuations, which are beneficial to the support of the current fishery. The fishery remained relatively stable during the drought of 1988-1990. Primary species pursued by anglers are walleye, northern pike, yellow perch, and white bass. White suckers and black bullheads are also present, but have not increased sufficiently to degrade the quality of the sport fishery. Tiger muskellunge are also present in low numbers. Prior to the recent rise in lake levels, virtually all game fish were artificially stocked due to low reproduction potential from brackish water quality. With current high lake levels freshening the lake, yellow perch, northern pike, white bass, crappie, and walleye are experiencing successful natural reproduction. Table 1 lists the fish species that occur in Devils Lake.

Table 1. Fishery Resources of Devils Lake.

Scientific name	Common Name
Ameiurus melas	black bullhead
Ameiurus nebulosa	brown bullhead
Catostomus commersoni	white sucker
Culaea inconstans	brook stickleback
Esox lucius	northern pike
Esox lucius X E. masquinongy	Tiger muskie
Morone chrysops	white bass
Perca flavescens	yellow perch
Pimephales promelas	fathead minnow
Pomoxis nigromaculatus	black crappie
Stizostedion vitreum	Walleye

The rising waters of Devils Lake have created ideal conditions for fish reproduction due to thousands of acres of flooded terrestrial vegetation. The rise of Devils Lake has increased food supplies for macro invertebrates and created excellent spawning areas for northern pike and yellow perch (Hiltner 2001a). Currently, northern pike and yellow perch comprise more of the

total fish population by weight than they did in the early 1990's. Walleye and white bass make up a slightly smaller portion (Hiltner 2001b).

Recent netting surveys have documented a resurgence in perch populations. Surprisingly, perch populations make up a higher percentage of total game fish weight. In 1993, 4 percent of game fish weight was perch, compared to 27 percent in 1999, and 22 percent in 2000. With the resurgent population of perch in Devils Lake, the fishing has gained region-wide notoriety. North Dakota Game and Fish Department fishery biologists indicate that the lake has all the factors necessary for perch to thrive: a large, relatively shallow basin, ideal spawning habitat, and abundant food. As a result, Devils Lake perch are in excellent body condition as compared to other perch populations around the Midwest. A healthy food supply of invertebrates, such as freshwater shrimp, chironomid larvae, and corixids are keeping Devils Lake perch well fed and growing rapidly (Hiltner 2001a).

The abundant perch population has lead to a renowned winter fishery. Perch accounted for 85 percent of the total game fish harvested from Devils Lake during the 1998-99 winter. Anglers kept 89 percent of the perch caught, with the average perch approximately 10 inches in length and weighing more than one-half pound (Hiltner 2001a).

Long-term maintenance of the fishery in Devils Lake is dependent on the balanced relationship of nutrients, salinity, water levels, and Total Dissolved Solids (TDS) concentrations. This balance helps to prevent oxygen depletion from occurring, has limited fish reproduction, and regulates algae blooms. The result has been a simple but highly-valued fishery.

Water Quality

The water quality of the Devils Lake basin is affected by factors such as climate, topography, and geology. Warm, dry periods generally increases evaporation efficiency, which results in a concentration of dissolved solids, while during wet periods, increased runoff, stream flow and lake levels tend to dilute dissolved solids. Topography and drainage also affect water quality by influencing the amount and rate of runoff (Lent and Zainhofsky 1995).

The issue of water quality in Devils Lake and its relationship to the fishery and the proposed outlet to the Sheyenne River is not entirely understood. Because freshwater flows enter Devils Lake on the west end, TDS concentrations are the lowest there. The TDS gradient increases eastward in Devils Lake, resulting in more saline conditions on the east side.

Based on field data gathered at Devils Lake, it is generally agreed that the existence of a healthy fishery depends on a balance between TDS and nutrient levels. Operation criteria for each of the features designed will have an impact on future fishery. To maximize protection of the valuable fish resource operation, criteria should consider long-term impact to the fish resource.

Nutrient loading is believed to be occurring in Devils Lake, in part, due to runoff from the intensively farmed basin, and to a lesser degree from livestock operations. Wetland drainage,

fall cultivation, and fertilizer application are some of the agricultural practices suspected of contributing to water quality degradation. To lessen potential impacts from water quality degradation, all steps should be taken to enhance the quality of the remaining water. These include, but are not limited to, protection and enhancement of riparian zones, reducing inflow nutrients and sediments through use of grassed waterways, reconnecting historic water flow routes to slow water movement and remove nutrients, and encouraging best management practices that enhance water quality.

Wildlife

Wildlife in the Devils Lake basin is closely associated with water and wetlands (Table 2). Historically, the Devils Lake basin has had one of the highest concentrations of prairie wetlands in the Northern Great Plains. These wetlands range from numerous large lakes to thousands of small, shallow potholes or marshes.

Shallow water wetland habitats are clearly the most valuable habitat types for waterfowl. Shallow, seasonally-flooded wetlands provide important pair habitat and breeding sites for dabbling ducks, including mallard, pintail, gadwall, and teal. Over-water nesters such as scaup, canvasback, and redhead build nests in vegetation, which grows in water depths of 5 feet and less. Broods feed and take cover in shallow, vegetated wetlands. Other wildlife such as white-tailed deer, fox, raccoon, muskrat, mink, beaver, and ring-necked pheasant rely on shallow water wetlands for food and cover.

Table 2. Partial List of Wildlife Species Found in the Devils Lake Basin and the Red and Sheyenne River Corridors.

Common Name - Mammals	**Scientific Name**	**Common Name - Birds**	**Scientific Name**
Beaver	*(Castor Canadensis)*	American kestrel	*(Falco sparverius)*
Eastern chipmunk	*(Tamias striatus)*	American Robin	*(Turdus migratorius)*
Cottontail rabbit	*(Sylvilagus floridanus)*	Bald eagle	*(Haliaeetus leucocephalus)*
Coyote	*(Canis latrans)*	Black-capped chickadee	*(Parus atricapillus)*
Fox squirrel	*(Sciurus niger)*	Broad-winged hawk	*(buteo platypterus)*
Grey squirrel	*(Sciurus carolinensis)*	Brown thrasher	*(Toxostoma rufum)*
Jackrabbit	*(Lepus townsendi)*	Canada goose	*(Branta canadensis)*
Mink	*(Mustela vison)*	Chipping sparrow	*(Spizella passerina)*
Moose	*(Alces alces)*	Common crow	*(Corvus brachyrhynchos)*
Muskrat	*(Ondatra zibethica)*	Cooper's hawk	*(Accipiter cooperii)*
Raccoon	*(Procyon lotor)*	Downy woodpecker	*(Dendrocopos pubescens)*
Red fox	*(Vuples fulva)*	Grackle	*(Quiscalus quiscula)*
Red squirrel	*(Tamiasciurus hudsonicus)*	Great horned owl	*(Bubo virginianus)*
Striped Skunk	*(Mephitis mephitis)*	Greater prairie chicken	*(Tympanuchus cupido)*
Long-tailed weasel	*(Mustela frenata)*	Grey partridge	*(Perdix perdix)*
White-tailed deer	*(Odocoileus virginianus)*	Hairy woodpecker	*(Dendrocopoc villosus)*
		Hooded merganser	*(Lophodytes cucullatus)*
		House wren	*(Troglodytes brunneicollis)*
		House sparrow	*(Passer domesticus)*
		Mallard	*(Anas platyrhynchos)*
		Mourning dove	*(Zenaida asiatica)*
		Northern Harrier	*(Circus cyaneus)*
		Peregrine falcon	*(Falco peregrinus)*
		Pheasant	*(Phasianus colchicus)*
		Piping plover	*(Charadrius melodus)*
		Purple martin	*(Progne subis)*
		Red-tail hawk	*(Buteo jamaicensis)*
		Sharptail grouse	*(Pedioecetes phasianellus)*
		Swainson's hawk	*(Buteo swainsoni)*
		Wild turkey	*(Meleagris gallopavo)*
		Wood duck	*(Aix sponsa)*
		Yellow warbler	*(Dendrocia petechia)*

Vegetation associated with these wetlands are especially valuable during winter as cover for upland species. Drainage of shallow wetland habitat for agricultural purposes has been significant in the Devils Lake basin.

