1-1-2011

Restoration of Emergent Sandbar Habitat Complexes in the Missouri River, North Dakota

Follow this and additional works at: http://digitalcommons.unl.edu/usarmyceomaha

Part of the Civil and Environmental Engineering Commons

http://digitalcommons.unl.edu/usarmyceomaha/87

This Article is brought to you for free and open access by the US Department of Defense at DigitalCommons@University of Nebraska - Lincoln. It has been accepted for inclusion in US Army Corps of Engineers, Omaha District by an authorized administrator of DigitalCommons@University of Nebraska - Lincoln.
DRAFT

ENVIRONMENTAL ASSESSMENT

Restoration of Emergent Sandbar Habitat Complexes in the Missouri River, North Dakota

March 2011

Prepared by:
U.S. Army Corps of Engineers, Omaha District
Environmental Resources and Missouri River Recovery Program Plan Formulation Section
Planning Branch, CENWP-PM-AC
1616 Capitol Avenue
Omaha, Nebraska 68102
Environmental Assessment  
Restoration of Emergent Sandbar Habitat  
Complexes in the Missouri River, North Dakota

**TABLE OF CONTENTS**

1.0 INTRODUCTION ................................................................................................................... 1  
2.0 LOCATION ............................................................................................................................. 1  
3.0 PURPOSE AND NEED .......................................................................................................... 3  
4.0 PROPOSED ACTION AND ALTERNATIVES ........................................................................ 4  
  4.1 Alternatives Not Considered for Further Analysis ............................................................ 4  
    4.1.1 Remove Vegetation, Herbicide Application and Overtop Using Existing Sand .......... 4  
  4.2 Alternatives Carried Forward for Further Analysis ........................................................... 5  
    4.2.1 Alternative 1 – No Action (Deny Permits and Access) .............................................. 5  
    4.2.2 Alternative 2 – Remove Vegetation and Apply Herbicide (Recommended Alternative) .. 5  
5.0 AFFECTED ENVIRONMENT .............................................................................................. 15  
  5.1 Physiography, Relief and Drainage .................................................................................... 15  
  5.2 Climate .............................................................................................................................. 16  
  5.3 Soils .................................................................................................................................. 16  
  5.4 Water Quality ................................................................................................................... 17  
  5.5 Wetlands ........................................................................................................................... 18  
  5.6 Threatened, Endangered, and Species of Concern ......................................................... 19  
  5.7 Vegetation and Noxious Weeds ....................................................................................... 20  
  5.8 Wildlife ............................................................................................................................ 20  
  5.9 Air Quality ........................................................................................................................ 21  
  5.10 Noise ............................................................................................................................... 22  
  5.12 Cultural Resources .......................................................................................................... 22  
6.0 ENVIRONMENTAL CONSEQUENCES ......................................................................... 23  
  6.1 Geology/Physiography ...................................................................................................... 23  
    6.1.1 Alternative 1 No Action ............................................................................................ 23  
    6.1.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide ..................... 23  
  6.2 Climate .............................................................................................................................. 23  
    6.2.1 Alternative 1 No Action ............................................................................................ 23  
    6.2.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide ..................... 23  
  6.3 Soils and Prime Farmland ................................................................................................. 23  
    6.3.1 Alternative 1 No Action ............................................................................................ 23  
    6.3.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide ..................... 23  
  6.4 Water Resources .............................................................................................................. 24  
    6.4.1 Alternative 1 No Action ............................................................................................ 24  
    6.4.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide ..................... 24  
  6.5 Wetlands/Riparian Habitat and Floodplains .................................................................... 24  
    6.5.1 Alternative 1 No Action ............................................................................................ 24
6.5.2 Alternative 2 Remove Vegetation on Sandbars

6.6 Threatened, Endangered, and Species of Concern
   6.6.1 Alternative 1 No Action
   6.6.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.7 Vegetation and Invasive Species
   6.7.1 Alternative 1 No Action
   6.7.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.8 Wildlife
   6.8.1 Alternative 1 No Action
   6.8.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.9 Air Quality
   6.9.1 Alternative 1 No Action
   6.9.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.10 Noise
   6.10.1 Alternative 1 No Action
   6.10.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.11 Socioeconomics
   6.11.1 Alternative 1 No Action
   6.11.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.12 Cultural Resources
   6.12.1 Alternative 1 No Action
   6.12.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

6.13 Cumulative Affects

7.0 CONSULTATION AND COORDINATION

8.0 STATUS OF ENVIRONMENTAL COMPLIANCE

LIST OF TABLES

Table 1: Vegetation Removal at Proposed Site Locations between RM 1375.0 and RM 1304.0
Table 2: Acres of vegetation to be removed and sprayed based on the 2009 habitat classifications
Table 3: Extent and Classification of Vegetation and Sand Coverage at RM 1374.5
Table 4: Extent and Classification of Vegetation and Sand Coverage at RM 1352.5
Table 5: Extent and Classification of Vegetation and Sand Coverage at RM 1348.0
Table 6: Extent and Classification of Vegetation and Sand Coverage at RM 1343.5
Table 7: Extent and Classification of Vegetation and Sand Coverage at RM 1304.0
Table 8: Temperature and Precipitation Data
Table 9: Federally-listed and Candidate Endangered and Threatened Species for all Countries, ND
Table 10: Biological Assessment Summary for Federally-listed and Candidate Endangered and Threatened Species
Table 11: Summary of EA Review and Comments

LIST OF APPENDICES

Appendix I Project Location Maps
Appendix II Consultation and Coordination Correspondence
Appendix III Imazapyr Fact Sheet
In 2003, the United States Fish and Wildlife Service (USFWS) issued an Amendment to the 2000 Biological Opinion (BiOp) with recommendations for the US Army Corps of Engineers’ (Corps) operations on the Missouri River Mainstem System (MRMS). The BiOp Amendment was the result of continuing consultation between the Corps and the USFWS under the Endangered Species Act (ESA) and supplemented the recommendations given in the previous BiOp (USFWS, 2000). The 2000 BiOp and amendments made in 2003 will be collectively referred to as“BiOp” hereafter. The document found that Corps operations on the Missouri River were not likely to jeopardize interior least tern and piping plover populations if the Reasonable and Prudent Alternative (RPA) set forth in the BiOp was implemented. Element IV.B. 3 of the RPA includes recommendations for the mechanical creation or restoration of Emergent Sandbar Habitat (ESH) as nesting habitat for these two species. ESH refers to exposed, inter-channel sandbars. In contrast to islands, ESH complexes are temporary formations and comparatively dynamic in nature. Creation or restoration of ESH should improve least tern and piping plover productivity number on the MRMS while enabling the Corps to manage the MRMS to meet congressionally authorized purposes.

This Environmental Assessment (EA) will focus on evaluating the removal of vegetation on ESH located within the Garrison reach of the Missouri River between Missouri River miles (RM) 1375.0 and RM 1300.0, along the boundaries of Burleigh/Morton, Mercer/McLean and McLean/Oliver Counties, North Dakota. More specifically, vegetation removal is proposed at the following approximate locations: RM 1374.5 (~150 acres), RM 1352.5 (~49 acres), RM 1347.5 and 1348.5 (~147 acres), RM 1343.5 (~46 acres) and RM 1304.0 (~50 acres). This EA is consistent with the National Environmental Policy Act (NEPA), the Council on Environmental Quality’s (CEQ) regulations for implementing NEPA (40 CFR 1500-1508), the Corps’ regulations for implementing NEPA (33 CFR 325 and ER 200-2-2) and other appropriate environmental laws and regulations, including the Endangered Species Act (ESA), the National Historic Preservation Act (NHPA) and Section 404 of the Clean Water Act (CWA). The Corps must evaluate the proposed project and decide whether its approval would result in a significant impact upon the human environment, thereby prompting an Environmental Impact Statement (EIS), or whether a Finding of No Significant Impact (FONSI) is appropriate.

2.0 LOCATION

In accordance with the recommendations of the USFWS found in the RPA of the BiOp, the Corps is proposing to restore ESH complexes by mowing, mulching and applying a pre-emergent herbicide on exposed sandbars within the Garrison Reach of the Missouri River. The Garrison Reach is defined as the 85.9-Mile Segment, described as Segment Four of the Missouri River in the BiOp, between the Garrison Dam and the headwaters of Lake Oahe. The locations were selected by staff from the Corps, USFWS, North Dakota Game and Fish Department (NDGF), North Dakota Department of Health (NDDH) and the North Dakota State Water Commission.
Figure 1 below shows the proposed project locations. For detailed project information by location, see Section 4.0.

Vegetation removal at all proposed locations would be completed in the spring 2011. If unforeseen circumstances prevent projects from being completed in this time frame, proposed activities would be accomplished in the fall, 2011 after the birds have migrated from the sandbars. The removal of vegetation would restore ideal nesting habitat intended to help limit declines in federally listed bird productivity. Table 1, below, shows proposed ESH restoration projects by Missouri River mile.

Table 1: Vegetation Removal at Proposed Ste Locations between RM 1375.0 and RM 1304.0

<table>
<thead>
<tr>
<th>Location (RM)*</th>
<th>Characteristics</th>
<th>Measures</th>
<th>Max Acres **</th>
</tr>
</thead>
<tbody>
<tr>
<td>1374.5</td>
<td>Existing, partially vegetated sandbars</td>
<td>Vegetation removal and application of herbicide</td>
<td>150</td>
</tr>
<tr>
<td>1352.5</td>
<td>Existing, partially vegetated sandbars</td>
<td>Vegetation removal and application of herbicide</td>
<td>49</td>
</tr>
<tr>
<td>1348.0</td>
<td>Existing, partially vegetated sandbars</td>
<td>Vegetation removal and application of herbicide</td>
<td>147</td>
</tr>
<tr>
<td>1343.5</td>
<td>Existing, partially vegetated sandbars</td>
<td>Vegetation removal and application of herbicide</td>
<td>46</td>
</tr>
<tr>
<td>1304.0</td>
<td>Existing, partially vegetated sandbars</td>
<td>Vegetation removal and application of herbicide</td>
<td>50</td>
</tr>
</tbody>
</table>

*RM locations are approximate

** Acreage calculated using 2009 aerial photographs at approximately 15,000 cubic feet per second flow rate
The ESH project development team (PDT) holds annual meetings to view current and historical imagery to discuss locations on the river to construct or restore ESH. During these annual meetings team members contribute information about the potential positive and negative aspects associated with restoration at each location. A list of potential projects is identified and prioritized at these meetings. The ESH PDT uses this information, along with team members’ personal knowledge of the trends at the prioritized sites (e.g. channel stability/thalweg shifts, vegetation and previous bird usage) and selects which areas to focus on in the upcoming year.

The proposed ESH sites have been historically used for nesting by birds and have become increasingly vegetated in recent years, limiting the amount of suitable nesting habitat. Each site is outside of any sensitive resource boundaries and located on areas of exposed or partially-exposed sandbars.

### 3.0 PURPOSE AND NEED

The purpose of this project is to remove and control vegetation on sandbars to make suitable nesting habitat available for the least tern and piping plover. It is anticipated that the restoration of suitable nesting habitat on sandbars would stabilize, and eventually recover, least tern and piping plover populations along the MRMS. This project was necessitated by the unforeseen loss of ESH due to construction of dams and subsequent channelization and flood control efforts along the Missouri River, and the resulting decline of tern and plover numbers. In addition, vegetation colonization and erosion of existing sandbars continue to degrade suitable breeding habitat which contributes to declining productivity numbers for both species. The Garrison Reach (Segment Four) of the Missouri River is identified as a “High Priority” reach for both terns and plovers under RPA Section IV of the BiOp.

While the ESH program is being analyzed in a Programmatic Environmental Impact Statement (PEIS), the need remains to implement interim actions during the period between the onset and completion of this document. This document is currently scheduled to be completed in the summer 2011. Interim actions are meant to restore a portion of the continually declining habitat in order to help sustain the population while the programmatic analysis is being completed. This need is particularly critical in light of the findings of the 2009-2010 monitoring efforts. These findings show that the adult least

![Missouri River Fledge Ratios 1986-2010](image-url)

**Figure 2: Missouri River Fledge Ratios 1986-2010**

*Environmental Assessment*  
*ESH Vegetation Removal Projects*  
*Page 3*
terns and piping plovers on the river have dropped below BiOp recommended goals of 658 and 606 adults, respectively. See Figure 2 for a graph depicting adult census counts since 1986. Restoration efforts have yet to be undertaken in Segment four of the Missouri River. The proposed projects would act as “pilot” projects to aid in determining future implementation strategies and their effectiveness at increasing bird productivity.

Both the adult least tern and piping plover population has continually declined since 2007 and 2005 to a level below that recommended in the BiOp. Productivity, as measured by fledge ratios, barely increased above the recommended level for the least tern, but remained below the recommended level for the piping plovers. See Figure 3 for a graph depicting fledge ratios.

High flows and water levels submerged a majority of ESH on the Missouri River during the nesting season 2010. It is anticipated that 2011 river conditions may be similar to 2010, making suitable nesting habitat that much more valuable. Overall, habitat quantity and quality have continually diminished on the Missouri River and there remains an urgent need to restore high quality habitat in order to improve species productivity.

While a PEIS on the overall program is currently underway, the proposed action is permissible under section 1506.1(c) of NEPA in that:

- It is justified independently of the program due to time restrictions described in the BiOp and a need to aide species productivity in the interim;
- It is being analyzed in an appropriate NEPA document; and
- This action would not preclude the ultimate decision of the PEIS and/or limit the alternatives within the PEIS.

4.0 PROPOSED ACTION AND ALTERNATIVES

4.1 Alternatives Not Considered for Further Analysis

4.1.1 Remove Vegetation, Herbicide Application and Overtop Using Existing Sand
Approval of a preliminary proposal option by the Corps will not be considered in detail or for further analysis in the EA, since the plan is no longer considered a viable option. However, it is described here for reference in how it differs from Alternative 2, the Corps’ Proposal. This Alternative evaluated clearing vegetation on existing sandbars as described in Alternative 2 (Recommended Alternative); however, in addition to vegetation removal and application of an herbicide, existing sand dunes atop sandbars would be spread out to cover de-vegetated areas. The accumulation of sand into dunes occurs behind trees and shrubs that catch fine sands blowing across sandbars. Overtopping recently de-vegetated areas would impede vegetation growth by removing sunlight, eliminate potential predator perches and raise the elevation of the sandbar so it remains emerged under higher flow conditions. Through coordination efforts with the USFWS, the State of North Dakota and ESH PDT members, it was determined that suitable material does not exist on top of the exposed sandbars. Although suitable material may be present to overtop in the shallowly submerged areas adjacent to the sandbars, it was agreed with the State of North Dakota that vegetation removal and herbicide spraying only would serve as pilot projects prior to implementing any overtopping efforts. As a result of coordination efforts, this alternative was removed from further consideration.

