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of Engineers ®
Omaha District

FINAL

ENVIRONMENTAL ASSESSMENT

Restoration of Emergent Sandbar Habitat Complexes in the Missouri River, Nebraska and South Dakota

April 2013

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FINDING OF NO SIGNIFICANT IMPACT
RESTORATION OF EMERGENT SANDBAR HABITAT
COMPLEXES IN THE MISSOURI RIVER, NEBRASKA AND SOUTH DAKOTA
APRIL 2013

In accordance with the National Environmental Policy Act and implementing regulations, an Environmental Assessment (EA), incorporated by reference herein, has been prepared for proposed emergent sandbar habitat (ESH) restoration projects pursuant to the Missouri River Recovery Program (MRRP). The proposed project area, bordered by the States of Nebraska and South Dakota, encompasses the Fort Randall and Gavins Point reaches, designated as the 39-mile District and 59-mile District of the Missouri River National Recreational River (MNRR) respectively, and includes the Lewis and Clark Lake segment. The Missouri River experienced a significant high water event during 2011 resulting in record discharges on the Missouri River Mainstem System (MRMS). The high releases resulted in the creation of large acreages of ESH below the dams, including an estimated combined total of 8,900 acres of ESH in the 39-Mile District and 59-Mile District of the Missouri River. As a result, the ESH Program will focus on maintaining as much of the ESH created in 2011 as possible over the next several years (2013-2017) through vegetation removal and control methods.

The proposed project would restore and maintain emergent sandbar habitat (ESH) lost due to the construction and on-going operations of the dam system on the MRMS and would benefit two federally-listed bird species, the endangered Interior least tern (*Sterna antillarum*) and the threatened Northern Great Plains piping plover (*Charadrius melodus*).

Two alternatives were considered: the Recommended Alternative and the No Action Alternative. The No Action alternative was eliminated from further consideration because it would not fulfill the purpose and need of the proposed action, which is to restore ESH lost as a result of the construction and operation of the mainstem dams. The Recommended Alternative involves the removal and control of vegetation on sandbars through the application of EPA aquatically approved herbicides (i.e., glyphosate and imazapyr) beginning in 2013 and continuing with spring and/or fall treatments as needed through fall 2017. In addition, aquatically approved adjuvants will be mixed to the herbicides to minimize potential impacts and increase efficacy of herbicide treatments.

The EA and comments received from resource agencies have been used to determine whether the proposed action requires the preparation of an Environmental Impact Statement. All environmental, social, and economic factors that are relevant to the proposal were considered in this assessment. These include, but are not necessarily limited to, prime farmland, water quality, air quality, noise, wetlands, wildlife, threatened and endangered species, and cultural resources. No significant adverse impacts to these resources would be expected to occur. The proposed actions would be in compliance with applicable environmental statutes.

It is my finding, based on the EA, that the proposed Federal activity will not have any significant adverse impacts on the environment and that the proposed project will not constitute a major Federal action significantly affecting the quality of the human environment. Therefore, an Environmental Impact Statement will not be prepared.

Date: 5-7-13

Joel R. Cross
Colonel, Corps of Engineers
District Commander

Final Environmental Assessment
Restoration of Emergent Sandbar Habitat
Complexes in the Missouri River, Nebraska and South Dakota

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Acronyms List

AM	Adaptive Management
ANS	Aquatic Nuisance Species
APE	Area of Potential Effect
ASV	All-surface Vehicle
ATV	All-terrain Vehicle
BA	Biological Assessment
BIA	Bureau of Indian Affairs
BiOp	Biological Opinion
BMPs	Best Management Practices
BSNP	Bank Stabilization and Navigation Project
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulation
CMP	Cottonwood Management Plan
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
EA	Environmental Assessment
EDWC	Estimated Drinking Water Concentration(s)
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Environmental Regulation
ESA	Endangered Species Act
ESH	Emergent Sandbar Habitat
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FONSI	Finding of No Significant Impact
FOTG	Field Office Technical Guide
FWCA	Fish and Wildlife Coordination Act
GIS	Geographical Information System
GPS	Global Positioning System
HBSLs or HBSL	Health Based Screening Level(s)
ISP	Missouri River Recovery Integrated Science Program
IWLA	Izaak Walton League of America
MBTA	Migratory Bird Treaty Act
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
Mitigation Project	Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project
MNRR	Missouri National Recreational River

MRI	University of South Dakota Missouri River Institute
MRMS	Missouri River Mainstem System
MRRP	Missouri River Recovery Program
MSAC	Missouri Sedimentation Action Coalition
MSDS	Material Safety Data Sheet
NDA	Nebraska Department of Agriculture
NDEQ	Nebraska Department of Environmental Quality
NDNR	Nebraska Department of Natural Resources
NDWR	Nebraska Department of Water Resources
NEPA	National Environmental Policy Act
NGPC	Nebraska Game and Parks Commission
NHPA	National Historic Preservation Act
NNRCS	Nebraska Natural Resources Conservation Service
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
ORVs	Outstandingly Remarkable Values
PMRNRD	Papio-Missouri River Natural Resources District
PCE	Primary Constituent Elements
PDT	Product Delivery Team
PEIS	Programmatic Environmental Impact Statement
PGP	Pesticide General Permit
PL	Public Law
ppb	parts per billion
PRPA	Paleontological Resources Preservation Act
PSPAP	Pallid Sturgeon Population Assessment Program
RM	River Mile
ROD	Record of Decision
RPA	Reasonable and Prudent Alternative
RPM	Reasonable and Prudent Measures
RW	Riverwash
SDDA	South Dakota Department of Agriculture
SDDENR	South Dakota Department of Environmentand Natural Resources
SDGFP	South Dakota Game, Fish and Parks
SDNRCS	South Dakota Natural Resources Conservation Service
SDWA	Safe Drinking Water Act
SDWF	South Dakota Wildlife Federation
SHPO	State Historic Preservation Office
TMDLs	Total Maximum Daily Loads

TP DMS	Missouri River Recovery Least Tern and Piping Plover Data Management System
USCG	U.S. Coast Guard Auxiliary
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
WQC	Water Quality Certification
WRDA	Water Resources Development Act
WSRA	Wild and Scenic River Act

Environmental Assessment
Restoration of Emergent Sandbar Habitat
Complexes in the Missouri River, Nebraska and South Dakota

1.0 INTRODUCTION

In 2003, the United States Fish and Wildlife Service (USFWS) issued an amendment to the 2000 Biological Opinion (BiOp) on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project (BSNP) and Operation of the Kansas River Reservoir System (USFWS, 2003). The 2003 Amended BiOp was the result of continuing consultation between the U.S. Army Corps of Engineers (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 2003 Amended BiOp will be collectively referred to as "BiOp" hereafter.

The USFWS BiOp found that Corps operations on the Missouri River were not likely to jeopardize the endangered Interior population of the least tern (tern; *Sterna antillarum*) and the threatened Northern Great Plains population of the piping plover (plover; *Charadrius melodus*) 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. Duberstein and Downs (2008) described ESH as exposed, inter-channel sand formations within the river. They further stated ESH complexes are often temporary formations, are extremely dynamic in nature, and have little to no vegetation. The restoration and maintenance of ESH should improve the quality and availability of suitable least tern and piping plover nesting habitat on the Missouri River Mainstem System (MRMS), potentially increasing the overall productivity of these two bird species along the upper Missouri River while enabling the Corps to manage the river system to meet congressionally-authorized purposes.

This Environmental Assessment (EA) will focus on evaluating the removal and control of vegetation on ESH located within the Fort Randall reach, Lewis and Clark Lake segment, and Gavins Point reach of the Missouri River between river mile (RM) 880.0 and RM 752.0, along the boundaries of Gregory, Charles Mix, Bon Homme, Yankton, Clay and Union Counties in South Dakota and Boyd, Knox, Cedar and Dixon Counties in Nebraska. This EA is intended to assess the environmental impacts of spring and/or fall vegetation removal and maintenance activities beginning in 2013 and ending fall of 2017.

A Record of Decision (ROD) was issued in August 2011 for the "Final Programmatic Environmental Impact Statement (PEIS) for the Mechanical Creation and Maintenance of Emergent Sandbar Habitat in the Riverine Segments of the Upper Missouri River" (Corps, 2011a). The PEIS analyzed the potential environmental consequences of implementing mechanical/artificial creation and maintenance of ESH on the riverine reaches of the Upper Missouri River, and selected a preferred alternative (i.e., Alternative 3.5) that allows for the support of tern and plover populations on the MRMS while minimizing negative environmental

consequences (Corps, 2011a). As authorized by the Council of Environmental Quality (CEQ) regulations contained in Title 40 of the Code of Federal Regulations (CFR), 1502.20 and 40 CFR 1502.28, and as outlined in sections 1.4 and 1.5 of the PEIS, this EA tiers from the analyses in the PEIS but will focus on site-specific issues and potential environmental effects of the proposed actions being considered. This EA incorporates by reference the PEIS and evaluates the application of herbicides and removal of vegetation on ESH located within the Missouri River in Nebraska and South Dakota.

This EA is consistent with the National Environmental Policy Act (NEPA), the CEQ's 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 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 to ecosystems and the human environment, thereby prompting the preparation of an Environmental Impact Statement (EIS), or whether this EA concludes that the project would not have any significant effect on the environment and a Finding of No Significant Impact (FONSI) is appropriate.

1.1 Project Authority

This project is proposed under the Corps' Missouri River Recovery Program (MRRP), which was established by the Corps in 2003 and essentially combined two related efforts including the responsibilities of compliance with the BiOp, and acquiring and developing lands to produce habitat as directed by the Missouri River Bank Stabilization and Navigation Fish and Wildlife Mitigation Project of Missouri, Kansas, Iowa, and Nebraska (Mitigation Project). The primary purpose of the Mitigation Project is to mitigate the habitat lost as a result of the Missouri River Bank Stabilization and Navigation Project (BSNP).

