US Army Corps
of Engineers®
St. Paul District

# FINAL

# DEVILS LAKE, NORTH DAKOTA

## INTEGRATED PLANNING REPORT AND ENVIRONMENTAL IMPACT STATEMENT

## VOLUME 1
(Main Report and Appendices 1, 2, 3, 4, 5, and 6)

April 2003

**FINAL INTEGRATED PLANNING REPORT AND ENVIRONMENTAL IMPACT STATEMENT**

**FOR**

**DEVILS LAKE, NORTH DAKOTA**

The responsible lead agency is the U.S. Army Corps of Engineers, with the Engineer District, St. Paul, having the lead in preparation of the Integrated Planning Report and Environmental Impact Statement.

Cooperating Agencies include: North Dakota State Water Commission, Bismarck, North Dakota; U.S. Environmental Protection Agency, Denver, Colorado; and Bureau of Indian Affairs, Aberdeen, South Dakota.

## ABSTRACT

In 1997, Congress directed the U.S. Army Corps of Engineers (Corps) to undertake preconstruction engineering and design, and to prepare an associated Environmental Impact Statement for an emergency outlet from Devils Lake, North Dakota, to the Sheyenne River for the purposes of reducing flooding problems caused by the rising water levels. In the Energy and Water Development Appropriations Act, 2003, Division D of Public Law 108-7, the Congress directed the Corps to construct an emergency outlet from Devils Lake to the Sheyenne River, subject to several conditions, including the Secretary of State providing assurances that the project will not violate the Boundary Waters Treaty of 1909. The Corps has identified for construction a 300 cubic feet per second (cfs) outlet at Pelican Lake as the preferred alternative to alleviate flood damages at Devils Lake if the lake continues to rise. Following public review of the Integrated Planning Report and Environmental Impact Statement, the Corps will recommend a final course of action. If the Pelican Lake outlet plan is selected, other Federal and State agencies would have to take additional actions before the outlet could be constructed and operated.

The Devils Lake study area encompasses the approximately 3,800 square mile Devils Lake drainage basin and almost 900 miles of the Sheyenne River and the Red River of the North, extending into Canada. The Corps has determined that, if the wet weather continues, another 163,000 acres could be flooded and additional damages in excess of $900 million could occur. Under such conditions, the lake would eventually overflow into the Stump Lakes and then the Sheyenne River. Then, besides elevated salinity levels in the river, this would cause the river to flood, the groundwater to rise, and erosion to increase as well as resulting in the loss of aquatic and riparian habitat. The Corps evaluated structural and nonstructural alternatives to reduce urban, infrastructure, and agricultural flood damage, including upper basin storage/watershed management and various infrastructure protection measures. The Corps also considered several structural alternatives involving the construction of a pumping station or emergency outlet to lower lake levels.

The Corps has identified the Pelican Lake 300 cfs outlet plan as the preferred alternative. This plan consists of pumping facilities, an open channel, a buried pipeline, and mitigation features. The estimated cost of the plan is $186.5 million. The outlet would be operated annually for 7 months from May through November. Operation would be constrained by channel capacity and 300 milligrams per liter (mg/l) sulfate at the point of discharge on the Sheyenne River. Where possible, measures are included to avoid/minimize impacts through project design. Where unavoidable impacts occur, mitigation is included to facilitate the recovery of the system after the project ceases operation.

Mitigation features include design features to avoid or minimize adverse effects, the acquisition and management of approximately 6,000 acres of riparian habitat, erosion protection to minimize the effects of turbidity and sedimentation, high flow bypass channels to maintain critical aquatic habitat, and a sand filter to minimize the risk of biota transfer. The mitigation proposal adopts an adaptive management approach by including extensive monitoring to: (1) establish baseline conditions on the Sheyenne River prior to outlet operation, (2) document expected level of effects associated with outlet operation, and (3) ensure that mitigation features are sufficient to allow recovery of resources along the Sheyenne River once operation of the outlet has ceased. Monitoring activities to establish baseline conditions and monitoring costs for the first 10 years of operation are proposed as first costs.

The Corps of Engineers traditionally recommends plans that show the greatest expected net benefits, where benefits exceed costs based on the probability of flood events (stochastic approach). As a standard process under the Principles and Guidelines, this is referred to as the National Economic Development, or NED, plan. None of the outlet plans meets that economic criterion using a stochastic approach. The benefit-cost ratio of the Pelican Lake 300 cfs outlet plan incorporating probabilities of occurrence is 0.19. However, in Public Law 108-7, the Congress removed the traditional requirements regarding economic justification and provided instead that the justification for the emergency outlet shall be fully described, including the analysis of the benefits and costs.

Further coordination is needed with respect to compliance with the Boundary Waters Treaty of 1909 and the Clean Water Act. Additional data acquisition and monitoring will be required to further define and evaluate the operational impacts of an outlet. Based on the results of these evaluations, supplemental National Environmental Policy Act (NEPA) documentation will be prepared as required.

For further information concerning this Integrated Planning Report and Environmental Impact Statement, please contact the following individuals at the address shown below.

Mr. David Loss (Integrated Planning Report)
Mr. Robert Anfang (Environmental Impact Statement)
St. Paul District, Corps of Engineers
190 Fifth Street East
St. Paul, Minnesota 55101-1638

**DEVILS LAKE, NORTH DAKOTA**

**FINAL INTEGRATED PLANNING REPORT AND ENVIRONMENTAL IMPACT STATEMENT**

**VOLUME 1**

## Table of Contents


Page

***COVER SHEET/ABSTRACT**

***TABLE OF CONTENTS ........ i**
- List of Tables ........ xi
- List of Figures ........ xiii

**GLOSSARY OF ACRONYMS ........ xv**

***SUMMARY ........ S-1**
- Major Conclusions and Findings ........ S-1
- Areas of Controversy and Unresolved Issues ........ S-11
- Relationship to Environmental Protection Statutes and Other Environmental Requirements ........ S-18

**INTRODUCTION ........ I-1**

**1 AUTHORITIES ........ 1-1**
- Preconstruction Engineering and Design and Environmental Impact Statement Preparation ........ 1-1
- Construction Funding – Emergency Outlet ........ 1-1

**2 *PURPOSE AND SCOPE ........ 2-1**

**3 PRIOR STUDIES, REPORTS, AND EXISTING WATER PROJECTS . 3-1**
- Prior Reports and Studies Prepared by the Corps of Engineers ........ 3-1
- Recent Reports by Other Agencies ........ 3-3
- Recent Studies Associated with This Report ........ 3-4
- Existing Water Projects ........ 3-8
  - City of Devils Lake Levee System ........ 3-8
  - Transportation Facilities ........ 3-9
  - Other Communities, Rural Areas, and Infrastructure ........ 3-11
  - Channel A ........ 3-13
  - Baldhill Dam/Sheyenne River ........ 3-13
  - Valley City ........ 3-14

**Table of Contents (cont)**


**Page**

**4 *DESCRIPTION OF STUDY AREA .......... 4-1**
General Description of Study Area .......... 4-1
Devils Lake Basin .......... 4-1
Area Downstream in the Red River of the North Basin .......... 4-7

**5 PLAN FORMULATION .......... 5-1**
Problems and Opportunities .......... 5-1
Flood Damages .......... 5-1
Significant Resources .......... 5-4
Existing Conditions/Affected Environment .......... 5-7
Devils Lake Basin .......... 5-7
Natural Resources .......... 5-7
Social Resources .......... 5-8
Cultural Resources .......... 5-9
Other States, Nations, and Tribal Resources .......... 5-10
Sheyenne River .......... 5-10
Natural Resources .......... 5-10
Water Use from the Sheyenne River .......... 5-12
Social Resources .......... 5-12
Cultural Resources .......... 5-13
Other States, Nations, and Tribal Resources .......... 5-13
Red River of the North .......... 5-13
Natural Resources .......... 5-13
Water Use from the Red River of the North .......... 5-14
Social Resources .......... 5-17
Cultural Resources .......... 5-17
Other States, Nations, and Tribal Resources .......... 5-17
Future Without-Project Conditions .......... 5-18
Planning Objectives .......... 5-18
Planning Constraints .......... 5-20
Cost-effectiveness .......... 5-20
Water Quality Standards .......... 5-21
Downstream Channel Capacity .......... 5-21
Alternative Plans .......... 5-22
Initial Screening of Alternatives .......... 5-22
No Action .......... 5-22
Most Likely Future Without Project .......... 5-23
Water Treatment .......... 5-23
Relocation .......... 5-24
Outlet Plans .......... 5-24
Expanded Infrastructure Protection .......... 5-26
Upper Basin Storage .......... 5-27

**Table of Contents (cont)**


| | Page |
|---|---|
| Intermediate Array of Alternatives | 5-29 |
| No Action | 5-29 |
| Most Likely Future Without Project | 5-29 |
| West Bay Outlet (Peterson Coulee) | 5-36 |
| Pelican Lake Outlet | 5-41 |
| East Devils Lake Outlet | 5-45 |
| Raise Natural Outlet | 5-47 |
| Upper Basin Storage | 5-48 |
| Expanded Infrastructure Protection | 5-49 |
| Combinations | 5-50 |
| Cost Estimates | 5-51 |
| Evaluation of Alternatives | 5-52 |
| General (Effectiveness, Efficiency, Acceptability) | 5-52 |
| Basis for a Scenario-Based Analysis in Addition to the Stochastic Analysis | 5-53 |
| Lake Level Forecasting for Stochastic and Scenario-Based Approaches | 5-54 |
| Stochastic Analysis | 5-55 |
| Wet Future Scenario Analysis | 5-55 |
| Sensitivity Analyses | 5-56 |
| No-Action Protection Strategy | 5-56 |
| Moderate Future Scenarios | 5-57 |
| Erosion of Natural Outlet | 5-57 |
| Proposed Temporary Outlet as Part of Future Conditions | 5-57 |
| Sulfate Constraints and Operational Plan | 5-58 |
| Dry Lake Diversion Incremental Justification | 5-58 |
| Stochastic Evaluation | 5-59 |
| Cost-effectiveness | 5-59 |
| Sensitivity of No-Action Base Condition | 5-60 |
| Hydrologic Effectiveness | 5-60 |
| Water Quality Considerations | 5-60 |
| Other Environmental Effects | 5-61 |
| Social Effects | 5-62 |
| Upper Basin Storage | 5-62 |
| 300-cfs Outlets | 5-66 |
| 480-cfs Outlets | 5-67 |
| Expanded Infrastructure Protection | 5-68 |
| Raise Natural Outlet | 5-68 |
| Cultural Effects | 5-69 |
| Scenario-Based Analysis – Wet Future | 5-69 |
| Cost-effectiveness | 5-69 |
| Sensitivity of No-Action Base Condition | 5-71 |
| Hydrologic Considerations | 5-71 |

## Table of Contents (cont)

**Page**


Water Quality Considerations ........ 5-72
In-Lake Water Quality Effects ........ 5-74
Downstream Water Quality Impacts ........ 5-75
Summary of Water Quality Effects ........ 5-77
Nutrient Loading Effects ........ 5-81
Hardness Effects ........ 5-86
Sodium Effects ........ 5-86
Chloride Effects ........ 5-89
Mercury Effects ........ 5-89
Other Downstream Water Quality Effects ........ 5-94
Effect of Sand Filter on Downstream Water Quality ........ 5-94
Effects of Uncontrolled Overflow from Stump Lake ........ 5-94
Sensitivity Analysis ........ 5-97
Moderate Future Scenarios ........ 5-97
1455 Peak Lake Level ........ 5-97
1450 Peak Lake Level ........ 5-98
Erosion of the Natural Outlet ........ 5-100
Proposed Temporary Outlet as Part of Future Conditions ........ 5-104
Sulfate Constraints and Operational Plan ........ 5-105
General ........ 5-105
Outlet Effectiveness Sensitivity to Pumping Constraints ........ 5-106
Water Quality Sensitivity to Sulfate Constraints ........ 5-106
Consideration of Systemic Operating Strategies to Reduce Water Quality Effects ........ 5-110
Dry Lake Diversion Incremental Justification ........ 5-113
Assessment of Alternatives to Meet Project Objectives ........ 5-115
Intangible Considerations ........ 5-115
General Conclusions ........ 5-115
Summary of Alternatives Selected for More Detailed Analysis ........ 5-117
Most Likely Future Without Project ........ 5-117
Outlets ........ 5-117
Raise Natural Outlet ........ 5-118
Upper Basin Storage ........ 5-118
Expanded Infrastructure Protection ........ 5-118
Description of Alternatives to be Evaluated in Detail ........ 5-118
Most Likely Future Without Project ........ 5-118
Introduction ........ 5-118
Devils Lake Features Analyzed ........ 5-119
Scope of the Additional Analysis ........ 5-120
Extent of Detailed Analysis ........ 5-121
Lake Levels and Flood Protection Decisions ........ 5-122
Flood Protection Actions for Individual Features ........ 5-125