4.2 Alternatives Carried Forward for Further Analysis

4.2.1 Alternative 1 – No Action (Deny Permits and Access)

Under the "No Action" alternative, no steps would be taken to create tern and plover habitat within the project area. This alternative would prevent the Corps from meeting the goals set forth for the Garrison Reach (Segment Four) of the Missouri River under the BiOp. Under this alternative the erosion trends and lack of suitable habitat, as seen in the period of 1998-2010, would likely continue unless another significant hydrologic event occurred in the near future. Sandbars would also likely continue to vegetate. It is probable, as a result of “no action”, that species productivity would continue to decline in Segment four of the Missouri River.

4.2.2 Alternative 2 – Remove Vegetation and Apply Herbicide (Recommended Alternative)

The Recommended Alternative would remove vegetation from sandbars and apply an herbicide at the following approximate locations: river mile (RM) 1374.5 (~150 acres), RM 1352.5 (~49 acres), RM 1348.0 (~147 acres), RM 1343.5 (~46 acres) and RM 1304.0 (~50 acres). These acreages were calculated by using a geographical information system (GIS) to encapsulate the entire exposed sandbar complex using 2009 USDA orthophotos. Actual amount of vegetation removed would depend on the river flow velocity and amount of exposed vegetation at the time removal activities begin. Section 4.2.2.1 further describes extent of vegetation coverage.
4.2.2.1 Habitat Classification

The Corps of Engineers Missouri River Recovery Integrated Science Program (ISP) further classified proposed project locations using QuickBird imagery collected in 2009. This data set is a characterization and classification of emergent sandbars, islands and floodplains on the Garrison segment of the Missouri River in 2009. The map was prepared from the analysis of a companion land cover data set produced from analysis of QuickBird imagery acquired on 27 May, 14 and 19 June, 25 July and 2 August 2009. The land cover map was prepared using a prototype knowledge- and object-based method to map land cover on the Missouri River developed at the U.S. Geological Survey's Northern Prairie Wildlife Research Center. This land cover map was prepared for use in the inventory, mapping and estimation of emergent sandbar habitat on the Garrison segment of the Missouri River in 2009. See Table 2 for data presenting total sandbar size and acreage of vegetation proposed to be removed as analyzed by the ISP.

Table 2: Acres of vegetation to be removed and sprayed based on the 2009 habitat classifications

<table>
<thead>
<tr>
<th>Site (RM)</th>
<th>Total Acres</th>
<th>Vegetated Acres</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1374.5</td>
<td>111.2</td>
<td>37.8</td>
<td>37.8</td>
</tr>
<tr>
<td>1352.5</td>
<td>35.1</td>
<td>23.2</td>
<td>66.2</td>
</tr>
<tr>
<td>1348.0</td>
<td>98.4</td>
<td>90.4</td>
<td>91.9</td>
</tr>
<tr>
<td>1343.5</td>
<td>13.2</td>
<td>11.9</td>
<td>90.7</td>
</tr>
<tr>
<td>1304.0</td>
<td>17.9</td>
<td>3.8</td>
<td>21.0</td>
</tr>
</tbody>
</table>

A breakdown of each site's habitat classification along with a generalization of the percent cover of vegetation versus sand cover can be found in Section 4.2.2.5.

4.2.2.2 Coordination

In accordance with the National Environmental Policy Act and regulations for its implementation, The Fish and Wildlife Coordination Act, the National Historic Preservation Act, and Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), numerous agencies, interest groups and Tribes were contacted for information and comments during the development of this project and this EA. Project locations and restoration methods were selected and developed with representatives of the USFWS, NDGFD, NDSWC and the NDDH through a series of meetings, phone calls and emails.

Scoping letters were sent to organizations including North Dakota State Historic Preservation Office, North Dakota State Historical Society, North Dakota Game and Fish Department, North Dakota Department of Health, North Dakota State Water Commission, North Dakota State Land Department, North Dakota Department of Agriculture, North Dakota Parks and Recreation Department, North Dakota Chapter of the Wildlife Society, Missouri River Joint Water Board, Dacotah Chapter of the Sierra Club, Friends of Lake Sakakawea, North Dakota Wildlife Federation, Bureau of Indian Affairs, United States Department of Agriculture, United States Department of the Interior, Natural Resources Conservation Service and the Bureau of...
Reclamation. Scoping letters were also sent to the Three Affiliated Tribes and the Standing Rock Sioux Tribe.

The Corps would make the draft EA available on the MRRP website and would notify the agencies, interested parties and the public that comments would be received and considered through April 1, 2011.

4.2.2.3 Site Access and Staging

In order to remove vegetation from sandbars, equipment would need to be transported by trucks to a nearby boat ramp and then to sandbars on boats and landing craft. The Corps, in coordination with the NDGFD, has chosen three primary and two backup public boat ramps to efficiently transport equipment and personnel to and from sandbars. The Stanton, Sanger and Little Heart boat ramps would be used for river access unless unforeseen circumstances arise and require the use of either the Washburn or Wilton boat ramps. See Figure 4 below for a map of boat ramp locations. See Section Appendix I for more detailed maps depicting boat ramps and project locations.

![Figure 4 - Boat Ramp Locations](image)

Typically, it takes less than two hours to load equipment from trailers onto landing crafts and into the river. After loading equipment, transport trucks with trailers and personal vehicles
would be moved into designated parking areas. Actual staging for vegetation removal would occur on the sandbar that work is occurring. Work crews and their vehicles would commute daily to boat ramps. See Figure 5 and Figure 6 for a typical view of equipment landing on sandbar and ESH vegetation removal staging area, respectively.

Best Management Practices (BMPs) would be used to avoid negative impacts to these areas and all changes resulting from use of staging and fueling areas, as well as access to these areas, would be returned to the original state upon completion of construction activities.

4.2.2.4 Proposed Activities

Vegetation removal activities may include: cutting, mulching, disking, mowing, raking and removing vegetation from the sandbars. The areas would also be sprayed with an herbicide, Imazapyr, which has low-toxicity to fish and wildlife. See Appendix III for a fact sheet on Imazapyr. Required permits and environmental compliance documents would be obtained in order to complete projects and create habitat for the birds to use during the nesting season, 2011. The least tern and piping plover usually begin to nest on the Garrison Reach in early May and typically the last chick fledges as late as early September. It is the intent of the Corps of Engineers to complete all proposed projects prior to the birds arriving in the spring 2011. If unforeseen circumstances prevent the proposed action from occurring in this timeframe, the proposed action would occur in the fall 2011, after the birds have left the sandbars.

An All Surface Vehicle (ASV), or large bobcat, with a brushcat attachment (Figure 7) would be used to clear a majority of the sandbars and would finely mulch and leave ground up
vegetation on islands. Finely mulched vegetation would eventually enter the river by natural means, i.e. gusts of wind. The brushcat has successfully been used to clear vegetation on sandbars in the Gavins Reach of the Missouri River. It can cut and finely mulch vegetation up to three inches in diameter. Trees larger than three inches in diameter and/or taller than 15 feet would be cut by hand or with a timber axe attached to the ASV (Figure 8). All large vegetative debris would be hauled off the sandbars and disposed of at a state approved location. Most of the vegetation on the sandbars is less than three inches thick; therefore, the brushcat would be the primary tool used. A pre-emergent herbicide would be applied using an ATV or backpack mounted sprayer immediately following removal activities.

The USFWS recommended project areas be surveyed for migratory bird nests prior to mowing and spraying sandbars. All areas to be mowed and sprayed would be surveyed by workers. Any nests found would be marked using surveyors tape and/or pin flags. All equipment will avoid marked nests. Additional care would be taken while applying herbicides to eliminate overspray from impacting nests. Also, tread marks from tracked equipment can pose a hazard to recently hatched tern and plover chicks on a sandbar. Workers would ensure that significant track marks are filled in to avoid creating hazards for these chicks.

Figure 6: ASV with Timber Ax Attachment

Duration of removal activities would vary depending on the size and extent of vegetation coverage at a particular bar. Typically the brushcat can remove up to 35 acres per day on a single bar if it does not have to be mobilized from boat ramps or other sandbar locations. On sandbars where multiple working days would be necessary, the equipment will be left on the sandbar overnight until the work is completed. Upon work completion, equipment would be removed and loaded out at the same boat ramp used to load into river. All work to remove vegetation would occur within the existing sandbar boundaries. Expansion of the existing footprint of the sandbar would not occur. See Figure 9 and Figure 10 for typical views of vegetation removal work in progress and resulting sandbar condition.
Figure 7: Vegetated Sandbar Prior to and During Removal

Figure 8: Island after vegetation removal. Notice fine debris left on bar.
4.2.2.5 Detailed Project Descriptions

The following section describes the general vegetative condition of each project location. While amounts of vegetation vary by site, all of these areas are adversely affected by increasing vegetative colonization, which is likely to increase over time.

4.2.2.4.1 River Mile 1374.5

The sandbar complex lies on the border of Mercer and McLean Counties, just south of the Garrison Dam near Stanton, North Dakota.

This site consisted of exposed sandbars that are moderately vegetated. This project would be staged from the Stanton Boat Ramp, approximately 1.5 miles downstream of the project location. See Figure 1 in Appendix I for Site Location Map depicting project and boat ramp location.

Habitat Classification

Based on ISP habitat classification from imagery collected in 2009, the sandbar at RM 1374.5 is 111.2 acres in size with 37.8 acres of sparse to moderately vegetated area. Table 3 below further describes vegetation and sand coverage on the sandbar.

Table 3: Extent and Classification of Vegetation and Sand Coverage at RM 1374.5

<table>
<thead>
<tr>
<th>Extent of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>73.4</td>
<td>66.0%</td>
<td>Approximate area of site with little to no vegetation (sand)</td>
</tr>
<tr>
<td></td>
<td>27.2</td>
<td>24.5%</td>
<td>Approximate area of the site with 15-50% visual coverage of vegetation</td>
</tr>
<tr>
<td></td>
<td>10.6</td>
<td>9.6%</td>
<td>Approximate area of the site with 50-100% visual coverage of vegetation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>111.2</td>
<td></td>
<td>Area of the Island</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.1%</td>
<td>Area of high canopy cover, high biomass herbaceous and woody seedlings and saplings</td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>1.1%</td>
<td>Area of high canopy cover, moderate biomass herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td></td>
<td>6.2</td>
<td>5.6%</td>
<td>Area of low canopy cover herbaceous and woody seedlings and saplings</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>1.4%</td>
<td>Area of moderate canopy cover, low biomass herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td></td>
<td>1.4</td>
<td>1.3%</td>
<td>Area of woody dominated</td>
</tr>
<tr>
<td></td>
<td>3.9</td>
<td>3.5%</td>
<td>Area of water</td>
</tr>
<tr>
<td></td>
<td>4.3</td>
<td>3.8%</td>
<td>Area of dry sand</td>
</tr>
<tr>
<td></td>
<td>5.3</td>
<td>4.8%</td>
<td>Area of dry sand, sparse vegetation</td>
</tr>
<tr>
<td></td>
<td>65.3</td>
<td>58.7%</td>
<td>Area of wet sand</td>
</tr>
<tr>
<td></td>
<td>21.9</td>
<td>19.6%</td>
<td>Area of wet sand, sparse vegetation</td>
</tr>
</tbody>
</table>
4.2.2.4.2 River Mile 1352.5

The proposed complex lies in between Oliver and McLean Counties, just downstream of Washburn, North Dakota. This site consisted of exposed sandbars that are sparsely to moderately vegetated. Boat ramps in Washburn or Sanger, ND would be used to get equipment to sandbars. The Washburn boat ramp is about three miles upstream of the project location while the Sanger boat ramp is six miles downstream. See Figure 2 in Appendix I for a Site Location Map depicting project and boat ramp location.

Habitat Classification

Based on ISP habitat classification from imagery collected in 2009, the sandbar at RM 1352.5 is about 35 acres in size with 27 acres of sparse to moderately vegetated area. Table 4 below further classifies habitat on the sandbar.

Table 4: Extent and Classification of Vegetation and Sand Coverage at RM 1352.5

<table>
<thead>
<tr>
<th>Extent of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approximate area of site with little to no vegetation (sand)</td>
<td>11.9</td>
<td>33.8%</td>
<td>Approximate area of site with little to no vegetation (sand)</td>
</tr>
<tr>
<td>Approximate area of the site with 15-50% visual coverage of vegetation</td>
<td>10.4</td>
<td>29.7%</td>
<td>Approximate area of the site with 15-50% visual coverage of vegetation</td>
</tr>
<tr>
<td>Approximate area of the site with 50-100% visual coverage of vegetation</td>
<td>12.8</td>
<td>36.5%</td>
<td>Approximate area of the site with 50-100% visual coverage of vegetation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area of the Island</td>
<td>35.1</td>
<td></td>
<td>Area of the Island</td>
</tr>
<tr>
<td>Area of high canopy cover, moderate biomass herbaceous / woody seedlings / saplings</td>
<td>3.9</td>
<td>11.1%</td>
<td>Area of high canopy cover, moderate biomass herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td>Area of low canopy cover herbaceous / woody seedlings / saplings</td>
<td>3.2</td>
<td>9.1%</td>
<td>Area of low canopy cover herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td>Area of moderate canopy cover, low biomass herbaceous / woody seedlings / saplings</td>
<td>5.4</td>
<td>15.3%</td>
<td>Area of moderate canopy cover, low biomass herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td>Area of woody dominated</td>
<td>0.3</td>
<td>1.0%</td>
<td>Area of woody dominated</td>
</tr>
<tr>
<td>Area of water</td>
<td>0.1</td>
<td>0.4%</td>
<td>Area of water</td>
</tr>
<tr>
<td>Area of dry sand</td>
<td>3.5</td>
<td>10.0%</td>
<td>Area of dry sand</td>
</tr>
<tr>
<td>Area of dry sand, sparse vegetation</td>
<td>4.8</td>
<td>13.6%</td>
<td>Area of dry sand, sparse vegetation</td>
</tr>
<tr>
<td>Area of wet sand</td>
<td>8.2</td>
<td>23.3%</td>
<td>Area of wet sand</td>
</tr>
<tr>
<td>Area of wet sand, sparse vegetation</td>
<td>5.7</td>
<td>16.1%</td>
<td>Area of wet sand, sparse vegetation</td>
</tr>
</tbody>
</table>
4.2.2.4.3 River Mile 1348.0

The proposed complex lies in between Oliver and McLean Counties, just downstream of Washburn, North Dakota. This site consisted of exposed sandbars that are sparsely to moderately vegetated. Boat ramps in Washburn or Sanger, ND would be used to get equipment to sandbars. The Sanger boat ramp would be the primary ramp and is about 2 miles downstream of the project location. If necessary, the Washburn boat ramp could be used and is located about 7 miles upstream. See Figure 3 in Appendix I for a Site Location Map depicting project and boat ramp location.

Habitat Classification

Based on ISP habitat classification from imagery collected in 2009, the sandbar at RM 1348.0 is 98.4 acres in size with 90.4 acres of sparse to moderately vegetated area. Table 5 below further classifies habitat on the sandbar.