The Mitigation Project was authorized by Section 601(a) of the Water Resources Development Act (WRDA) of 1986 [Public Law (PL) 99-662], as amended by Section 334(a) of WRDA 1999 (PL 106-53) increasing the amount of acreage to be acquired and/or mitigated from 48,100 acres to 166,750 acres. Section 3176(a) of WRDA 2007 further amended the Mitigation Project authorization by allowing funds made available for recovery or mitigation activities in the lower basin of the Missouri River to be used for recovery or mitigation activities in the upper basin of the Missouri River, including the states of Montana, North Dakota and South Dakota.

2.0 LOCATION

In accordance with the recommendations of the USFWS found in the RPA of the BiOp, the Corps is proposing to maintain ESH complexes by aerial and/or ground-based spraying of pre-emergent and/or post-emergent vegetation by herbicide, mowing, and removal from exposed sandbars within the Fort Randall reach, Lewis and Clark Lake and Gavins Point reach of the Missouri River. The BiOp divided the Missouri River into 15 segments based on unique morphological characteristics. The Fort Randall reach, situated between the Fort Randall Dam and the confluence of the Missouri and Niobrara Rivers, is defined in the BiOp as Segment 8 and is the 35-mile riverine segment between RM 880.0 and RM 845.0. The Niobrara River to Lewis

and Clark Lake, including Lewis and Clark Lake is defined as Segment 9 and is situated between RM 845.0 and 811.1. The Gavins Point reach, situated between Gavins Point Dam and Ponca, Nebraska, is defined in the BiOp as Segment 10 and is the 58.1-mile riverine segment between RM 811.1 and RM 753.0. The entire project area includes the Missouri River from RM 880.0 to RM 752.0.

Portions of the project area lie within river segments designated as the Missouri National Recreational River (MNRR). Under the Wild and Scenic Rivers Act (WSRA), designated rivers are classified as wild, scenic or recreational and are to be managed in a way that protects and enhances the values that prompted their designation. The 39-Mile District of the MNRR on the Fort Randall reach is administered by the National Park Service (NPS) and the 59-Mile District of the MNRR on the Gavins Point reach is managed cooperatively by NPS and the Corps; however, the NPS retains the responsibility of being the overall administrator of the 59-Mile District. Although influenced by controlled dam releases, these two stretches of the Missouri River remain in a non-channelized (i.e., regulated free-flowing) and semi-natural state.

The sandbars proposed for treatment and removal of vegetation within the project area (shown in Figure 1) will be evaluated on an annual basis by staff from the Corps, USFWS and NPS. Appendix A includes maps depicting the locations of individual sandbars within the entire project area. Each sandbar or portion thereof will be evaluated and potentially selected for herbicide treatment and vegetation removal or eliminated from treatment based on other factors such as cottonwood regeneration, or high rates of erosion, predation or recreational activity.

Figure 1. Project area (shown in red)

3.0 PURPOSE AND NEED

The purpose of the proposed project is to remove and control vegetation, primarily through the application of aquatically approved herbicides, on river sandbars to ensure that an adequate

amount of suitable nesting habitat remains available for the least tern and piping plover in the Fort Randall and Gavins Point reaches and Lewis and Clark Lake segment of the Missouri River. Record discharge levels from the Missouri River in 2011 created a significant amount of ESH in the MRMS that exceeded all habitat creation targets recommended in the PEIS. There has not been a significant natural sandbar creation event on the Missouri River since 1997. With the substantial amount of ESH acres created in 2011, an opportunity exists at this time to maintain as much tern and plover habitat as feasible in these reaches, for as long as possible, through control and removal of vegetation on selected sandbars. It is anticipated that with the increased acres of suitable habitat available that the reproductive success for the tern and plover over several years will result in increased populations for both species.

After the 2011 flood event, it was estimated that over 4,500 acres of sandbar were available in the Gavins Point reach, over 2,000 acres in the Fort Randall reach, and more than 2,400 in Lewis and Clark Lake segment (Corps, 2013); however, it is expected that this large amount of newly created sandbar habitat will begin degrading due to erosion and vegetation growth as was seen in 1997, when record runoffs resulted in high water releases from the dams. Research by Vander Lee (2002) found that the total ESH in the Gavins Point reach increased from 1,593 acres in 1996 to 4,855 in 1998. Piping plover and least tern productivity appeared to be affected by the habitat change, as monitoring conducted in 1998 found that hatch rates and fledgling rates significantly increased with the substantial increase in sandbar habitat (USFWS, 2000). However, with flows remaining steady in the following years, little or no vegetation scouring occurred. As a result, vegetation on persistent inter-channel sandbars increased three-fold between 1998 and 2000. Another 1,100 acres of sandbar were lost to erosion during this period. Total sandbar acres decreased by 60 percent and the average sandbar size decreased by 55 percent in 2000 (Vander Lee, 2002). In 2004, the Corps began mechanically constructing ESH to supplement the remaining degraded habitat. During 2004-2010, the total amount of constructed ESH was approximately 847 acres, or an average construction rate of 169 acres/year in years where construction took place (Corps, 2011b); however, regulated flows precluded the scouring or natural creation of sandbars, and coupled with the decline and degradation in existing sandbars, a habitat deficit resulted. Consequently, by 2010 the Corps had not been successful in reaching the intended target acreage for ESH. With the amount of naturally created sandbar habitat available as a result of the 2011 flood, mechanical creation of ESH is not needed at this time to supplement natural sandbars, although artificial creation may need to be implemented in the future when ESH acreage is close to or falls below target acreages. In addition, it is anticipated that reproductive success for both species will result in increased populations as occurred following the high flows of 1997.

The Fort Randall reach, Lewis and Clark Lake segment and Gavins Point reach of the Missouri River are identified as “High Priority” segments (Segments 8, 9 and 10, respectively) for both terns and plovers under RPA Section IV of the BiOp. The “Emergent Sandbar Habitat Annual Adaptive Management Report for 2011” reported that the availability of ESH nesting habitat declined from 2008 to 2010, due in part to losses from erosion and vegetation growth, as well as increased releases from the Gavins Point and Fort Randall reservoirs during 2009 and 2010 (Corps, 2011b). The baseline ESH area was estimated to have declined 23% between 2010 and 2011, with nesting acreage substantially decreasing in 2011 due to extremely high releases

throughout the MRMS and was projected to be essentially absent for all reaches (Corps, 2012). On Lewis and Clark Lake, where reservoir levels are relatively constant (~1206.0 elevation), an estimated 117 acres were projected to be available in 2011 (Corps, 2012); however, based on data retrieved from the Missouri River Recovery Least Tern and Piping Plover Data Management System (TP DMS), plovers were concentrated on only three sandbars located at RM 842.2, RM 826.6, and RM 826.3. This results in overcrowding of nesting birds on remaining available habitat and reduces fledge ratios through resource competition, use of marginal habitat, and attraction of predators. Terns were distributed more widely across eight sandbars, located between RM 842.2 – RM 816.0. In 2012, monitoring results showed a much wider distribution of the plovers and terns nesting on sandbars between RM 843.5 and 835.3 (Corps TP DMS, 2012). Monitoring data from 2012 indicates that population sizes for both the plover and tern were increasing, though still below target (tern adults =743, plover adults =782). Adult numbers suggest that birds that were not present on the river in 2011 returned in 2012, though it is unknown how much of the population typically nesting on the MRMS has not returned but may in the future (Corps, 2013).

Overall, habitat quantity and quality for these two species have continually diminished on the Missouri River system, contributing to declining productivity numbers for both species. The goal of the ESH program is to provide sufficient habitat throughout the MRMS to support self-sustaining populations of terns and plovers. "Self-sustaining" means that the population has a high probability of meeting population recovery targets. If plovers and terns do not have access to bare sandbar habitat in the spring, they are less likely to nest and reproduce successfully. Recovery targets currently set by the USFWS Species Recovery Plan for the tern (1990) and the plover (1988) along the MRMS include increasing and stabilizing tern and plover populations at a minimum of 1,139 piping plovers for 15 consecutive years and a minimum of 900 interior least terns for 10 consecutive years; and increasing tern and plover fledge ratios with ultimate targets of 0.94 and 1.22, respectively (USFWS, 2003).

Based on analysis reported in the "Emergent Sandbar Habitat Annual Adaptive Management Report for 2012 (draft form)", from 1986 to 1996 and for 2010 and 2011, fledge ratios for terns and plovers were generally low and well below target values. Fledge ratios for plovers peaked during 2002 and increased again in 2012. Fledge ratios for terns peaked during 1998 and have alternated above and below the target since then, with a sharp decrease in 2011 and increasing again to be above target in 2012 (Corps, 2013). Figures 2 - 4 compare the estimated ESH acres with tern and plover populations numbers and fledged chicks in the Gavins Point reach (Figure 2), Lewis and Clark Lake (Figure 3) and the Fort Randall reach (Figure 4) from 1998-2012. As shown in the graphs, both tern and plover population sizes and fledge ratios dropped markedly in 2010 and 2011. Some portion of this decline can be attributed to high flows in 2010 and extremely high flows in 2011 that limited habitat availability and may have reduced the number of adult birds present in the MRMS during the adult census, as was also observed in 1997(Corps 2012) In 2012, habitat was plentiful and birds returned to the MRMS, leading to moderate population sizes and high fledge ratios, most similar to 2000 (plovers) and 2002 (terns) (Corps, 2013). Maintaining suitable habitat through vegetation removal and control would help to reach recovery targets for the least tern and piping plover populations along the MRMS.