**Table of Contents (cont)**


| | Page |
|---|---|
| Summary of More Detailed Analysis at First Action Level | 5-129 |
| Summary of Analysis for All Features and All Action Levels | 5-133 |
| Outlet Plan – Pelican Lake 300-cfs Outlet | 5-133 |
| Components | 5-134 |
| Operation Plan | 5-143 |
| Cost Estimate | 5-147 |
| Economics Analysis Summary | 5-150 |
| Upper Basin Storage | 5-150 |
| Expanded Infrastructure Protection | 5-151 |
| General Information | 5-152 |
| Protection Strategy by Lake Level | 5-154 |
| Protection Strategy Description | 5-154 |
| Environmental/Cultural Issues | 5-156 |
| Economics of Flood Protection | 5-157 |
| **6 ENVIRONMENTAL CONSEQUENCES** | **6-1** |
| Introduction – Future Without-Project Conditions (Stochastic Future and Scenario Future) | 6-1 |
| Stochastic Future | 6-1 |
| Future Without-Project Conditions | 6-2 |
| Social Resources | 6-5 |
| Social Effects | 6-6 |
| Local Economic Implications of Physical Effects | 6-19 |
| Downstream Water Users | 6-29 |
| Natural Resources | 6-30 |
| Cultural Resources | 6-33 |
| Other States, Nations, and Tribal Resources | 6-33 |
| Mitigation | 6-34 |
| Upper Basin Storage | 6-34 |
| Social Resources | 6-34 |
| Natural Resources | 6-37 |
| Cultural Resources | 6-39 |
| Other States, Nations, and Tribal Resources | 6-39 |
| Mitigation | 6-39 |
| Expanded Infrastructure Protection | 6-40 |
| Social Resources | 6-40 |
| Natural Resources | 6-44 |
| Cultural Resources | 6-44 |
| Other States, Nations, and Tribal Resources | 6-44 |
| Mitigation | 6-45 |

**Table of Contents (cont)**


**Page**

Outlet Plan ........ 6-45
Social Resources ........ 6-45
Natural Resources ........ 6-53
Devils Lake Effects ........ 6-54
Upper Basin Effects ........ 6-55
Sheyenne River Effects ........ 6-56
Red River Effects ........ 6-66
Cultural Resources ........ 6-72
Other States, Nations, and Tribal Resources ........ 6-73
Mitigation ........ 6-75
Scenario Future ........ 6-86
Future Without Project ........ 6-86
Social Resources ........ 6-86
Natural Resources ........ 6-94
Devils Lake ........ 6-94
Downstream Areas ........ 6-95
Cultural Resources ........ 6-98
Other States, Nations, and Tribal Resources ........ 6-99
Mitigation ........ 6-99
Upper Basin Storage ........ 6-99
Social Resources ........ 6-99
Natural Resources ........ 6-99
Cultural Resources ........ 6-100
Other States, Nations, and Tribal Resources ........ 6-100
Mitigation ........ 6-100
Expanded Infrastructure Protection ........ 6-100
Social Resources ........ 6-100
Natural Resources ........ 6-100
Cultural Resources ........ 6-100
Other States, Nations, and Tribal Resources ........ 6-100
Mitigation ........ 6-101
Outlet Plan ........ 6-101
Social Resources ........ 6-101
Natural Resources ........ 6-101
Cultural Resources ........ 6-102
Other States, Nations, and Tribal Resources ........ 6-102
Mitigation ........ 6-102
Risk and Uncertainty ........ 6-102
Sensitivity ........ 6-108
Social Resources ........ 6-109
Natural Resources ........ 6-109
Erosion of Natural Outlet ........ 6-109

**Table of Contents (cont)**


**Page**

Moderate Lake Levels of 1450 or 1455 ........ 6-109
No Action ........ 6-110
State Outlet Alternative and 300-mg/l Sulfate Constraint Feature ........ 6-110
Cultural Resources ........ 6-110
Other States, Nations, and Tribal Resources ........ 6-111
Cumulative Effects ........ 6-111

**7 REAL ESTATE PLAN ........ 7-1**
Introduction ........ 7-1
Pelican Lake Outlet ........ 7-1
General Description ........ 7-1
Project Authorization ........ 7-2
Project Description ........ 7-2
Sponsor-Owned Lands, Easements, Rights-of-Way ........ 7-4
Estates ........ 7-4
Existing Federal Project and Federally Owned Lands ........ 7-6
Navigational Servitude ........ 7-8
Map ........ 7-10
Induced Flooding ........ 7-10
Baseline Cost Estimate ........ 7-11
Public Law 91-646 Residence/Business Relocations ........ 7-11
Mineral Activity ........ 7-12
Sponsor Assessment ........ 7-12
Zoning ........ 7-12
Acquisition Schedule ........ 7-13
Facility/Utility Relocations ........ 7-13
Environmental Clearance ........ 7-13
Landowners ........ 7-13
Miscellaneous ........ 7-13
Likely Future Without Project ........ 7-19
Feature 1: Churchs Ferry ........ 7-21
Feature 2: City of Devils Lake ........ 7-22
General Description ........ 7-22
Project Authorization ........ 7-22
Project Description ........ 7-22
Sponsor-Owned LER ........ 7-23
Estates ........ 7-23
Existing Federal Project ........ 7-23
Federally Owned Lands ........ 7-23
Navigational Servitude ........ 7-23
Map ........ 7-24

## Table of Contents (cont)


| | Page |
|---|---|
| Induced Flooding | 7-24 |
| Baseline Cost Estimate | 7-24 |
| Public Law 91-646 Residence/Business Relocations | 7-24 |
| Mineral Activity | 7-24 |
| Sponsor Assessment | 7-24 |
| Zoning | 7-27 |
| Acquisition Schedule | 7-27 |
| Facility/Utility Relocations | 7-27 |
| Environmental Clearance | 7-27 |
| Landowners | 7-27 |
| Feature 3: Fort Totten | 7-27 |
| Feature 4: City of Minnewaukan | 7-28 |
| General Description | 7-28 |
| Project Authorization | 7-28 |
| Project Description | 7-28 |
| Sponsor-Owned LER | 7-28 |
| Estates | 7-29 |
| Existing Federal Project | 7-29 |
| Federally Owned Lands | 7-29 |
| Navigational Servitude | 7-29 |
| Map | 7-29 |
| Induced Flooding | 7-29 |
| Baseline Cost Estimate | 7-30 |
| Public Law 91-646 Residence/Business Relocations | 7-30 |
| Mineral Activity | 7-30 |
| Sponsor Assessment | 7-30 |
| Zoning | 7-30 |
| Acquisition Schedule | 7-32 |
| Facility/Utility Relocations | 7-32 |
| Environmental Clearance | 7-32 |
| Landowners | 7-32 |
| Feature 5: St. Michael | 7-32 |
| Feature 6: Gilbert C. Grafton Military Reserve | 7-33 |
| Feature 7: Grahams Island State Park | 7-34 |
| Feature 8: Rural Features | 7-34 |
| Feature 10: Canadian Pacific Railroad | 7-35 |
| Feature 11: Burlington Northern Santa Fe Railroad | 7-36 |
| Feature 16: U.S. Highway 281 (South of U.S. Highway 2) | 7-36 |
| Feature 17: U.S. Highway 281 (North of U.S. Highway 2) | 7-37 |
| Feature 19: ND Highway 1 | 7-38 |
| Feature 22: ND Highway 20 | 7-39 |

**Table of Contents (cont)**


**Page**

Feature 23: BIA Highway 1 .......... 7-40
Feature 24: BIA Highway 26 .......... 7-40
Expanded Infrastructure Protection .......... 7-41
General Description .......... 7-41
Project Authorization .......... 7-41
Project Description .......... 7-41
Mission Township Area .......... 7-42
Acorn Ridge Area .......... 7-42
Sponsor-Owned Lands, Easements, Rights-of-Way .......... 7-42
Estates .......... 7-43
Existing Federal Project .......... 7-43
Federally Owned Lands .......... 7-43
Navigational Servitude .......... 7-44
Map .......... 7-45
Induced Flooding .......... 7-45
Baseline Cost Estimate .......... 7-45
Public Law 91-646 Residence/Business Relocations .......... 7-45
Mineral Activity .......... 7-45
Sponsor Assessment .......... 7-46
Zoning .......... 7-46
Acquisition Schedule .......... 7-46
Facility/Utility Relocations .......... 7-46
Environmental Clearance .......... 7-46
Landowners .......... 7-46

**8 *PUBLIC INVOLVEMENT, REVIEW, CONSULTATION .......... 8-1**
Scoping .......... 8-2
Distribution of the Draft Integrated Planning Report/EIS .......... 8-4
Recommendations from Fish and Wildlife Coordination Act Report .......... 8-4

**9 VIEWS OF NON-FEDERAL SPONSOR .......... 9-1**

**10 LOCAL COOPERATION REQUIREMENTS .......... 10-1**

**11 COST SHARING .......... 11-1**

**12 *CONCLUSIONS .......... 12-1**

**13 RECOMMENDATION .......... 13-1**

**14 *LIST OF PREPARERS .......... 14-1**

"*" Indicates information required for NEPA compliance (see 40 CFR 1502.10).

## APPENDIXES

### VOLUME 1

**APPENDIX 1 – 404(b)(1) Evaluation**

**APPENDIX 2 – Fish and Wildlife Coordination Act Report**

**APPENDIX 3 – Mailing List**

**APPENDIX 4 – Letters of Comment on the Draft Integrated Planning Report/Environmental Impact Statement**

**APPENDIX 5 – Summary of Comments and Corps Responses**

**APPENDIX 6 – Cultural Resources Programmatic Agreement**

### VOLUME 2

**APPENDIX A – Hydrology, Hydraulics, and Water Quality Modeling**

**APPENDIX B – Economic Evaluations**

**APPENDIX C – Environmental Resources**

**APPENDIX D – Plan Formulation**

**APPENDIX E – Infrastructure Protection Plan**

**APPENDIX F – Cost Estimate for Outlet Plan**

**Table of Contents (cont)**

**LIST OF TABLES**


| Number | | Page |
|---|---|---|
| S-1 | Comparison of Lake Level Probability Estimates made in 1994, 1995, 1998 and 1999 with the Actual Peak Lake Levels reached from 1994 through 1999 | S-3 |
| S-2 | Comparison of Selected Outlet Plan and No Outlet | S-4 |
| S-3 | Relative Risk of Building or Not Building an Outlet | S-7 |
| 5-1 | Threatened and Endangered Species | 5-15 |
| 5-2 | Infrastructure Strategies | 5-37 |
| 5-3 | Alternative Costs | 5-40 |
| 5-4 | Matrix of Alternatives Considering Cost Effectiveness and Lake Stage Effectiveness – Stochastic Analysis | 5-59 |
| 5-5 | Impact Matrix for Devils Lake Study Alternatives | 5-63 |
| 5-6 | Matrix of Alternatives Considering Cost Effectiveness, Lake Stage Effectiveness, and Water Quality – Wet Future Scenario | 5-70 |
| 5-7 | State of North Dakota Water Quality Standards for the Red River of the North | 5-72 |
| 5-8 | State of North Dakota Water Quality Standards for the Sheyenne River | 5-73 |
| 5-9 | State of Minnesota Water Quality Standards for the Red River of the North | 5-76 |
| 5-10 | International Joint Commission Boundary Waters Water Quality Objectives, Red River of the North | 5-77 |
| 5-11 | Water Quality Effects, Sulfate – Percent of Time Exceeding 250 mg/l During First 10 Years (2005-2014) | 5-78 |
| 5-12 | Water Quality Effects, TDS – Percent of Time Exceeding 500 mg/l During First 10 Years (2005-2014) | 5-78 |
| 5-13 | Water Quality Effects, Sulfate – Percent of Time Exceeding 450 mg/l During First 10 Years (2005-2014) | 5-78 |
| 5-14 | Matrix of Alternatives Considering Cost Effectiveness, Lake Stage Effectiveness, and Water Quality, Moderate Future Scenario (1455) | 5-99 |
| 5-15 | Matrix of Alternatives Considering Cost Effectiveness, Lake Stage Effectiveness, and Water Quality, Moderate Future Scenario (1450) | 5-101 |
| 5-16 | State's Proposed Temporary Outlet Operated Indefinitely | 5-105 |
| 5-17 | Dry Lake Diversion Economic Analysis | 5-115 |
| 5-18 | Matrix of Alternatives – Other Considerations | 5-116 |
| 5-19 | Most Likely Future Without Project – Summary of Economics Analysis – Flood Protection Strategies at First Action Level | 5-130 |