Open water habitats provide, to varying degrees of importance, brood, migratory, molting, and staging areas for most ducks, geese, and swans. Some diving ducks such as scaup, ringneck and redhead use these wetlands as feeding areas. Sub-irrigated meadows are used to some extent by feeding waterfowl, but to a greater extent by feeding and nesting shorebirds.

Saline wetland habitats are used heavily by nesting and feeding ducks. Saline wetlands or bays less than 4 feet deep, which permit growth of aquatic vegetation, are more productive for waterfowl and shorebirds than deeper, open-water areas. Because of their physical and chemical nature, few of these wetlands are drained.

In addition to waterfowl, many other species of marsh and shorebirds use the lakes and wetlands of the basin for migration and nesting habitat, including black-crowned night herons, great blue herons, great or common egrets, American bitterns, western and eared grebes, white pelicans, double-crested cormorants, and ring-billed gulls.

The Chain of Lakes located north of Devils Lake in the middle of the basin provides a unique combination of feeding and resting habitats utilized by migrating waterfowl. Large concentrations of migrating geese, ducks (primarily canvasbacks, scaups, and mallards), cranes, swans, cormorants, and pelicans congregate in this area during spring and fall migrations. It is one of the most important areas remaining in eastern North Dakota for recreational activities such as hunting of small game, white-tailed deer, and waterfowl; photography; bird watching; and nature study.

Grasslands

The Devils Lake basin is located within the transitional zone between the tall grass and mixed grass prairies. Historically, nearly 2 million acres of the Devils Lake basin was native grasslands, interspersed with wetlands, woodlands, and shrub lands. By the mid-1970's, only 127,875 acres of native grassland remained, comprising 8 percent of the basin's cover type (Devils Lake Basin Advisory Committee 1976). Conversion of native grassland to cropland continues, but at a much reduced rate, because most lands suitable for farming have already been plowed. Remaining grasslands are grazed or cut for hay. Various conservation programs such as Conservation Reserve Program, waterbank, and planted wildlife cover have established tame grass as an important habitat in the basin.

Grassland, in association with wetlands, is vital to upland nesting waterfowl and other migratory birds. Native grasslands are also important habitat for resident species such as sharp-tailed grouse, ring-necked pheasant, gray partridge, white-tailed deer, jack rabbit, skunk, badger, fox coyote, and many nongame bird species.

There are three major types of native grassland sites in the basin, each with its own distinctive plant community. These types are silty, overflow, and thin upland range sites. Silty range sites are the most common, occurring on nearly-level to rolling glacial till plains, lake plains, and on high-stream terraces. This grassland type is dominated by cool season grasses. In good condition, this type would be expected to have needle and thread, green needlegrass, western wheatgrass, porcupine grass, numerous forb species, and a few shrubs.

The overflow-range type occurs on nearly level swales and depressions in glacial till plains and on stream terraces and floodplains, and is the second most frequently occurring grassland type. Dominant species of this type include big bluestem, switch grass, little bluestem, green needlegrass, and porcupine grass. Forbs and shrubs such as Maximilian sunflower, fringed sagebrush, western snowberry, chokecherry, and Juneberry are also common.

The other common grassland type in the basin is the thin-upland type. This type is found on gently-sloping to moderately-steep glacial till uplands. A mixture of both cool and warm season grasses dominate this type. Principal species are needle and thread, porcupine grass, green needlegrass, and little bluestem. All native grassland areas, regardless of type, are extremely important to both game and nongame wildlife species.

Woodlands

Woodlands cover 3 percent of the basin. The native forest surrounding the Devils Lake chain ranks as one of the three largest blocks of contiguous forest remaining in the State. The North Dakota Forest Service classifies the native forest in the basin into four types: lowland hardwoods, aspen-birch, oak timber, and brush timber. Acre-for-acre prairie woodlands are second only to wetlands in providing diverse breeding habitat and cover for birds and mammals.

The lowland hardwoods type is composed primarily of American elm, green ash, box elder, cottonwood, and basswood. This type predominates along water drainages and river bottoms.

The primary species in the aspen-birch type are trembling aspen, balsam poplar, and paper birch. Stands of these trees prefer northern and eastern slopes or other sites where soils are well drained, but moisture is abundant.

The oak-timber type is composed primarily of burr oak. It dominates dry forest sites in the area, especially in the area south of Devils Lake. Burr oak also grows on moist sites, but in association with other species, such as green ash.

The brush-timber type is composed of native forest shrubs such as willows, chokecherry, American or beaked hazel, red-stemmed dogwood, hawthorne, Juneberry, pincherry, silverberry, buffaloberry, American plum, highbush cranberry, and others. Scattered native trees like burr oak and green ash are normally associated with the shrubs.

A forest inventory of the Devils Lake area by the North Dakota Forest Service in January 1980, revealed that during 1971-1977 about 6,700 acres of native forest were converted to other uses.

Agricultural clearing for cropland, hayland, and pastures, along with clearing for residential development, were the principal causes for forest conversion. In addition to the losses from clearing, about 25 percent of the native forest lands in the area are grazed by livestock.

Because North Dakota has such limited woodlands, prairie woodland habitats in the basin are valuable to a wide variety of wildlife. Prairie woodlands are especially important during winter when they provide protective cover for both game and nongame wildlife. Raptors such as the Swainson's hawk and great horned owl require woodlands for nesting.

Since 1993, Devils Lake has inundated approximately 4,090 acres of forest. Over 1.1 million trees have died as a result (North Dakota Forest Service 1999).

Riparian Habitats

Riparian habitats are generally defined as the zone of vegetation influenced by the hydrology of streams and rivers. Riparian vegetation usually exhibit a higher degree of robustness than that located in adjacent areas, and as such, represents a transitional zone between wetland and upland environments. Riparian corridors along intermittent streams and tributaries to Devils Lake provide valuable habitat for fish and wildlife. Marsh habitat within riparian corridors often provide waterfowl habitat as good as prairie wetlands. Riparian areas in the Devils Lake basin are important not only as habitat for fish and wildlife, but also for flood control, streambank stabilization, and to improve water quality.

During high precipitation or runoff events, riparian corridors slow the rate of surface water runoff or overland flow. The dense, thick vegetation of a healthy, unaltered riparian corridor, and its deep humus layer of soil, act as retardants, holding back and slowing runoff. Cottonwood, ash, and elm with their deep roots, and willow, dogwood, and buck brush with shallow, dense roots effectively hold the soil in place and deflect water to reduce streambank erosion. Riparian areas can improve water quality by acting as filters to remove chemical compounds, toxic substances, sediments, and trash as the water moves through the system.

Threatened or Endangered Species and Rare Species

Threatened or Endangered Species: Federally endangered and threatened species that may be present in the Devils Lake basin include the bald eagle (*Haliaeetus leucocephalus*) and piping plover (*Charadrius melodus*). The bald eagle generally migrates through the area, but beginning in 1998, eagles have nested in the Devils Lake area. Piping plovers migrate through the project area and are recorded as nesting on exposed alkaline shoreline within the basin.