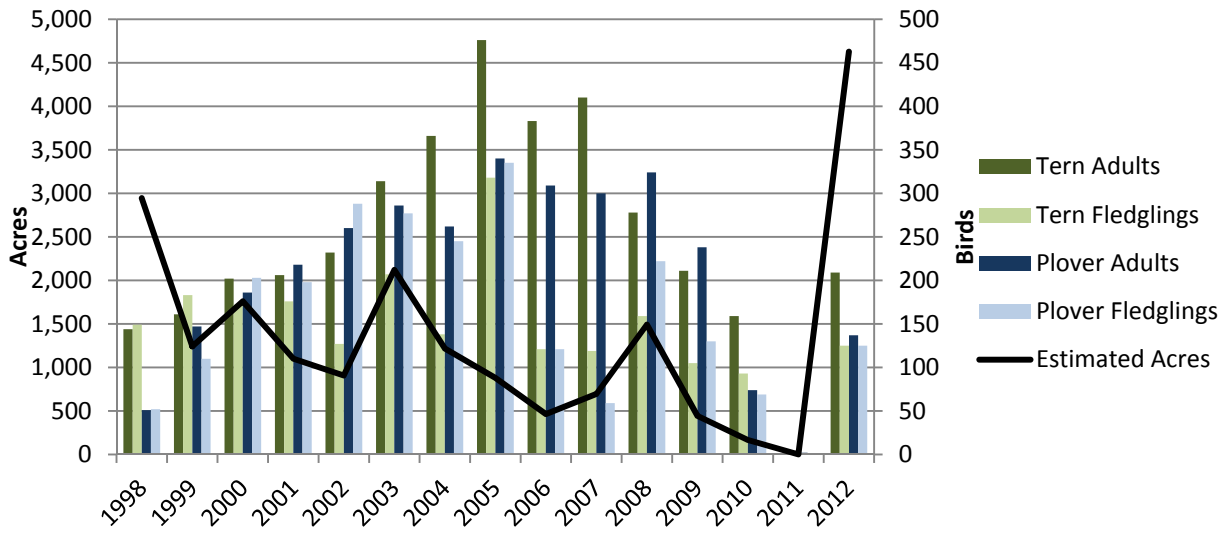

Figure 2. Estimated ESH acres for the Gavins Point reach with tern and plover population numbers and fledged chicks

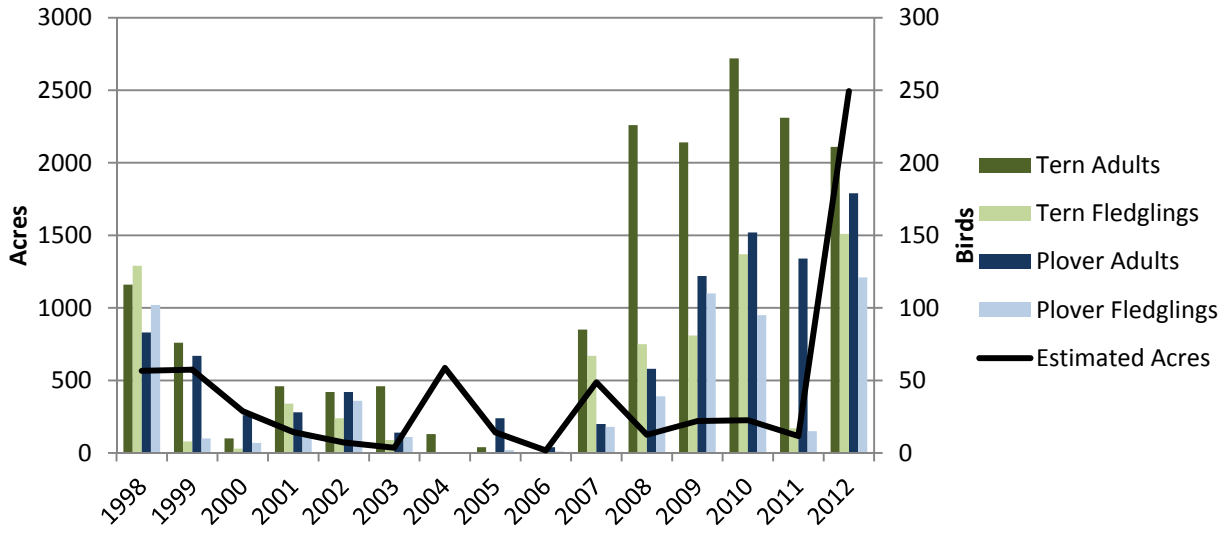

Figure 3. Estimated ESH acres for the Lewis and Clark Lake segment with tern and plover population numbers and fledged chicks

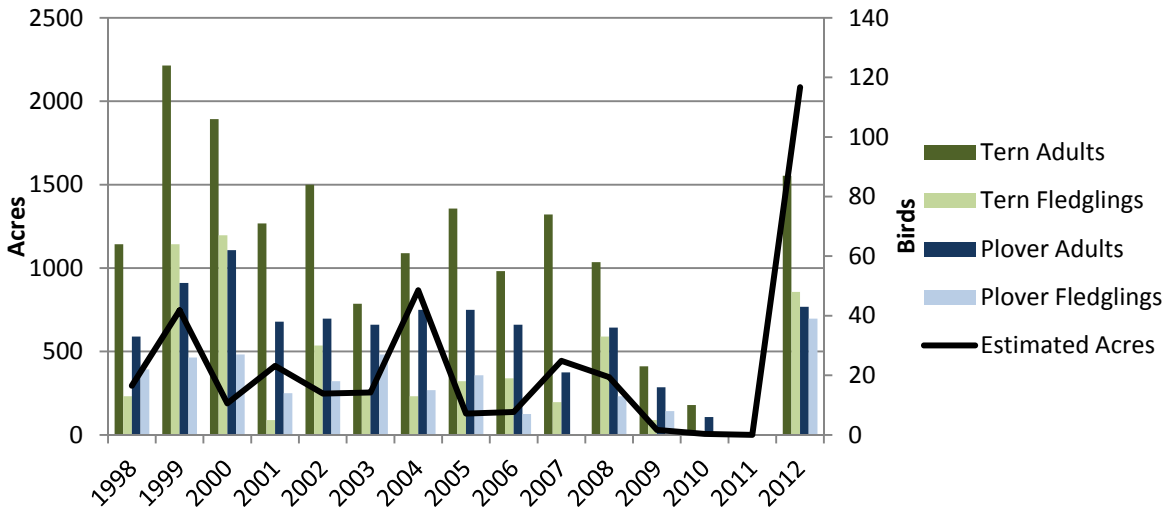

Figure 4. Estimated ESH acres for the Fort Randall reach with tern and plover population numbers and fledged chicks

4.0 PROPOSED ACTION AND ALTERNATIVES

4.1 Alternatives Carried Forward for Further Analysis

4.1.1 Alternative 1 – No Action

Under the No Action alternative, no steps would be taken to restore or maintain tern and plover habitat within the project area. The naturally occurring cycles of erosion and vegetative succession would encroach on the existing tern and plover habitat, and in turn, potentially decrease the amount of available nesting habitat for the terns and plovers on these reaches of the river.

This alternative would not support the Corps in meeting the BiOp goals for the Fort Randall reach, Lewis and Clark Lake segment and Gavins Point reach (Segments 8, 9 and 10) of the Missouri River. This alternative is also likely to have negative impacts on nesting terns and plovers, possibly resulting in a decrease in fledge ratios and nest success as vegetation increases on the sandbars.

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

Alternative 2 is the Recommended Alternative and would remove and control vegetation through the application of pre-and/or post-emergent herbicides on selected sandbars between RM 880.0 and RM 752.0. Glyphosate and imazapyr are two types of herbicides that are approved by EPA for use in aquatic environments. Detailed information on the herbicides and adjuvants (i.e., drift retardant and surfactant) proposed for use are provided in Section 4.1.2.3.1.

Spraying would begin in 2013, and then continue on an 'as needed' basis in the spring and/or fall of 2017. Vegetation treatment and removal is not being proposed in 2013 along the stretch of river beginning just above the Niobrara River (RM 846.0) and extending into Lewis and Clark

Lake (RM 811.0). During the peak of the 2011 high water, constructed bars in the Lewis and Clark Lake segment provided some of the only exposed habitat, resulting in highly concentrated nesting habitat (natural sandbars were completely inundated). On these bars, productivity suffered due to high rates of predation despite efforts to remove predators from the site, including great horned owls, mink, crows, gulls and raccoons (Corps, 2012). The PDT discussed the potential to "remove" or discourage use of previously created ESH sites in Lewis and Clark Lake based on the extremely high predation rates experienced during the 2011 and 2012 nesting seasons. Predation rates continued to be high even with the abundance of habitat in 2012. It was recommended that the Lewis and Clark Lake segment be allowed to vegetate to discourage birds from nesting. Sandbars in this lake segment will still be evaluated each year to assess the potential for vegetation treatment, as the site could potentially be reclaimed for nesting by removing vegetation after sufficient time has passed and predators are not as accustomed to finding nests on this site (Corps, 2013).

Initial sandbar acreages would be calculated by using a Geographical Information System (GIS) to encapsulate the entire exposed sandbar complex using orthorectified satellite imagery acquired annually. The actual amount of vegetation removed would depend on the river level, flow velocity, annual vegetative growth, and amount of exposed vegetation at the time removal activities begin. Vegetation control and removal activities in the spring would occur after ice out (break up of ice during spring thaw), but before the arrival of the least terns and piping plovers. Activities in the fall would occur after the terns and plovers have migrated from the area and while the vegetation is still green. The USFWS, NPS, Nebraska Game and Park Commission (NGPC), and South Dakota Game, Fish and Parks (SDGFP) will be notified before any ground spraying or aerial spraying would occur and the sandbars would be surveyed for recreating public before spraying activities would take place. In addition, the Corps will notify the public through a press release when activities are proposed to take place.