## Table of Contents (cont)

## LIST OF TABLES (cont)


| Number | | Page |
|---|---|---|
| 5-20 | Most Likely Future Without Project – Lake Levels for Flood Protection – Flood Protection Strategies at First Action Level | 5-131 |
| 5-21 | Most Likely Future Without Project – Economics Summary – Flood Protection Strategies up to Lake Level 1463 | 5-132 |
| 5-22 | Estimated Cost, Pelican Lake 300-cfs Outlet Plan | 5-149 |
| 5-23 | Pelican Lake 300 cfs Outlet Economic Analysis | 5-150 |
| 5-24 | Roads Acting as Dams – History of Flood Protection | 5-155 |
| 5-25 | Expanded Infrastructure Economics Summary – Flood Protection Strategies for First Increment | 5-157 |
| 5-26 | Expanded Infrastructure Economics Summary – Flood Protection Strategies up to Lake Level 1463 | 5-158 |
| 5-27 | "Benefit-Cost Ratios" for Alternatives Being Evaluated in Detail | 5-158 |
| 6-1 | Stochastic Analysis Impact Matrix | 6-3 |
| 6-2 | 2000 County Population Composition, Devils Lake Study Area | 6-13 |
| 6-3 | Population Profile of Census Block Groups Along Outlet/Overflow Routes, 2000 | 6-14 |
| 6-4 | Populations in Poverty by County, 1997 | 6-21 |
| 6-5 | Percent of Geographic Unit in Land Use Category | 6-30 |
| 6-6 | Land Use at the Upper Basin Storage Sites | 6-38 |
| 6-7 | Land Use along the Sheyenne River | 6-64 |
| 6-8 | Summarized Project Results: Screening of All Devils Lake Taxa and Automatically Listed Taxa, with Recommendations for Further Action | 6-70 |
| 6-9 | Scenario Analysis Impact Matrix | 6-87 |
| 6-10 | Comparison of Lake Level Probability Estimates Made in 1994, 1995, 1998 and 1999 with the Actual Peak Lake Levels Reached from 1994 through 1999 | 6-103 |
| 6-11 | Comparison of Selected Outlet Plan and No Outlet | 6-104 |
| 6-12 | Relative Risk of Building or Not Building an Outlet | 6-107 |
| 7-1 | Likely Future Without Project Features - Estimated Real Estate Costs | 7-21 |

**Table of Contents (cont)**

## LIST OF FIGURES


| Number | | Page |
|---|---|---|
| S-1 | Benefit-Cost Ratio by Lake Elevation | S-6 |
| S-2 | Relative Water Quality Impacts (Natural Overflow and Controlled Outlet Alternatives) | S-8 |
| 3-1 | City of Devils Lake Levee System | 3-9 |
| 4-1 | Location of Devils Lake Basin | 4-2 |
| 4-2 | Devils Lake Historic Records | 4-2 |
| 4-3 | Devils Lake Fluctuations – 4,000 Years | 4-3 |
| 4-4 | Devils Lake and Vicinity | 4-4 |
| 4-5 | Devils Lake – West-to-East Cross Section | 4-5 |
| 4-6 | Devils Lake at Various Elevations | 4-6 |
| 4-7 | Devils Lake Elevation-Area Relationship | 4-7 |
| 4-8 | Devils Lake Elevation-Volume Relationship | 4-7 |
| 5-1 | Rating Curve, Devils Lake to Stump Lake, Existing Conditions | 5-2 |
| 5-2 | Stump Lake (Tolna Coulee) Elevation-Discharge Rating Curves | 5-3 |
| 5-3 | Features Adjacent to Devils Lake | 5-31 |
| 5-4 | Devils Lake Basin | 5-38 |
| 5-5 | West End Alternative Features | 5-39 |
| 5-6 | Devils Lake: Probability of Exceedance in 50 Years | 5-61 |
| 5-7 | Devils Lake Elevation – Wet Future | 5-71 |
| 5-8 | Main Bay Water Quality – Wet Future Scenario | 5-75 |
| 5-9 | Sulfate Effects – Wet Future at Valley City, ND | 5-79 |
| 5-10 | TDS Effects – Wet Future at Halstad, MN | 5-79 |
| 5-11 | TDS Effects – Wet Future at Emerson, MB | 5-79 |
| 5-12 | Phosphorus Concentrations in Upper Sheyenne River | 5-82 |
| 5-13 | Phosphorus Loads to Lake Ashtabula | 5-83 |
| 5-14 | Phosphorus Concentrations below Lake Ashtabula | 5-84 |
| 5-15 | Phosphorus Concentrations on the Red River at Halstad | 5-85 |
| 5-16 | Phosphorus Loadings on the Red River at Emerson | 5-85 |
| 5-17 | Total Hardness – Wet Future at Halstad, MN | 5-87 |
| 5-18 | Total Hardness – Moderate 1455 scenario at Halstad, MN | 5-87 |
| 5-19 | Total Hardness – Moderate 1455 scenario at Grand Forks, ND | 5-88 |
| 5-20 | Total Hardness – Moderate 1455 scenario at Emerson, MB | 5-88 |
| 5-21 | Sodium Effects – Wet Future at Cooperstown, ND | 5-89 |
| 5-22 | Sodium Effects – Moderate 1455 scenario at Halstad, MN | 5-90 |
| 5-23 | Chloride Effects – Wet Future at Cooperstown, ND | 5-90 |
| 5-24 | Chloride Effects – Wet Future at Halstad, MN | 5-90 |
| 5-25 | Mercury Effects – Lake Sites | 5-92 |
| 5-26 | Mercury Effects – Stream Sites | 5-92 |
| 5-27 | Sulfate Effects – Wet Future at Valley City, ND | 5-95 |
| 5-28 | TDS Effects – Wet Future at Halstad, MN | 5-95 |

**Table of Contents (cont)**

## LIST OF FIGURES (cont)


| Number | | Page |
|---|---|---|
| 5-29 | TDS Effects – Wet Future at Emerson, MB | 5-96 |
| 5-30 | Devils Lake Elevation Scenarios | 5-98 |
| 5-31 | Devils Lake Elevation Moderate Trace 1455 | 5-100 |
| 5-32 | Devils Lake Elevation Moderate Trace 1450 | 5-102 |
| 5-33 | Devils Lake Elevation with Erosion of Tolna Coulee Outlet | 5-102 |
| 5-34 | Peak Elevation Reduction as a Function of mg/l Constraint | 5-106 |
| 5-35 | Effect of Pumping Constraints, Wet Scenario | 5-107 |
| 5-36 | Effect of Pumping Constraints, Moderate Future, Maximum Lake Level 1455 | 5-107 |
| 5-37 | Effect of Pumping Constraints, Moderate Future, Maximum Lake Level 1450 | 5-107 |
| 5-38 | Elevation Plot, Pelican Lake Outlet, Wet Scenario | 5-108 |
| 5-39 | Elevation Plot, Pelican Lake Outlet, Moderate 1455 Scenario | 5-108 |
| 5-40 | Elevation Plot, Pelican Lake Outlet, Moderate 1450 Scenario | 5-108 |
| 5-41 | Relative TDS Concentration Effect at Valley City, Wet Scenario | 5-109 |
| 5-42 | Relative TDS Concentration Effect at Valley City, Moderate Future Maximum Lake Level 1455 | 5-109 |
| 5-43 | TDS Exceedances at Halstad, Wet Scenario | 5-111 |
| 5-44 | TDS Exceedances at Halstad, Moderate Scenario | 5-112 |
| 5-45 | Results of Sensitivity Runs, with and without Dry Lake Diversion | 5-114 |
| 5-46 | Cumulative Exceedance Levels for Devils Lake 1% Probability | 5-124 |
| 5-47 | Infrastructure Protection Costs by Elevation | 5-133 |
| 5-48 | Dry Lake Diversion | 5-134 |
| 5-49 | Proposed Devils Lake Outlet | 5-136 |
| 5-50 | Expanded Infrastructure Features | 5-153 |
| 6-1 | Probability of Reaching Lake Level by Year X | 6-5 |
| 6-2 | Devils Lake Outlet Flow | 6-56 |
| 6-3 | Outlet Flow at Cooperstown – Year 2017 | 6-57 |
| 6-4 | Aquatic Habitat Sampling, Upper Sheyenne River | 6-61 |
| 6-5 | Aquatic Habitat Sampling Downstream of Kindred | 6-61 |
| 6-6 | Potential Locations for Mitigation and Monitoring Sites | 6-77 |
| 6-7 | Overview of Cultural and Erosion Protection Sites | 6-82 |
| 6-8 | Benefit-Cost Ratio by Lake Elevation | 6-106 |
| 7-1 | Estates | 7-14 |
| 7-2 | Sponsor Assessment | 7-18 |
| 7-3 | Sponsor Assessments | 7-25 |
| 7-4 | Sponsor Assessment | 7-31 |

## GLOSSARY OF ACRONYMS

ACHP - Advisory Council on Historic Preservation
ADT - Average Daily Traffic
ARCOMP - Bayesian Autoregressive Modeling Approach
ARFIMA - Fractionally Integrated Autoregressive Moving Average Model
ASA - Assistant Secretary of the Army
BCR - Benefit-Cost Ratio
BIA - Bureau of Indian Affairs
BNSF - Burlington Northern Santa Fe Railroad
BOD - Biochemical Oxygen Demand
BWT – Boundary Waters Treaty of 1909
CCA - Canonical Correspondence Analysis
CCI - Construction Cost Index
CEQ - Council on Environmental Quality
CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act
CFR - Code of Federal Regulations
CL - Chloride
CRP - Conservation Reserve Program
CDBG - Community Development Block Grants
CFS - Cubic Feet per Second
CWA – Clean Water Act
DEM - Digital Elevation Model
dS/m - deci-Siemens per meter
DO - Dissolved Oxygen
DSS - Data Storage System
DTM - Digital Terrain Model
DOM - Dissolved Organic Material
EC - Electrical Conductivity
EIS - Environmental Impact Statement
EIP - Expanded Infrastructure Protection
ENR - Engineering News Record (Building Index)
ERDC - Engineer Research and Development Center
EO - Executive Order
FAM - Feature Analysis Model
FEMA - Federal Emergency Management Agency
fps – feet per second
Ft - Feet
GeoRAS - Geospatial River Analysis System
GI - General Investigations (program)
GIS - Geographic Information Systems
GUI - Graphical User Interface
HEC - Hydrologic Engineering Center
HME - Hazard Mitigation Economics
HMS – Hydrologic Modeling System
H5QGUI – (Downstream Hydraulic Model for) Graphical User Interface