Table 5: Extent and Classification of Vegetation and Sand Coverage at RM 1348.0

<table>
<thead>
<tr>
<th>Extent of Vegetation and Sand Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>11.9</td>
</tr>
<tr>
<td>10.4</td>
</tr>
<tr>
<td>12.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of Vegetation and Sand Coverage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>35.1</td>
</tr>
<tr>
<td>3.9</td>
</tr>
<tr>
<td>3.2</td>
</tr>
<tr>
<td>5.4</td>
</tr>
<tr>
<td>0.3</td>
</tr>
<tr>
<td>0.1</td>
</tr>
<tr>
<td>3.5</td>
</tr>
<tr>
<td>4.8</td>
</tr>
<tr>
<td>8.2</td>
</tr>
<tr>
<td>5.7</td>
</tr>
</tbody>
</table>
4.2.2.4.4 River Mile 1343.5

The proposed complex lies in Burleigh, Oliver and McLean Counties, about 11 miles downstream of Washburn, North Dakota. This site consisted of exposed sandbars that are sparsely to moderately vegetated. The Sanger boat ramp would be the primary ramp and is about two miles upstream of the project location. If necessary, the Wilton boat ramp could be used and is located about 1.5 miles downstream. See Figure 4 in Appendix A for a Site Location Map depicting project and boat ramp location.

Habitat Classification

Based on ISP habitat classification from imagery collected in 2009, the sandbar at RM 1343.5 is 13.2 acres in size with 12.0 acres of sparse to moderately vegetated area. Table 6 below further classifies habitat on the sandbar.

Table 6: Extent and Classification of Vegetation and Sand Coverage at RM 1343.5

<table>
<thead>
<tr>
<th>Extent of Vegetation and Sand Coverage</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres 1.2</td>
<td>% 9.3%</td>
</tr>
<tr>
<td>Acres 5.6</td>
<td>% 42.7%</td>
</tr>
<tr>
<td>Acres 6.3</td>
<td>% 48.1%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of Vegetation and Sand Coverage</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acres 13.2</td>
<td>%</td>
</tr>
<tr>
<td>Acres 0.7</td>
<td>% 5.2%</td>
</tr>
<tr>
<td>Acres 0.6</td>
<td>% 4.5%</td>
</tr>
<tr>
<td>Acres 5.0</td>
<td>% 37.6%</td>
</tr>
<tr>
<td>Acres 0.1</td>
<td>% 0.7%</td>
</tr>
<tr>
<td>Acres 0.1</td>
<td>% 0.9%</td>
</tr>
<tr>
<td>Acres 0.0</td>
<td>% 0.2%</td>
</tr>
<tr>
<td>Acres 1.1</td>
<td>% 8.4%</td>
</tr>
<tr>
<td>Acres 5.6</td>
<td>% 42.5%</td>
</tr>
</tbody>
</table>

4.2.2.4.5 River Mile 1304.0

The proposed complex lies in between Burleigh and Morton Counties, just downstream of Bismarck, North Dakota. This site consisted of exposed sandbars that are sparsely to moderately vegetated. The Little Heart boat ramp, about two miles downstream of project location, would be used to get equipment into the river. See Figure 5 in Appendix I for a Site Location Map depicting project and boat ramp location.
Habitat Classification

Based on ISP habitat classification from imagery collected in 2009, the sandbar at RM 1304.0 is 17.9 acres in size with 3.8 acres of sparse to moderately vegetated area. Table 7 below further classifies habitat on the sandbar.

Table 7: Extent and Classification of Vegetation and Sand Coverage at RM 1304.0

<table>
<thead>
<tr>
<th>Extent of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>14.1</td>
<td>79.0%</td>
<td>Approximate area of site with little to no vegetation (sand)</td>
</tr>
<tr>
<td></td>
<td>3.4</td>
<td>19.0%</td>
<td>Approximate area of the site with 15-50% visual coverage of vegetation</td>
</tr>
<tr>
<td></td>
<td>0.4</td>
<td>2.0%</td>
<td>Approximate area of the site with 50-100% visual coverage of vegetation</td>
</tr>
</tbody>
</table>

Classification of Vegetation and Sand Coverage

<table>
<thead>
<tr>
<th>Classification of Vegetation and Sand Coverage</th>
<th>Acres</th>
<th>%</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17.9</td>
<td></td>
<td>Area of the Island</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.7%</td>
<td>Area of low canopy cover herbaceous and woody seedlings and saplings</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.7%</td>
<td>Area of moderate canopy cover, low biomass herbaceous / woody seedlings / saplings</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.5%</td>
<td>Area of woody dominated</td>
</tr>
<tr>
<td></td>
<td>0.1</td>
<td>0.5%</td>
<td>Area of water</td>
</tr>
<tr>
<td></td>
<td>1.6</td>
<td>9.0%</td>
<td>Area of dry sand</td>
</tr>
<tr>
<td></td>
<td>0.3</td>
<td>1.9%</td>
<td>Area of dry sand, sparse vegetation</td>
</tr>
<tr>
<td></td>
<td>12.4</td>
<td>69.5%</td>
<td>Area of wet sand</td>
</tr>
<tr>
<td></td>
<td>3.1</td>
<td>17.1%</td>
<td>Area of wet sand, sparse vegetation</td>
</tr>
</tbody>
</table>

5.0 AFFECTED ENVIRONMENT

5.1 Physiography, Relief and Drainage

All counties where work would be completed lie within the Northwestern Great Plains ecoregion, which encompasses the Missouri River Plateau section of the Great Plains. Landforms in this area are characterized by rolling fields and native ranges dissected by tributaries that flow into the Missouri River. The elevation within project boundaries ranges from approximately 1665 feet to 1700 feet above mean sea level (msl). The Missouri River drains nearly 530,000 square miles and flows in a southeasterly direction until reaching the Mississippi River, near St. Louis, Missouri.
5.2 Climate

The climate of areas where projects are proposed is cool and semiarid to sub humid and continental. The area is usually quite warm in summer with frequent spells of hot weather and occasional cool days. It is very cold in winter, when arctic air frequently surges over the area. Most precipitation falls in late spring and early summer. See Table 8 below an outline of temperature and precipitation data by county.

Table 8: Temperature and Precipitation Data

<table>
<thead>
<tr>
<th>County</th>
<th>Temperature</th>
<th>Precipitation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
</tr>
<tr>
<td>Burleigh</td>
<td>-37°F</td>
<td>104°F</td>
</tr>
<tr>
<td>McLean</td>
<td>-31°F</td>
<td>103°F</td>
</tr>
<tr>
<td>Mercer</td>
<td>-34°F</td>
<td>103°F</td>
</tr>
<tr>
<td>Morton</td>
<td>-41°F</td>
<td>105°F</td>
</tr>
<tr>
<td>Oliver</td>
<td>-35°F</td>
<td>103°F</td>
</tr>
</tbody>
</table>

Note: Temperature and precipitation data acquired from the NRCS National Weather and Climate Center (http://www.wcc.nrcs.usda.gov/cgibin/state.pl?state=nd) and reflects the probability that the above measurements will occur at least every 2 out of 10 years.

5.3 Soils

All of the proposed sites are within the channel of the Missouri River. Soil surveys designate a majority of these areas as Water (W) with some Riverwash (RW) components. Water classification is described as 100% water in the National Resources Conservation Service and Field Office Tech Guide (FOTG). Soil scientists do not map soil units within the river banks due to the dynamic nature of the river and variability of sandbar locations. The FOTG describes RW components as 0 to 1 percent slope, frequently flooded and poorly drained soils located on bars and channels within floodplains. RW soils are composed of gravelly coarse sand to gravelly sandy loam. See Figure 11 for an example of soil mapping units within the river channel at river mile (RM) 1304.0. The proposed project site is not located on any prime farmlands.
5.4 Water Quality

The Missouri River is approximately 2,340 miles long and drains nearly 530,000 square miles of the eastern Rocky Mountain and the Great Plains, spanning parts of nine U.S. States and two Canadian Provinces. The river originates in the Centennial Mountains of southern Montana and drains into the Mississippi River near Saint Louis, Missouri. See Figure 12 below for a map of the contributing tributaries and drainage basin of the Missouri River.

Water quality management for these water bodies is under the jurisdiction of the North Dakota Department of Health – Division of Water Quality (NDOH). The NDOH develops water quality standards that designate the beneficial uses to be made of surface waters and the water quality criteria to protect the assigned uses. North Dakota Century Code 33-16 forms the basis of water quality protection for all surface water quality programs conducted by NDOH. As required by Section 303(d) of the CWA, NDOH must submit a list of lakes, wetlands, streams, rivers and portions of rivers that do not meet state water quality standards (40 CFR 130.7).
These are considered “impaired water bodies” and states are required to calculate total maximum daily loads (TMDLs) for pollutants causing impairments in these waters. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water quality standards. Specifically, the Missouri River is not listed on the state’s 2010 303(d) list; however, several tributaries are on the list of impaired streams for exceeding the standards of nutrients and fecal coliform. See Figure 13 below for a graphical representation of TMDL water bodies within Segment four of the Missouri River, ND.

5.5 Wetlands

The areas proposed for sandbar restoration in the Garrison Reach have succumbed to terrestrial vegetation encroachment and erosion over the last few decades. Some edge areas of the sandbars could contain temporary wetland communities. The USFWS National Wetlands Inventory (NWI) Map classifies the project locations as Riverine Unconsolidated Bottom, Permanently Flooded (R2UBH) deepwater habitats.
5.6 Threatened, Endangered, and Species of Concern

In accordance with Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service’s (USFWS) was contacted (letter dated November 8, 2010) for listed species occurring in North Dakota to determine which federally listed threatened or endangered species could potentially occur in the proposed project area. See Table 9 below for more information about listed species.

Table 9: Federally-listed and Candidate Endangered and Threatened Species for all Countries, ND

<table>
<thead>
<tr>
<th>Status</th>
<th>Common Name (Scientific Name)</th>
<th>Likelihood of Occurrence</th>
<th>Preferred Habitat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Endangered</td>
<td>Interior least tern <em>(Sterna antillarum)</em></td>
<td>likely</td>
<td>Nests along midstream sandbars of Missouri and Yellowstone Rivers and along shorelines of Lake Sakakawea and Oahe. About 100 pairs nest in North Dakota each year.</td>
</tr>
<tr>
<td>Endangered</td>
<td>Whooping crane <em>(Grus americana)</em></td>
<td>may occur</td>
<td>Historically nested in ND, but currently only migrates through west central ND in spring and fall (Howe 1989). Roosts on shallow wetlands and stock dams with good visibility and feeds on adjacent cropland.</td>
</tr>
<tr>
<td>Endangered</td>
<td>Pallid sturgeon <em>(Scaphirhynchus albus)</em></td>
<td>may occur</td>
<td>Known primarily from the confluence of the Missouri and Yellowstone Rivers where waterway is wide and shallow with sand and gravel bars.</td>
</tr>
<tr>
<td>Endangered</td>
<td>Black-footed ferret <em>(Mustela nigripes)</em></td>
<td>would not occur</td>
<td>Historically present in extreme southwestern ND. Habitat is exclusive to large prairie dog towns or complexes of towns.</td>
</tr>
<tr>
<td>Endangered</td>
<td>Gray wolf <em>(Canis lupus)</em></td>
<td>would not occur</td>
<td>Infrequent visitor in Turtle Mountains area of ND (NDGFD 2006). Require dense and contiguous forests of northcentral or northeast parts of state.</td>
</tr>
<tr>
<td>Threatened</td>
<td>Piping plover <em>(Charadrius melodus)</em></td>
<td>likely</td>
<td>Nests on midstream sandbars and barren sand and gravel shores of Missouri and Yellowstone Rivers and along shorelines of saline wetlands and lakes throughout ND.</td>
</tr>
<tr>
<td>Candidate</td>
<td>Dakota skipper <em>(Hesperia dakotae)</em></td>
<td>unlikely</td>
<td>Habitat in western ND includes ungrazed native prairie with high native species diversity, specifically upland prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, purple coneflower, and blanketflower.</td>
</tr>
<tr>
<td>Candidate</td>
<td>Sprague’s pipit <em>(Anthus spragueii)</em></td>
<td>unlikely</td>
<td>Breeding range includes western ND. Preferred habitat is open, extensive, ungrazed or lightly grazed native mixed grass prairie. The species avoids shrubs.</td>
</tr>
</tbody>
</table>

The North Dakota Game and Fish Department website (www.gf.nd.gov) was consulted to determine if any state-listed endangered or threatened species occur in affected counties, North Dakota. The State of North Dakota does not have State listed endangered or threatened species but they do coordinate on Species of Conservation Priority. The State has listed 100 species of Conservation Priority. The list can be found at http://gf.nd.gov/conservation/levels-list.html.

5.7 Vegetation and Noxious Weeds

The region surrounding and including the proposed project areas is in the Northwestern Great Plains ecoregion (Missouri Slope), which is predominantly a western mixed-grass/short-grass prairie characterized by numerous native grasses and upland sedges species. The proposed projects would restore sandbars within the Missouri River channel. Vegetation observed during a site visit in the fall 2010 included: cocklebur (Xanthium strumarium), little bluestem (Andropogon scoparius), western wheatgrass (Agropyron smithii), blue grama (Bouteloua gracilis), Indian grass (Sorghastrum nutens), cottonwood (Populus deltoides), sandbar willow (Salix exigua) and peachleaf willow (Salix amygdaloides). No sensitive, watch, threatened or endangered plant species were observed, as defined by the North Dakota Sensitive Plant Field Guide and the Endangered Species Act (16 U.S.C. 1531 et seq.).

Fifteen species have been designated as noxious in North Dakota, according to the USDA invasive and noxious weed list for North Dakota. For a list of North Dakota’s noxious weed list see http://www.agdepartment.com/programs/plant/noxiousweeds.html. None of these species were observed during site visits; however, these species may occur on sandbars or lands adjacent to project locations.

5.8 Wildlife

Birds

The Missouri River in the vicinity is home to 25 year-round resident bird species, 58 migrant species which nest along the river, 15 species that are winter residents, 115 species that are spring migrants and 110 species that are fall migrants (NPS, 1999). The Missouri River is home to many species of waterfowl and shorebirds including geese, ducks, herons, bitterns, pelicans, avocets, plovers, sandpipers, gulls, terns and kingfishers. Birds of prey include eagles, hawks, vultures, osprey, falcons and owls. Other species that would be expected along the river include doves, woodpeckers, swallows, blackbirds and sparrows.

Mammals

There are a variety of small mammals common to the project area including opossums (Didelphis virginiana), woodchucks (Marmota monax), beaver (Castor canadensis), muskrat (Ondatra zibethicus), raccoons (Procyon lotor) and mink (Neovison mustela). Mink are of concern as they are a potential predator of both terns and plovers.
Fish

The Missouri River was historically extremely turbid, but the placement of dams has reduced the sediment load by dropping it in the reservoir basins. The lowered sediment load and turbidity in the modern river have made fish species that evolved in dark turbid environments more vulnerable to predation and competition from sight-feeding predators. The historic flood plain habitat of the Missouri River also provided important habitat features and functions for riverine fishes. Cottonwoods and other trees washed into the river during floods and collected in side channels, along inside bends or behind sandbars. The decomposing trees provided food and substrate for insects and other organisms, which were in turn consumed by fish. These trees also created a habitat complex utilized by fish for cover. Depth and flow diversity in the main channel border area are thought to be important habitat elements for native species including the endangered pallid sturgeon.