4.1.2.1 Sandbar Selection

Sandbars resulting from the high discharges of 2011 would be evaluated on an annual basis to ensure they meet the criteria for vegetation treatment or if they should be excluded from treatment. In general, sandbars proposed for treatment have historically been used by least terns and piping plovers as nesting habitat. Uncontrolled vegetation growth would eventually limit the amount of suitable nesting habitat available to the birds. Each proposed site is located on exposed or partially-exposed sandbars and is situated outside of any sensitive resource boundaries. Examples of sensitive resources include cultural resources, eagle nests, bridges, utilities, water intakes, recreation areas, power stations, industrial structures, urban zones, and agricultural lands.

A multi-step process will be used to select sandbars for treatment. The first step involves using remote sensing data to calculate and estimate existing ESH acreage for the entire project area. The second step includes remote sensing and field observations to identify potential ESH that have vegetation present and may require herbicide treatment and/or removal of vegetation. A sandbar may be excluded from vegetation treatment for the purpose of cottonwood regeneration or because of changing conditions due to erosion, scouring or other factors (e.g., susceptible to

high rate of predation, increased recreation). Sandbars may be eliminated from treatment altogether for various reasons, such as being located in proximity to the dam, the sandbar is less than one acre in size, there are landowner issues or the sandbar exhibits high levels of predation or recreation use.

Land classes typically associated with ESH include emergent sandbar dominated by dry sand, wet sand and sparsely vegetated. Non-ESH generally includes, but is not limited to, sandbars or portions of larger sandbars that are in proximity to riparian areas, exhibit high rates of predation or recreational use, or is densely vegetated. Land classes typically associated with non-ESH include wooded islands, mid-and late-successional stage woodlands, and herb-shrub. The existence of residual vegetation was based on inspection of aerial imagery taken in May 2012, as well as on the percentage of sandbar that was counted as ESH (acres meeting habitat requirements). If the sandbar was not 100% ESH then it was considered to have residual vegetation and these vegetated areas were classified as non-ESH acres that do not meet habitat requirements for the tern and plover. The total acreage (Acres column on spreadsheet in Appendix A) includes ESH acres, as well as non-ESH acres and areas of water that may be present on a sandbar. 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.

In addition to the BiOp requirements for ESH, the Corps was also directed to preserve, create, and restore cottonwood habitat. The cottonwood ecosystems have been greatly altered by flow regulation. The 2011 flood event provided favorable areas for natural cottonwood regeneration and the Corps, in collaboration with NPS are incorporating future management efforts that focus on limiting further loss of remnant cottonwood stands and develop approaches to restore recruitment processes. The selection process for determining which sandbars would be treated for vegetation removal purposes also includes determining which sandbars appear to be conducive to cottonwood regeneration. At the time the May 2012 imagery was taken, it was estimated that the acres of cottonwood sites within the project area totaled about 4,000 acres (J. Stirling, personal communication, April 22, 2013). These sites will not be treated in 2013; however, they will be evaluated on an annual basis to determine if cottonwood establishment is successful. The NPS identified natural cottonwood regeneration sites using the following guidelines:

- Sandbars within 100 meters (~300 feet) of shoreline and/or connected to shoreline.
- Islands with extensive, established vegetative growth (particularly established cottonwoods).
- Areas landside of the shoreline will be left for cottonwood regeneration purposes.
- Nesting activity and/or presence of existing cottonwood recruitment were considered for borderline areas based on the above criteria.

Sandbars left untreated for cottonwood regeneration that prove to be unsuccessful in the long-term establishment of cottonwoods could be selected for future vegetation removal treatments. Final selection of the sandbars proposed for vegetation spraying in 2013 and in subsequent years will be determined by the ESH PDT and appropriate agencies (e.g., NPS, USFWS and NGPC).

4.1.2.1.1 Systematic Site Selection

An important component in applying management actions is to evaluate the efficacy of those actions for the target species (i.e., tern and plover). One method frequently used is systematic sampling, a type of random sampling that involves selecting items (i.e., sandbars) from a larger population using a constant interval between selections (e.g., every fourth) with the first interval having a random start. Appendix A contains spreadsheets for the Fort Randall and Gavins Point reaches, as well as an information sheet explaining each of the column headers on the spreadsheet. Each spreadsheet identifies sandbars by river mile location and lists the different types of treatment intervals that were evaluated to determine which treatment would provide the highest amount of habitat acres and also allow for sandbars not previously considered for vegetation removal to be treated. As shown on the Fort Randall and Gavins Point spreadsheets, a total of nine treatments were evaluated. The selected treatment is Treatment 6, which consists of treating every other sandbar. Treatment 6 was selected as it provides the same or a greater amount of ESH acres as the other treatments, but also allows the flexibility to treat additional sites in the future if needed (e.g., unsuccessful cottonwood site). The sandbars excluded from treatment will be used as controls (not exposed to treatment) to serve as a standard for comparing metrics (measure to assess effectiveness) at untreated sites to metrics at treated sites. Differences in these metrics would most likely indicate the treatment had a positive effect. Without evaluating against a control, it would be difficult to determine if the changes could be attributed to the management action (i.e., vegetation treatment) or some other factor.

Starting at the uppermost sandbar in each of the reaches and working downstream, sandbars will be systematically assigned as either a treatment or as a control (every other sandbar). The frequency of treatment will be determined based on the acreage needed to maintain as much ESH acres as possible. The sandbars assigned as a control is for the purpose of habitat monitoring. Data will be collected through the monitoring effort and will be used to compare nest success and fledgling success at treated versus control sites. The habitat monitoring objectives are as follows:

1) Assess the efficacy of the herbicide treatment, for both maintaining bare sand habitat as well as removing small amounts of residual vegetation. Effectiveness of the treatment will be determined based on detectable changes in ground cover estimates of vegetation at treated versus control sites.

2) Evaluate the effect of the management action on tern and plover productivity. This will be accomplished by comparing nesting success and fledgling success at treated versus control sites.

4.1.2.1.2 Cottonwood Recruitment Study

Following the 2011 flood event, a post-flood cottonwood study was undertaken by the University of South Dakota Missouri River Institute (MRI) to sample and evaluate cottonwood survival and the potential for natural regeneration of cottonwood forest along various segments of the Missouri River. The cottonwood study involves post-flood re-sampling of up to 180 forested stands previously sampled prior to the flood in 2006-2009, as well as an assessment of the

distribution and density of post-flood cottonwood seedling establishment. Each stand is characterized by vegetation composition and structure within the overstory (tree), shrub/sapling, and herbaceous/ground layer strata. Findings from this study will help to better understand the immediate effects of the 2011 flood, as well as possible impacts on future, long-term trajectories of cottonwood forests and their wildlife (Dixon, 2013). It is expected that the bulk of tree mortality or stress will be evident in the first growing season following the flood (2012), and that initial recruitment responses in 2012 will be important for long-term success of cottonwood regeneration (Dixon, 2013). The Corps is coordinating closely with the MRI and NPS in identifying sandbars that show promising results if natural regeneration were allowed to continue and the sandbars left untreated. To the extent feasible, the Corps will try to avoid these sandbars.

Data collection for this study is expected to be completed by summer of 2014. After all data is collected, these cottonwood study areas will be evaluated to determine if they will continue as cottonwood recruitment sites or if the site is proving unsuccessful in establishing cottonwoods and could potentially be treated. It is anticipated that the vegetation at these sites would be in an early-successional stage and not well established and could be easily treated and the site reverted back into bare sand to provide suitable tern and plover habitat.

4.1.2.1.3 Vegetation Treatment Study

An on-going vegetation treatment study will be conducted to evaluate the effects of various treatments on vegetation. In 2008, a Vegetation Modification Study (Corps, 2009) designed in cooperation with USFWS, NPS, U.S. Geological Survey (USGS) and numerous state agencies was implemented to help determine the most effective method to remove vegetation or prevent encroachment on sandbars. The study was designed in two phases: 1) evaluate methods of vegetation removal to determine which treatments are most effective, and 2) evaluate methods of vegetation maintenance to determine which treatments are most effective for maintaining sandbars to meet desired habitat characteristics. Phase 1 was completed in 2008 and results found that in general, there were no differences found among pretreatments, reaches or habitat classifications (Corps, 2009). Phase 2 of the study began in fall 2009 after bird departure and was to continue through 2011 to identify a successful treatment; however, due to high water levels the study could not be completed (J. Stirling, personal communication, April 19, 2013).

Phase 2 of the study will resume in 2013 and similar to Phase 1, a block and plot design will be used to evaluate various techniques to maintain desired habitat characteristics on sandbars. The study will be implemented on a minimum of three sandbars within the Fort Randall and Gavins Point segments. These vegetation study sandbars may overlap with the sandbars that are included in the systematic site selection either as a treatment or control. Multiple combinations of treatments will be tested to determine which combination is most effective at both maintaining bare sand habitat as well as removing small amounts of residual vegetation. Combinations of imazapyr and glyphosate, mowing, and no treatment would be tested. The treatment applied would depend on the vegetation characteristics. The longevity of each of these treatments would also be tested.

Effectiveness of treatments will be determined by comparing habitat characteristics at plots to those of desired habitat characteristics of tern and plover nests on the Missouri River. A final report will be compiled upon the completion of this study and will include recommendations to the ESH PDT on methodology for vegetation removal and maintenance to create and/or maintain ESH. The 2009 Vegetation Modification Study is included in Appendix A and provides additional details on the study.

4.1.2.2 PEIS Selected Plan and Adaptive Management

The PEIS, completed in August 2011, considered a range of ESH acreage goals from Alternative 1 (11,866 acres) through Alternative 5 (1,315 acres). The PEIS provided the Corps with a Selected Plan (Alternative 3.5 in the PEIS), which allows for incremental increases in the construction of ESH acres. Alternative 3.5's goal of 4,370 acres is based on the average of the 6,754 habitat acres available in 1998/1999 (Alternative 3) and the 1,985 habitat acres available in 2005 (Alternative 4). The ceiling of 4,370 acres (total acres for all reaches) was proposed because it represents a midrange of habitat available at a time when the birds were highly productive. Both species were meeting or approximating the fledge ratio goals until 2005 when fledge ratios dropped below the goals prescribed in the BiOp.