A list of federally endangered and threatened species for each county in the project area is provided in Table 3. This list fulfills requirements of the Fish and Wildlife Service under Section 7 of the Endangered Species Act.

If a Federal agency authorizes, funds, or carries out a proposed action, the responsible Federal agency, or its delegated agent, is required to evaluate whether the proposed action "may affect"

listed species. If it is determined that the action "may affect" a listed species, then the responsible Federal agency shall request formal Section 7 consultation with this office. If the evaluation shows a "no effect" situation to the listed species, further consultation is not necessary.

Table 3. Occurrence of Threatened and Endangered Species in Counties Surrounding Devils Lake.

	Ramsey	Benson	Towner	Cavalier	Nelson	Walsh
Bald Eagle - T	X	X	X	X	X	X
Whooping Crane - E		X	X	X		
Gray Wolf - E			X	X		X
Piping Plover -T		X				

Special Resource Areas

There are a number of public wildlife lands within the basin that are managed for the benefit of fish and wildlife resources. The North Dakota Game and Fish Department manages seven Wildlife Management Areas (Black Swan, Crary, Minnewaukan, Nesvig, Pelican Township, C.C. Underwood, and Kenner Marsh) within the Devils Lake basin, totaling 2,513 acres.

The Service administers fee-title National Wildlife Refuges (NWR) and Waterfowl Production Areas (WPA), as well as wetland easement tracts and easement refuges throughout the State of North Dakota. Wetland easements, while still in private ownership, are protected from all drainage, filling, and burning activities. The Service requires that all practical actions be taken to avoid impacts to wetlands under its jurisdiction during project construction. Although permits for activities are generally not required on these lands if facilities are placed in the existing rights -of-way, Special Use or right-of-way permits will be necessary for any construction activities on fee lands or easements where wetlands are impacted. An analysis of impacts and alternatives pursuant to Section 404(b)(1) of the Clean Water Act or Corps nationwide permit for impacts to waters of the U.S. may also be required..

Within the Devils Lake Wetland Management District, the Service administers 14,786 acres of fee-title refuge lands, 48,065 acres of WPA's, 154,748 acres of wetland easements, and 18,868 acres of refuge easement. All Service administered properties contain intact wetlands currently functioning to store water and preventing additional inflows to Devils Lake.

The Service has developed a digital database that depicts all Service fee-title and wetland easement tracts for the Devils Lake basin. This database has previously been distributed to the

Corps in a digital format. It is important to understand that the areas depicted as fee-title lands are for illustrative purposes only and do not represent legal boundaries of owned units. Additionally, wetlands displayed on the map are derived from the Service's NWI and may not represent the actual size, location, shape, or existence of wetlands protected by individual easement agreements. For more detailed information on the boundaries of fee-title land or easement areas, please contact the Service's Wetlands Acquisition Office, Bismarck, North Dakota.

Valley City National Fish Hatchery

The Valley City National Fish Hatchery (NFH) includes two rearing stations located in Barnes County, North Dakota. The main rearing station is located about 3 miles northwest of Valley City. A second rearing station is located about 5 miles north, just downstream of the Bald Hill Dam. Both stations rear fish in earthen ponds, although the Valley City station also has a research building with a recycled water-rearing system that discharges to a leach field. Water is drawn directly from the Sheyenne River by siphon/gravity flow at the Bald Hill station, and by pumping Sheyenne River water at the Valley City station. The source water from the Sheyenne River is not treated at either station.

FUTURE WITHOUT THE PROJECT

Aquatic Resources

When analyzing the future without project conditions, both the stochastic and "wet future" scenarios must be taken into account. The "wet future" scenario assumes the lake will rise to its overflow elevation of 1459 msl, and in the process the lake would cover approximately 330,000 acres in the Devils Lake basin. In the event of a spill out of the basin, the overall water quality of the lake would improve while the water quality of the Sheyenne River would be degraded with poorer Devils Lake water quality.

Wetlands

Wetlands would continue to be inundated by a rising Devils Lake to approximately 1459 msl, which is the natural overflow out of the basin. This occurrence will result in the conversions of temporary, seasonal, and semipermanent palustrine (PEMA, PEMC, and PEMF) wetlands to lacustrine wetlands (L1 or L2). Under the stochastic method, the probability of a natural overflow is about 10 percent, rendering the likelihood of this occurring remote. The acres of wetlands converted from emergent to lacustrine is dependent on the eventual lake level.

The natural transition of palustrine to lacustrine wetlands is not viewed as a negative impact, since it is normal for wetlands to fluctuate between open water, emergent, or dry depending on hydrologic conditions. Although the lake rise would result in a loss of emergent wetlands which are used by waterfowl and shorebirds as nesting and brood habitat, to more open-water habitat,

the change would be temporary in nature. The inundated palustrine wetlands would eventually re-emerge once lake levels decline.

Fishery

With the rising lake levels under the wet future scenario, it is expected that the lake's fishery will continue to improve as newly flooded habitat becomes productive spawning habitat for the lake's fish species. Flooded timber also provides valuable escape cover for young fish, ambush cover for certain predatory fish, and provides substrate for invertebrate food production. Similar gains in fish habitat would be seen with the stochastic scenario at an eventual stable lake level. In time, however, Devils Lake would be expected to recede, following a typical prairie lake hydrologic cycle. Under this situation, the fishery would be adversely affected by the loss of habitat, significantly degraded water quality, and the concentration of fish in a receding lake. Natural reproduction of the lake's fish species would cease or be severely restricted when water quality reaches approximately 2500 mg/l TDS. Continued infrastructure protection measures would increase disturbance and turbidity that would affect a temporary impact to aquatic species in Devils Lake.

In a natural overflow event predicted under the wet future scenario, Devils Lake fish species could be introduced to the Sheyenne and Red Rivers through the Tolna Coulee. Under the stochastic method, the lake's chance of overflowing out of the basin is approximately 10 percent. Striped bass were stocked in Devils Lake in 1977. According to North Dakota Game and Fish divisional reports No. 23 and 23a (Steinwand et. al., 1996), no reproduction or hybridization is known to have occurred. The striped bass is the only species recorded in Devils Lake that does not occur in the Sheyenne and Red Rivers. If striped bass exist in Devils Lake, they are in very low numbers; however, there is a low probability that this fish species would be introduced downstream.

The Corps initiated a fish health study in 2001 to assist in assessing the potential risk factors associated with transfer of fish pathogens from Devils Lake through an emergency outlet to the Sheyenne and Red Rivers. The Corps contracted with the Service's Missouri River Fish and Wildlife Assistance Office in Bismarck, North Dakota, to conduct fish sampling work and the Bozeman Fish Health Center (FHC) in Bozeman, Montana, to conduct the fish health analysis. The goal of the fish health study is to collect representative fish from Devils Lake, the Sheyenne River, and the Red River and test their tissues for specific fish pathogens.

During October 2001 and August 2002, more than 500 fish were collected from Devils Lake, the Sheyenne River, and the Red River. These fish were tested for several specific fish pathogens, using protocols developed by U. S. Fish and Wildlife Service National Wild Fish Health Survey. The survey was performed to establish baseline data in response to concerns over the transfer of biota from either natural overflow or construction of an outlet that would connect Devils Lake to the Sheyenne and Red Rivers.

In summary, fish from across the survey area appeared in be in good health and condition. No external or internal signs were observed that would indicate fish were affected by disease. Many

fish screened were suspected positive for *R. salmoninarum,* but results of those tests could not be confirmed with the highly sensitive and specific PCR assay. None of the other specific fish pathogens listed in the survey were detected from Devils Lake or the Sheyenne and Red Rivers.