The most commonly captured species in the project areas include: Banded killifish (*Fundulus diaphanous*), Bigmouth buffalo (*Ictiobus cyprinellus*), Black bullhead (*Ameiurus melas*), Black crappie (*Pomoxis nigromaculatus*), Bluegill (*Cycleptus elongates*), Channel catfish (*Ictalurus punctatus*), Common carp (*Cyprinus carpio*), Fathead minnow (*Pimephales promelas*), Goldeye (*Hiodon alosoides*), Longnose sucker (*Catostomus catostomus*), River carpsucker (*Carpiodes carpio*), Shovelnose sturgeon (*Scaphirhynchus platorynchus*), Smallmouth buffalo (*Ictiobus bubalus*) and White sucker (*Catostomus commersoni*).

Macroinvertebrates

When compared to Missouri River reaches downstream, the Garrison Reach has the lowest taxonomic richness of both benthic and snag-surface macroinvertebrate assemblages. Today, nematodes, aquatic worms (*Nais sp.*), corixidae (water boatman), and non-biting midges (*Cricotopus/Orthocladius sp.*) comprise the majority of the littoral benthic macroinvertebrate composition of the Garrison Reach. Most snags in this reach contain visible algae on their surface and the most abundant snag colonizers include chironomids (*Cricotopus/Orthocladius sp.* and *Nais sp.*) and net spinning caddisflies (Hydropsychidae). The unstable, moving-sand habitat that characterizes much of Garrison Reach substratum essentially precludes establishment of macroinvertebrate communities that do not dwell beneath the benthic substrate or can attach themselves to substrate such as stabilization structures or snags. Taxonomic diversity becomes higher in the headwaters of Lake Oahe, which provides suitable habitat for organisms that would otherwise be swept away in moving-sand habitats, such as burrowing mayflies (*Hexagenia sp.*).

5.9 Air Quality

Burleigh, McLean, Mercer, Morton and Oliver Counties, North Dakota are in attainment with National Ambient Air Quality Standards, which assess the levels of air pollutants such as ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter and lead. These counties meet the standards for all criteria pollutants and are usually well below established limits.
5.10 Noise

Ambient human-generated noise levels at the project site are currently very low. Sources of noise near the project site may result from standard urban activities. Background noise levels in the proposed project sites are generally low.

5.11 Socioeconomics

Burleigh County

The population of Burleigh County was estimated at 79,822 in 2009, a 15% increase since 2000. Bismarck is the largest city in Burleigh County with approximately 58,333 citizens. Per capita income for residents is $20,436 (115% of the North Dakota per capita income of $17,769), with a median household income of $54,040 (122% of the North Dakota median of $45,996).

McLean County

The population of McLean County was estimated at 8,310 in 2009, a 10.8% decrease since 2000. Washburn is the largest city in McLean County with approximately 1,389 citizens. Per capita income for residents is $16,220 (91% of the North Dakota per capita income of $17,769), with a median household income of $46,131 (100% of the North Dakota median of $45,996).

Mercer County

The population of Mercer County was estimated at 7,873 in 2009, a 8.9% decrease since 2000. Beulah is the largest city in Mercer County with approximately 3,152 citizens. Per capita income for residents is $18,256 (102% of the North Dakota per capita income of $17,769), with a median household income of $63,570 (138% of the North Dakota median of $45,996).

Morton County

The population of Morton County was estimated at 26,464 in 2009, a 4.6% increase since 2000. Mandan is the largest city in Morton County with approximately 16,718 citizens. Per capita income for residents is $17,202 (100% of the North Dakota per capita income of $17,769), with a median household income of $50,812 (110% of the North Dakota median of $45,996).

Oliver County

The population of Oliver County was estimated at 1,643 in 2009, a 20.4% increase since 2000. Center is the largest city in Oliver County with approximately 678 citizens. Per capita income for residents is $16,271 (92% of the North Dakota per capita income of $17,769), with a median household income of $50,353 (109% of the North Dakota median of $45,996).

5.12 Cultural Resources

A Corps archeologist reviewed the proposed locations, and a file search revealed no recorded sites within the Areas of Potential Effect. A letter was sent (dated November 8, 2010) to the North Dakota State Historic Preservation Office (SHPO) and other potential interested parties.
under Section 106 of the National Historic Preservation Act. The SHPO recommended that two of the proposed sites be surveyed or monitored during vegetation removal activities, and a report forwarded to that office. No responses were received from other parties.

5.13 Sovereign Lands

According to North Dakota Century Code 61-33 all areas within the State, including beds and islands, lying within the ordinary high watermark (OHWM) of navigable lakes and streams are the sovereign land of North Dakota. Lands established to be riparian accretion or newly created dry land, as a result of permanent river retreat; pursuant to section 47-06-05 are considered to be above the OHWM and are not sovereign lands. All projects proposed to take place within the OHWM of navigable lakes and streams are required to receive the authorization of the State Engineer to construct or operate within these boundaries. A sovereign land permit must be acquired to complete the proposed projects within the OHWM of the Missouri River.

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 Geology/Physiography

6.1.1 Alternative 1 No Action
No impacts to the geology/physiography of the area would occur.

6.1.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
The proposed vegetation removal project would have minimal affects on the local geology/physiography resulting from removing vegetation from existing sandbars. These affects would not be considered significant.

6.2 Climate

6.2.1 Alternative 1 No Action
No impacts to the climate of the area would occur.

6.2.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
No change in climactic conditions is expected due to the proposed projects.

6.3 Soils and Prime Farmland

6.3.1 Alternative 1 No Action
No impacts or disturbance to the soils of the area would occur, other than from naturally occurring disturbances or current land uses.

6.3.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
Soils at the project locations are classified primarily as water (W) and riverine wash (RW). Disturbance to soils would be limited to the surface and cause by tracks from machinery working on the sandbars. No prime farmland exists at the proposed project site; therefore, none will be impacted. A Farmland Conversion Impact Rating Form (AD-1006) need not be completed.

6.4 Water Resources

6.4.1 Alternative 1 No Action
No impacts to the water resources of the area would occur, other than from naturally occurring disturbances or current land uses.

6.4.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
BMPs would be used to minimize any release of fuels or lubricants from construction equipment. A low toxicity herbicide, imazapyr, is being used as a pre-emergent and would be sprayed on relatively bare sand. The desired outcome is that imazapyr would remain within the sand in order to effectively slow or eliminate vegetative growth rates; however an insignificant amount may enter the water column due to runoff.

The acute toxicity of imazapyr for oral consumption is greater than 5,000 mg/kg. Chronic toxicity (90 days) for oral consumption in rodents was tested and there was no observable adverse effect from the highest dose tested of 1,784 mg/kg of body weight per day. It was noted that it is highly unlikely that imazapyr concentrations in drinking water would ever exceed levels that would be of concern to human health. See Appendix III for a fact sheet on Imazapyr.

Due to project having a minimal, if any, impact to water quality, it has been determined by the ND Department of Health that the project would not require a Section 401 Water Quality Certification. Impacts to water quality are not expected to be significant.

6.5 Wetlands/Riparian Habitat and Floodplains

6.5.1 Alternative 1 No Action
No impacts to wetlands/riparian habitat would occur.

6.5.2 Alternative 2 Remove Vegetation on Sandbars
Wetland vegetation typically surrounds the shoreline of sandbars and fluctuates annually as a part of the dynamic river system. As a result of vegetation removal, some temporary impacts would occur to wetland vegetation on the sandbars. Temporary impacts are not expected to exceed one growing season. No fill or discharged material would be placed into Waters of the U.S.; therefore a Section 404 or Section 10 permit is not required.
The temporary conversion of sandbar habitats for compliance with the BiOp would have insignificant impacts to wetlands when viewed in terms of these species’ recovery efforts and actions toward ecosystem management.

6.6 Threatened, Endangered, and Species of Concern

6.6.1 Alternative 1 No Action

Besides naturally occurring disturbances or as a result of current land use, no impacts to threatened, endangered and species of concern within the area would occur.

6.6.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

In a letter dated December 20, 2010, the USFWS provided a list of the listed species, proposed species, candidate species and designated critical habitat in order to facilitate the determination of affect on these species as a result of implementing proposed alternatives. The determination of direct affects of the proposed project on threatened, endangered and candidate species was based on species presence/absence and availability of potential habitat on or near the project area. The following determinations were assigned: no affect and may affect/not likely to adversely affect. Measures to avoid or mitigate potential future affects/impacts were identified unless “no affect” was determined. See Table 10 for a summary of the Biological Assessment for each of these species.

No affects are expected for the black-footed ferret, gray wolf, Dakota skipper or Sprague’s pipit as suitable habitat is not present at project locations. Potential habitat is present for the whooping crane, which may temporarily utilize complexes of wetland-cropland in the region while migrating. The project may affect, but would not likely adversely affect whooping cranes. To minimize potential impacts, workers will stop all work and notify the USFWS if a whooping crane is sighted within one mile of project location. In consultation with the USFWS, work may continue once the bird(s) have left the area. Pallid sturgeons are native to the Missouri River and may be found within the channel adjacent to project(s) locations. The projects may affect, but would not likely adversely affect pallid sturgeons. To reduce potential impacts to water quality, workers will minimize overspray into the Missouri River by using an ATV and/or backpack sprayer to apply herbicides to sandbars. The intent of the projects is to restore habitat for the least tern and piping plover, two federally listed species. A determination of “may affect, but not likely to adversely affect” is the accepted affect determination used by the USFWS, even if affects are anticipated to be beneficial. It is anticipated that making more suitable breeding habitat available will have a positive impact on least tern and piping plover productivity. An email received on March 16, 2011 from the USFWS concurs with the determinations as described above.
Table 10: Biological Assessment Summary for Federally-listed and Candidate Endangered and Threatened Species

<table>
<thead>
<tr>
<th>Common Name (Scientific Name)</th>
<th>Habitat Availability within Project Area/Rationale</th>
<th>Determination</th>
<th>Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Interior least tern (Sterna antillarum)</td>
<td>The purpose of the project is to restore nesting habitat for this species. All work would be performed either before or after the birds utilize affected sandbars.</td>
<td>May affect / Not likely to adversely affect.</td>
<td>Restoration of suitable nesting habitat may increase productivity.</td>
</tr>
<tr>
<td>Whooping crane (Grus americana)</td>
<td>Migrating cranes could potentially make stopovers along the banks and sandbars of the Missouri River. Project construction will likely occur during the migration season.</td>
<td>May affect / Not likely to adversely affect.</td>
<td>If a whooping crane is sighted, work would stop and the USFWS would be contacted.</td>
</tr>
<tr>
<td>Pallid sturgeon (Scaphirhynchus albus)</td>
<td>Project-related activities are not expected to affect water quality or quantity in the Missouri River. Some finely mulched vegetation may naturally enter water. Vegetation would be sprayed with Imazapyr. Imazapyr has a low toxicity to fish and invertebrates.</td>
<td>May affect / Not likely to adversely affect.</td>
<td>Use ATV and backpack sprayers to minimize herbicide overspray.</td>
</tr>
<tr>
<td>Black-footed ferret (Mustela nigipes)</td>
<td>The project area has no active or historically active prairie dog towns. No black-footed ferrets have been reintroduced to the region. No suitable habitat is available for future prairie dog towns.</td>
<td>No affect.</td>
<td>----</td>
</tr>
<tr>
<td>Gray wolf (Canis lupus)</td>
<td>The project area does not have large and contiguous forested cover or suitable prey base for this species. It is also unlikely that this species would transit the area due to distance from known populations. There have been no historical sightings within or near the project area.</td>
<td>No affect.</td>
<td>----</td>
</tr>
<tr>
<td>Piping plover (Charadrius melodus)</td>
<td>The purpose of the project is to restore nesting habitat for this species. All work would be performed either before or after the birds utilize affected sandbars.</td>
<td>May affect / Not likely to adversely affect.</td>
<td>Restoration of suitable nesting habitat may increase productivity.</td>
</tr>
<tr>
<td>Dakota skipper (Hesperia dakotae)</td>
<td>Dakota skippers are found on native prairies containing a high diversity of wildflowers and grasses. There is no suitable habitat at the project location(s).</td>
<td>No affect.</td>
<td>----</td>
</tr>
<tr>
<td>Sprague’s pipit (Anthus spraguei)</td>
<td>Sprague’s pipit nest in native and planted grassland and prefers at least 72 acres of undisturbed area. There is no suitable habitat at the project location(s).</td>
<td>No affect.</td>
<td>----</td>
</tr>
</tbody>
</table>
6.7 Vegetation and Invasive Species

6.7.1 Alternative 1 No Action
No impacts to vegetation within the area would occur, other than from naturally occurring disturbances or current land uses.

6.7.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
No significant impacts to sensitive plant species or their habitat are expected due to this project. Vegetation would be removed to restore ideal bare sand nesting habitat. A pre-emergent herbicide, Imazapry, would be applied to the sandbars following vegetation removal and should control the re-emergence of vegetation and colonization of noxious weeds on sandbars. These islands are actively monitored for bird activity throughout the nesting season which mostly coincides with the growing season. Contractors could be hired to control noxious weeds, if identified, by applying spot chemical treatments or hand pulling.

Under the advice of the NDGFD and in compliance with Aquatic Nuisance Species (ANS) rules, several preventative measures must be undertaken to control the spread of undesirable plant and animal species. Required measures include removing any and all aquatic vegetation from vessels, motors, trailers or construction equipment; all water shall be drained from bilge or confined spaces on vessels, boat motors or construction equipment; all species of ANS must be removed from vessel, motors, trailers or construction equipment and water must be drained from confined spaces on vessels, motors or construction equipment. A list of ANS can be found on the NDGFD website at http://gf.nd.gov/fishing/ans.html.

The entity undertaking the work must allow the NDGFD a reasonable opportunity to inspect any and all vehicles, vessels, pumps and equipment that would be used in the project in or on the waters of the state prior to those items being launched or placed in the waters of the state. A minimum of 72 hours notice is required.

6.8 Wildlife

6.8.1 Alternative 1 No Action
No impacts to wildlife within the area would occur, other than from naturally occurring disturbances or current land uses.

6.8.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide
Disturbance to wildlife due to noise, increased traffic and human presence may temporarily displace individuals during the construction period. It is expected that most species (i.e. medium to large mammals and birds) would disperse from project areas...
during construction and re-enter the area following completion of construction activities. These affects are not likely to cause long term declines in populations.

Minimal impacts are expected for migratory birds. All project activity would occur prior to or after the 2011 migration and nesting seasons. No nests for raptors or other migratory birds are known within the project area. No wetlands or crucial/unique wildlife habitats would be impacted for a significant amount of time.

6.9 Air Quality

6.9.1 Alternative 1 No Action

No impacts to air quality within the area would occur, other than from naturally occurring conditions, current land uses, and emissions.

6.9.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

Minor impacts to air quality would be associated only with construction period. Minor and temporary increases in dust and equipment exhaust are expected during construction. Equipment needed to construct the proposed sandbars would likely include ASV (all-surface vehicles), ATV (all-terrain vehicles) and watercraft. Due to the relatively short estimated construction period emissions from construction would not be expected to have a significant affect on air quality. No long term increases in emissions would occur. The proposed actions would not reduce air quality for the region.