A recommendation from the "2010 ESH Annual Adaptive Management Report" (Corps, 2011b) was to begin increasing the rate of habitat construction; however, the 2011 high flows created significant amounts of sandbar habitat that remain available for nesting at the current time. Therefore, work plans have shifted from habitat construction to an emphasis on habitat maintenance. Alternative 3.5 calls specifically for a total of 1,912 acres of ESH in the Gavins Point reach, 212 acres in the Fort Randall reach and 354 acres in Lewis and Clark Lake. Maintaining habitat acres at a higher amount than the Alternative 3.5 maximum acreage (i.e., 4,370 acres) allows for loss of ESH due to erosion or fluctuation in water level, but with some assurance that enough sandbars are treated so that an adequate amount of suitable ESH would still be available as the sandbars degrade or erode and yet still meet the defined target acreage for the Fort Randall and Gavins Point reaches. In addition, the USFWS established sandbar acreage goals for the ESH program. The following acreage goals need to be achieved by the year 2015: Fort Randall reach - 20 acres per mile; Lewis & Clark Lake - 80 acres per mile; and Gavins Point reach - 80 acres per river mile (USFWS, 2000). As ESH begins to degrade and habitat acres begin to reach the target acres defined in Alternative 3.5, the Corps may need to revisit and assess other restorative methods or strategies (e.g., mechanical means) that could potentially be implemented to maintain or increase habitat acres.

A major component of Alternative 3.5 is the implementation of an Adaptive Management (AM) strategy. The process of AM allows for regular modification of management actions in response to new information and changing environmental conditions. This includes an annual monitoring program which allows actions to be progressively implemented and monitored until the desired biological response of terns and plovers is attained and sustained. It is important to note the integration of annual monitoring and AM could potentially increase or decrease the amount of acreage depending on the findings. It is anticipated it will take a few years to accumulate enough data to compare productivity numbers to the amount of habitat available and used by the birds to

make a determination as to the appropriate acres of ESH needed to sustain the tern and plover population. Initial population and productivity targets established by USFWS Species Recovery Plans and the BiOp may not accurately reflect population dynamics that will prevent jeopardy or lead to species recovery (Corps, 2011a). These target numbers may be revised based on recorded species trends or updated population models. In turn, if a higher or lower acreage is sufficient to meet the biological metrics, the acreage target would be adjusted accordingly (Corps, 2011a).

The key concept to AM is that rather than selecting a specific acreage alternative, actions would be progressively implemented until the desired biological response is attained and sustained. While the exact number of acres needed for AM is uncertain, the PEIS discloses the impacts associated with up to the maximum 4, 370 acres (Alternative 3.5). An AM strategy is included as Appendix H in the PEIS and was developed to serve four primary functions: 1) identify the uncertainties involved with ongoing and potential management actions; 2) identify metrics that will help decision makers measure the success of the ESH program at meeting its stated objectives; 3) identify monitoring needed to measure progress toward these metrics; and 4) identify the AM strategy by which management actions are adjusted over time to ensure success (Corps, 2011a).

4.1.2.3 Proposed Project Activities

The Corps, in coordination with NPS and USFWS, identified 39 sandbars on the Gavins Point reach and 12 sandbars on the Fort Randall reach (refer to Treatment 6 on spreadsheets in Appendix A) that meet the selection criteria for spring/and or fall spraying proposed to begin in 2013. The total number of acres proposed for treatment on the 12 sandbars on the Fort Randall reach is 34 acres and for the 39 sandbars on the Gavins Point reach is 150 acres. It is estimated that after treatment, a total of 3,234 acres of ESH would be available on the Fort Randall reach and 5,347 acres of ESH available on the Gavins Point reach; however, it is important to note that not all these acres would be used by the terns or plovers in any given year, but that they exhibit the characteristics and meet the criteria needed for ESH. Treatment would be limited to treating only those areas on the sandbar with visible vegetation, and treatment will only be done on as needed basis, so sandbars may only be treated once during the year with either a spring or fall treatment. Appendix A contains a listing of potential sandbars and their locations within the project area that have been identified as potential ESH that will be evaluated on an annual basis.

Vegetation treatment and removal in Lewis and Clark Lake is not being proposed for 2013, although sandbars in this lake segment will be evaluated each year (see Section 4.1.2). Following the initial spray treatment in the Fort Randall and Gavins Point reaches in 2013, the Corps will coordinate with the appropriate agencies each following year through the year 2017 before any spring or fall spraying takes place to evaluate and determine which sandbars meet the criteria for vegetation treatment. These updated lists will then be sent to all the applicable agencies, Tribes, and interested stakeholders for their review and to obtain required permits.

Vegetation removal activities would be undertaken during the absence of terns and plovers so as not to interfere with the courting / breeding activities of these birds. The least tern and piping

plover usually begin to nest on the MNRR in early May and typically the last chick fledges as late as early September. The proposed work in 2013 and in subsequent years would be done prior to the birds arriving in the spring, and again in the fall as needed after the birds have left. Spring spraying would occur within a ten day period within each segment no earlier than April 1 and all spraying would stop once the birds return to a particular segment. Fall spray applications generally occur during the first two weeks of September on each segment following abandonment of the sandbars by the birds. Some research has show that herbicides are more effective in the fall by penetrating the root and moving throughout the plant as the plant begins to increase root uptake to store nutrients and water, and by preventing the germination of seed in the spring.

4.1.2.3.1 Herbicides and Adjuvants

The Corps proposes to clear the vegetation by applying an imazapyr-based (e.g., Habitat) and/or a glyphosate-based (e.g., Rodeo) herbicide approved by EPA for aquatic use. The behavior of each herbicide and its effects on target plants are different and a combination of these two herbicides could provide an effective treatment combination. The Corps will monitor and evaluate all products used in ground or aerial to determine efficacy and potential impacts to the environment.

Imazapyr is a low toxicity non-selective herbicide that controls a broad range of terrestrial and aquatic weeds. It can be applied pre-emergent but is most effective when applied as a post-emergent herbicide, as it eliminates the vegetation for a longer time period (Tu et al. 2001). Imazapyr is absorbed quickly through plant tissue and can be taken up by roots and is efficient at killing large woody species (Tu et al., 2001). The half-life (time required for half of the compound to dissipate or degrade) of imazapyr is approximately 3 to 5 days in surface water (EPA, 2005). The half-life of imazapyr in soil varies greatly depending on the soil type and persists with a half-life of one to five months (Tu et al., 2001). Imazapyr is both persistent and mobile in soil and can travel through soil entering groundwater or enter surface water through runoff; however, its low application rates minimize potential impacts on surface or groundwater (Trevathan, 2002). Imazapyr is degraded primarily by microbial metabolism (Tu et al., 2001) and does not bioaccumulate (build-up) in aquatic organisms (EPA, 2005). The desired outcome is that imazapyr would remain within the sand in order to effectively slow or eliminate vegetative growth rates.

Glyphosate is a non-selective herbicide where total vegetation control is desired and controls most annual and perennial plants. Glyphosate is absorbed across the leaves and stems of plants and is translocated throughout the plant. After glyphosate is applied by spraying, it is strongly adsorbed to soil, remains in the upper soil layers (0-6 inches), and has a low propensity for leaching (EPA, 2012a). It degrades over time by soil microbes into naturally-occurring substances. In water, glyphosate is rapidly dissipated through adsorption to suspended and bottom sediments, and has a half-life of 12 days to ten weeks (EPA, 1993). To determine glyphosate persistence in soil, a field dissipation study was conducted at eight different field sites across the U.S. (EPA, 1993). The median half-life for glyphosate applied at maximum annual use rates was 13.9 days with a range of 2.6 (Texas) to 140.6 days (Iowa) with an average half-life of

about 40 days (EPA, 1993; Monsanto, 2005). The reported half-lives from the field studies conducted in the coldest climates were the longest indicating that glyphosate residues in the field are somewhat more persistent in cooler climates as opposed to milder ones. (EPA, 1993). In 2002, the European Commission (2002) completed an assessment fate and behavior of glyphosate in the environment. Under a wide range of climatic conditions found in the U.S., Canada, and Europe, the mean half-life for glyphosate degradation in field soil was reported to be 30 days, with a range from 1 to 130 days. In another study (Giesy et al., 2000) a comprehensive ecotoxicological assessment of glyphosate concluded that field studies (13 studies, five countries, 47 different sites) indicated an average half-life of 32 days. The variability in rates of glyphosate degradation is believed to be due to the varying microbial activity and extent of soil-binding at the different study sites (Giesy et al., 2000; Monsanto, 2005). Due to its ionic state in water, glyphosate would not be expected to volatilize from water or soil (EPA, 1993). EPA determined that glyphosate is of relatively low toxicity to birds, mammals, invertebrates, and fish (EPA, 1993; Tu et. al, 2001). The lack of similarity of action between glyphosate and imazapyr would indicate no interactive toxicity.