Terrestrial Resources

Wildlife, grasslands, woodlands, and riparian habitats within the basin will be impacted as the lake rises. Wildlife in the basin will generally be expected to relocate and adapt to the gradual loss of habitat due to the rise of lake levels. Inundated grasslands will be converted to aquatic habitat and will provide excellent spawning and nursery habitat for the fishery. Woodlands are perhaps the terrestrial resources at greatest risk, as they will be negatively impacted as inundated tree species are flooded and subsequently killed.

Threatened or Endangered Species and Rare Species

Since 1998 bald eagles have been observed nesting in dead timber around the shoreline of Devils Lake. Piping plovers migrate through the project area and have been recorded as nesting on exposed shorelines of alkali lakes in the basin. Under the "future without the project" scenario, climate would drive lake level changes. The natural rise and fall of the lake would not adversely affect bald eagle and piping plover nesting habitat.

DESCRIPTION OF PROPOSED ACTION

Infrastructure Protection

The Devils Lake Infrastructure Protection Study identified the costs and benefits of flood protection measures for roads, railroads, state facilities, communities, and rural areas in and around Devils Lake. Previous studies focused on determining the costs and benefits of providing an outlet (pump station and pipeline to remove water) for Devils Lake. In this study the flood protection measures were treated as projects in themselves, without relating them to the potential effects of an outlet. In the event the lake continues to rise and an outlet is not selected, continued infrastructure protection would still be required and would become the "no action" alternative.

A total of 17 features were identified by the Corps as being subject to imminent impact from rising lake levels, thereby warranting additional analysis. The features identified include the following:

- Churches Ferry
- City of Devils Lake
- Fort Totten
- City of Minnewaukan
- St. Michael

- Gilbert C. Grafton Military Reservation
- Grahams Island State Park
- Rural Areas
- Canadian Pacific Railroad
- Burlington Northern Railroad (Along US Highway 2)
- US Highway 281 (South of US Highway 2)
- US Highway 281 (North of US Highway 2)
- ND Highway 1
- ND Highway 20 (ND Highway 57 to Tokio)
- BIA Highway 1
- BIA Highway 6
- Roads Acting as Dams

For each feature, different flood protection strategies can be used to deal with the problem of flooding. Most features have at least one type of no-protection strategy, incremental strategy, and maximum-protection strategy. "Hybrid" or combination strategies might also be implemented. The no-protection strategy provides no flood protection for impacted features. Incremental protection strategies provide flood protection in a series of small elevation increments, such as raising a levee or a road 5 feet at a time. Relocation for structures can also be done in small increments by relocating groups of flood-prone homes and structures based on the water level. Maximum-protection strategies would mean after the implementation of the protection measure no additional actions would be necessary, even if the lake should rise to its potential maximum elevation of 1463. Maximum-protection strategies for road raises, railroad raises, and levee raises were considered to be feasible strategies. A hybrid strategy would be a combination of the incremental and the maximum-protection strategies.

Dry Lake Diversion Feature

The Dry Lake Diversion is identified as a project feature required to modify and operate the existing Dry Lake Channel A project to restore a portion of the flow of fresh water from Dry Lake to Pelican Lake via Big Coulee as part of the proposed Devils Lake Outlet Plan. The introduction of additional water with lower sulfate concentrations will allow the operation of the proposed Devils Lake Outlet to be more effective and feasible in lowering lake levels.

The Dry Lake Diversion Feature Development Report analyzes the hydrologic and hydraulic conditions present in the chain of lakes watershed tributary to Devils Lake from the north. The proposed plan consists of the following components:

- A 400 cfs diversion channel and control structure from Dry Lake to Mikes Lake
- A new control structure on Channel A
- Improvements to existing channels, roadways, and control structures in the chain of lakes
- Flowage easements around lakes affected by operation of the project
- Installation of a flow monitoring structure on Big Coulee

An alternative diversion alignment bypasses the chain of lakes to the south and connects directly to Big Coulee from Mikes Lake. This alternative would consist of an excavated channel that would avoid impacts to Lake Alice National Wildlife Refuge.

Interim Mitigation Plan

The overall goal of the proposal is, at a minimum, to maintain the ecological integrity of the Sheyenne River and its riparian corridor in the face of externally imposed changes to the physical environment resulting from the proposed project. It is designed to measure, evaluate, and protect various ecosystem components so that when the project is completed, all those components would still be present in the system. There may ultimately be unmitigated losses during outlet operation. However, the intent of this proposal is to minimize the effects of the proposed discharge during operation as much as practicable, and to retain all elements of the system in some fashion so that the river's natural state can be restored upon cessation of the project.

The proposed monitoring and mitigation program also includes a phased approach. Existing physical and biological conditions along the Sheyenne River, as described in previous project studies, would be verified and refined during the initial implementation phase through additional surveys. The resulting data would allow quantification of existing conditions through the use of measures such as the index of biotic integrity (IBI) and floristic quality index (FQI). These baseline values can then be used as measures against which subsequent data collection can be compared.

The subsequent phases of implementation rely heavily on monitoring. However, where impacts are fairly certain to result from the proposed outlet, mitigation measures have been proposed to directly address impacts or to indirectly improve conditions through restorative means. The monitoring program presented in this proposal is designed to provide data that can be used to identify changes in baseline conditions, to evaluate the effectiveness of implemented mitigation measures, and to identify unexpected conditions. Additional steps could then be taken to address any ongoing concerns in an iterative fashion.

The monitoring and mitigation proposal is designed to address natural resource impacts from operation of the Pelican lake constrained outlet alternative. The outlet consists of an intake structure connected to a buried pipeline with open channel features (restricted to an area along Highway 281, north of Minnewaukan), and an outlet to the Sheyenne River through Peterson Coulee. According to the draft IPR/EIS, there would be temporary impacts along the pipeline corridor during construction, but long-term impacts of outlet construction should, at most, be minimal and would not require mitigation. Since the release of the draft IPR/EIS, additional wetland impacts have been identified. Three acres of permanent wetland impact will result from construction of the regulation reservoir. There may be additional wetland impacts from construction of the Dry Lake Diversion and dredging of some wetland areas currently inundated by Devils Lake. Any wetland acres destroyed during project construction should be replaced on an acre-for-acre basis.

This proposal deals exclusively with potential effects of outlet operation at, and downstream, of its discharge into the Sheyenne River. Mitigation alternatives do not include changes in the design or operation of the Pelican Lake 300 cfs outlet. Operation would be constrained by conditions in the receiving waters of the Sheyenne River at the point of insertion. Specifically, pumping operations would be constrained by the bankfull capacity of the Sheyenne River (600 cfs) and by a maximum sulfate concentration of 300 mg/1. Outlet operation would be curtailed or halted if the flow magnitude or water quality criteria were exceeded by blended waters in the Sheyenne River below the point of insertion.

Included in the mitigation plan is the proposed acquisition and management of approximately 6,000 acres of riparian habitat along the Sheyenne River to mitigate for elevated groundwater effects from outlet operation. These lands would be located in high quality habitats including lands affected by the project and adjacent lands. Vegetation planting, fencing, and other management activities are proposed. The acquisition and management of these areas is intended to preserve and enhance existing riparian habitats. The protected areas will presumably be positioned to support natural recovery and restoration of the riparian corridor after outlet operations stop. Natural recovery and restoration of degraded riparian habitats will take time and require favorable conditions. The mitigation plan should include provisions for the immediate restoration and protection of disturbed areas exposed by a cessation of pumping to reduce erosion and prevent the establishment of invasive species.

The lands acquired or leased for mitigation of project impacts to public trust resources can provide significant additional benefits if public recreational use is allowed wherever possible. Use of these lands for public activities such as hiking, bird watching, hunting, and fishing can easily be accommodated on these lands without compromising their mitigation value.