## GLOSSARY OF ACRONYMS (cont)

HRD - Total Hardness
HTRW - Hazardous, Toxic, Radioactive Waste
HUD - Housing and Urban Development
IFIM - Instream Flow Incremental Methodology
IHA - Indicators of Hydrologic Alteration
IJC – International Joint Commission
ITR - Independent Technical Review
IWR - Institute for Water Resources
LIDAR - Light Detection and Ranging
LER - Lands, Easements, Rights-of-Way
LERRD's - Lands, Easements, Rights-of-Way, Relocations, and dredged material Disposal areas
LRHSC - Lake Region Human Service Center
LTM - Landsat Thematic Mapper
MCACES – Micro Computer Aided Cost Engineering System
MGD - Million Gallons per Day
mg/l - Milligrams per Liter msl - Mean Sea Level
MVD - Mississippi Valley Division
MWTF - Municipal Water Treatment Facilities
NAS - National Academy of Sciences
NASS – National Agricultural Statistics Service
NBI – National Bridge Inventory
NCDC - National Climatic Data Center
NCHRD - Non-Carbonate Hardness
NCPC - North Central Planning Council
NDGS - North Dakota Geological Survey
NDSWC - North Dakota State Water Commission
NED - National Economic Development
NIMBY - Not In My BackYard
NEPA - National Environmental Policy Act
NFIP - National Flood Insurance Program
$NH_3$ - Ammonia
NHPA - National Historic Preservation Act
$NO_3$ - Nitrate
NRCS - Natural Resource Conservation Service
NRHP - National Register of Historic Places
NWI - National Wetlands Inventory
OMRR&R - Operation and Maintenance, Rehabilitation, Repair, and Replacement
O&M - Operation and Maintenance
P&G - Economic and Environmental **Principles and Guidelines** for Water and Related Land Resources Implementation Studies (developed in 1983 to guide the formulation and evaluation studies of the major Federal water resource development agencies)
PBOC - Potential Biota of Concern
PCA - Project Cooperation Agreement

## GLOSSARY OF ACRONYMS (cont)

PDF - Probability Distribution Function
PED - Preconstruction Engineering and Design
PHABSIM - Physical Habitat Simulation
PL - Public Law
PL300/300 - Sample nomenclature for outlet alternatives (Pelican Lake Outlet with design capacity of 300 cubic feet per second (cfs) and sulfate constraint of 300 milligrams per liter (mg/l)
PMF - Probable Maximum Flood
PMP - Project Management Plan
$PO_4$ - Phosphate
PRINET - Pothole-River Networked Watershed Model
PVWC - Pembina Valley Water Cooperative Inc.
Q - flow or discharge, usually expressed in cubic feet per second (cfs)
RAS - River Analysis System
REDs - Regional Economic Damages
REP - Real Estate Plan
SAR - Sodium adsorption ratio
SHPO - State Historic Preservation Office
SIA - Social Impact Assessments
SLP - Sea level pressure
$SO_4$ - Sulfate
SPF - Standard project flood
SSURGO - (digital soils data)
STATSGO - State Soil Geographic Database
TCP - Traditional Cultural Properties Analysis
TDS - Total Dissolved Solids
TIC - Total Inorganic Carbon
TMDL - Total Maximum Daily Load
TOC - Total Organic Carbon
TSS - Particulate organic material
USDA - United States Department of Agriculture
USGS - United States Geological Survey
UBS - Upper Basin Storage
USGS 5-Box Model - Hydrologic and water quality mass balance models used for in-lake evaluations
UWRL - Utah Water Research Laboratory
WRC - Water Resources Council
WUA - Weighted Usable Area
YOY - Young Of the Year

## SUMMARY

## MAJOR CONCLUSIONS AND FINDINGS

In accordance with the Energy and Water Development Appropriations Act, 2003, Division D of Public Law 108-7, and other laws, the Corps has prepared the Final Integrated Planning Report and Environmental Impact Statement for Devils Lake, North Dakota, to describe study methodology, alternatives evaluated, and findings. The Corps has identified the Pelican Lake 300 cubic feet per second (cfs) outlet plan as the preferred alternative. Pursuant to Public Law 108-7, Congress directed the Corps to construct an emergency outlet from Devils Lake to the Sheyenne River, subject to several conditions, including the Secretary of the State providing assurances that the project will not violate the Boundary Waters Treaty of 1909. Public Law 108-7 removed the traditional requirements regarding economic justification and provided instead that the justification for the emergency outlet shall be fully described, including the analysis of benefits and costs.

In early March 2003, Devils Lake was at elevation 1446.9 feet above mean sea level (msl), having fallen about 1.4 feet from the highest level ever recorded, 1448.33 in July 2001. Devils Lake is a terminal lake with no outlet at the current elevation. The lake has naturally spilled into the Sheyenne River several times in geologic history. The last spill is estimated to have occurred 800 to 1,200 years ago. The Devils Lake region has experienced a number of years of unusually wet conditions. The lake has risen over 25 feet since 1993. More than 500 homes have been destroyed or relocated and over $350 million in Federal emergency funding has been expended to relocate people, raise roads, and build levees to combat the flooding. The natural overflow elevation for the lake is elevation 1459 feet msl.

The St. Paul District, U.S. Army Corps of Engineers has prepared this Integrated Planning Report and Environmental Impact Statement to present information on the results of its studies to address flooding problems associated with the rising levels of Devils Lake in North Dakota, and to analyze the effects of the alternatives.

This report consists of an Integrated Planning Report and Environmental Impact Statement. The primary purposes of this Integrated Report, in accordance with the authorizing legislation, are: 1) to implement "tiering" as permitted by Council on Environmental Quality (CEQ) Regulation 40 C.F.R. 1508.28, and 2) to evaluate an outlet plan (proposed action being evaluated) and present a preferred outlet alternative. Tiering procedures allow for supplemental EIS documentation.

The Federal environmental review process for this project consisted of a discussion of the plan selection process, potential impacts of alternatives, potential mitigation features for the direct impacts of construction, and future mitigation plans and studies. Further coordination is needed with respect to compliance with the Boundary Waters Treaty of 1909 and the Clean Water Act. Additional data acquisition and monitoring will be required to further define and evaluate the operational impacts of an outlet. Based on the results of these evaluations, supplemental National Environmental Policy Act (NEPA) documentation will be prepared as required.

The identified preferred alternative is the Pelican Lake 300 cfs outlet plan. The Pelican Lake 300 cfs outlet would consist of pumping facilities, an open channel, a buried pipeline, and mitigation features. The outlet would be constructed to a maximum capacity of 300 cfs and would be operated annually for 7 months from May through November. Operation would be constrained by channel capacity and a 300 milligrams per liter (mg/l) sulfate concentration at the discharge point on the Sheyenne River.

Alternatives discussed in the Integrated Report and EIS include other outlet plans, upper basin storage/watershed management, infrastructure protection, raising the natural outlet, combination plans, and no action. Infrastructure protection includes raising roads and levees, relocations, and similar actions. Upper basin storage/watershed management consists of increasing the available storage for runoff in upper basin depressions, thus reducing the water that would otherwise flow into Devils Lake. This alternative may also include land management measures such as increasing the use of irrigation, increasing the amount of land in conservation reserve and similar programs, and other land management practices.

A significant portion of the Corps of Engineers' historic expertise has dealt with riverine hydrology. In riverine hydrology, small changes in precipitation and evaporation are not significant considerations for hydrometeorological phenomena. Therefore, climate is assumed to be stationary (or stable) for the analysis of riverine systems. As a result, the Corps of Engineers' guidelines for hydrologic analysis generally assume climate stationarity.

The assumption of climate stationarity is key to the analysis of the Devils Lake basin. This assumption means that climatic conditions in the basin in the "recent" past are representative of climatic conditions during the foreseeable future. The climate in the Devils Lake basin changed significantly during the late 1970's, but has remained relatively homogeneous from 1980 to the present. Therefore, for the stochastic analysis, the "recent" past is defined as the period 1980-1999. Although it is unknown exactly how long the wet conditions of the 1990s may persist, or if even wetter conditions may be in store in the future, climate during the next 10 to15 years is assumed to be similar to climate during the period 1980-1999. Climate more than 10 to 15 years into the future was assumed to be similar to the somewhat drier period of 1950-1999.

There is considerable debate within the scientific community, however, regarding the stationarity of climate in the Devils Lake basin. In fact, it has been argued by some that climate in the Devils Lake basin may be nonstationary for a variety of reasons, such as the existence of natural climate cycles caused by global ocean and atmospheric circulation patterns or the existence of global warming due to anthropogenic causes.

To assess the effects of a hydroclimatological phenomenon on lake level probabilities of a terminal lake, both rainfall/runoff and evaporation are important considerations because they are cumulative in their impact and are subject to persistent weather patterns. If climate is nonstationary, then stage in a terminal lake such as Devils Lake will experience wide variability. Even small changes in precipitation or evaporation can have significant effects on lake levels, since these changes occur over the 3,800-square-mile drainage basin.

Table S-1 illustrates the uncertainty in forecasting lake levels. It is a historic summary of projected probabilities of lake stages from 1994 through 1999. As can be seen, on many occasions actual stages were given only a very slight chance (1 to 3 percent) of occurring. The analysis shows that, from a probability standpoint, the current conditions at Devils Lake are indeed a rare event.

The uncertainty in forecasting lake levels has made it difficult to specifically identify the risks associated with the decision to build an outlet. Based on the probabilities in 1994 of Devils Lake rising in future years, deciding to invest in an outlet in 1994 would have been a risky proposition in terms of economic feasibility. In 1994, the risk was low that the lake would continue to rise, causing additional flood damage or additional investment in protecting the infrastructure. Hence, in 1994, an outlet was seen as not likely to be necessary. Conversely, the risk was high that, if an outlet were built, it would likely sit idle for most of the time and the investment would be open to criticism since the probability of the lake rising (from a 1994 perspective) was so low.

**Table S-1**

**Comparison of Lake Level Probability Estimates Made in 1994, 1995, 1998 and 1999 with the Actual Peak Lake Levels Reached from 1994 through 1999 Devils Lake, North Dakota**

| | | Indicated Probability of Reaching or Exceeding the Actual Lake Level | | | |
|---|---|---|---|---|---|
| Year | Elevation | Estimates Made in Spring 1994 | Estimates Made in Spring 1995 | Estimates Made in Spring 1998 | Estimates Made in Spring 1999 |
| 1994 | 1430.7 | 36% | | | |
| 1995 | 1435.9 | 3% | 12% | | |
| 1996 | 1437.8 | 3% | 12% | | |
| 1997 | 1443.0 | Less than 1% | 2% | | |
| 1998 | 1444.7 | Less than 1% | 2% | 42% | |
| 1999 | 1447.5 * | Less than 1% | Less than 1% | 6% | 5% |

| | | | | |
|---|---|---|---|---|
| 1% Chance Level | 1443.4 | 1446.6 | 1453.0 | 1453.4 |
| 0.2% Chance Level | | | | 1457.3 |

(*) Based on forecast made in April 1999.

Given the uncertainty and controversy around the ability to forecast future lake stages and given the experience of the past 10 years, one could view the construction of an outlet from a different perspective, as an insurance policy, rather than an investment. That is, what is the relative risk of not building an outlet, versus building an outlet, and not needing it? Risk avoidance in light of the rapid rise in lake elevation from 1993 to 1999 and the potential for continued rise in water levels was considered in evaluating the alternatives.

Public Law 108-7 requires the Corps to fully describe the justification for an emergency outlet in the project plan documents, including the analysis of benefits and costs. Table S-2 presents the relative benefit-cost ratios, expected lake stages, probabilities of those stages being reached or exceeded, and risks associated with building or not building the preferred outlet plan, the Pelican

Lake 300-cfs outlet. The information is shown for the stochastic analysis, as well as for three scenarios evaluated.