Combining the two herbicides is often more effective in controlling established vegetation and different vegetation types. The herbicides would be mixed at a maximum rate of six pints imazapyr plus seven pints glyphosate for each acre to be targeted. Added to the herbicide mix is a surfactant (i.e., Destiny HC) and drift retardant (i.e., Grounded) and enough water to equal 100 gallons. Destiny HC is a highly concentrated methylated soy oil-based spray designed to improve adhesion and coverage of plant surfaces. Destiny HC is approved for aquatic use with herbicides labeled for aquatic use and is compatible for use with glyphosate. Grounded, which will be used for ground spraying application, is particularly effective with some herbicides in sandy soils that are low in organic content and helps to retain droplets on the leaf surface and reduce drift by reducing splash and subsequent scattering of the spray droplets on equipment and non-target surfaces. Grounded is also labeled for use with products registered for aquatic use and may improve the herbicide product by increasing absorption of the applied spray mix by soil resulting in a reduced potential for leaching away of the active ingredient. The rate at which these adjuvants will be applied will be dependent on the area of sandbar that will be sprayed or the amount recommended to be mixed for 100 gallons. Rates of application will strictly adhere to label recommendations. Each acre would receive the maximum rate of herbicide. Material Data Safety Sheets (MSDS) and product labels for each of the herbicides and adjuvant products described above can be accessed at the following site, as they were not available for download: Destiny HC: http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=8510&t=1,2,3,4; and Grounded: http://www.cdms.net/LabelsMsds/LMDefault.aspx?pd=3286&t=. The product labels list the recommended rate applications. If aerial applications prove necessary, the adjuvants used for ground spraying will be evaluated to determine if they are applicable to aerial spraying. The Corps will work with other agencies (e.g., USFWS, NPS, and NGPC), to determine the products best suited for aerial applications.

In addition to the herbicide and adjuvant mix, a spray indicator, Hi-Light Blue Liquid, will be used during ground spraying to mark the area of treatment as it is being sprayed. Hi-Light is a temporary colorant used for effectively marking spray applications and allows for a more uniformly application of the herbicides. Spray indicators, or dyes, are considered non-hazardous

and thus are not regulated by the EPA. They are also considered low-toxicity, and are considered safe for humans, animals and the environment. Exceptions are some red/purple dyes that contain Rhodamine B or Basic Violet 3, both of which are carcinogenic, and not considered for application on Missouri River sandbars. Spray indicators are considered beneficial as they provide visual assurance of uniform spray applications (reducing overlap and missed areas), as well as alerting the operator to equipment issues (leaks or clogged nozzles) in real-time. They also serve as a safety tool to alert the operator to exposure of the solution to non-target areas or clothing. Appendix B contains the MSDS and technical sheet for Hi-Light Blue Liquid.

4.1.2.3.2 Application and Removal Methods

The primary and preferred method of vegetation removal from selected sandbars would be spraying from an all-terrain vehicle (ATV) or hand spraying for smaller areas with less vegetation. In areas that are large and/or densely vegetated and ground-spraying would not be conducive, aerial spraying from a helicopter would be conducted. The helicopter would begin at a staging area where it would be loaded with water, herbicide, and aquatic-approved adjuvants (surfactant and drift retardant) following all label recommendations.

Aerial spraying (Figure 5) would only be conducted if the vegetated areas proposed for spraying are large and use of an ATV and/or hand spraying would not be an efficient method. The helicopter would begin at a staging area (e.g., boat ramp) where it would be loaded with water, herbicide, and aquatic-approved adjuvants, following all label recommendations. The helicopter would be capable of treating upwards of 30 acres per hour. The helicopter would return to the staging area as needed to refuel and refill the chemical mix. Wind speed, before and during aerial applications, are typically measured by the contractor who is required by contract to follow all label recommendations. In addition, the Corps will be on–site during spraying activities and will also be measuring wind speed as part of quality control. Aerial applications would be postponed if wind conditions were not favorable (<10 mph). The following methods or best management practices (BMPs) would be utilized to minimize drift during helicopter application:

- The helicopter would fly slowly and low, as slow speeds can be combined with lower pump pressures to produce larger droplets. Aerial applications would be made only when ground wind speed is below 10 mph or in accordance with the label's directions for use.
- Nozzle orientation would be appropriately aligned to produce the desired droplet size.
- Boom length would be less than overall rotor diameter to ensure reduced drift caused by wingtip and rotor vortices.
- A microfoil boom or equivalent drift control system would be used.
- Aerial applicators would check calibration and follow all practices that enhance accurate delivery of pesticides.
- Fuel and herbicides would be added to vehicles at sites away from the water. Fill sites would have proper spill protection equipment in place to contain and clean up any spilled material.


Figure 5. Aerial spraying of vegetated sandbar

Additional vegetation removal activities may include cutting, mulching, disking, mowing, raking and removing vegetation from the sandbars. Depending on height and density of vegetation on an individual sandbar, it is anticipated that woody vegetation with large stems that will not breakdown readily by themselves would require post-treatment removal (e.g., mowing). Field evaluation will determine the diameter size of stem that would most likely require mechanical removal of the treated plants from the sandbar.

Figure 6. Brushcat mounted on ASV

Typically, the first step is to apply the herbicide on the vegetation, which is absorbed by the plant roots, stems, or leaves. Once the herbicide has taken effect and the vegetation dies off, any standing dead woody debris would be mechanically removed. An all-surface vehicle (ASV) or large bobcat with a brushcat attachment (Figure 6) is typically used to clear the sandbars of remaining dead vegetation. Finely mulched vegetation would eventually enter the river by natural means, i.e. gusts of wind or high water, and large vegetative debris would be hauled off the sandbars and disposed of at a state-approved location. The brushcat has successfully been used to clear vegetation on sandbars in the Gavins Point reach of the Missouri River in the past. 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 7).

Figure 7. ASV with timber ax attachment

Because the Missouri River experienced an historic flood in 2011, most of the vegetation on the sandbars would be less than three inches in diameter; therefore, the brushcat would be the primary tool used to clear vegetation. To discourage growth, pre- and or post-emergent herbicides would be applied using an ATV, backpack mounted sprayer or helicopter immediately following removal activities. Mowing and spraying activities would take place in the spring before the terns and plovers arrive, and in the early fall after they leave. This should also avoid the primary nesting periods of most other migratory birds; however, to avoid the potential take of migratory birds, all areas to be mowed and sprayed would be surveyed for nests prior to the commencement of any work. Any active migratory bird nests found would be marked using surveyors tape and/or pin flags. All equipment would 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.

The duration of the removal activities would vary depending on the size and extent of vegetation coverage at a particular sandbar. Typically, a 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 would be left on the sandbar overnight until the work is completed. Upon completion, equipment would be removed and loaded out at the same boat ramp used to load into the river. All work to remove vegetation would occur within the existing sandbar boundaries. Construction to expand the existing footprint of the sandbar would not occur. Figures 8 and 9 illustrate typical views of vegetation removal work in progress and the resulting sandbar condition.

In the future, maintenance activities will be completed on an annual basis (spring and/or fall spraying) as necessary, to control any vegetation that emerges after the initial vegetation removal/spraying efforts in 2013. Maintenance activities will be completed in the same manner as the initial effort and will be monitored as to the effectiveness of the treatments.

Figure 8. Vegetated sandbar prior to and during removal

Figure 9. Sandbar after vegetation removal (notice fine debris left on bar)

Required permits and environmental compliance documents will be obtained in order to complete projects and maintain habitat for the birds to use during the nesting season. The least tern and piping plover usually begin to nest on the MNRR in early May and typically the last chick fledges as late as early September. The spring and/or fall spraying activities will begin in 2013 and continue through fall of 2017.

4.1.2.4 Site Access and Staging

In order to remove vegetation from sandbars, staging areas would need to be established. The staging areas for aerial spraying would need to be at least one-tenth of a mile long with no tall obstructions such as trees or telephone poles (Figure 10). Any staging area would be as close as possible to the sandbars.

Figure 10. Helicopter and water truck at staging area

For the more intensive vegetation removal methods, 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 USWFS, NPS, SDGFP and NGPC, would choose suitable boat ramps nearest to ESH sites and will obtain any necessary leases for staging areas as required by the Corps' Real Estate Division.

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, and the Corps may transport contractors and equipment to and from the sandbars. Figures 11 and 12 are representative photos of crew and equipment landing on a sandbar and a typical staging area for ESH vegetation removal, respectively.

Figure 11. Staging area on sandbar

Figure 12. Transporting ASV on landing craft to sandbar

Best management practices (BMPs) would be used to avoid or minimize negative impacts to these areas, and all areas disturbed by staging and fueling activities would be restored to their original condition upon completion of spraying and removal activities. Vegetation removal activities in the Fort Randall and Gavins Point reaches and Lewis and Clark Lake segment are not anticipated to last more than a few weeks. In consideration of potential effects on other resources, BMPs include, but are not limited to:

1. Regularly checking equipment and implementing safety measures to minimize the risk of spills.
2. Promptly cleaning spills following applicable standards.
3. Limiting idling of equipment.
4. Locating equipment and staging areas away from sensitive resource areas (e.g., wetlands).
5. Limiting the staging area to the minimum area needed.
6. Restoring disturbed areas to original state upon completion of project activities by re-vegetating with appropriate native plantings.
7. Strict adherence to pesticide label instructions.
8. No treatments will occur within 250 feet of any water intakes, potable or otherwise.
9. No treatments will be applied to or near any Clean Water Act 303(d) impaired waters.
10. Record-keeping and management by Corps. Records will be maintained for a minimum of three years from the date of pesticide application and will include spray locations, amounts, dates, and field conditions.

4.1.2.7 Project Coordination

In accordance with NEPA and its implementing procedures, the Fish and Wildlife Coordination Act (FWCA) and the NHPA, numerous agencies and interest groups were contacted for

information and comments during the development of this project and preparation of this EA. Project locations and restoration methods were selected by the Corps' ESH PDT and developed with representatives of the USFWS, NGPC, SDGFP and NPS through a series of meetings, phone calls and emails.

Scoping letters were sent to organizations including Nebraska Department of Agriculture (NDA), Nebraska Department of Environmental Quality (NDEQ), Nebraska Department of Natural Resources (NDNR), Nebraska Department of Water Resources (NDWR), NGPC, Nebraska Natural Resources Conservation Service (NNRCS), South Dakota Department of Agriculture (SDDA), South Dakota Department of Environment and Natural Resources (SDDENR), SDGFP, South Dakota Natural Resources Conservation Service (SDNRCS), Bureau of Indian Affairs (BIA), U.S. Coast Guard (USCG) Auxiliary, Izaak Walton League of America (IWLA), Missouri Sedimentation Action Coalition (MSAC), South Dakota Wildlife Federation (SDWF) and the Papio-Missouri River Natural Resources District (PMRNRD).