The proposed mitigation for erosion and sedimentation includes a combination of direct and indirect means for reducing the amount of sediments entering the Sheyenne River and spreading out the effects of the proposed discharge, such that they are not concentrated in any one location.

The direct means proposed involve stabilizing 14 banks in the high gradient area near the discharge point and 9 in the first high gradient areas downstream of Bald Hill Dam. These locations are where the introduction of additional water is likely to have the greatest impact on the existing river velocity-sediment load equilibrium. By protecting the most highly erodible areas, the stream would be allowed to reach sediment load equilibrium slowly and develop graded conditions under the new flow regime, without causing excessive erosion or deposition in any one location. The stabilization sites downstream of Bald Hill Dam will also help protect infrastructure and historic structures in Valley City.

The sites proposed for stabilization would be protected using armoring, retaining walls, cribbing, bioengineering, or instream vanes depending upon site conditions and access considerations. Construction of bank stabilization measures will result in additional impacts to the aquatic environment.

The indirect mitigation measures proposed involve acquisition of riparian lands and restoring a wider vegetated buffer in these locations in order to protect river banks and slow the movement of water during high-flow periods. Approximately 133 acres of riparian land between the discharge point and the first vegetation mitigation parcel are being proposed for acquisition and management. The intent of this proposal is to ameliorate the effects of higher flows in the area immediately downstream from the insertion point, because this area would experience the greatest relative increase in flows, as compared to pre-pumping conditions. Acquisition could be accomplished either in fee or as an easement or other use right that would allow creation of a vegetated buffer along the river. Livestock should be excluded from these riparian areas and alternative water sources provided if necessary. With increased flows and prolonged bank full conditions, portions of the riparian zone may be saturated for most of the season. Under these conditions, livestock use of these areas will cause continual and long lasting damage to the area, which would cause increased erosion.

The restoration/mitigation of grasslands would involve the reintroduction of mixed and tall grass native prairie communities on lands either under agricultural production or degraded grasslands adjacent to the Sheyenne River. The process of restoring/mitigating would involve site preparation and seeding of prairie species and a cover crop, plus the application of straw mulch, all within the first year. A maintenance regime would be established based on the relative quality of individual sites. Mowing and/or burning to control undesirable invasive plant species may be necessary, as needed. All mitigation areas would be protected from grazing activity to ensure desired grassland growth and composition.

The proposed erosion and sedimentation monitoring protocol includes three elements: river erosion surveys, sedimentation monitoring, and aerial photography review.

The proposed outlet could have effects on habitat by altering flow rates, water depth, substrate composition, and river geomorphology. The projected 50-year analysis by West Consultants (2001) demonstrated that, assuming a moderate hydrologic future scenario, the 300 cfs discharge would minimally or moderately change Sheyenne River geomorphic characteristics, including channel forming flows, channel width, channel depth (bottom elevation), meander length, or meander amplitude. With the possible exception of erosion rates, these factors would not change substantially enough to dramatically change aquatic habitat, although habitat locations and orientations would likely shift.

With specific regard to fish habitat, the aquatic impact report indicates that the increased-stage and lowered-stage variability during summer would generally increase the amount of habitable area by increasing flooded area (Earth Tech 2001). Under existing conditions, the Sheyenne River periodically experiences extremely low flows, including periods of no flow in some reaches, which degrade habitat quality and quantity. Some less-studied fish species may depend upon the existing flow variability and shallow habitats, so some effects of deeper, faster, more consistent flows on fish habitat may not be predictable based on present knowledge.

As discussed above, the habitats that would most likely decrease as a result of the outlet would be riffles and shallow pools in the Upper Sheyenne River. These habitats are important for many

fish species as well as macro invertebrates. Thus, these are the habitats targeted for mitigation measures. The proposed mitigation method is to create diversion channels around selected river reaches, which would divert excess flow away from these reaches in order to maintain existing flow conditions in the reaches. These diversions would be created by the construction of two earthen dams, one blocking the natural channel and the other blocking the entry to the artificial channel, penetrated by culverts of such sizes and elevations that up to 300 cfs would be diverted into the artificial channel, while all additional flow would run through the natural channel.

Construction of earthen diversion dams across the main channel may restrict fish passage. During periods of low water, the presence of these dams may result in habitat fragmentation. The use of fish ladders, slot weirs, rock slope fishways, and/or low-flow channels will be necessary to allow fish movement past the dams. Allowing upstream and downstream movement of fish past these barriers is critical to insure fish do not become isolated in a particular stretch of the river. The location and design of fish passage structures must take into consideration the habitat requirements of different aquatic species and age classes. The diversion features have merit for maintaining some of the existing riffle/pool habitat in the upper Sheyenne River during project operation. However, the mitigation plan details require further coordination and should include mitigation for dam construction and possibly channel restoration after outlet operations have ceased.

While the proposed habitat mitigation would not preserve riffle and shallow pool habitats in their pre-pumping abundances, these habitats' flows and depths would be recreated by restored flow conditions after pumping ends. As flow rates and stage heights return to pre-pumping levels, substrate scour and deposition would restore substrate conditions over time. Meanwhile, the protected habitats in the mitigation reaches would provide refuge areas for species that require those habitats, and these possibly reduced populations would serve as sources for dispersal to the rehabilitating habitats.

Biological effects of an outlet on Sheyenne River biota will likely become apparent only after the outlet project is underway.

Fishes are the best known biota group in the Sheyenne River, and they are the most thoroughly studied of aquatic biota groups. Thus, impacts of the outlet can be best predicted for fishes, and managing rivers for fishes is often used as a way to manage for all biota groups by proxy. No fish species are likely to be extirpated by the direct effects of an outlet, but sublethal impacts may occur.

Refuge habitat would occur within the river channel, and even greater areas of refuge habitat would be created by flooding of off-channel depressions, such as abandoned meanders and ox-bows. However, by occupying these newly-flooded areas, some individuals could be subject to isolation in small depressions when pumping stops at the end of each pumping season.

If outlet pumping is halted abruptly each year at the end of the pumping season, some organisms could be stranded in isolated off-channel pools. This would likely prove fatal for most fish and mussels, and many other macroinvertebrates, whether the pool dries down or not. For this

reason, pumping could be gradually increased and decreased at the beginning and end of the pumping season. Gradual increases of approximately 50 cfs per day over a 6-day period would allow most organisms time to respond to the flow changes, while reducing the substrate-scouring effect that an abrupt flow pulse could cause. Gradual decreases of approximately 25 cfs per day over a 12-day period at the end of the season would allow animals to move in response to falling water levels, thus minimizing the risk of their being stranded in isolated depressions or on high ground. This ramping of flows would probably have little benefit for adult mussels, due to their sedentary nature. Typically, the only movements undertaken are vertical adjustments of the animals' position in the substrate in response to changing environmental conditions.

Mussels are treated as a separate group from other macroinvertebrates because mussels are of particular concern, given their relatively high diversity in the Sheyenne River and the declining mussel diversity throughout the country. In general, adverse impacts to mussels would likely include loss of density and, perhaps, loss of mussel diversity.

If baseline surveys indicate that some mussel species are present only in the Sheyenne River mainstem below the outlet insertion point (i.e., not in tributaries or upstream from insertion point), relocation of portions of the populations could be considered if long-term monitoring identifies a problem. Suitable habitat could be located in tributaries and/or upstream from the insertion point, and the appropriate species could be collected in numbers considered by experts to be sufficient to maintain population viability.

The Valley City NFH facilities and operations may be impacted by increased flows in the Sheyenne River, by increased total dissolved solids, or by increased turbidity.