6.10 Noise

6.10.1 Alternative 1 No Action

No impacts to noise within the area would occur, other than from naturally occurring conditions or current land uses.

6.10.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

The noise analysis is limited to changes in noise due to construction activities of the proposed actions. Construction noise would be intermittent and of short duration during normal work hours. This level of noise could be an annoyance to any persons or animals within 500 yards of the construction activity. No permanent residences are located within a half-mile of the proposed project. The proposed action would not impact ground noise levels for any long term duration. No significant impacts to short or long term ground noise levels are expected.
6.11 Socioeconomics

6.11.1 Alternative 1 No Action

No economic benefits to the area would occur if the proposed project would not be approved.

6.11.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

The proposed project is not expected to have measurable impacts on demographic distributions. No environmental or health impacts are expected for local human residents, since the population of the area is low with no residences or towns nearby the project area. Any minor affects to the local population would not disproportionately affect low income or minority components of the population.

6.12 Cultural Resources

6.12.1 Alternative 1 No Action

No impacts to cultural resources within the area would occur.

6.12.2 Alternative 2 Remove Vegetation on Sandbars and Apply Herbicide

No affects to cultural resources are expected from the proposed projects. All previously recorded sites are far enough away from the vegetation removal sites that they would not be affected by the project. Monitoring would occur simultaneously with vegetation removal work. A Corps archaeologist would brief workers on what to look for and be aware of during work activities and require that if cultural resources are discovered during construction or operation, work would stop immediately. Workers would secure the affected site and notify Corps archaeologists. Following project completion, a report would be prepared and forwarded to the North Dakota State Historical Preservation office.

6.13 Cumulative Affects

The combined incremental affects of human activity are referred to as cumulative impacts (40CFR 1508.7). While these incremental affects may be insignificant on their own, accumulated over time and from various sources, they can result in serious degradation to the environment. The cumulative impact analysis must consider past, present, and reasonably foreseeable actions in the study area. As required by NEPA, the Corps has prepared the following assessment of cumulative impacts related to the alternatives being considered in this EA.
Past actions have had dramatic and lasting effects on the Missouri River’s features, ecosystem and flow dynamics. Flood frequency and intensity has been reduced through the installation of dams, levees and dikes and sections of the river have been channelized for navigation. Sandbar habitat has been lost due to vegetative encroachment, erosion and high summer water levels. In addition, the formations of new inter-channel and floodplain features have been subdued due to changes in the flow regime, bank stabilization, human development and other factors.

Presently, no ESH construction or vegetation removal projects have been undertaken between RM 1304.0 and RM 1375.0. Vegetation removal and chemical spraying projects were completed in 2006 through 2008 in the headwaters of Lake Oahe, between RM 1284.0 and RM 1293.0. Results in 2006 and 2007 indicate that nesting increased on some restored sandbars and decreased on others. Some of these sandbars were initially densely covered with vegetation and grasses to the point where even after vegetation removal the remaining stubble would have been too dense for the birds to use. Even though the birds may not have chosen these areas to nest, the treatment was effective by removing predator habitat and giving the birds a clear view of approaching predators. The Garrison Dam flow releases declined from 2006 to 2008, which exposed more nesting habitat in the river and reservoirs. As a result of the lowered water elevation, the quantity of nesting habitat within the river channel and reservoirs increased, which may have impacted study results.

It is reasonably foreseeable that natural processes will continue to be impeded by the impoundments constructed on the Missouri River mainstem. Reduced flood frequency and flow variability limits the ability of sandbars to naturally form and receive the beneficial effects of scouring from periodic high flows, which reduces vegetation growth. Under the current ESH program, it is possible to avoid impacts to most other sensitive resources on the system, thereby eliminating any significant impacts to non-target resources. Through coordination efforts in selecting site locations, the Recommended Alternative (Alternative 2) avoids impacts to river hydrology, erosion rates, flood frequency, non-target fish and wildlife and cultural resources. Impacts to air and water quality are below threshold levels. Noise and recreation impacts are largely contained to within a half-mile radius of the restoration sites and only occur within the construction period. Future efforts may require overtopping of sandbars to cover vegetation stubble and increase elevation of sandbars in order to provide suitable nesting habitat during high flow events. In addition to the difficulty in predicting future water elevations, emerged sandbars are continually being eroded each year by wind and water.

Approval of the Recommended Alternative is not expected to add significantly to cumulative impacts on resources in the region. The project intends to provide a beneficial impact to federally listed species by increasing the amount of habitat available for nesting, thus increasing productivity and progressing towards the goal of recovery and delisting. The Recommended Alternative may also add an incremental benefit when
combined with other restoration actions by the State of North Dakota, the USFWS and the Missouri River Recovery Program.

No additional cumulative impacts are expected under Alternative 1, the no-action alternative, other than from those occurring from other current and future land uses described in sections 6.13.1 and 6.13.2.

7.0 CONSULTATION AND COORDINATION

Scoping letters and responses are presented in Appendix II. Six comments were received within the review period and are summarized below (Table 11). This EA was circulated for a 14-day review and comment period to the following concerned agencies and individuals, those comments were also incorporated into Table 11.

Table 11: Summary of EA Review and Comments

<table>
<thead>
<tr>
<th>Agency Contact</th>
<th>Comment &amp; Response to Comment (italicized)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dacotah Chapter of the Sierra Club</td>
<td>No comments.</td>
</tr>
<tr>
<td>Friends of Lake Sakakawea</td>
<td>No comments.</td>
</tr>
<tr>
<td>Terry Fleck</td>
<td>No comments.</td>
</tr>
<tr>
<td>MHA Nation – Three Affiliated Tribes</td>
<td>No comments.</td>
</tr>
<tr>
<td>Tex Hall, Chairman</td>
<td>No comments.</td>
</tr>
<tr>
<td>Mr. Perry “No Tears” Brady</td>
<td>No comments.</td>
</tr>
<tr>
<td>Missouri River Joint Water Board</td>
<td>No comments.</td>
</tr>
<tr>
<td>Ken Royse, Director</td>
<td>No comments.</td>
</tr>
<tr>
<td>North Dakota Chapter of the Wildlife Society</td>
<td>No comments.</td>
</tr>
<tr>
<td>North Dakota Department of Health</td>
<td>A 401 water quality certification is not required for this project Noted.</td>
</tr>
<tr>
<td>Mike Sauer, Water Quality Special Projects Manager</td>
<td></td>
</tr>
<tr>
<td>North Dakota Game &amp; Fish Department</td>
<td>Comply with aquatic nuisance guidelines to avoid the spread of undesirable plants and animal species. Must contact Department at least 72 hours prior to work commencing to allow time for inspection. Noted.</td>
</tr>
<tr>
<td>Paul Schadewald, Chief</td>
<td></td>
</tr>
<tr>
<td>Steve Dyke, Conservation Biologist</td>
<td>No comments.</td>
</tr>
<tr>
<td>Dave Fryda, Conservation Biologist</td>
<td>No comments.</td>
</tr>
<tr>
<td>Dan Halstead, Conservation Biologist</td>
<td>No comments.</td>
</tr>
<tr>
<td>Bruce Kreft, Conservation Biologist</td>
<td>No comments.</td>
</tr>
<tr>
<td>Patrick Isakson, Conservation Biologist</td>
<td>No comments.</td>
</tr>
<tr>
<td>North Dakota Parks &amp; Recreation Department</td>
<td>Based on review of ND Natural Heritage biological conservation database, multiple occurrences of plant or animal species of concern or other significant ecological communities are within a one-mile radius of project area.</td>
</tr>
<tr>
<td>Jesse Hanson, Manager</td>
<td></td>
</tr>
<tr>
<td>Agency Contact</td>
<td>Comment &amp; Response to Comment (italicized)</td>
</tr>
<tr>
<td>------------------------------------------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td><strong>Agency Contact</strong></td>
<td></td>
</tr>
<tr>
<td><strong>North Dakota State Historical Society</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>Merlin Paaverud, Jr., SHPO Officer</td>
<td>However the species that may potentially be impacted are the terns and plovers and it is the intent to restore habitat on island prior to the arrival of these species in spring 2011. Recommend impacted areas be re-vegetated with native species.</td>
</tr>
<tr>
<td><strong>North Dakota State Land Department</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>Mike Brand, Manager</td>
<td></td>
</tr>
<tr>
<td><strong>North Dakota State Water Commission</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>John Paczkowski, Chief of Regulatory</td>
<td>Recommended a Class III Cultural Resource Inventory for project area at RM 1304.0 and 1374.5. Monitoring of the area during project would also be acceptable. Corps would submit a report noting findings or lack thereof following project completion.</td>
</tr>
<tr>
<td>Jerry Heiser, Regulatory Specialist</td>
<td></td>
</tr>
<tr>
<td>Kelly Casteel, Regulatory Specialist</td>
<td></td>
</tr>
<tr>
<td><strong>U.S. Dept. of Defense, Corps of Engineers</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>Patsy Crooke, Project Manager, ND Regulatory Office</td>
<td>Concurrence that selected sites appear to be good choices based on constraints of restoring ESH in Segment four of the Missouri River. Stated a sovereign lands permit would be required. Concerns with overtopping methodology (alternative considered, but dismissed).</td>
</tr>
<tr>
<td><strong>U.S. Dept. of Interior, Bureau of Indian Affairs</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>Alice Harwood</td>
<td>Sovereign land permit acquired for project locations. No comment.</td>
</tr>
<tr>
<td><strong>U.S. Dept. of Interior, Bureau of Land Management</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>North Dakota Field Office, Dickinson, ND</td>
<td>No comments.</td>
</tr>
<tr>
<td><strong>U.S. Dept. of Interior, Fish and Wildlife Service</strong></td>
<td><strong>Noted.</strong></td>
</tr>
<tr>
<td>Mike Olson, Missouri River Coordinator, ND Field Office</td>
<td>Listed species list. Avoid impacts to terns, plovers and migratory birds by constructing outside nesting season; if unavoidable, perform survey prior to work commencing. Ensure herbicide residuals are not harmful to river ecosystem.</td>
</tr>
<tr>
<td>Carol Aron, Fish &amp; Wildlife Biologist</td>
<td>Concurrence of biological assessment determination.</td>
</tr>
</tbody>
</table>
8.0 STATUS OF ENVIRONMENTAL COMPLIANCE

Archeological and Historic Preservation Act, as amended, 16 U.S.C. 469, et seq, and National Historic Preservation Act, as amended, 16 U.S.C. 470a, et seq. In compliance. Coordination with the North Dakota State Historic Preservation Office (SHPO) resulted in a letter dated November 22, 2010, requesting that a Class III pedestrian survey or monitoring during the project be completed. This request was forwarded to Ms. Sandra Barnum, Cultural Resources Specialist with Corps of Engineers – Omaha District. Ms. Barnum coordinated efforts to ensure that monitoring will take place while the project is ongoing and a report will be completed and sent to the SHPO.

If a discovery is made during construction, all activity would be halted around the discovery site and a Corps archaeologist would inform the North Dakota SHPO of the discovery. The Corps archaeologist would examine the discovery area as soon as possible and then consult with the North Dakota SHPO about the nature of the discovery and National Register of Historic Places eligibility of the area prior to resumption of any activity near the site.

Bald and Golden Eagle Protection Act, 16 U.S.C. Sec. 668, 668 note, 669a-668d. In compliance. This Act prohibits the taking or possession of and commerce in bald and golden eagles, with limited exceptions for the scientific or exhibition purposes, for religious purposes of Indian tribes, or for the protection of wildlife, agriculture or preservation of the species. The Corps has, and will continue, to coordinate with the USFWS and the appropriate state agencies to avoid “taking” the species during construction activities.

Clean Air Act, as amended, 42 U.S.C 1857h-7, et seq. In compliance. Air quality is not expected to be impacted to any measurable degree by construction activities associated with the project.

Clean Water Act, as amended, (Federal Water Pollution Control Act) 33 U.S.C. 1251, et seq. In compliance. The objective of this Act is to restore and maintain the chemical, physical, and biological integrity of the Nation’s waters (33 U.S.C. 1251). The Corps regulates discharges of dredge or fill material into waters of the United States pursuant to Section 404 of the Clean Water Act. This permitting authority applies to all waters of the United States including navigable waters and wetlands. The Corps regulatory office in North Dakota has stated that a section 404 permit is not required as fill or discharge material will not be placed into a waters of the United States; therefore, a 401 water quality certification is not needed. An email received from the ND State Health Department on March 9, 2011 verifies a water quality certification is not required.

Comprehensive Environmental Response Compensation and Liability Act (CERCLA). Not applicable. Typically CERCLA is triggered by (1) the release or substantial threat of a release of a hazardous substance into the environment; or (2) the release or substantial threat of a release of
any pollutant or contaminant into the environment which presents an imminent threat to the public health and welfare. To the extent such knowledge is available, 40 CFR Part 373 requires notification of CERCLA hazardous substances in a land transfer. This project would not involve any real estate transactions.

Endangered Species Act, as amended, 16 U.S.C. 1531, et seq. *In compliance.* The Corps sent correspondence to the USFWS requesting concurrence with “may affect/beneficial affect”, “may affect/not likely to adversely affect” and “no affect” determination to listed species. In response, the USFWS provided the Corps with an email dated March 16, 2011. In that email, the USFWS concurred with the Corps’ determinations.

Environmental Justice (E.O. 12898). *In compliance.* Federal agencies shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations in the United States. The project does not disproportionately impact minority or low-income populations.

Farmland Protection Policy Act (Subtitle I of Title XV of the Agriculture and Food Act of 1981), effective August 6, 1984. *In compliance.* Compliance with this act also will satisfy the requirements set forth in Council on Environmental Quality (CEQ) Memorandum of August 11, 1980, Analysis of impacts on Prime or Unique Agricultural Lands in Implementing NEPA. This project would not involve the conversion of prime farmland to non-agricultural use.


Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq. *In compliance.* The USFWS and North Dakota Game and Fish Department were coordinated with for this project. The USFWS concurred with the Corps’ determination of “may affect/beneficial affect”, “may affect/not likely to adversely affect” and “no affect” determination to listed species. The North Dakota Game and Fish Department response only provided guidance with respect to aquatic nuisance species.

Floodplain Management (E.O. 11988). *In compliance.* On December 13, 2010, Mr. Randall Behm of the Flood Risk and Floodplain Management Section of the U.S. Army Corps of Engineers sent a letter to Mr. Doug Hogan, Director of Public Works in Jamestown, North Dakota informing him that the proposed project would result in a “no rise” or risk to the floodplain.