The ESH Product Delivery Team (PDT) will continue to meet annually to view current and historical imagery and to discuss locations on the river where vegetation treatment should be conducted in an effort to maintain as much ESH as possible, while considering competing efforts, such as the natural regeneration of cottonwood. A list of potential sandbars is identified and prioritized at these meetings. During these annual meetings, team members discuss the potential positive and negative aspects associated with vegetation treatment at each location. The ESH PDT uses these aspects, along with team members' personal knowledge of the trends at the prioritized sites (e.g. channel stability/thalweg shifts, vegetation and previous bird usage), to select which areas to focus on in the upcoming year.

5.0 AFFECTED ENVIRONMENT

5.1 Physiography, Relief and Drainage

The proposed project falls within two primary ecoregions, the Western Corn Belt Plains and the Northwestern Glaciated Plains. Ecoregions denote areas of general similarity in ecosystems and in the type, quality and quantity of environmental resources. The Western Corn Belt Plains ecoregion is situated on the southeastern edge of the project where the Missouri River begins to exit South Dakota and flow in a more southerly direction. Landforms in the Western Corn Belt Plains are characterized by nearly level to gently rolling glaciated till plains and hilly loess plains. There are intermittent and perennial streams, many of which have been channelized. A few areas have natural lakes (Wiken et al., 2011).

The Missouri River flows in and along the southern and western border of the Northwestern Glaciated Plains ecoregion. The Northwestern Glaciated Plains landforms are a transitional region between the generally more level, moister, more agricultural Northern Glaciated Plains to the east and the generally more irregular, dryer, Northwestern Great Plains to the south and southwest. The western and southwestern boundary roughly coincides with the limits of continental glaciation. The rolling hills and gentle plains are almost entirely moraine, outwash and sediment deposited in lakes by glaciations (Wiken et al., 2011). The Missouri River drains

nearly 530,000 square miles and flows in a southeasterly direction until reaching the Mississippi River near St. Louis, MO.

5.2 Climate

The climate of the proposed project area is cool and semiarid to sub-humid and continental. The area is generally 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. The majority of annual precipitation falls in late spring and early summer.

Specifically, the Western Corn Belt Plains ecoregion has mostly a dry, mid-latitude steppe climate. It is marked by warm to hot summers and cold winters. The mean annual temperatures of the ecoregion range from 2.5° Celsius (C) in the north to 7°C in the south. The mean summer temperatures are 15.5°C to 16°C, and the mean winter temperatures are -10°C to -11°C. The frost-free period ranges from 95 days to 170 days. The mean annual precipitation ranges from 250 to 350 millimeters (mm) in drier areas and from 350 to 550 mm in moist areas (Wiken et al., 2011).

The Northwestern Glaciated Plains ecoregion has a severe, mid-latitude, humid continental climate, marked by hot summers and cold winters. The mean annual temperature is approximately 6°C in the north to 12°C in the south. The frost-free period ranges from 140 to 200 days. The mean annual precipitation is 800 mm, ranging between 610 and 1,000 mm and occurring mainly in the growing season (Wiken et al., 2011).

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 with some sands and Riverwash (RW) components. Water classification is described as 100 percent water in the NRCS Field Office Technical Guide (FOTG). The FOTG describes RW components as 0 to 1 percent slope, frequently flooded and poorly drained soils located on bars and channels within floodplains. These soils are composed of gravelly coarse sand to gravelly sandy loam. Figure 13 provides an example of soil mapping units within the river channel at RM 767.0. More detailed soil information by county is listed in Table 1. None of the proposed project sites are located on prime farmland (NRCS, 2012a).

Figure 13. Typical soil classification map (Source: NRCS, 2012a)

Table 1. Soil Information by County

Nebraska	**Soils**			
Boyd	Water	--	--	--
Cedar	Water	Barney variant fine sand	Sarpy loamy fine sand	Sarpy fine sand
Dixon	Water	Riverwash	--	--
Knox	Water	Norway loamy fine sand	Fluvaquents	--
South Dakota	**Soils**			
Bon Homme	Water	--	--	--
Charles Mix	Water	Norway loamy fine sand	--	--
Clay	Water	Norway loamy fine sand	Meckling loamy fine sand	Norway-Meckling loamy fine sands
Gregory	Water	Riverwash	--	--
Union	Water	--	--	--
Yankton	Water	Sardak loamy fine sand	--	--

5.4 Water Quality

The Missouri River is approximately 2,340 miles long and drains nearly 530,000 square miles of the eastern Rocky Mountains 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 St. Louis, MO. The map below (Figure 14) shows the major contributing tributaries and drainage basin of the Missouri River.

Figure 14. Missouri River drainage basin and contributing tributaries.
Source USGS DEMIS Map Server, 2010

The water quality management for these water bodies within the project area is under the jurisdiction of the NDEQ and SDDENR. Each state develops water quality standard regulations and establishes the beneficial use or uses (e.g., recreation, aquatic life, water supply, etc.) to be made of a water body, sets criteria necessary to protect the uses, and establishes policies to maintain and protect water quality. As required by Section 303(d) of the CWA, states 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.

Based on the NDEQ "2012 Water Quality Integrated Report," Lewis and Clark Lake is listed on the Nebraska 303(d) list because the water body's aquatic life beneficial use is impaired and not fully supported because of chlorophyll-a; however, the Missouri River main channel within the project area is not listed (NDEQ, 2012). According to the SDDENR "2012 Integrated Water Quality Report," the Missouri River fully supports all beneficial uses. Lewis and Clark Lake is not identified as an impaired water (SDDENR, 2012).

5.5 Vegetation

5.5.1 Wetlands

In general, the distribution of wetland communities across the Missouri River floodplain range from sparsely vegetated sandbar and semi-permanently flooded exposed sandbar to temporarily/seasonally flooded riparian forest, woodland, and shrubland. The wetland classes along the Missouri River fall into four major groups, each based on dominant vegetation structure: 1) emergent - dominated by perennial or persistent herbaceous plants; 2) scrub-shrub -

dominated by woody vegetation less than 20 feet tall; 3) forested - dominated by woody vegetation greater than 20 feet tall, and 4) exposed shore – refers to shoreline wetlands, both vegetated and unvegetated with less than 30 percent cover of trees, shrubs, or persistent emergents and associated with rivers, reservoirs, or lakes (Corps, 2004). The sandbars proposed for vegetation treatment typically fall under the exposed shore wetland class.

Dam operations affect sandbar creation by reducing sediment input and reducing high spring flows that both deposit new sandbars and scour vegetation off existing sandbars. The hydrology and morphology of the Missouri River influence the composition and distribution of vegetation, causing habitat changes on a seasonal, annual, and long-term basis. Erosion and sediment transport play an important role in the creation and degradation of sandbar habitat; scouring or elimination of vegetated land; creation of suitable substrate for plant germination; and the initiation of early–successional plant communities (Corps, 2004). Seasonal flow patterns dictate the frequency and duration of wetland flooding, and lake storage levels determine the water depths in wetlands located in the reservoirs (Corps, 2004).

Rolfsmeier and Steinauer (2010) classified 70 natural community types of Nebraska streams, which included wetland sparsely vegetated communities. Within this classification, Sandbar/Mudflat was defined as a community occurring along river shorelines, islands, pointbars, and flats, and subject to regular flooding. These sandbars are formed when receding floodwaters deposit sand and lesser amounts of clay, silt, and cobbles in the streambed. Soils are often undeveloped due to the ephemeral nature of the sandbars and drainage depends on elevation above the water surface. Sandbars are highly vulnerable to undercutting and erosion throughout the years. Plant species found along the sandbar edges or margins typically consist of smartweeds (*Polygonum* spp.), cottonwood and willow seedlings, cocklebur (*Xanthium strumarium*), beggarticks (*Bidens* spp.), flatsedges (*Cyperus* spp.), barnyard grass (*Echinochloa crusgalli*), and sand dropseed (*Sporobolus cryptandrus*) (Rolfsmeier & Steinauer, 2010; NatureServe, 2012). Woody cover is generally absent in the first year of establishment but can increase if the site does not flood. The vegetation is highly variable due to the ephemeral, successional nature of the community. Recently exposed sandbars are initially devoid of vegetation, but are soon colonized by opportunistic annual herbs and graminois, usually under 0.5 meter tall. Lower areas adjacent to the river channel are dominated by hydrophytic species, while higher areas of the sandbar are dominated by plants tolerant of the drier conditions present on the more rapidly drained soils. Species diversity is low to moderate (Rolfsmeier & Steinauer, 2010).

The areas proposed for vegetation treatment in the Gavins Point and Fort Randall reaches are all recently created sandbars in the Missouri River channel resulting from the 2011 high flows. The Lewis and Clark Lake segment contained an estimated 15,000 wetland acres prior to the 2011 flood; however, much of the vegetation was scrubbed off during the high flows although the sandbars generally remained in place and quickly re-established wetland vegetation (G. Jons, personal communication, April 15, 2013). As mentioned previously, Lewis and Clark Lake segment is excluded from vegetation treatment in 2013; however, sandbars within this lake segment will be evaluated on an annual basis and could potentially be proposed for treatment in subsequent years.

Vegetation observed on the sandbars during an ESH PDT boat trip in late summer of 2012 included small amounts of cocklebur (*Xanthium strumarium*) and sweet clover (*Melilotus* sp.) on the higher areas; and cottonwood (*Populus deltoides*), sandbar willow (*Salix exigua*) and peachleaf willow (*Salix amygdaloides*) seedlings along the edges and lower areas of the sandbars. The USFWS National Wetlands Inventory (NWI) online map accessed May 10, 2012 classifies the project locations as Riverine Unconsolidated Bottom, Permanently Flooded (R2UBH) deepwater habitats and Riverine, Lower Perennial, Unconsolidated Shore, Seasonally Flooded (R2USC) habitats (USFWS, 2012a). There are no threatened or endangered plant species identified within the project area.