**Table S-2**

**Comparison of Selected Outlet Plan and No Outlet**

| | Stochastic | Wet Scenario | 1455 Scenario | 1450 Scenario |
|---|---|---|---|---|
| | | | | |
| Benefit-Cost Ratio | | | | |
| of Outlet | 0.19 | 1.54 | 0.55 | 0.13 |
| | | | | |
| Expected | | | | |
| Stage w/o Outlet | 1450.06 | 1460.6 | 1454.9 | 1450.0 |
| | | | | |
| Probability of Stage | | | | |
| w/o Outlet be Exceeded | 50% | 5.5% | 20.8% | 50.6% |
| | | | | |
| Expected Lake | | | | |
| Stage w/ Outlet | 1449.33 | 1457.5 | 1452.1 | 1448.9 |
| | | | | |
| Increased Risks | | Natural Overflow | | |
| w/o Outlet | Lake damages with | Lake damages with | Lake damages with | Lake damages with |
| | extra 0.5-ft.stage | extra 3.1-ft.stage | extra 2.8-ft.stage | extra 1.1-ft.stage |
| | | | | |
| Increased Risks | Downstream Impacts | Downstream Impacts | Downstream Impacts | Downstream Impacts |
| w/ Outlet | | | | |
| | | | | |

**Note: The exceedance probabilities shown in the above table represent the likelihood of the respective lake stages being reached or exceeded during the next 50 years based on 10,000 traces used in the stochastic analysis. The benefit-cost ratios for the scenarios are not related to these probabilities, since a specific scenario is assumed to have a 100-percent chance of occurring for each scenario evaluated.**

In considering risk for Devils Lake, it is important to understand the differences in regional damages between lake and river flooding. Typically, the Corps does not include regional damages in its economic analysis, even though such damages may occur in the region. When a river floods, the water recedes and the floodplain is available for use again. The risk of flooding in subsequent years is no higher than it was in the flooded year, and some reasonable use can be made of the floodplain. When Devils Lake hits a new high elevation, however, the land may not be available for many years. Over 80,000 acres of land have been inundated since 1993. Accordingly, the regional impacts may be very significant.

As discussed above, when the water level rises in a closed basin, it does not go back down except by evaporation. Additional flooding then accumulates upon the existing floodwaters. Depending on the climatic future, the lake may either go up or down, and any of the alternatives may be more or less effective. For a wet future scenario, a discharge from a natural overflow could approach 6,000 cfs, assuming the full extent of erosion, and carry as much as 940,000 cubic yards of material into the Sheyenne River. Water quality would be significantly affected, with sulfate concentrations increasing from a median base condition of about 200 mg/l to 1,600 mg/l, making alternative water supplies mandatory for downstream communities such as Valley

City. Other communities, such as Fargo and Grand Forks, will have difficulty providing safe and aesthetically acceptable drinking water. A probability of full erosion occurring has not been determined but would probably be small and, based on past emergency measures taken in the area, was assumed to be prevented in the future without-project condition.

The base condition for the wet future scenario shows the lake reaching an overflow elevation in about year 2015. The Pelican Lake 300-cfs outlet (preferred outlet plan) would limit the maximum stage to 1457 and generally result in lake stages about 3 feet lower than the base condition. The continued rise of the lake affects the viability of the regional economy and general well-being of the Devils Lake area. The farmland (approximately 50,000 acres of land within this 3-foot band), homes, roads, and other infrastructure features would not be flooded or affected by higher groundwater levels under this scenario.

As an example of a more moderate scenario, for a scenario where the lake would reach elevation 1455 without an outlet, the Pelican Lake 300 cfs outlet is able to limit the maximum stage to elevation 1452, or a 3-foot reduction, (with approximately 35,000 acres of land in this band).

Although there is a low probability of occurrence, the potential effects associated with a natural overflow, together with the opportunity to reduce the damages around Devils Lake with a reduced rate of rise on the lake, make the outlet plan the preferred option.

The infrastructure protection alternative only, without an outlet, does not address the potential effects of a natural overflow. However, under some climatic futures, the lake would continue to rise and overflow, even if an outlet were constructed. Many infrastructure protection measures would still be required, even with construction and operation of this outlet. From an economic standpoint, continuing to protect infrastructure features around the lake is a wise investment of funds, because the protection is constructed incrementally as needed and is shown to be cost-effective under the stochastic approach and the wet future scenario (benefit-cost ratios were not determined for this alternative for the moderate scenarios). The preferred outlet alternative is shown to be cost-effective under the wet future scenario, but not for the stochastic or other scenarios.

Using the stochastic analysis, an outlet would reduce the chance of an overflow from 9.4 percent to 4.6 percent (more than a 50-percent reduction in the chance of an overflow) over the without-project conditions. The risk still exists that, because of the limited effectiveness of a constrained outlet, the lake may still rise, it may still overflow, and residents may be disappointed that the outlet does not completely solve their flooding problem.

There is the investment risk of building an outlet that may not be needed. This can be inferred from the probability of the lake reaching or exceeding a particular elevation. Under the without-project future condition, there is a 50.6-percent chance that the lake will reach or exceed elevation 1450 over the next 50 years. Therefore, there is about a 50-percent chance that the lake will hold relatively steady or decline and that an outlet would be operated only minimally. On the basis of the scenarios analyzed, there is a 6.5-percent chance that in the next 15 years the lake will reach or exceed elevation 1458, the approximate lake stage showing economic viability.

Therefore, there is about a 93.5-percent chance that if an outlet were built it would not be economically beneficial on a national level of evaluation.

As shown on Figure S-1 and in Table S-3, the relative risk of building or not building an outlet could be expressed in terms of costs that could be expected with a particular scenario occurring in the future. Figure S-1 illustrates the relationship between future lake elevation and the expected benefit-cost ratio for an outlet. The figure shows that for an outlet to be economically feasible, the lake must reach an elevation of at least 1458 in fifteen years. If the lake is expected to rise above 1458, the expected benefit-cost ratio will increase. Quadrants A and B represent all scenarios in which the lake will not reach 1458 in fifteen years, a situation with a 93.5-percent chance of occurrence. Moderate Future 1 (lake peak of 1450) may be representative of these scenarios. An outlet built among these scenarios will not be feasible. For example, an outlet built under the Moderate Future 1 scenario will cost approximately $186.5 million, but will reduce damages around the lake and downstream along the Sheyenne and Red Rivers by only $46 million.

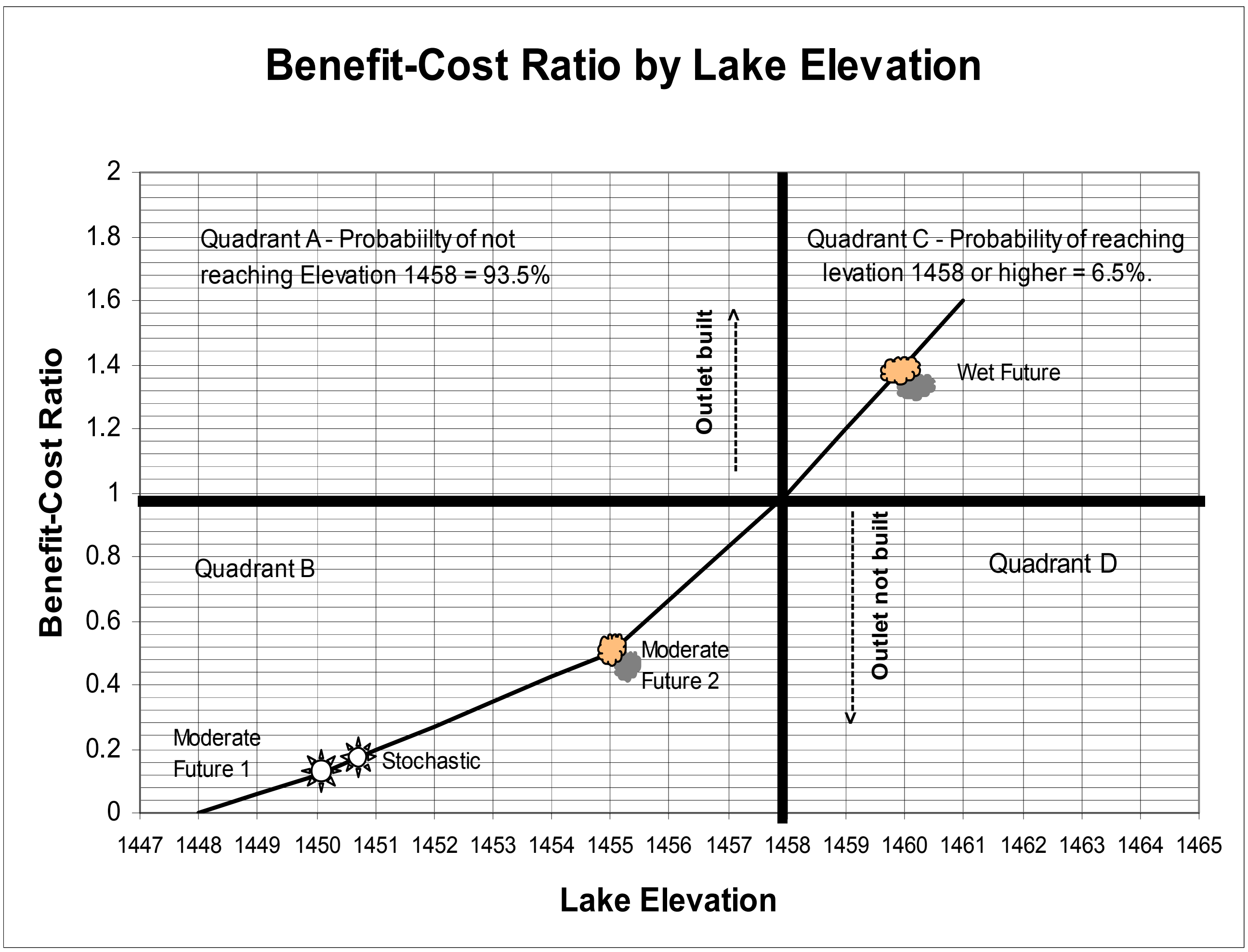


**Figure S-1: Benefit-Cost Ratio by Lake Elevation**

Quadrants C and D represent those scenarios in which an outlet is feasible (lake elevation above 1458). There is a 6.5-percent chance of this occurrence in the next 15 years. The Wet Future scenario (lake elevation peaking at 1460) may be representative of these scenarios. If an outlet is built costing $186.5 million, damages in the amount of $577 million (present value basis) will still occur under the Wet Future scenario. If a decision is made not to build an outlet, the outlet costs of $186.5 million will be saved, but an additional $340 million in damages around the lake and downstream along the rivers, for a total of $917 million, will occur. The risk of not building an outlet means that there is a 6.5-percent chance that the lake will rise to a height that is sufficient to generate enough damages that could have justified construction of the outlet.

### Table S-3: Relative Risk of Building or Not Building an Outlet

(Costs expressed in $ million's)

| Quadrant | A | B | C | D |
|---|---|---|---|---|
| Scenario [5] | Moderate Future 1 (1450) With Outlet [4] | Moderate Future 1 (1450) W/out Outlet | Wet Future With Outlet [4] | Wet Future Without Outlet |
| Max Lake Stage (feet above msl) | 1447 | 1450 | 1457 | 1460 |
| PV of Future Emergency Costs and Damages (Lake) | $54.2 | $102.2 | $381.1 | $673.9 |
| Downstream Damages and Costs (w/out erosion of natural outlet) [1] | $229.4 | $227.4 | $195.9 | $242.7 |
| Total Damages and Costs (w/out erosion of natural outlet) [1] | $283.6 | $329.6 | $577.0 | $916.6 |
| Damage and Cost Reduction Benefits due to Outlet | $46.0 | | $339.6 | |
| Outlet First Costs | $186.5 | | $186.5 | |
| PV of Net Benefits | -$140.5 | | $153.1 | |
| Downstream Damages and Costs (with erosion of natural outlet) [2] | $229.4 | $227.4 | $195.9 | $315.2 |
| Total Damages and Costs (with erosion of natural outlet) [2] | $283.6 | $329.6 | $577.0 | $989.1 |
| Damage and Cost Reduction Benefits due to Outlet | $46.0 | | $412.1 | |
| Outlet First Costs | $186.5 | | $186.5 | |
| PV of Net Benefits | -$140.5 | | $225.6 | |

[1] Assumed to be the most likely future condition - expected overflow of 550 cfs
[2] Estimated to reach maximum discharge of 6,000 cfs; would only occur under wet future without an outlet; with-erosion scenario evaluated using only the West Bay outlet ---> results from this analysis used as a proxy for the equivalent value for the Pelican Lake outlet.
[3] Monetary values expressed in Present Value terms as million $'s
[4] With outlet means with Pelican Lake 300 cfs outlet
[5] Scenarios are representative of all traces that fall within the range indicated by the Quadrant

There has also been considerable discussion about the potential negative impacts of a natural overflow from Devils Lake into the Sheyenne River. Although the downstream effects of a natural overflow and a constructed outlet may be similar, there are some important differences. The effects of a natural overflow would be more short-term and drastic because of the magnitude of the event. The effects of an outlet are more long-term, subtle, and controllable, especially as related to some of the terrestrial and aquatic resources. If an outlet is constructed and the lake is still rising or even holding steady, the outlet would probably be operated. Downstream effects due to a natural overflow have a 9.4 percent chance of occurring in 50 years without an outlet. If an outlet is constructed and operated, downstream effects due to the operation of a constructed outlet would occur, even if the lake level does not go any higher.