Migratory Bird Treaty Act of 1918 as amended, 16 U.S.C. 703-711, et seq. *In compliance.* The Migratory Bird Treaty Act of 1918 (MBTA) is the domestic law that affirms, or implements, the United States commitment to four international conventions with Canada, Japan, Mexico and Russia for the protection of shared migratory bird resources. The MBTA governs the taking, killing, possession, transportation, and importation of migratory birds, their eggs, parts and nests.
The take of all migratory birds is governed by the MBTA's regulation of taking migratory birds for educational, scientific, and recreational purposes and requiring harvest to be limited to levels that prevent over utilization. Executive Order 13186 (2001) directs executive agencies to take certain actions to implement the act. The Corps will avoid impacts to migratory birds, and their nests, to the greatest extent possible. If construction occurs during the primary nesting season of migratory birds in North Dakota, surveys would be conducted of trees, shrubs and herbaceous vegetation to be removed to ensure that no active nests are present. If active nests are present, those trees, shrubs and herbaceous vegetation will be avoided.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq. *In compliance.* This environmental assessment and finding of no significant impact (FONSI) have been prepared for the proposed action.

Noise Control Act of 1972, 42 U.S.C. Sec. 4901 to 4918. *In compliance.* This Act establishes a national policy to promote an environment for all Americans free from noise that jeopardizes their health and welfare. Federal agencies are required to limit noise emissions to within compliance levels. Noise emission levels at the project site will temporarily increase above current levels due to construction; however, appropriate measures will be taken to keep the noise level within compliance levels (e.g., performing construction during daylight hours, avoiding idling of machinery when not in use, etc.).

Protection of Wetlands (E.O.11990). *In compliance.* The removal of vegetation from sandbars would not require the placement of fill in any wetlands. Temporary impacts to wetland vegetation may occur and would last approximately one growing season.

Rivers and Harbors Act, 33 U.S.C. 401, et seq. *Not applicable.* A Section 10 permit is not required for Corps’ projects.

Watershed Protection and Flood Prevention Act, 16 U.S.C. 1101, et seq. *Not Applicable.* The contractor will provide the Corps with an erosion and sedimentation control plan prior to the start of construction. Best Management Practices will be implemented to minimize erosion and sedimentation potential.

Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq. *Not applicable.* The area in which the proposed activity would occur is not a wild or scenic river, nor is it in an area potentially eligible for inclusion in the wild and scenic system.

CEQ Memorandum, August 10, 1980, Interagency Consultation to Avoid or Mitigate Adverse Effects on Rivers in the Nationwide Rivers Inventory. *Not applicable.* Adverse impacts are not expected from restoring sandbars within the Missouri River.
APPENDIX I

SITE LOCATION MAPS
APPENDIX II

CONSULTATION AND COORDINATION
CORRESPONDANCE
Mr. John Shelman, CENWO-PM-AC
U.S. Army Corps of Engineers, Omaha District
1616 Capitol Avenue
Omaha, Nebraska 68201-4901

RE: Scoping for ESH work in North Dakota

Dear Mr. Shelman:

We are in receipt of a letter dated November 8, 2010, addressed to Michael Olson, U.S. Fish and Wildlife Service (Service) Missouri River Coordinator from Brad Thompson, Chief, Environmental Resources and Missouri Recovery Program and Plan Formulation Planning Branch, U.S. Army Corps of Engineers. The letter is a scoping request concerning a proposal to remove vegetation from existing sandbars between river mile (RM) 1375 and RM 1300 along the boundaries of Burleigh/Morton, Mercer/McLean, and McLean/Oliver Counties, North Dakota, to provide breeding habitat for the federally listed endangered Interior least tern and threatened piping plover. Please note that future correspondence and project coordination of projects in North Dakota should be addressed to the field supervisor, Ecological Services, North Dakota Field Office. Vegetation removal is proposed for the following approximate locations:

- RM 1374.5 (150 acres)
- RM 1352.5 (49 acres)
- RM 1347.5 and 1348.5 (147 acres)
- RM 1343.5 (46 acres)
- RM 1304.0 (50 acres)

The letter requests an updated list of the listed, proposed, candidate species and designated critical habitat in order to help the Corps develop an Environmental Assessment (EA). We offer the following comments under the authority of and in

A list of federally endangered and threatened species that may be present within the proposed project’s area of influence is enclosed. This list fulfills requirements of the Service under Section 7 of the ESA. This list remains valid for 90 days.

The Service is highly supportive of work to provide more habitat throughout the Missouri River system, especially in the Garrison River reach where higher flows are likely to inundate much of the remaining sandbars during the 2011 nesting season. However, we are concerned with the proposal to flatten existing sand dunes. From our on-the-ground observations, sand dunes appear to be composed primarily of fine sugar sand which readily blows around and which both least terns and piping plovers appear to avoid. It is possible that spreading the material throughout the island may reduce, rather than enhance, its suitability. We recommend that further analysis of this option be undertaken before it is implemented. Further, if you do opt to consider flattening existing sand dunes, we recommend that it be applied at first to only one island or portion of an island until the Corps can determine how the birds respond.

In order to avoid impacts to nesting least terns and piping plovers, we recommend that all work be performed outside of the least tern and piping plover nesting season (April 1-August 15). With coordination with the Service, work can be done during that period if it is at least one-half mile from active nesting sites, or after monitoring has determined that all birds have fledged from the area.

**Bald and Golden Eagles**

The BGEPA, prohibits anyone from taking bald eagles, including their parts, nests, or eggs without a permit issued by the Secretary of the Interior. The Act provides criminal and civil penalties for persons who take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or in any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof. The Act defines take as pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb. "Disturb means to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle, 2) a decrease in its productivity, by substantially interfering with normal breeding, feeding, or sheltering behavior, or 3) nest abandonment, by substantially
interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts that result from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagles return, such alterations agitate or bother an eagle to a degree that injures an eagle or substantially interferes with normal breeding, feeding, or sheltering habits and causes, or is likely to cause, a loss of productivity or nest abandonment.

Especially early in the nesting season, eagles can be very sensitive to disturbance near the nest site and may abandon their nest as a result of low disturbance levels, even from foot traffic. A buffer of at least one-half mile should be maintained for all bald and golden eagle nests. A permit is required for any take of golden eagles or their nests. Permits to take golden eagles or their nests are available only for legitimate emergencies and as part of a program to protect golden eagles.

If the work will be done during the eagle nesting season (February 1 through August 15), we recommend that the Corps perform an eagle survey within a one-half mile line of sight of the islands prior to starting any work. Surveys should be done from approximately March 1-May 15, before leaf-out, so that nests are most visible. The North Dakota Game and Fish Department (NDG&F) tracks bald eagle nests in the State, and we recommend that the Corps contact NDG&F to determine if they are aware of any nests in the area prior to surveying. Any nests found should be reported to this office and NDG&F. If no nesting raptors are present, work can be done prior to April 1, when least terns and piping plovers start to arrive.

**Migratory Birds**

To minimize disturbance to migratory birds, the Service recommends that you schedule work for late summer or fall/early winter so as not to disrupt waterfowl or other wildlife during the breeding season (February 1 to July 15). If work is proposed to take place during the breeding season or at any other time which may result in the take of migratory birds, eggs, or active nests, the Service recommends that the project proponent arrange to have a qualified biologist conduct a field survey of the affected habitats to determine the absence or presence of nesting migratory birds. If nesting migratory birds are found, we request you contact this office, suspend construction, or take other measures, such as maintaining adequate buffers, to protect the birds until the young have fledged. The Service further recommends that field surveys for nesting birds, along with information regarding the qualification of the biologist(s) performing the surveys, and any avoidance measures implemented at the project site, be thoroughly documented and that such documentation be shared with the Service and maintained on file by the Corps.
The EA should include a plan for disposal of the vegetation from the islands. It may be beneficial to the fish community to dispose of the material directly into the river to provide nutrients and structure for fish to use. However, prior to placing the material in the river, we recommend that the Corps confirm that the herbicide does not have residuals which may be harmful to the river ecosystem.

The Service would like to stress the importance of the Missouri River system in North Dakota to recovery of both least terns and piping plovers. We encourage the Corps to continue to look for other opportunities to provide nesting habitat on the system, including ESH construction both in the Garrison reach and in the headwaters of Lake Oahe. In addition, The Nature Conservancy (TNC) has some land along the Missouri River in the Garrison River reach that they may be willing to make available for a river-widening project, including the option of creating some ESH. We recommend that the Corps contact TNC to explore potential future project opportunities.

The Service appreciates the opportunity to comment on this proposal. If you have questions regarding our comments, please contact Carol Aron of my staff at (701) 250-4481, or at the letterhead address.

Sincerely,

Jeffrey K. Towner
Field Supervisor
North Dakota Field Office

Enclosures

cc: Missouri River Coordinator, Bismarck
   (Attn: Mike Olson)
   Director, ND Game and Fish Department, Bismarck
   (Attn: Steve Dyke)
   The Nature Conservancy, Center
   (Attn: Eric Rosenquist)
ENDANGERED SPECIES

Birds

Interior least tern (Sternula antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Whooping crane (Grus americana): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Gray wolf (Canis lupus): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

CANDIDATE SPECIES

Birds

Sprague’s Pipit (Anthus spragueii): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).
Invertebrates

Dakota skipper (*Hesperia dacotae*): Found in native prairie containing a high diversity of wildflowers and grasses. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple and upright coneflowers and blanketflower.

**DESIGNATED CRITICAL HABITAT**

**Birds**

Piping Plover - Lake Oahe - Critical habitat includes sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.
ENDANGERED SPECIES

Birds

1. Interior least tern (Sternula antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

2. Whooping crane (Grus americana): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Black-footed ferret (Mustela nigripes): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future.

Gray wolf (Canis lupus): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

1. Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

CANDIDATE SPECIES
Birds

Sprague’s Pipit (Anthus spragueii): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).

DESIGNATED CRITICAL HABITAT

Birds

Piping Plover - Lake Oahe - Critical habitat includes sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.
ENDANGERED SPECIES

Birds

Interior least tern (Sterna antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Whooping crane (Grus Americana): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Black-footed ferret (Mustela nigripes): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future.

Gray wolf (Canis lupus): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

CANDIDATE SPECIES
Birds

Sprague’s Pipit (*Anthus spragueii*): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).

**DESIGNATED CRITICAL HABITAT**

Birds

Piping Plover - Lake Sakakawea - Critical habitat includes sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.
ENDANGERED SPECIES

Birds

Interior least tern (*Sternula antillarum*): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Whooping crane (*Grus Americana*): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (*Scaphirhynchus albus*): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Gray wolf (*Canis lupus*): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

Piping plover (*Charadrius melodus*): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

CANDIDATE SPECIES

Birds

Sprague’s Pipit (*Anthus spragueii*): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).

Invertebrates
Dakota skipper (*Hesperia dacotae*): Found in native prairie containing a high diversity of wildflowers and grasses. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple and upright coneflowers and blanketflower.

**DESIGNATED CRITICAL HABITAT**

**Birds**

Piping Plover - Lake Sakakawea - Critical habitat includes sparsely vegetated shoreline beaches, peninsulas, islands composed of sand, gravel, or shale, and their interface with the water bodies.
ENDANGERED SPECIES

Birds

Interior least tern (Sternula antillarum): Nests along midstream sandbars of the Missouri and Yellowstone Rivers.

Whooping crane (Grus americana): Aransas-Wood Buffalo Population (264 birds) occurs in North Dakota counties during spring and fall migration between breeding and wintering areas. Whooping cranes prefer to roost overnight in shallow open water wetland habitat with good visibility during migration stopovers.

Fish

Pallid sturgeon (Scaphirhynchus albus): Known only from the Missouri and Yellowstone Rivers. No reproduction has been documented in 15 years.

Mammals

Black-footed ferret (Mustela nigripes): Exclusively associated with prairie dog towns. No records of occurrence in recent years, although there is potential for reintroduction in the future.

Gray wolf (Canis lupus): Occasional visitor in North Dakota. Most frequently observed in the Turtle Mountains area.

THREATENED SPECIES

Birds

Piping plover (Charadrius melodus): Nests on midstream sandbars of the Missouri and Yellowstone Rivers and along shorelines of saline wetlands. More nest in North Dakota than any other state.

CANDIDATE SPECIES

Birds
Sprague's Pipit (*Anthus spragueii*): Nests in native and planted grassland. Prefers patches of grassland at least 72 acres (29 hectares).

**Invertebrates**

Dakota skipper (*Hesperia dacotae*): Found in native prairie containing a high diversity of wildflowers and grasses. Habitat includes two prairie types: 1) low (wet) prairie dominated by bluestem grasses, wood lily, harebell, and smooth camas; 2) upland (dry) prairie on ridges and hillsides dominated by bluestem grasses, needlegrass, pale purple and upright coneflowers and blanketflower.

**DESIGNATED CRITICAL HABITAT**

**Birds**

Piping Plover - Missouri River - Critical habitat includes sparsely vegetated channel sandbars, sand and gravel beaches on islands, temporary pools on sandbars and islands, ant the interface with the river.
Johnathan:

Attached immediately below is my staff's response to your request for concurrence, with the following qualifier.

For the piping plover and least tern, the accepted determination should be "may affect, not likely to adversely affect", although all effects are anticipated to be beneficial. If you agree with that slight modification to your effect determination and our concurrence with same, no further consultation is required.

Regards,
Jeff

Jeffrey K. Towner, Field Supervisor
Ecological Services
U.S. Fish & Wildlife Service
3425 Miriam Avenue
Bismarck ND 58501
Telephone: 701-250-4481 ext. 508
Fax: 701-355-8513

"We do not inherit the earth from our ancestors, we borrow it from our children." --Native American Proverb

----- Forwarded by Jeffrey Towner/R6/FWS/DOI on 03/16/2011 04:02 PM -----

Carol
Aron/R6/FWS/DOI

03/16/2011 03:20 Jeffrey Towner/R6/FWS/DOI@FWS
PM cc

Subject

Fw: ND ESH Vegetation Removal (UNCLASSIFIED)

Jeff, I have reviewed the attached document and concur with the Corps' determinations as follows:
Dear John,

The Service has reviewed the Corps' determination of affects for sandbar habitat manipulation in North Dakota to provide breeding habitat for the least tern and piping plover.

The Service concurs with the Corps' determination of "May affect/beneficial affect" for the interior least tern and piping plover.

The Service concurs with the Corps' determination of "May affect, not likely to adversely affect" for the whooping crane. This concurrence is predicated on all work being stopped within one-mile of a whooping crane sighting and the Service being contacted. In consultation with the Service, work may continue once the bird(s) has left the area.

The Service concurs with the Corps' determination of "May affect, not likely to adversely affect" for the pallid sturgeon. This concurrence is predicated on the Corps using ATV and backpack sprayers to minimize herbicide overspray.

The Service acknowledges the Corps "No effect" for the black-footed ferret, gray wolf, Dakota skipper, and Sprague's pipit.

Thank you for the opportunity to review the proposed project. We hope that the vegetation clearing will provide habitat for both species to successfully nest. If you have any questions, feel free to contact myself or Carol Aron of my staff.

Carol Aron
U.S. Fish and Wildlife Biologist
3425 Miriam Avenue
Bismarck, ND 58501
Telephone: (701) 355-8506
Fax: (701) 355-8513
E-mail: Carol_Aron@fws.gov

"Anyone can love a mountain, but it takes a soul to love the prairie."
- Variously attributed
----- Forwarded by Carol Aron/R6/FWS/DOI on 03/16/2011 03:12 PM -----
Carol,

See attached .pdf. I have amended the whooping crane rationale and mitigation text as we discussed. Thanks for the quick turnaround.