High river flows may occasionally interfere with draining the ponds at the Valley City and Bald Hill rearing stations. Two mitigation alternatives have been identified, manipulating river flows using Lake Ashtabula storage and using portable pumps to drain the ponds.

It should be possible to mitigate the effects of higher Sheyenne River flows on hatchery operations through short-term manipulation of the storage capacity of Bald Hill Dam. By reducing the discharge from the dam and storing water in Lake Ashtabula for short periods of time (e.g., 1 or 2 days), it may be possible to drain specific ponds at both hatcheries and stock the fish. Several flow reductions might be required in high-flow years in order to drain all of the ponds. An alternative to the recommended plan is to use trailer-mounted, portable pumps (e.g, Crisafulli pumps) to drain the ponds when the fish are ready to be stocked. Potential problem with pumps is that it is unknown if the ponds can be isolated from groundwater influences. Significant groundwater inflow to the ponds could make pumping impractical and may cause slumping and pond wall failure. In addition, there is a high probability of fish entrainment into the pumping system and subsequent mechanical damage to small fish. This uncertainty, combined with the capitol and operating costs, make this a less desirable mitigation alternative.

The potential increase in turbidity at the hatchery, if any, is likely to be small. Thus, mitigation probably would not be required. The hatcheries should be inspected periodically to monitor potential impacts from increased TDS and turbidity. Since changes would be minor from year to

year, a frequency of 5 years is recommended. Inspections should focus on iron pipe, other metallic equipment, and possible infilling of the ponds.

To address concerns related to biota transfer from Devils Lake to the Hudson Bay drainage via an outlet to the Sheyenne River, the Corps has proposed construction of a sand filtration system. Due to the flow rate and influent water quality, a gravity-type, deep-bed rapid sand filtration system was evaluated. The system would consist of 14 cells, each approximately 1,000 square feet in area. A dual-media filter bed would consist of a layer of anthracite coal on top of a layer of fine, silica sand. The system would drain to a clear well and from there to the regulating reservoir. A backwash system will clean the filters when a reduction in the hydraulic capacity of the filter cell causes the water level to rise. The backwash water will be treated on site. The filter system will be drained and moth balled when the outlet is not in operation. The system is designed to filter particles 2 microns and larger. This should provide a sufficient barrier to most organisms, however, if viruses (20 to 200 nanometers) are present, they may be able to pass though the filter.

DESCRIPTION OF IMPACTS

Infrastructure Protection Feature Impacts

Impacts to wetland communities due to the infrastructure protection measures (Table 4) can include filling and hydrology alterations due to levee and road construction activities, and flooding due to ponding behind the roads that are acting as dams. Fill used in the construction of the levees could cause environmental impacts due to encroachment upon wetlands and surrounding upland plant communities. Complete or partial loss of wetland functions and conversion to upland due to filling is possible in some locations. In areas where some hydrology is maintained and wetland conditions remain, changes in plant community and hydrology could lead to a wetland type change. The loss of wetland area will impact waterfowl, marsh bird and songbird-nesting areas, as well as impacting reptile and amphibian population due to habitat loss and fragmentation. Muskrats, beaver, mink, and white-tailed deer are some of the mammal species that may also be affected by loss of wetland areas.

Table 4. Approximate Wetland Acres Impacted By Infrastructure Protection Features.

Feature	Action Level 1	Action Level 2	Action Level 3	USFWS Easement	USFWS Waterfowl Production Area
City of Minnewaukan	4.6	0.3			
City of St. Michael	7.0				
Grahams Island State Park	1.6				
Canadian Pacific Railroad	10.2			0.4	
Burlington Northern Railroad	2.5				
Highway 281 South of Cando	8.8			1.6	
Highway 281 North of Cando	2.1			0.1	
ND Highway 20	5.2			0.4	
BIA Highway 1	1.0				
BIA Highway 6	3.1				
Roads Acting as Dams	1523.8			34.7	342.2
Total	1569.9	0.3		37.2	342.2

In upland areas, a loss of native species due to grading and filling could be expected to occur. Subsequent revegetation of fill or borrow locations may allow for the introduction of weedy, non-native species. A loss of native tree species due to grading and filling, as well as the introduction of weedy, non-native, under-story species could also be expected in these areas. The loss of woodland areas will impact songbird nesting and small mammal populations, as well as impacting reptile and amphibian population due to habitat loss and fragmentation. Impacts to upland plant communities, including woodland (Table 5), grasslands (Table 6), and cover crop easement areas, have the potential to impact nesting bird populations.

Table 5. Approximate Woodland Acres Impacted By Infrastructure Protection Features.

Feature	Action Level 1	Action Level 2	Action Level 3	USFWS Waterfowl Production Area
City of Ft. Totten	2.7	0.7	0.5	
City of Minnewaukan	4.4	0.5		
City of St. Michael	1.4	2.3		
Grahams Island State Park	6.0			
Canadian Pacific Railroad	0.9			
Burlington Northern Railroad	7.6			
Highway 281 South of Cando	3.2			
Highway 281 North of Cando	0.8			
ND Highway 20	1.7			
BIA Highway 1	1.7			
BIA Highway 6				
Roads Acting as Dams	471.4			0.2
Total	501.8	3.5	0.5	0.2

Table 6. Approximate Grassland Acres Impacted By Infrastructure Protection Features.

Feature	Action Level 1	Action Level 2	Action Level 3	USFWS Waterfowl Production Area
City of Ft. Totten	4.0	0.5	0.9	
City of Minnewaukan	15.7	6.0		
City of St. Michael	0.4	0.1		
Grahams Island State Park	34.8			
Canadian Pacific Railroad	33.1			
Burlington Northern Railroad	122.3			
Highway 281 South of Cando	107.5			
Highway 281 North of Cando	85.5			
ND Highway 20	26.4			0.1
BIA Highway 1	6.0			
BIA Highway 6	0.6			
Roads Acting as Dams	990.3			28.0
Total	1426.6	6.6	0.9	28.1

Upland impacts are expected from levees and the roads that are acting as dams. These impacts relate to inundation and subsequent conversion of upland area to aquatic habitat. Complete or partial loss of habitat functions due to conversion to deep-water habitat is possible in some locations. In areas where wetland conditions remain, changes in plant community and hydrology will lead to wetland creations. Inundation will also lead to the displacement of terrestrial species and those aquatic species that need shallow water areas.

Dry Lake Diversion Impacts

Operation of the proposed diversion will result in changes to flows and lake elevations in the chain of lakes. These changes are only expected to be of minor duration, frequency, and depth. However, they have the potential to affect a number of acres due to the ever-changing lake levels experienced in the region. Flowage easements on about 5,000 acres of lake would be required around Chain Lake and Mikes Lake. Flowage easements on about 16,600 acres would also be required around Dry Lake in order to operate the diversion project.

An additional 7,000 acres of land in the Lake Alice National Wildlife Refuge would also be affected by changing water level elevations. The design and operational criteria of the diversion channels and their control structures have not been described in sufficient detail to enable an analysis of impacts to Service refuge lands and wetland easements. Specifically, additional information on the proposed construction, hydrology, and operations is needed to assess the impacts to Lake Alice National Wildlife Refuge from the proposed Dry Lake Diversion feature. This information is essential for refuge staff to make a determination of whether the project is compatible with the purposes for which Lake Alice National Wildlife Refuge was established.

The National Wildlife Refuge Administration Act (16 U.S.C. 688dd) requires that any use of a National Wildlife Refuge must be compatible with the purpose for which that refuge was established. It is important to note that current Service policy, as published in the Federal Register on October 18, 2000, prohibits using compensatory mitigation as a means of converting a proposed use that would otherwise be considered incompatible into a compatible use. The proposed use must meet the compatibility requirements on its own merits.