Figure S-2 illustrates relative water quality impacts of water flowing to the Sheyenne River from Devils Lake for a natural overflow and from a controlled outlet from the Pelican Lake area. Figure S-2 illustrates the impact downstream at Cooperstown on the Sheyenne River with an assumed wet future scenario. The base condition (no outlet) assumes no erosion at the natural overflow. With this assumption, the overflow rate for this scenario would be 550 cfs. As a point of reference on Figure S-2, the standard for sulfate in the Sheyenne River is 450 mg/l. The median base condition has sulfate levels of approximately 200 mg/l. At the time of a natural overflow, this level increases by a factor of 8, to 1,600 mg/l, and remains over 700 mg/l for much of the 11-year period of overflow. Other alternatives shown on this figure are the Pelican Lake outlets for both a constrained 300-cfs operating plan and a 480-cfs unconstrained operating plan. The highest readings for sulfate levels with a constrained operating plan are approximately 250 mg/l; for an unconstrained operating plan, the highest readings are in the range of 600 mg/l.

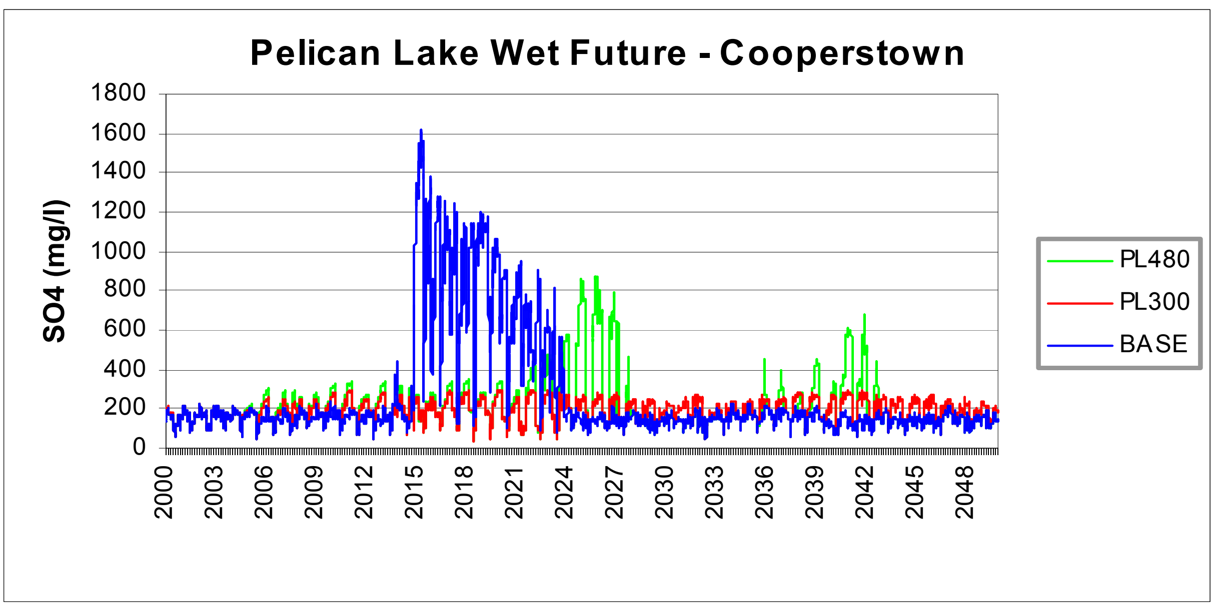


**Figure S-2: Relative Water Quality Impacts (Natural Overflow and Controlled Outlet Alternatives)**

As stated, the above discussion is based on no erosion at the natural overflow. Since it is unknown whether measures will be taken to minimize erosion at the natural outlet, a sensitivity analysis was performed to evaluate the impacts of assuming a reasonable rate of erosion at the natural outlet for the wet future scenario. If the natural overflow area were to erode, it is estimated that the peak discharge of 6,000 cfs could be expected (compared to assumed 550 cfs). Under the eroded conditions, the peak sulfate concentrations would be similar to those shown on Figure S-2 (1,600 mg/l), but the concentrations would drop to a range of 300 to 400 mg/l after the first few years. Downstream effects resulting from the erosion of the natural outlet would be significant. There would be increased sedimentation in the Sheyenne River and Lake Ashtabula. Erosion would also increase in the Sheyenne River. There would be substantial effects to downstream aquatic resources on the Sheyenne and Red Rivers. Higher flows, changed water quality, sedimentation, erosion, increased groundwater levels, and overbank flooding would affect farms, buildings, roads, bridges, water supply for downstream communities, and would result in loss of aquatic and riparian habitats.

*The conclusions of the Integrated Report/EIS are summarized below.*

On the basis of studies and coordination, the Pelican Lake 300 cfs outlet alternative has been identified to be the best outlet plan to meet the purpose and objectives of the project. The actual operating plan may be further refined to minimize downstream water quality impacts, in concert with minimizing lake stage increases. The outlet discharge evaluated for impacts is constrained such that sulfate levels and flow rate in the Sheyenne River do not exceed 300 mg/l or 600 cfs, respectively, at the insertion point. These constraints are based on minimizing downstream water quality impacts, while balanced with effectiveness of lake stage reduction. The sulfate standard in the Sheyenne River is 450 mg/l, and the nominal channel capacity in the upper Sheyenne River is approximately 600 cfs.

The current mitigation proposal acknowledges potential effects on aquatic and riparian resources but assumes that if the ecological integrity of the Sheyenne River and the riparian corridor is maintained, the river's natural state will recover upon cessation of project operation. Because of the inability to define how the alternatives would actually be constructed and operated, the limited precision of modeling techniques, and the lack of detailed system-wide information regarding terrestrial and aquatic species and habitat distribution, many of the operational impacts can not be quantified. The conclusions regarding potential impacts are based on the best available information. However, the eventual occurrence of any impacts is highly dependent on the eventual length of operation and the final operational constraints. Therefore, there is a high level of uncertainty with respect to the actual occurrence, location, and timing of potential effects.

Mitigation measures are proposed to help ensure the recovery of the system after the outlet has ceased operation. Mitigation features include design features to avoid or minimize adverse effects, the acquisition and management of approximately 6,000 acres of riparian habitat, erosion protection to minimize the effects of turbidity and sedimentation, high flow bypass channels to maintain critical aquatic habitat, and a sand filter to minimize the risk of biota transfer. The mitigation proposal adopts an adaptive management approach by including extensive monitoring to: (1) establish a reliable reflection of baseline conditions on the Sheyenne River prior to outlet operation, (2) document expected level of effects associated with outlet operation, and (3) ensure that mitigation features were sufficient to allow recovery of aquatic resources on the Sheyenne River once operation of the outlet has ceased. Monitoring activities to establish baseline conditions and monitoring costs for the first 10 years of operation are proposed as first costs. At this time, with uncertainty regarding future climatic conditions, it appears to be reasonable to include the monitoring costs for the first 10 years of operation as a project cost.

An outlet is not economically justified using methods that would determine expected net benefits by producing probability-weighted benefits and costs. However, there is uncertainty in forecasting lake levels as well as risk of major impacts in the event of an overflow. As noted previously, in Public Law 108-7, the Congress removed the traditional requirements regarding economic justification and provided instead that the justification for the emergency outlet shall be fully described, including the analysis of the benefits and costs.

An outlet would drain water from the lake, thereby slowing or eliminating its rise or hastening its fall. However, it would also increase concentrations of pollutants in the lake in the short term because the outlet would drain the lake's higher quality water. However, the decrease in water quality would be greater if the same lake level reduction were achieved through evaporation. This may have an impact on aquatic resources in the lake, possibly resulting in decline or loss sooner than under the future without-project conditions. The extent that an outlet would lower peak lake levels depends on the future climatic conditions. Lower lake levels would accelerate vegetation growth in exposed areas that had been inundated. An outlet would have adverse effects in downstream receiving waters, including degraded water quality, increased erosion, increased sedimentation, reduced aquatic habitat value, higher river stages, minimal increased overbank flooding, extended duration of inundation, impeded river access, loss of aquatic resources, loss of riparian habitat, effects on agricultural uses, effects on water treatment facilities, social effects, cultural resource losses, effects on irrigation, and effects on Tribal resources. The mitigation features included with the project are intended to alleviate the construction and operation effects and help compensate landowners for the flow and water quality effects. Natural resource mitigation features would help the recovery of the system after the outlet has ceased operation. All of the operation effects would not be eliminated with the mitigation features. The intent is to alleviate the effects to the extent practicable.

Continued infrastructure protection would result in protection of the major features in the basin such as the City of Devils Lake, important facilities, and major roads. The construction of infrastructure features would not alleviate the disruption of social services, transportation systems, and loss of features that are not protected. Environmental effects would be localized and include increased sedimentation and turbidity, effects on aquatic resources, losses due to acquisition of borrow material, and disruption of social services. From an economic standpoint, infrastructure protection is a wise investment of funds because this type of protection is constructed incrementally as it is needed. Continued infrastructure protection, the most likely future without a project, is economically justified using either the stochastic, the wet future scenario, or 1455 maximum lake level scenario approaches.

Upper basin storage/watershed management consists of storing water in depressions in the upper basin. This alternative would result in the conversion of agricultural lands to intermittent or permanent wetland storage sites. There would be significant effects on current land uses, loss of agricultural lands, and benefits to wetland and wildlife resources. On the basis of the stochastic analysis, upper basin storage/watershed management is not economically justified, however, net benefits result under the wet future scenario. Further analysis to optimize the most cost-effective plan for upper basin storage/watershed management as a complementary project feature, along with further evaluation of associated social, economic, and environmental effects, appears warranted.

Having reviewed and evaluated documents concerning the proposed action and views of other interested agencies and parties, the Corps of Engineers has identified the 300 cfs Pelican Lake outlet as the preferred alternative.

The preferred alternative consists of an outlet from Pelican Lake to the Sheyenne River. It would include an open channel from Pelican Lake to the pump station located just north of Minnewaukan and a buried pipeline from the pump station to the Sheyenne River, with a total length of about 22 miles. A regulation reservoir would be located at the divide to regulate flows to the Sheyenne River. The plan includes provisions to close Channel A during outlet operation and divert flows from Dry Lake to the intake area of the outlet in Pelican Lake. The outlet operation would be constrained to a 600 cfs channel capacity (maximum outlet flow 300 cfs) and a 300 mg/l sulfate constraint on the Sheyenne River. Other features of the plan include a sand filter to address biota transfer concerns, erosion protection measures along the Sheyenne River, protection of cultural resource sites along the Sheyenne River, construction of by-pass channels to alleviate effects to aquatic resources, water treatment for municipal and industrial water users, the acquisition of 6,000 acres of riparian lands along the Sheyenne River for mitigation, and the acquisition of flowage easements. Long-term monitoring and adaptive management is also included to evaluate the effectiveness of the mitigation features and to determine the need for additional mitigation measures.

The estimated cost of this outlet plan is $186.5 million. Following applicable cost sharing provisions, the Federal share of the total project cost will be $121,650,000 (65 percent) and the non-Federal share will be $64,850,000 (35 percent). Estimated annual operation and maintenance costs, which are to be borne by the Non-Federal sponsor, are estimated to be almost $3.0 million, however, this may vary dependent on future climate.