-John

-----Original Message-----
From: Shelman, Johnathan A NWO
Sent: Monday, March 14, 2011 9:19 AM
To: 'Carol_Aron@fws.gov'
Subject: ND ESH Vegetation Removal (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Carol,

Nice to see you at the conference last week. I'm attaching a determination of affect table for the vegetation removal projects within the Garrison Reach of the Missouri River, ND. The species analyzed for affect were derived from a scoping response letter the USFWS provided on 20 DEC 2010. More text references the table within the appropriate section(s) in the EA that will be available for review by the end of this week. Please advise on concurrence of affect as outlined in the attached table.

I think you're pretty familiar with the project locations and type of work that will be completed. One concern mentioned in the USFWS scoping response indicated unfavorable nesting habitat would be created by pushing around some of those "sand dunes" that are currently on the bars due to substrate content (sugar sand). To alleviate this concern, we will not overtop with existing sand at sandbar locations. Operations will be limited to mowing, mulching, removing large vegetative debris and spraying mowed areas with a low toxicity herbicide, likely Imazapyr. Helicopters will not be used to apply herbicide, which should reduce overspray. Spraying would occur from an ATV or backpack sprayer. If you need additional information, please give me a call.

Thanks,

John Shelman

Environmental Resource Specialist
U.S. Army Corps of Engineers
CENWO-PM-AC
1616 Capitol Ave.
Omaha, NE 68102
T: (402) 995 2708
F: (402) 995-2758
johnathan.a.shelman@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE
December 8, 2010

US Army Corp of Engineers, Omaha District
ATTN: John Sherman, CENWO-PM-AC
1616 Capitol Ave
Omaha, Nebraska 68102-4901

Dear Mr. Sherman,

RE: Restoration of Emergent Sandbar Habitat

The North Dakota Game and Fish Department (Department) has the following comments of the provided scoping letter relating to the planning and evaluation of restoring emergent sandbar habitat (ESH) to the Missouri River in North Dakota. The Department has worked closely with the US Army Corp of Engineers (Corp) coordinating the progression of the ESH program at a number of interagency meetings and feel that our comments have been considered in that venue. The Department does offer one comment that was not discussed in these meeting related to the logistics of this environmental assessment.

Effective April 1, 2008, Aquatic Nuisance Species (ANS) rules were enacted by the Department. These new regulations are to prevent the introduction of undesirable species of plants and animals. Preventive measures are now required to bring equipment into the state. State law allows for fines up to $1,000 and the confiscation of equipment.

Required measures include removing any and all aquatic vegetation from vessels, motors, trailers, or construction equipment; all water shall be drained from bilge or confined spaces on vessels, boat motors or construction equipment; all species of ANS (this list can be found at the Department’s website) must be removed from vessel, motors, trailers or construction equipment and water must be drained from confined spaces on vessels, motors, or construction equipment. These ANS preventative
measures extend to any and all vehicles, vessels, trailers, pumps, and such equipment that will be used in the project or any/all construction efforts connected with this project in or on the waters of the State. This requirement should be included if occurring during the open water season or if the operation proceeds on the ice pack.

The contractor or his agents or subcontractors must provide the Department a reasonable opportunity to inspect any and all vehicles, vessels, pumps, and equipment that will be used in the project in or on the waters of the state prior to those items being launched or placed in the waters of the state. A minimum of 72 hours notice must be provided to the Department for scheduling an inspection. The Department’s Special Project Biologist, Mr. Lynn Schlueter, is to be contacted at the Devils Lake Office (701-662-3617) for equipment inspections or any additional information regarding ANS prevention protocols.

Sincerely,

[Signature]

Paul Schadewald
Chief
Conservation and Communication

pti
December 8, 2010

U.S. Army Corps of Engineers, Omaha District
ATTN: John Shelman, CENWO-PM-AC
1616 Capitol Avenue
Omaha, NE 68102-4901

RE: Restoration of Emergent Sandbar Habitat Project

Dear Mr. Shelman:

The North Dakota Parks and Recreation Department (the Department) has reviewed the above referenced project to restore Emergent Sandbar Habitat located on sandbars in the Missouri River in Oliver, McLean, Burleigh, Morton and Mercer Counties.

Our agency scope of authority and expertise covers recreation and biological resources (in particular plant and animal species of concern and significant ecological communities). With some reservation, the Department supports the Corps’ project to restore Emergent Sandbar Habitat (ESH) which will provide foraging and nesting habitat for the interior least tern and piping within the Missouri River in North Dakota. We have concerns with how the mechanical and chemical manipulation of the sandbars will affect native species within and adjacent to the river. Bald eagles nest along the river adjacent to project area. As bald eagles are sensitive to disturbances, we recommend that the Corps perform all work outside of the active nesting period (February – August 15). In addition, we suggest that if construction is to be performed during bald eagle nesting season that it be conducted at least .5 miles away from and outside of the line-of-sight of any active bald eagle nests. If chemical treatment is utilized, how does the Corps propose to prevent adverse impacts to non-target species?

We applaud the Corps for its leaderships and dedication for monitoring Missouri River least tern and piping plover populations and productivity surveys. We assume the Corp will continue to monitor the least terns and piping plovers but would recommend that surveys on the ESH complexes include specific data collection that will allow for assessments on the longevity and condition of the islands and sandbars (vegetation encroachment, loss to erosion). The removal of vegetation on the islands and sandbars could encourage the proliferation of noxious and invasive species. We encourage the Corps to develop preventative measures, monitoring and/or implementation plans for the management of invasive species ensuring for a timely and effective control of noxious and invasive species.

The North Dakota Natural Heritage biological conservation database has been reviewed to determine if any current or historical plant or animal species of concern or other significant ecological communities are known to occur within an approximate one-mile radius of the project area. Based on this review, multiple occurrences have been identified within or adjacent to the project area. Please see the attached spreadsheet and map for more specific information on these occurrences. We defer further comments regarding animal species to the North Dakota Game and Fish Department and the United States Fish and Wildlife Service.

Because this information is not based on a comprehensive inventory, there may be species of concern or otherwise significant ecological communities in the area that are not represented in the database. The lack of data for any project area cannot be construed to mean that no significant features are present. The absence of data may indicate that the project area has not been surveyed, rather than confirm that the area lacks natural heritage resources.

We appreciate your commitment to rare plant, animal and ecological community conservation, management and interagency cooperation to date. For additional information please contact Kathy Duttenhefner (701-328-5370 or kdhuttenhefner@nd.gov) of our staff. Thank you for the opportunity to comment on this proposed project.

Sincerely,

[Signature]

Jesse Hanson, Manager
Planning and Natural Resources Division

R:USNDNH*2010-270 CD/1202/DL1210/rev.KD

[Play in our backyard!]
North Dakota Natural Heritage Inventory Biological and Conservation Data Disclaimer

The quantity and quality of data collected by the North Dakota Natural Heritage Inventory are dependent on the research and observations of many individuals and organizations. In most cases, this information is not the result of comprehensive or site-specific field surveys; many natural areas in North Dakota have never been thoroughly surveyed, and new species are still being discovered. For these reasons, the Natural Heritage Inventory cannot provide a definite statement on the presence, absence, or condition of biological elements in any part of North Dakota. Natural Heritage data summarize the existing information known at the time of the request. Our data are continually upgraded and information is continually being added to the database. This data should never be regarded as final statements on the elements or areas that are being considered, nor should they be substituted for on-site surveys.

**Estimated Representation Accuracy**

Value that indicates the approximate percentage of the Element Occurrence Representation (EO Rep) that was observed to be occupied by the species or community (versus buffer area added for locational uncertainty). Use of estimated representation accuracy provides a common index for the consistent comparison of EO reps, thus helping to ensure that aggregated data are correctly analyzed and interpreted.

- Very high (>95%)
- High (>80%, <= 95%)
- Medium (>20%, <= 80%)
- Low (>0%, <= 20%)
- Unknown
- (null) - Not assessed

**Precision**

A single-letter code for the precision used to map the Element Occurrence (EO) on a U.S. Geological Survey (USGS) 7.5’ (or 15’) topographic quadrangle map, based on the previous Heritage methodology in which ECIs were located on paper maps using dots.

- S - Seconds: accuracy of locality mappable within a three-second radius; 100 meters from the centerpoint
- M - Minute: accuracy of locality mappable within a one-minute radius; 2 km from the centerpoint
- G - General: accuracy of locality mappable to map or place name precision only; 8 km from centerpoint
- U - Unmappable
Luke Wallace, Biologist
USACE, Omaha District
Environmental Resources and MRRP Plan Formulation
215 N. 17th St.
Omaha, Nebraska 68102

Dear Mr. Wallace:

Thank you for organizing the meeting and giving the entire Team an opportunity to review and comment on the methods and project areas being considered by your office. It is unfortunate that the U. S. Fish and Wildlife Service and the North Dakota Department of Health were not represented at the meeting, as they are both key players in this effort.

First, I would like to offer some general comments. As you are aware, studies are currently being conducted to determine which methods for improving emergent sandbar habitat (ESH) are most effective on the Missouri River in North Dakota. Results at this point are inconclusive. It is not yet known which methods produce the best results. Selecting and implementing methods for ESH improvement at this point may be premature.

It bears reemphasizing the concerns raised at a recent meeting with representatives of the Water Resource Districts (WRD) proximate to the Missouri River, Garrison Reach. Currently, material dredged from the Missouri River during the construction of any project must be disposed of on an approved upland site at expense to the applicant. The Corp of Engineer’s (COE) proposal to overtop the islands with material dredged from the bed of the Missouri River is viewed by the WRDs as a “double standard.” The representatives of the WRDs went on record as being opposed to the COE proposal to overtop islands with dredged material from the bed of the Missouri River because of their perceived double standard.

Right or wrong, ESH improvements for terns and plovers on the Missouri River in North Dakota have been and will continue to be very high profile. River recreationists, riparian landowners, and local governments have taken a keen interest in what is trying to be accomplished, how it is accomplished, associated costs, and potential impacts to their respective interests. Decisions need to be made based upon the best available science with proven results and the associated costs.
It is imperative that the environmental assessment be prepared in a very open and public manner that allows for public participation and buys in if there is any hope for accomplishment. The politics of doing business cannot be avoided.

It is important that the COE make it clear to the public where it gets its authority to conduct the ESH program and that the U.S. Fish and Wildlife Service has mandated the ESH program through its Biological Opinion (BiOp). It would be wise for the COE to develop as part of any presentation used in all public communications dealing with the ESH program, a statement that references where in the BiOp the ESH program is mandated. This may go a long way in addressing some of the criticism the COE has received in its efforts to improve tern and plover habitat on the Missouri River in North Dakota.

Having said that, the six proposed project areas appear to be a good choice from the standpoint of physical attributes of each site: historic and potential tern and plover use; and avoiding conflicts with river recreationists. Efficient access to individual sites needs to be determined and obtained. This may not be possible for all sites causing one or more sites to become impractical.

As noted at the meeting, each individual site would require a separate authorization from the State Engineer. Permit applications should include the individual island on which the work is to be performed and any sovereign lands on the banks of the Missouri River that may be crossed to access the island. Application for Authorization to Construct a Project within Islands and Beds of Navigable Streams and Waters forms can be downloaded from our website at www.swc.nd.gov.

Three methods for ESH improvement are being considered. Method 3 causes some concern. First, effectiveness of this method is not currently being tested on the Missouri River in North Dakota. Second, the shear volume of dredged material necessary for overtopping to the 42K cfs flow elevation and associated costs may be extreme. Third, expensive, long term maintenance to control vegetation on the island may be necessary due to the lack of scouring. I know it was pointed out that this has not been an issue in Nebraska, but that may not be the case here. Fourth, the costs associated with dredging this amount of material are sure to raise a lot of eyebrows locally. While this concern should not by itself be a “show stopper,” it does warrant consideration.

Thank you for the opportunity to provide input on this important project. I look forward to working with the Team to make improvements to tern and plover habitat on the Missouri River in North Dakota with the least amount of impact to local and state interests.

Sincerely,

John Paczkowski
Regulatory Section Chief

JP:GRH:mmb/1625
November 22, 2010

Mr. John Shelman CENWO-PM-AC
Corps of Engineers, Omaha District
1616 Capitol Avenue
Omaha NE 68102-4901

ND SHPO Ref.: 11-0243 COE Restore Emergent Sandbar Habitat (ESH) by removing vegetation in five locations at and near River Mile 1304.0, 1374.5, 1343.5, 1348.5, 1352.5 in Burleigh/Morton, Mercer/McLean and McLean Oliver Counties, North Dakota

Dear Mr. Shelman,

We reviewed ND SHPO Ref.: 11-0243 COE Restore Emergent Sandbar Habitat (ESH) by removing vegetation in five locations at and near River Mile 1304.0, 1374.5, 1343.5, 1348.5, 1352.5 in Burleigh/Morton, Mercer/McLean and McLean Oliver Counties, North Dakota. We recommend a Class III (pedestrian survey by archaeologists) of the Area of Potential Effect, (ground disturbance) for the following locations: River Mile 1304.0, (32MOx29 Sibley Island), and 1374.5 (32MLx26). Monitoring during the project would also be acceptable, if more feasible than survey before the project.

Also, if there is any borrow material, it is to be from an approved source, that is a material source surveyed by an archaeologist and found to contain no significant cultural resources.

Thank you for the opportunity to review this project to date. We look forward to review of the Class III pedestrian survey by archaeologists prior to the start of the project, or a monitoring report. Please include the ND SHPO Reference number listed above in further correspondence for this specific project. If you have any questions please contact Susan Quinnell, Review and Compliance Coordinator at (701) 328-3576, e-mail squinnell@nd.gov

Sincerely,

[Signature]
Merlan E. Paaverud, Jr.
State Historic Preservation Officer (North Dakota)
John: A 401 WQC is not required for this project. Mike Sauer NDDoH

-----Original Message-----
From: Shelman, Johnathan A NWO [mailto:Johnathan.A.Shelman@usace.army.mil]
Sent: Tuesday, March 08, 2011 2:37 PM
To: Sauer, Mike T.
Subject: ND ESH Vegetation Removal Projects (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Mike,

Thanks for taking a few minutes to talk with me about the sandbar vegetation removal projects within the Garrison Reach of the Missouri River, North Dakota. As a reminder, the basic scope of the project will be to mow the sandbars and leave all finely mulched material on bars so that it may enter the river through natural means, i.e. gusts of wind, etc. Large debris will be hauled off of the sandbar and disposed at a state approved facility. An approved for aquatic use (low toxicity to fish and wildlife) herbicide will be applied either by ATV or backpack sprayer to prevent the re-emergence of vegetation. The projects will occur in the spring prior to birds arriving or if unforeseeable events arise, the fall after the birds have left. Project description is the same under both scenarios. We are not placing fill or discharged material into waters of the U.S. and are not required to apply for a Section 10 or 404 permit. Please advise on 401 water quality certification requirements. Finally, we plan on making the draft EA available for review within the next week or two. I will send you a notification on where to view and how to comment at that time.