Mitigation and Monitoring Plan Impacts

The proposed mitigation measures are designed to mitigate for increased flows and higher water levels in the Sheyenne River downstream of the outlet insertion point. While these measures may mitigate some of the impacts from additional water, the proposed mitigation measures in and of themselves, such as construction of cutoff channels, flow diversion structures, and bank stabilization measures, will have considerable direct and indirect impacts on existing aquatic and riparian habitat.

In the Service's view, the Corps' plan does not adequately describe the erosion protection measures that will be used to stabilize the 23 areas in the Sheyenne River that have been identified as needing additional protection. Such measures may cause downstream bank erosion resulting in the need to add additional protection in the future. Bank stabilization has additional impacts, e.g. traditional bank stabilization techniques (riprap, cribbing, gabions) reduce the diversity of instream and riparian habitat.

Measures that stabilize river banks and attempt to train rivers, such as armoring, flow deflection structures and energy reduction measures, can adversely affect the natural form and function of the river, thus adversely affecting fish and wildlife and their associated habitats in both the aquatic (riverine) and riparian (floodplain) communities. Such measures physically stabilize river banks and may increase river flow velocities, exacerbate downstream bank erosion, and lead to channel narrowing and bed degradation. Associated impacts can include reduced shallow-water riverine habitat, reduced riverine-floodplain connection, loss of backwater chutes, and reduced sediment and debris input, which can adversely affect nutrient cycling and creation and maintenance of aquatic habitat features. Thus, depending on the type and extent of bank stabilization used, the impacts from these features may require additional mitigation.

The use of earthen dams across the main channel to divert up to 300 cfs of water into the meander cutoffs may restrict fish passage if the structures are not constructed to allow for upstream and downstream fish movement. Construction of high flow by-pass channels will result in shortening the stream meander length. This could significantly increase stream gradient and erosive velocities in the cutoff channels. Without additional erosion protection, the result could be major down cutting of the Sheyenne River, with resultant sedimentation impacts downstream and loss of stream access to the cut off oxbows. Sediment deposition above the dams will also have impacts to mussels and aquatic insects that rely on clean substrate.

Construction of nine proposed diversion structures on the main channel may result in aquatic habitat fragmentation. Fragmentation occurs as a result of the disruption of connectivity of

habitats, causing formerly continuous systems to be broken up into isolated segments. This often diminishes the resilience and viability of resident wildlife populations. Habitat fragmentation can reduce fish populations directly by reducing the amount or quality of available habitat or indirectly by reducing the connectivity between suitable habitats. Fragmentation may impact mussel survival and distribution by restricting the movements of host fish between different habitat types.

Additional Impacts

Impact of outlet on Devils Lake aquatic habitat and lake levels. The Service is concerned with TDS concentrations greater than 2500 mg/l, as natural fish reproduction is inhibited through disturbances to the fertilization process of fish eggs. With the exception of Pelican Lake, no outlet draws enough water out of the lake to concentrate TDS levels above 2500 mg/l. East Devils Lake concentrations actually go down after the years 2004-2005, because the wet scenario assumes the lake continues to rise to an elevation range of between 1452 to 1457 msl.

According to the draft IPR/EIS, in Pelican Lake the TDS levels rise above 2500 mg/l between the years 2029-2031 on all outlet alternatives, and remain above 2500 mg/l for up to 5 years. Because the wet future predicts a Devils Lake overflow lasting from years 2014-2025, the higher TDS levels in the years 2029-2031 are likely the result of a declining lake level and subsequent concentration of dissolved solids in the lake. This appears to be driven by a switch from the wet future water model ("wet seven" hydrologic cycle of 1993-1999, used back-to-back from 2001 forward to create the overflow of Devils Lake in the year 2014) to the long-term 1980-1999 hydrologic cycle after 2025. The long-term 1980-1999 cycle, which contains the drought years in the mid-to-late 1980's, will be repeated after 2025 and will draw the lake down.

The Service is concerned that the Pelican Lake area will not support natural reproduction of fish with TDS concentrations above 2500 mg/l. An analysis of TDS data from 1993-1999 showed that Big Coulee concentrations averaged 455 mg/l. With Big Coulee emptying into the Pelican Lake area and TDS concentrations above 2500 mg/l produced from a declining lake level, it's unlikely that the Pelican Lake area will remain a viable spawning area for the Devils Lake fishery. With the exception of the East Devils Lake numbers going down from the beginning of pump operations, the remainder of Devils Lake will not likely be affected by TDS concentrations that will negatively impact the long-term fishery of the lake.

Accelerated wetland drainage in the upper basin as a result of the outlet. The Service is concerned about the accelerated loss of wetland habitat in the upper basin as a result of this project. A private drainage survey conducted from 1965 to 1980 documented a 2.5 percent drainage rate of wetlands per year in the Devils Lake basin. The Service believes that the pressure to drain remaining unprotected wetlands for agricultural and other purposes has not diminished over time. Within the basin, there is continuing legal action by lower basin landowners who claim that they have been adversely affected by the rise of Devils Lake, due in part to decades of wetland drainage by upper basin landowners. In the recent wet cycle, the practice of wetland drainage, including pumping, has shown itself to be a contributing factor in the rise of the lake. The Service is concerned that the construction of an outlet, without control

on additional inflow to the lake from drainage, will provide the supporters of wetland drainage a way to export water out of the basin.

RECOMMENDATIONS

The Service provides the following recommendations to protect and enhance fish and wildlife resources in the project area.

1. **Wherever feasible, use bank stabilization alternatives that work with the natural river system and are more environmentally compatible than traditional rock riprap.** Stabilization techniques may include vegetation plantings, soil bioengineering, tree revetments, root wads, log crib structures, sloping of streambanks, and structures that mimic natural stream channel features. Installation of these types of stabilization measures can reduce erosion, while providing fish and wildlife habitat.

2. **Take steps to ensure that fish passage is not restricted.** If proposed earthen diversion dams are constructed, use fish ladders, slot weirs, rock slope fishways, and/or low-flow channels to allow fish movement past the dams. Allow upstream and downstream movement of fish past barriers where feasible. Locate and design fish passage structures or features to accommodate different aquatic species and age classes to the extent possible. Remove dams and restore channel habitats at the end of the project life.

3. **Minimize impacts to existing resources and mitigate for all unavoidable impacts to wetlands and woody vegetation.** Minimize vegetation removal and restore disturbed areas with native plants. Coordinate with State and Federal agencies, such as Natural Resource Conservation Service and the Fish and Wildlife Service, to develop a native plant species list. Replace all wetland losses with restored, created, or preserved wetlands on a value-for-value basis. This may require replacement/enhancement on a minimum 2:1 basis. Acquisition/preservation will require a higher ratio, in the neighborhood of 6:1. Preserve the existing trees and shrubs to the extent possible. Replace unavoidable losses of trees and shrubs with native species on a 2:1 basis.

Recommendations 4-14 were adequately addressed by the Corps in the draft IPR/EIS and are reiterated here to emphasize the Service position that upper basin storage and watershed management should be a significant component of any comprehensive flood control plan for the Devils Lake Basin.

4. **Obtain Service compatibility determination, obtain the necessary permits and establish wetland exchange and mitigation prior to the start of construction.** All wetland easements and fee-title land interests administered by the Service have been provided to the Corps in a digital format. If easement wetlands or fee-title property are

impacted, please contact Mr. Roger Hollevoet, Project Leader, Devils Lake Wetland Management District at 701-662-8611, to determine appropriate permits and conditions.