## AREAS OF CONTROVERSY AND UNRESOLVED ISSUES

This section describes areas of controversy identified during the EIS process. Each area of controversy or unresolved issue is summarized and addressed below.

### Areas of Controversy

#### *Benefit-Cost Analysis*

In Public Law 108-7, the Congress removed traditional economic justification requirements and instead only required the Corps to fully describe the justification for an emergency outlet in the project plan documents, including the analysis of the benefits and costs. The Corps of Engineers traditionally recommends plans that show the greatest expected net benefits, where benefits exceed costs based on the probability of events (stochastic approach). As a standard process under the Principles and Guidelines, this is referred to as the National Economic Development, or NED, plan. A stochastic approach was used to determine whether any of the outlet plans met that criterion. Stochastic modeling was based on an assumption of climate stationarity. The benefit-cost ratio of the selected outlet plan incorporating probabilities, or the stochastic approach, is 0.19. However, pursuant to Public Law 108-7, economic justification of an outlet is no longer a requirement.

Because of uncertainty and differing scientific opinions regarding future climatic conditions in the Devils Lake basin, a scenario-based analysis was also performed. In situations of uncertainty, the Principles and Guidelines allow for development of alternative future conditions, or scenarios. This scenario-based analysis was used to specifically address potential solutions to the problems in the basin if the recent wet conditions continue. Under the wet scenario approach, the benefit-cost ratio of the selected outlet plan was 1.54.

***Alternatives Analysis***
While it has been asserted that alternatives to the outlet have not been fairly analyzed in this Integrated Report, the report does include an analysis of alternatives. The report discusses potential measures to address the rising lake levels, including upper basin storage/watershed management, infrastructure protection, and an outlet. This report contains conclusions about the reasonableness and feasibility of these alternatives and the impacts associated with them. Preconstruction engineering and design concurrent with the EIS preparation of the identified outlet plan, in accordance with Public Laws 105-18 and 106-246, did not limit alternatives' analysis and did not preclude selection of an alternative other than the preferred alternative.

***Effectiveness of Outlet***
Many contend that an outlet is not a solution to the problem at Devils Lake. They further contend that an outlet has a limited effect on the lake levels, and other alternatives are either just as effective or should be used in conjunction with an outlet. It is true that the outlet has limited effectiveness for some of the possible scenarios for future lake stages. Many also contend that any decrease in lake level is a risk reduction benefit and that the decision to proceed with the outlet should not be based solely on economics or the benefit-cost ratio. Under the stochastic model, the 300 cfs Pelican Lake outlet would reduce the probability of an overflow to the Sheyenne River in the next 50 years from 9.4 percent to 4.6 percent. Therefore, the outlet will be effective in reducing lake levels and downstream impacts under some scenarios.

***Future Without-Project Conditions***
There is uncertainty over what future climatic conditions will prevail in the region. Some interests contend that the current wet cycle will continue, while others contend that future climatic conditions will tend to reflect the average conditions over the past 20 or 50 years. The cost-effectiveness of an outlet is dependent upon which future is assumed. The Integrated Report identifies a stochastic (probability weighted) future and a wet scenario (similar to 7 wet years from 1993 to 1999) future and compares alternatives under both futures.

***Temporary Outlet in Future Conditions***
There is controversy over including the North Dakota temporary outlet in the future without-project conditions. North Dakota has pursued design and construction of a temporary outlet because it feels that construction of a permanent outlet will, at best, occur years into the future and something needs to be implemented soon. North Dakota completed much of the design for an outlet along the Peterson Coulee route, has also initiated construction of an access road and site preparation at the pump station area, and has approved funding for the Peterson Coulee channel portion of the outlet. There is a high probability for delay or suspension of the plan due to possible litigation and permitting issues. Therefore, the Corps is not including this outlet in the future without-project conditions analysis. However, to address concerns associated with the uncertainty of the implementation of a temporary outlet, a sensitivity analysis was completed that assumes the temporary outlet is constructed and operated. The analysis included a discussion of the potential effect of the temporary outlet on lake levels, and how it would affect the economic feasibility of the Pelican Lake outlet alternative. This analysis showed that the benefit-cost ratio of the Pelican Lake outlet for a stochastic approach is reduced from 0.19 to 0.13 with a temporary outlet included in the future without-project conditions and from 1.54 to 1.17 for the wet future scenario approach. By Public Law 108-7, Congress removed the traditional economic justification requirement for construction of an outlet and only required a description of the justification, including an analysis of the benefits and costs.

***Biota Transfer***
Existing information shows low potential for transfer of biota from Devils Lake to the Red River drainage basin as a result of the outlet. Various agencies have indicated that additional studies are needed to identify biota in the various basins.

In response to these concerns, field studies for the screening of fish pathogens have been conducted, a sand filter is proposed to minimize the risk of biota transfer, and the framework for a response plan to address invasive species has also been developed. The sand filter would be effective in removing all matter down to 2 microns and would provide incidental benefits from the reduction in particulate mercury, nitrogen, and phosphorus. See Unresolved Issues, “Mitigation of Impacts.”

***Interconnectivity Between Devils Lake and Local Aquifers***
Reports containing analysis of the connection between Devils Lake and local aquifers dating back to 1986 were reviewed. These reports indicate there is little groundwater movement from Devils Lake to surrounding aquifers.

Devils Lake is a regional depression both in surface topography and in groundwater levels. Groundwater levels in the basin are generally higher than lake levels in Devils Lake except very near the lake, and have been even higher in drier periods in the past. Therefore, rising lake levels would only tend to affect water levels very near the lake as they rise above local surface groundwater levels. The soils immediately surrounding Devils Lake have very low hydraulic conductivity. This is also generally true of all the significant deposits throughout the basin. Therefore, there are only small amounts of groundwater movement in either direction between the lake and the aquifers. With little groundwater movement to and from the lake, aquifer levels are much more influenced by precipitation, infiltration, and evapotranspiration than by lake levels. Lake levels are much more dependent on precipitation, inflow from runoff, and evaporation than on groundwater levels. The fact that higher surrounding groundwater levels do not cause the lake to rise in the winter is evidence of this.

Soils with low hydraulic conductivity cause groundwater to move very slowly through the Devils Lake basin. This slow-moving water in contact with the glacial drift in the basin gradually becomes high in dissolved solids, particularly sulfate and chloride. Deeper aquifers such as the Spiritwood Aquifer have total dissolved solids levels comparable to those in Devils Lake itself. The water quality in the Spiritwood Aquifer does not correlate to its vicinity to the lake, though, and areas far from the lake may have higher total dissolved solids (TDS) than areas nearer the lake. This indicates that the groundwater quality is not determined by seepage from the lake. The effects of Devils Lake on groundwater quality in the Devils Lake basin would be expected to be limited to slow-moving percolation to very localized areas around Devils Lake itself.

***Inlet from Missouri River***

The purpose of an inlet from the Missouri River would be to help stabilize the lake during drier climatic conditions. Regionally, there is great interest in stabilizing lake levels to try to maintain the recreational and economic value of the lake. Other states (i.e., Minnesota and Missouri), Canada, and some agencies are concerned about water quality, water quantity, and biota transfer issues associated with an inlet.

Many believe that an outlet is the first step toward an inlet and oppose the outlet for that reason or feel that the report should include a discussion of the effects of an inlet.

Public Law 105-62 prohibited the Corps of Engineers from using any of the funds to study any inlet involving the transfer of water from the Missouri River basin. Therefore, an inlet is not viewed as a reasonably foreseeable action and it is not part of the analysis.

***Upper Basin Storage/Watershed Management***

Controversy about upper basin storage/watershed management appears to be primarily between lakeside communities that desire an outlet and downstream communities (including those on the overflow and outlet routes) that support increased upper basin storage/watershed management. However, landowners in the upper basin have also expressed concerns regarding this alternative. Specifically, they are concerned about the fairness of compensation for easements on their land and taking land out of agricultural production. Many agencies and groups also feel that upper basin storage/watershed management, closing drains, and placing a moratorium on future drainage is the main solution to the rising lake levels. Others feel that it would have little effect on the lake. Upper basin storage/watershed management is considered by many to be one of the legs of the “three-legged stool” solution to the problem, along with infrastructure protection and an outlet. Upper basin storage/watershed management was evaluated as an alternative as a part of this report. If upper basin storage/watershed management were pursued, additional studies would be needed to determine the most cost-effective and acceptable locations for storing water.

## Unresolved Issues

***Mitigation of Impacts***

Because of the inability to predict how the alternatives would actually be constructed and operated and the limited precision of modeling techniques, not all impacts and associated mitigation needs have been quantified. Various mitigation features have been identified to help ensure the recovery of the system after the outlet ceases operation. To address data gaps and the difficulty in predicting effects, monitoring of various resources during project operation has been identified as a mitigation feature. The results of monitoring would be used to modify the mitigation measures as needed during operation to appropriately address project impacts. The analysis in this report is based on currently available information. This information is considered adequate to address the decision to be made at this time, which is the identification of a preferred alternative.

Long-term monitoring of impacts is included, as well as agency coordination, to determine if additional mitigation measures are needed. A framework for the monitoring has been identified. This framework will be revised as necessary to ensure the objectives of monitoring are met. No costs are included for agency participation in the long-term monitoring, interpretation of the long-term monitoring data, or implementation of any additional mitigation features identified through the long-term monitoring. An interagency task force would have to be established to manage and coordinate the long-term monitoring program. Some mitigation measures would be implemented concurrently with construction, and ongoing studies and adaptive management are included. Monitoring will provide the data necessary to confirm the effect of operation on the system and will assist in determining any future mitigation needs. Costs for any future mitigation needs are not included and could be significant. Supplemental EIS documentation may be required in the future based on the results of the monitoring program.

***Feasibility of Constructing an Outlet***

The selected outlet plan may be difficult to construct because of the inability to meet water quality goals and standards. The selected outlet plan is constrained by downstream channel capacity and water quality at the insertion point on the Sheyenne River, but would result in some minor increased flooding and some water quality degradation to downstream areas. This document describes the effects of the alternatives. The framework for an outlet operation plan has been developed and is expected to be refined through coordination with an outlet operation committee composed of local, State, and Federal interests to further minimize water quality and other downstream impacts. The Corps may prepare additional NEPA documentation through a tiered process.

***Water Quality Considerations***

The economic analysis and conclusions reached in the study are based on the present operating plan. The present operating plan does not meet all downstream water quality standards and objectives. Any revised operating plan that attempts to reduce water quality effects would likely reduce the outlet's effectiveness in reducing lake levels. Without treatment of the discharge water (which was deemed cost prohibitive), it is not possible to design an effective outlet that will assure attainment of all downstream water quality standards. Any permits needed for compliance with water quality criteria would need to be obtained prior to construction or operation. The Corps has applied to the North Dakota Department of Health for Section 401 water quality certification in accordance with the Clean Water Act. The local sponsor, North Dakota, has applied for a Section 402, National Pollutant Discharge Elimination System, permit for the operation of an outlet.

***Lack of Tribal Resource Information***
Information on tribal resources and traditional cultural properties has been sought. Information currently is not available for all resources. A draft Programmatic Agreement identifying needs and agency responsibilities has been prepared for the Devils Lake Project and is provided in Appendix 6. Although the Programmatic Agreement has not been signed by all parties at this time, if necessary, the Corps intends to request formal comments from the Advisory Council on Historic Preservation in order to comply with NEPA and Section 106 of the National Historic Preservation Act.

***Transboundary and Boundary Waters Treaty Effects***
Water quality effects have been identified at the Canadian border. Effects in Canada have not been fully analyzed. Canada opposes the outlet, both as a violation of the Boundary Waters Treaty (BWT) and as environmentally unacceptable to Canadian interests. Pursuant to Public Law 108-7 and before the project is implemented, the U.S. State Department will need to provide assurances that the project will not violate the Boundary Waters Treaty of 1909. Section 207 of Public Law 107-206 authorized the Corps to provide funds to the United States Section of the International Joint Commission (IJC) for the purpose of conducting investigations, undertaking studies and preparing reports in connection with a Reference to the IJC under Article IX of the BWT for an emergency outlet for Devils Lake, North Dakota. Pursuant to that authority, the Corps transferred funds in the amount of $500,000 to the IJC's U.S. Section on 26 September 2002.