Thanks Mike.

John Shelman

Environmental Resource Specialist
U.S. Army Corps of Engineers
CENWO-PM-AC
1616 Capitol Ave.
Omaha, NE 68102
T: (402) 995 2708
F: (402) 995-2758
johnathan.a.shelman@usace.army.mil

Classification: UNCLASSIFIED
Caveats: NONE
APPENDIX III

IMAZAPYR FACT SHEET
**IMAZAPYR**

**Herbicide Basics**

**Chemical formula:** \((\pm)-2-[4,5\text{-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl}]3\text{-pyridinecarboxylic acid}\)

**Herbicide Family:** Imidazolinone

**Target Species:** grasses, broadleaves, vines, brambles, shrubs and trees, riparian and emerged aquatics

**Forms:** acid & salt

**Formulations:** SL, GR

**Mode of Action:** Amino acid synthesis inhibitor

**Water Solubility:** 11,272 ppm

**Sorption potential:** low

**Primary degradation mech:** Slow microbial metabolism and photolysis

**Average Soil Half-life:** 25-141 days

**Mobility Potential:** high

**Dermal LD50 for rabbits:** >2,000 mg/kg

**Oral LD50 for rats:** >5,000 mg/kg

**LC50 for bluegill sunfish:** >100 mg/L

**Trade Names:** Arsenal®, Habitat®, Chopper®, and Stalker®

**Manufacturer:** BASF (previously American Cyanamid Company)

**Synopsis**

Imazapyr is a non-selective herbicide used for the control of a broad range of weeds including terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It controls plant growth by preventing the synthesis of branched-chain amino acids. Because imazapyr is a weak acid herbicide, environmental pH will determine its chemical structure, which in turn determines its environmental persistence and mobility. Below pH 5 the adsorption capacity of imazapyr increases and limits its movement in soil. Above pH 5, greater concentrations of imazapyr become negatively charged, fail to bind tightly with soils, and remain available (for plant uptake and/or microbial breakdown). In soils imazapyr is degraded primarily by microbial metabolism. It is not, however, degraded significantly by photolysis or other chemical reactions. The half-life of imazapyr in soil ranges from one to five months. In aqueous solutions, imazapyr may undergo photodegradation with a half-life of two days. Imazapyr is not highly toxic to birds and mammals, but some formulations (for instance, the inert ingredients in Chopper® and Stalker®) can cause severe, irreversible eye damage. Studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation. It has a low toxicity to fish, and algae and submersed vegetation are not affected. Because imazapyr can affect a wide range of plants and can remain available, care must be taken during application to prevent accidental contact with non-target species. Further, a few studies have reported that imazapyr may be actively exuded from the roots of legumes (such as mesquite), likely as a defense mechanism by those plants. This exudate and the ability of imazapyr to move via intertwined root grafts may therefore adversely affect the surrounding desirable vegetation with little to no control of the target species.
Herbicide Details

Chemical Formula: $(\pm)$-2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid

Trade Names: Arsenal®, Chopper®, and Stalker®. As of September 2003, imazapyr has received an EPA aquatic registration for Habitat®.

Manufacturer: BASF (previously by American Cyanamid Company, which was purchased by BASF in 2000)

Use Against Natural Area Weeds: Imazapyr is a broad-spectrum herbicide that controls terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. It can be used where total vegetation control is desired or in spot applications. Imazapyr is relatively slow acting, does not readily break down in the plant, and is therefore particularly good at killing large woody species. Imazapyr can control saltcedar (*Tamarix ramossissima*), privet (*Ligustrum vulgare*), blackberries (*Rubus* spp.), field bindweed (*Convolvulus arvensis*), bahiagrass (*Paspalum notatum*), and downy brome (*Bromus tectorum*) (American Cyanamid 1986). Caution should be used when applying imazapyr, as a few reports to TNC from the field indicate that imazapyr might be exuded from the roots of target species. Some legume species, such as mesquite, may actively exude imazapyr (J. Vollmer pers. comm.). Imazapyr herbicide can be mobile within roots and transferred between intertwined root systems (root grafts) of many different plants and/or to several species. Movement of imazapyr via root grafts or by exudates (which is a defense mechanism of those plants) may therefore adversely affect the surrounding vegetation. This movement of herbicide may also be compounded when imazapyr is incorrectly overapplied. Movement of soil particles that contains imazapyr can also potentially cause unintended damage to desirable species.

Imazapyr is effective for creating openings for wildlife use. It can be applied pre-emergent, but is most effective when applied as a post-emergent herbicide. Care should be taken in applying it around non-target species, as it is readily adsorbed through foliage and roots, and therefore, could be injurious by drift, runoff, or leaching from the roots of treated plants. To avoid injury to desirable trees, do not apply imazapyr within twice the drip line (tree canopy).

On TNC preserves in Texas, imazapyr provided good control of saltcedar (*Tamarix* spp.) and Chinese tallow tree (*Sapium sebiferum*). In North Carolina preserves, it was effective against oriental bittersweet (*Celastrus orbiculata*), cut-stumps of Chinese privet (*Ligustrum sinese*), and tree-of-heaven (*Ailanthus altissima*). Recent work in California demonstrated that foliar applications of imazapyr effectively controlled jubatagrass and pampasgrass (*Cortaderia jubata* and *C. selloana*) (DiTomaso et al. 1999; Drewitz 2000), and experimental studies in Washington showed that imazapyr provided excellent control of smooth cordgrass (*Spartina alterniflora*) in tidal estuarine habitats (Patten 2002).

Mode of Action: Imazapyr is absorbed quickly through plant tissue and can be taken up by roots. It is translocated in the xylem and phloem to the meristematic tissues, where it inhibits the enzyme...
acetohydroxy acid synthase (AHAS), also known as acetolactate synthase (ALS). ALS catalyzes the production of three branched-chain aliphatic amino acids, valine, leucine, and isoleucine, required for protein synthesis and cell growth. The rate of plant death usually is slow (several weeks) and is likely related to the amount of stored amino acids available to the plant. Only plants have ALS and produce these three amino acids, and therefore, imazapyr is of low toxicity to animals (including fish and insects). Animals need these three branched chain aliphatic amino acids, but obtain them by eating plants or other animals.

Dissipation Mechanisms:

Summary: Imazapyr is degraded in soils primarily by microbial metabolism. It will quickly undergo photodegradation in aqueous solutions (photohydrolysis), but there is little to no photodegradation of imazapyr in soil, and it is not readily degraded by other chemical processes. Imazapyr does not bind strongly with soil particles, and depending on soil pH, can be neutral or negatively charged. When negatively charged, imazapyr remains available in the environment.

Volatilization
Imazapyr does not volatilize readily when applied in the field (T. Lanini, pers. obs.). The potential to volatilize, however, increases with increasing temperature, increasing soil moisture, and decreasing clay and organic matter content (Helling et al. 1971).

Photodegradation
Imazapyr is rapidly degraded by sunlight in aquatic solutions. In soils, however, there is little or no photodegradation of imazapyr (WSSA 1994). The half-life of imazapyr due to photodegradation in aqueous solution is approximately two days, and decreases with increasing pH (Mallipudi et al. 1991, Mangels 1991a).

Microbial Degradation
Microbial degradation is the primary mechanism of imazapyr degradation in soils (WSSA 1994). American Cyanamid (1986) reported that the half-life of imazapyr in soils typically ranged from one to seven months, depending on soil type, temperature, and soil moisture (Mangels 1991b). The half-life of imazapyr is shorter at cooler soil temperatures (25° C versus 35° C) and in sandier soils (sandy loam versus clay loam) (American Cyanamid 1986). Degradation rates are decreased in anaerobic soil conditions (WSSA 1994).

In studies of the related compound imazaquin, microbial degradation rates increased with increasing soil moisture content (between 5-75% of field capacity) and increasing soil temperatures (from 15° C to 30° C) (Mangels 1991b). Microbial degradation additionally, was more rapid in soils that did not bind the herbicide strongly. Imazapyr that is bound strongly to soil particles may be unavailable for microbial degradation.

Adsorption
The adsorption of imazapyr to soil particles is generally weak, but can vary depending on soil properties (Mangels 1991b). Adsorption is reversible, and desorption occurs readily (WSSA 1994). Because the exact chemical form of the herbicide is determined by environmental pH, the adsorption capacity of imazapyr changes with soil pH. A decline in pH below 5 increases
adsorption of imazapyr to soil particles. Above pH 5, imazapyr becomes ionized, increasing its negative charge, and limiting its ability to bind with soils (Mangels 1991b). Vizantinopoulos and Lolos (1994) found that adsorption decreased with increasing soil temperature, and Dickens and Wehtje (1986) found that adsorption increased with time and decreased soil moisture. In general, imidazolinone herbicides show an increase in soil adsorption capacity with an increase in soil clay content and organic matter, but studies of imazapyr have been conflicting (Dickens and Wehtje 1986, Wehtje et al. 1987, Mangels 1991b, McDowell et al. 1997, Pusino et al. 1997, El Azzouzi et al. 1998).

**Chemical Decomposition**

Imazapyr changes form readily with changes in pH, but is not necessarily degraded in this process. It does not readily undergo hydrolysis (Mangels 1991a), and no other chemical degradation mechanisms have been reported.

**Behavior in the Environment**

**Summary:** Imazapyr is slowly degraded by microbial metabolism and can be relatively persistent in soils. It has an average half-life in soils that range from one to five months. At pH above 5, it does not bind strongly with soil particles and can remain available (for plant uptake) in the environment. In water, imazapyr can be rapidly degraded by photolysis with a half-life averaging two days. There have been a few reports from the field of unintended damage to desirable, native plants when imazapyr has either exuded out of the roots of treated plants into the surrounding soil, or when intertwined roots transfer the herbicide to non-target plants. Make sure to not overapply imazapyr, and also confirm that soil particles with imazapyr are not moved in-contact with desirable species.

**Soils**

Depending on environmental conditions, imazapyr has an average half-life in soils of several months (Vizantinopoulos and Lolos 1994, El Azzouzi et al. 1998). El Azzouzi et al. (1998) reported half-lives between > 58 to 25 days in two Moroccan soils. In a laboratory study, the half-life of imazapyr ranged from 69-155 days, but factors affecting degradation rates were difficult to identify because the pH varied with temperature and organic content (McDowell et al. 1997). In a more extreme example, Vizantinopoulos and Lolos (1994) found that in loam and clay loam soils with pH 7-8, half-lives ranged up to 50 months. The manufacturer reports that persistence in soils is influenced by soil moisture, and that in drought conditions, imazapyr could persist for more than one year (Peoples 1984).

Lee et al. (1991) reported that imazapyr residues in soil following postemergent application increased eight days after initial application and continued to increase until a peak of 0.23 ppm at day 231 post-treatment. The authors attributed these increases to runoff of residues from plant surfaces following rainfall and to the release of residues from decaying plant matter.

Under most field conditions imazapyr does not bind strongly to soils and can be highly available in the environment. Above pH 5, the herbicide will take on an ionized form, increasing the risk of herbicide runoff. McDowell et al. (1997) found that heavy rainfall caused significant movement...
of the herbicide (or more likely, moved the soil particles that the imazapyr was adsorbed to), and leaching up to 50 cm deep in soils have been reported (WSSA 1994).

**Water**
Despite its potential mobility, imazapyr has not been reported in water runoff, and we found no reports of imazapyr contamination in water. If it enters the water column, imazapyr can be photodegraded by sunlight with an average half-life of two days (Mallipudi et al. 1991).

**Vegetation**
Because imazapyr kills a wide variety of plants and can be relatively persistent and remain available in soils, damage to desirable non-target plants is possible. When imazapyr is applied in high rates, directly to soil, it can result in season-long soil activity. Plant species that are resistant to imazapyr apparently metabolize it to an immobile form that cannot be translocated to the meristematic tissues (Shaner & Mallipudi 1991).

**Environmental Toxicity**

**Birds and Mammals**
Imazapyr is of relatively low toxicity to birds and mammals. The LD50 for rats is > 5,000 mg/kg, and for bobwhite quail and mallard ducks is >2,150 mg/kg (WSSA 1994). American Cyanamid reports that studies with rats indicate that imazapyr was excreted rapidly in the urine and feces with no residues accumulating in the liver, kidney, muscle, fat, or blood (Miller et al. 1991). Imazapyr has not been found to cause mutations or birth defects in animals, and is classified by the U.S. EPA as a Group E compound, indicating that imazapyr shows no evidence of carcinogenicity.

**Aquatic Species**
Imazapyr is of low toxicity to fish and invertebrates. The LC50s for rainbow trout, bluegill sunfish, channel catfish, and the water flea (*Daphnia magna*) are all >100 mg/L (WSSA 1994). As of September 2003, imazapyr (tradename Habitat®) is registered for use in aquatic areas, including brackish and coastal waters, to control emerged, floating, and riparian/wetland species. A recent study from a tidal estuary in Washington showed that imazapyr, even when supplied at concentrations up to 1600 mg/L, did not affect the osmoregulatory capacity of Chinook salmon smolts (Patten 2003). Similarly, the Washington State Department of Agriculture reported that the 96-hour LC50 for rainbow trout fry to be 77,716 mg/L (ppm) -22,305 ppm of the active ingredient- which represents a greater concentration of imazapyr than found in commercially-sold containers (J. Vollmer, pers. comm.).

**Other Non-Target Organisms**
Limited information was found on the effects of imazapyr on other non-target organisms such as soil bacteria and fungi. The manufacturers report that Arsenal® is non-mutagenic to bacteria (Peoples 1984).

**Application Considerations:**
Imazapyr is a slow acting herbicide that is not readily metabolized in plants. It can be very effective against woody species. Due to its persistence in the environment, it may be preferable to
apply imazapyr directly to vegetation (using a low-volume backpack, cut-stump, or basal bark application) instead of using a broadcast spray method. When using a cut-stump application, be careful to avoid overapplication of imazapyr on the stump, as this may lead to excess imazapyr to be transferred between root grafts or movement by soil particles. When completing a cut-stump treatment, apply imazapyr only to the outer cambium layer of the stump (versus applying herbicide to the entire cut-stump), and this should sufficiently kill the tree (J. Vollmer, pers. comm.).

A study of wipe-on applications to the reed *Phragmites australis*, however, found that this method provided some suppression of reeds in the short-term, but failed to control them in the long term (Kay 1995). Malefyt and Quakenbush (1991) reported better results when imazapyr was applied at 21°C rather than 32°C. Rainfall is considered important for good activity following soil application (Malefyt and Quakenbush 1991) but can increase movement of imazapyr in the soil column. A non-ionic surfactant can improve the efficacy of imazapyr.

**Safety Measures:**
Some formulations of imazapyr can cause severe irreversible eye damage. Care should be taken to prevent accidental splashing or other exposure of eyes to the herbicide.

**Human Toxicology**
Imazapyr is of relatively low toxicity to mammals, and shows no mutagenic or teratogenic potential. It can be an eye and skin irritant, but is not a dermal sensitizer (American Cyanamid 1986; Cyanamid Ltd. 1997).

**References**


**Date Authored:** April 2001

**Updated:** June 2004