5. **Include the sponsors' proposal for restoration and creation of storage in the watershed.** In addition to, or in place of an outlet and infrastructure protection, wetland restoration, and other means of holding water on the landscape should be examined as possible solutions to the rising water level in Devils Lake. The Corps should identify all agencies that have authority to work on water storage and assist them in seeking ways to increase water storage. The Service recommends establishing a minimum of 50,000 acre-feet of new storage in the Devils Lake upper basin.

6. **Moratorium on all existing drainage maintenance that increases volume, peak or duration of flow.** Management and maintenance of existing drainage projects, which increase the speed and quantity of runoff to Devils Lake, should be postponed or minimized during the life of the project. Develop a basin-wide water management plan in order to effectively manage the flow of water to Devils Lake.

7. **Moratorium on new wetland drainage and pumping within the basin for the life of the project.** The Service recommends that the Corps coordinate with the State to insure that any plans to remove water from the landscape and place it into the lake through wetland drainage or pumping be postponed during the life of the project to avoid the need to move additional water downstream. Taking precautions to prevent further aggravating factors, such as wetland drainage and pumping from increasing lake levels is consistent with the goal of the outlet to reduce lake levels and prevent a natural overflow of Devils Lake to the Sheyenne River.

8. **Close all unauthorized drainage and cease all unauthorized pumping.** The State Engineer has estimated approximately 3 percent of all wetland drains in the basin are operating illegally. The Service recommends that these drains be closed to prevent the unauthorized drainage of wetlands adding to the problem of high lake levels in Devils Lake.

9. **Monitor wetland loss within the basin.** The Service is concerned that with an operational outlet comes the social demand to use it to its maximum capacity. With this in mind, the Service is concerned that additional pressure to drain wetlands will be placed on the existing wetland base within the basin. Therefore, a monitoring plan should be established to track the security of water storage

10. **Maximize the use of public lands in the upper basin for multi-purpose functions.** The Corps and State should assist agencies and organizations in obtaining necessary permits for storage projects that include public lands.

11. **Develop an outlet operation plan with interagency involvement.** To date, no operational plan has been developed for an outlet that includes the Dry Lake Diversion.

Before an outlet is constructed, an interagency advisory team should develop and approve an operational plan. This approach will be more productive than having the Corps develop various plan options for resource agency comment.

12. **Establish an operational Devils Lake level at or above 1443.0 msl.** The Service recommends that elevation 1443 msl be established as a target elevation for Devils Lake to minimize effects to the lake and impacts to the Sheyenne River. Once pumping or natural draw down brings the lake to this elevation, all pumping would cease. This provides approximately 380,000 acre-feet of storage between 1443 msl and 1446.5 msl (the overflow to Stump Lake). With Stump Lake at approximately 1411.0 msl, there is approximately 371,155 acre-feet of storage to elevation 1446.5 msl. Therefore, with the lake at 1443 msl, there would be approximately 751,155 acre-feet of storage below 1446.5 msl in Devils Lake and Stump Lakes. Additionally, this elevation is consistent with the Service's State-approved water right for Lake Alice National Wildlife Refuge, and allows for some measure of wildlife management at the refuge. Establishing the operating level at or above 1443 msl also provides for the long-term health of the Devils Lake fishery.

13. **Include the State of North Dakota's intent to construct an outlet to the "Future Without the Project" conditions.** The State has begun construction of an emergency outlet, with site preparation for a pump station near Round Lake. They have demonstrated their intent to move ahead in the construction phase of their outlet in the event that a Corps outlet project is not forthcoming. The Corps has stated in the draft IPR/EIS that if the State began construction of an outlet, the Corps would reevaluate whether to include the State's outlet in their future without condition. Including this commitment is needed to accurately reflect the future without the project condition.

14. **Continue early interagency coordination as study progresses and project design is finalized.** An interagency planning effort could streamline the planning process and ensure that all agency concerns and recommendations are given adequate consideration prior to submission of draft or final project proposals.

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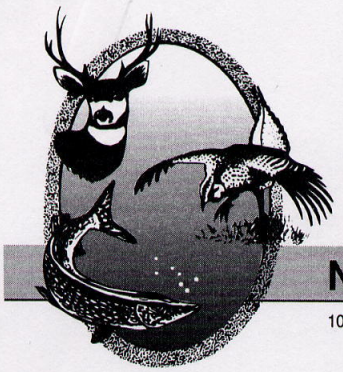

"VARIETY IN HUNTING AND FISHING"

NORTH DAKOTA GAME AND FISH DEPARTMENT

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March 13, 2003

Terry Ellsworth
U.S. Fish and Wildlife Service
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3425 Miriam Ave
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Dear Mr. Ellsworth:

Thank you for the opportunity to review the "Supplemental Fish and Wildlife Coordination Act Report for the Devils Lake Outlet Flood Control Project". Overall, we generally agree with the context and content of the report. Divergence from the previous statement is voiced in the following.

On page 5 in the "Fishery" portion you reference that "Prior to 1965, no game fishery existed in Devils Lake..." Our stocking records document that game fish were first introduced into Devils Lake in 1956 and continued through 1958. Our files indicate that declining water levels caused a brief cessation in stocking activities but were once again initiated in 1967 and a sport fishery has occurred since that time.

On page 5, "Fishery" portion, in the last sentence you state that "...yellow perch, northern pike, white bass, crappie, and possibly walleye are experiencing natural reproduction." We've documented naturally reproduction of walleye since 1999 and have not stocked them since 2000. I suggest removing the word "possibly" from this sentence. As referenced later in the report, successful natural reproduction is highly likely when TDS levels remain below 2,500 mg/l.

On page 13 in the Future Without The Project and under the Fishery section, the newly flooded habitat is valuable for more than just spawning habitat. It also is valuable for escape cover of young fish, ambush cover for certain predatory fish, and provides substrate for invertebrate food production.

On page 14, second paragraph where striped bass and potential hybridization is mentioned, I

suggest you quote the sources of this information, i.e., North Dakota Game and Fish Divisional Reports No. 23 and 23a (Steinwand, Terry R., L.R. Schlueter, and R. Hiltner. Analysis of Long Term Survival, Natural Reproduction and Potential Hybridization of Striped Bass (*Morone saxatilis*) in Devils Lake, ND. N.D. Game and Fish Dept., Div. Rpt. 23. 35 pp. October, 1996. And Hiltner, Randy and T. Steinwand. Addendum to Analysis of Long Term Survival, Natural Reproduction and Potential Hybridization of Striped Bass (*Morone saxatilis*) in Devils Lake, ND. N.D. Game and Fish Dept. Div. Rpt. 23a. 23 pp. October, 1996).

On page 18 under the heading of "Interim Mitigation Plan", in the fourth paragraph, I suggest that wording be included that would restrict or prohibit all livestock use from those areas and provide for alternative water sources if required. With consistently increased flows and 'bank full conditions' there is some speculation that portions of the riparian zone will be saturated for most of the season. Livestock use will cause continual and long lasting damage to the area, which could cause increased erosion.

On page 19, second paragraph, I agree with the predicted impacts on riffles and shallow pools. I suggest that macroinvertebrates be included as a resource being impacted.

On page 21, first paragraph, you recommend using a "trailer mounted, portable pump (e.g., Crisafulli pumps) to drain the (hatchery) ponds when the fish are ready to be stocked." This is not a good option because of the high probability of fish entrainment into the pumping system and subsequent mechanical damage to the small fish. Under the current system, gravity flow into a collecting basin is the method used.

As a final overall suggestion, any lands acquired or leased for this project should be open to public use if at all possible.

Thank you again for allowing comment on the report.

Sincerely,

Terry Steinwand

Terry Steinwand, Chief
Fisheries Division