***Clean Water Act Section 404(b)(1) Guidelines Evaluation***
The Environmental Protection Agency (EPA) commented on the draft report that the 404(b)(1) evaluation is too narrow in scope and should consider the effects associated with the operation of an outlet in determining compliance of the proposed action with the Section 404(b)(1) Guidelines. EPA feels that the effects associated with outlet operation are secondary impacts that should be fully discussed in the evaluation and considered in determining compliance.

The Corps believes that environmental effects associated with outlet operation should be and are fully discussed in the EIS. The proper interpretation of 40 C.F.R. 230.11(h)(1) is that the Section 404(b)(1) Guidelines do not require operational impacts of the outlet plan to be considered as part of the 404(b)(1) analysis itself. 40 C.F.R. 230.11(h)(1) provides, in part, that "Information about secondary effects on aquatic ecosystems *shall be considered prior to the time final Section 404 action is taken by the permitting authorities.*" (emphasis added) The EIS considers operational impacts, and this consideration is prior to the time final Section 404 action will be taken. 40 C.F.R. 230.11(h) contains the only references to evaluation of secondary impacts in the guidelines and it imposes no requirement to evaluate those effects as part of the 404(b)(1) analysis, but specifically provides that such analysis may be done (at any time) "prior to the time final Section 404 action is taken." Therefore, the EIS, as written, is fully compliant with the requirement to consider secondary effects on aquatic ecosystems of the outlet discharge. The

Corps and Army decision-makers for the outlet proposal will fully consider the information on secondary environmental effects of outlet operation before taking action under Clean Water Act (CWA) Section 404 to authorize any discharges of dredged or fill material associated with proposed construction of the outlet.

Nevertheless, the Corps' evaluation of operational impacts of an outlet (see Chapter 6) leads us to conclude that, even when those operational impacts are included within the 404(b)(1) analysis itself, the outlet project, and all proposed discharges of dredged or fill material associated with its construction, will comply with the 404(b)(1) guidelines. The issue of compliance with water quality standards promulgated by the State of North Dakota is a matter that properly lies with the State of North Dakota. The State of North Dakota, while not having made a final permit decision, has suggested that the project (including operation) will meet applicable State water quality standards. If the State of Minnesota in the future were to raise objections regarding possible effects of the outlet's operation on downstream water quality in Minnesota, that matter would likely be addressed by the EPA and the affected states pursuant to the provisions of CWA Section 401(a)(2) and corresponding regulations. With respect to impacts due to water quantity to be discharged by the outlet during its operation, mitigation proposed in the EIS (see Chapters 5 and 6) will alleviate any adverse impacts.

***Appropriateness of Tiering***
The EPA commented on the draft report that the Corps' use of tiering to identify and quantify mitigation needs is inappropriate. The EPA believes that reasonably foreseeable water quality and other impacts of the outlet alternatives are essential to a reasoned choice among alternatives and must be included in the EIS.

The Corps agrees with the general concepts put forth by the EPA. However, the key is in determining what are "reasonably foreseeable" impacts. While the potential changes in water quality on the Sheyenne and Red Rivers have been modeled, only limited baseline and modeling efforts have been possible for many resource categories. While investigations to date have allowed for the identification of the types and approximate magnitude of impacts, they have also indicated that it would be unreasonable to assume that the specific effects of an outlet can be sufficiently quantified at this time. The collection of additional baseline information and mitigation measures have been included as part of an outlet plan. Because of the high degree of uncertainty associated with the specific occurrence/timing/magnitude of potential impacts, the Corps recommends an adaptive approach to further quantify/mitigate impacts, based on the approach of developing management indicators as recommended by the EPA.

As a result of the comments received to the draft IPR/EIS, the Corps has added additional mitigation features to address anticipated impacts. These added features on the Sheyenne River include aquatic habitat preservation through the creation of cutoffs across meanders and additional erosion protection at critical locations. Also, a sand filtration system has been added on the outlet to address biota transfer and filter much of the organic material from the water before it enters the Sheyenne River. These added features have been coordinated with both the regional and national offices of the EPA.

Based on the addition of mitigation features and the uncertainty associated with the specific occurrence/timing/magnitude of potential impacts, the Corps does not concur that tiering is inappropriately applied in this case. CEQ guidelines (40 C.F.R. Section 1508.28 (b)) allow for tiering when the sequence of statements or analysis is "From an environmental impact statement on a specific action at an early stage…to a subsequent statement or analysis at a later stage (such as a more detailed operating plan and detailed design of the Dry Lake feature)." The current EIS identifies the potential environmental risks and costs associated with the proposed alternatives for the public and decision-makers, fully discloses issues of concern and data deficiencies, and outlines what needs to be done prior to operation to ensure that potential impacts are adequately addressed during the operation of the project. The Corps has determined that tiering is appropriate under the circumstances because it allows for a timely decision as to whether or not the construction of an outlet should proceed.

***Determination of Refuge Compatibility***

Some of the Pelican Lake features could affect the Lake Alice Refuge and other lands along the outlet route that are administered by the U.S. Fish and Wildlife Service. The U.S. Fish and Wildlife Service has identified that, in accordance with the Refuge Improvement Act of 1997, a compatibility statement will be required for some of the Pelican Lake features. A compatibility determination cannot be provided at this stage of the project. The U.S. Fish and Wildlife Service will make a determination of compatibility when more detailed design/operation information is available for the Dry Lake feature. The intent of any proposed action would be to avoid actions that are not compatible with the operation of any Service administered lands. If this activity is found to be incompatible with the purposes for which the refuge was established, then an alternate alignment that does not involve refuge property will be explored and any required supplemental NEPA analysis will be performed.

## RELATIONSHIP TO ENVIRONMENTAL PROTECTION STATUTES AND OTHER ENVIRONMENTAL REQUIREMENTS

This Final Integrated Planning Report and EIS is prepared in compliance with Federal environmental laws, executive orders and policies, and State and local laws and policies, including the Clean Air Act, as amended; the Clean Water Act of 1977; the Endangered Species Act of 1973, as amended; the National Historic Preservation Act of 1966, as amended; the Land and Water Conservation Fund Act of 1965, as amended; the National Environmental Policy Act of 1969, as amended; the Fish and Wildlife Coordination Act of 1958, as amended; the Farmland Protection Policy Act; Executive Order 11990, Protection of Wetlands; Executive Order 13112, Invasive Species; Executive Order 12898, Environmental Justice; and Executive Order 11988, Floodplain Management.

# DEVILS LAKE, NORTH DAKOTA

## FINAL INTEGRATED PLANNING REPORT AND ENVIRONMENTAL IMPACT STATEMENT

## INTRODUCTION

Since 1993, Devils Lake has risen more than 25 feet, flooding homes, roads, farmlands, utilities, and railways, and threatening several communities. During this period, the lake has expanded from 70 square miles to over 200 square miles. The shoreline has expanded landward 1 to 10 miles. Devils Lake is now higher than at any time since the 1830's. In response to this situation, more than $350 million in Federal emergency response funding has been spent relocating people, raising roads, and building levees to combat the flooding. In early March 2003, Devils Lake was at an elevation of about 1446.9 feet above mean sea level (msl). The highest stage in recorded history was reached in July 2001, at elevation 1448.33 msl. At elevation 1446.6 msl, water began flowing into Stump Lake, a smaller lake located just to the east, and could eventually inundate a National Wildlife Refuge. If Devils Lake rises to elevation 1459 msl, areas downstream of Devils Lake (extending into Canada) will be threatened as well, including the Sheyenne River and the Red River of the North - which flow into Manitoba. An east-end overflow into these rivers may threaten water quality conditions because Devils Lake contains high concentrations of solids including chlorides and sulfates. It is estimated that an additional $900 million in potential damages would occur if levels continue to rise to a point of overflowing into the Sheyenne River.

The primary purpose of this Integrated Report, in accordance with the authorizing legislation, is to evaluate the results of studies to address flooding problems associated with the rising levels of Devils Lake in North Dakota and relevant consequences of implementing various alternatives.

# 1 AUTHORITIES

## PRECONSTRUCTION ENGINEERING AND DESIGN AND ENVIRONMENTAL IMPACT STATEMENT PREPARATION

In the 1997 Emergency Supplemental Appropriations Act for Recovery from Natural Disasters, and for Overseas Peacekeeping Efforts, Including Those in Bosnia (Public Law 105-18), Congress provided funds for the Corps of Engineers to undertake preconstruction engineering and design (PED) and the associated Environmental Impact Statement (EIS) for an emergency outlet from Devils Lake to the Sheyenne River. Additional funds for this work were provided in subsequent laws, including the Emergency Supplemental Appropriations Act, 2000 (Public Law 106-246).

In accordance with these laws, the Corps designed a selected outlet plan (Pelican Lake 300 cfs outlet plan) as this report was being prepared and coordinated. The Corps' preconstruction engineering and design efforts did not preclude the selection of an alternative other than the selected outlet plan. As a part of the ongoing PED and associated EIS effort, the Corps conducted the necessary evaluations in accordance with the National Environmental Policy Act (NEPA). These evaluations will also provide data related to requirements of the Boundary Waters Treaty of 1909.

## CONSTRUCTION FUNDING – EMERGENCY OUTLET

In the Energy and Water Development Appropriations Act, 2003, Division D of Public Law 108-7, Congress authorized and directed the following:

*"That the Secretary of the Army, acting through the Chief of Engineers, is authorized and directed to use $5,000,000 of Construction, General funding as provided herein for construction of an emergency outlet from Devils Lake, North Dakota, to the Sheyenne River, at an estimated total cost of $100,000,000, which shall be cost-shared in accordance with section 103 of the Water Resources Development Act of 1986, as amended (33 U.S.C. 2213), except that the funds shall not become available unless the Secretary of the Army determines that an emergency (as defined in section 102 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (42 U.S.C. 5122)) exists with respect to the emergency need for the outlet and reports to Congress that the construction is technically sound and environmentally acceptable, and in compliance with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et. seq.): Provided further, That the justification for the emergency outlet shall be fully described, including the analysis of the benefits and costs, in the project plan documents: Provided further, That the plans for the emergency outlet shall be reviewed and, to be effective, shall contain assurances provided by the Secretary of State, that the project will not violate the Treaty Between the United States and Great Britain Relating to Boundary Waters Between the United States and Canada, signed at Washington January 11, 1909 (36 Stat. 2448; TS 548) (commonly know as the "Boundary Waters Treaty of 1909"): Provided further, That the Secretary of the Army shall submit the final plans and other documents for the emergency outlet to Congress: Provided further, That no funds made available under this Act or any other Act for any fiscal*

*year may be used by the Secretary of the Army to carry out the portion of the feasibility study of the Devils Lake Basin, North Dakota, authorized under the Energy and Water Development Appropriations Act, 1993 (Public Law 102-377), that addresses the needs of the area for stabilized lake levels through inlet controls, or to otherwise study any facility or carry out any activity that would permit the transfer of water from the Missouri River Basin into Devils Lake."*

Public Law 108-7 directs the Corps to construct an outlet from Devils Lake to the Sheyenne River, subject to several conditions, including the Secretary of State providing assurances that the project will not violate the Boundary Waters Treaty of 1909. Additionally, it differs from the Energy and Water Development Appropriations Act, 2001, Public Law 106-377, and earlier laws by no longer that the outlet be economically justified. Rather, Public Law 108-7 requires instead that the justification for the outlet by fully described, including the analysis of the benefits and costs.

# 2 PURPOSE AND SCOPE

The Purpose and Need Statement has been defined in the NEPA Notice of Intent as follows: "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." Specific objectives supporting this purpose and need statement include the following:

1) Minimize further flood damages around Devils Lake.
2) Minimize the potential of uncontrolled flows into the Sheyenne River.
3) Be flexible to operate over a range of Devils Lake inflows and channel capacity and water quality conditions downstream in the Sheyenne and Red Rivers.
4) Be flexible to deal with increased flood risks associated with elevated lake levels.
5) Avoid to the maximum extent possible, or mitigate, adverse impacts.