5.5.2 Noxious Weeds

Eleven species have been designated as noxious in Nebraska (NRCS, 2012b) and 31 species (NRCS, 2012c) have been designated as noxious for South Dakota, according to the U.S. Department of Agriculture (USDA) invasive and noxious weed list. For a list of Nebraska's noxious weeds see http://plants.usda.gov/java/noxious?rptType=State&statefips=31.

For a list of South Dakota's noxious weeds see http://plants.usda.gov/java/noxious?rptType=State&statefips=46. Currently, about eight non-native species targeted for action within the MNRR include purple loosestrife (*Lythrum salicaria*), salt cedar (*Tamarix spp*.), Russian olive (*Elaeagnus angustifolia*), Canada thistle (*Cirsium arvense*), and leafy spurge (*Euphorbia esula*). None of these species were observed during the 2012 boat trip; however, many of these species may occur on sandbars or lands adjacent to project locations.

5.5.3 Cottonwoods

Plains cottonwood (*Populus deltoides*) forests were historically a major component of the floodplain of the Missouri River. Cottonwoods provide important habitat for a variety of game and non-game wildlife including sensitive species like bald eagles. Cottonwoods grow well only where their roots can reach moisture provided by underground water and where their seeds can germinate on bare, moist soil. Alteration of the Missouri River through the construction of dams, reservoirs and channelization has significantly reduced the natural processes (i.e., natural river flooding, shifting channels and sandbars) needed for cottonwood regeneration. In particular, dams reduce floodplain inundation during spring, and spring flooding is necessary for cottonwood regeneration (NRCS, 1997). The conversion of forest and grassland to cropland or urban development has also contributed to the landscape change (Dixon et al., 2012). Cottonwoods do not reproduce on already established forest sites, which allows for other late-successional species, such as green ash (*Fraxinus pennsylvanica*), boxelder (*Acer negundo*), and American elm (*Ulmus americana*) to reproduce abundantly in the understory of cottonwood forests. Encroachment by non-native species including Russian olive, salt cedar, and native eastern red cedar (*Juniperus virginiana*) is a concern as these species outcompete and displace native riparian vegetation such as cottonwood and willow.

The BiOp directed the Corps to develop a management plan that preserves, creates or enhances cottonwood habitat along the Missouri River (see Section 6.5.2.3). As part of the data collection effort for the Cottonwood Management Plan (CMP), surveys were conducted from 2007-2009 to determine the current status of cottonwood forests along the Missouri River. This survey found that 48 percent to 91 percent of the cottonwood area was greater than 50 years old (i.e., mature). This survey also measured the maturity and approximate acreage of cottonwood forest per river mile in some segments including the Fort Randall segment, where 68 percent of cottonwoods were found to be mature, Lewis and Clark Lake where greater than 50 percent were mature, and the Gavins Point segment where the majority of cottonwoods were under 50 years old (Dixon et al., 2010). Most cottonwood stands (62 percent by area), established before the placement of the dams and reservoirs (mid-1950s), with only 14 percent establishing in the last 25-30 years (Dixon et. al., 2010).

The impacts of the 2011 flood event on cottonwoods are not completely known, but potentially include both losses of established forest and increased opportunities for natural recruitment. The 2011 Missouri River flood event had positive and negative effects on the cottonwood ecosystem. The flood created hundreds of acres of sandbars promoting the natural regeneration of cottonwoods on newly formed depositional bars; however, the flood also eroded away existing stands of cottonwoods and the prolonged inundation of the flood caused mortality of cottonwoods and other native floodplain trees.

5.6 Federally-listed Threatened and Endangered Species

The USFWS previously considered the biological effects of the construction and maintenance of ESH in the development of the RPA for the BiOp and determined that it is an integral component to avoid jeopardy to listed species. Therefore, the Corps is not required to prepare a Biological Assessment (BA) for this action; however, for the purposes of NEPA, this EA discloses the effects and benefits of the project on federally-listed threatened and endangered species in Nebraska and South Dakota counties that border the proposed project.

The species intended to benefit from the Corps' actions are the threatened interior least tern and the endangered piping plover. These species utilize sparsely vegetated sandbars for nesting, foraging and brood-rearing habitat during the period from approximately late April to late August. Least terns are colonial nesters and piping plovers often nest with a colony of least terns for added protection, as terns actively defend their colonies by mobbing intruders (Catlin, 2009). Within the project area, terns and plovers frequently cohabitate, establishing residence on the same sandbars.

Based on earlier communication received from the USFWS during previous ESH efforts (Corps, 2010), and in review of the USFWS threatened and endangered species website listing for each state, the USFWS identifies the pallid sturgeon (*Scaphirhynchus albus*), interior least tern (*Sterna antillarum*), piping plover (*Charadrius melodus*), whooping crane (*Grus americana*), Eskimo curlew (*Numenius borealis*), Topeka shiner (*Notropis topeka*), scaleshell mussel (*Leptodea leptodon*), Higgins eye pearlymussel (*Lampsilis higginsii*), western prairie fringed orchid (*Platanthera praeclara*), American burying beetle (*Nicrophorus americanus*), and the

black-footed ferret (*Mustela nigripes*) as federally-listed species that occur in all or portions of the Nebraska and South Dakota counties bordering the proposed project area. Federally-listed threatened and endangered species known to occur in the vicinity of the proposed project area are described below.

5.6.1 Pallid Sturgeon (*Scaphirhynchus albus*), Endangered

The endangered pallid sturgeon is a descendant of a group of ancient (Paleozoic) fish. The pallid was federally listed on September 6, 1990. The Missouri River from Gavins Point Dam to its confluence with the Mississippi River is designated as a recovery-priority area for the pallid sturgeon. According to the five-year review for the pallid sturgeon (USFWS, 2007), current sturgeon habitat in the upper Missouri River is highly fragmented and reduced, restricting the life cycle requirements of pallid sturgeon by creating physical barriers that block normal migration patterns, degrading and altering physical habitat (e.g., water temperature and turbidity), and altering the natural hydrograph of the river. To avoid jeopardizing the continued existence of the pallid sturgeon, the BiOp requires the Corps to restore a portion of suitable riverine aquatic habitat and hydrologic conditions necessary for successful reproduction and recruitment of this species.

The pallid sturgeon is well adapted to life on the river bottom and prefers large, turbid, free-flowing riverine habitat with rocky or sandy substrates. Based on information presented in the USFWS Recovery Plan (USFWS, 1993), the pallid sturgeon most frequently occupies river bottoms where water velocity ranges from 0.3 to 2.9 feet per second (fps). These fish are most often found over sandy substrate in waters with a velocity of 0.3 to 2.9 feet per second (fps) and depths of 3 to 26 feet (USFWS, 1993). They are believed to prefer the cooler (0 - 30° C), turbid waters typical of the historic Missouri River and are frequently captured in areas characterized by high sediment load (USFWS, 1993). Pallids feed primarily on aquatic insects and small bottom dwelling fish. Kallemeyn (1983) reported that spawning appears to occur between June and August, and females may not spawn each year (as cited in USFWS, 2007; PRRIP, 2012). Substrates associated with spawning in the Missouri River and major tributaries include rock, rubbles and gravel (USFWS, 1993).

5.6.2 Interior Least Tern (*Sternula antillarum*), Endangered

The interior least tern was listed as a federally endangered species on June 27, 1985. The least tern is a shorebird that prefers to nest in colonies on unvegetated to sparsely vegetated sandbars. They feed primarily on small fish, which are gathered from shallow water (NGPC, 2012). Least terns begin arriving on the MNRR in mid to late May. The least tern prefers sandbars that are toward the center of the river, with little vegetation and a sandy/gravelly substrate. Adults and juveniles head for the wintering grounds after fledging (when chicks learn to fly), with most terns departing the MNRR by the end of August. Much of the habitat historically utilized by these birds has been lost due to reservoir inundation, vegetative encroachment, erosion, and high summer releases. Many of the remaining bare sandbars along the Missouri River are used for recreation and are prone to human disturbance during the bird's nesting season. Predation (e.g., mink, great-horned owl) can also be problematic, particularly on sandbars that are attached to the riverbank.

5.6.3 Piping Plover (*Charadrius melodus*), Threatened

The Northern Great Plains population of the piping plover was listed as a federally-threatened species on December 11, 1985. Construction and operation of reservoirs on the Missouri River and other river systems have resulted in a loss of sandbar habitat. Plovers using the remaining sandbars on the river are susceptible to predation, direct disturbance by people, and water fluctuations as the result of dam operations. Predation is a major factor affecting the birds as changes in the landscape have increased predator populations, particularly raptors and mammals (USFWS, 2002).

This small shorebird feeds primarily on insects, crustaceans and mollusks. The piping plover arrives on the MNRR in mid April with nest initiations beginning in late April and continuing through May and June. The plover prefers sandbars with little vegetation and the birds' preferred substrate for nesting is a sand and gravel mix. Following fledging, the adults and young juveniles depart for the wintering grounds, generally by the end of August.

5.6.3.1 Piping Plover Critical Habitat

The project area lies within a reach designated as "Critical Habitat" for the piping plover. This designation was made on September 11, 2002 under recommendation of USFWS. All projects are within the Missouri River's "Critical Habitat" designated area from RM 987.5-752.2. Critical habitat is defined as "the specific areas within the geographic area occupied by a species, at the time it is listed in accordance with the Act, on which are found those physical or biological features (a) essential to conserve the species and (b) that may require special management considerations or protection and (c) specific areas outside the geographic area occupied by a species at the time it is listed, upon determination that such areas are essential to conserve the species." In order to be considered critical habitat, a specific area must exhibit one or more of the primary constituent elements for that habitat type. The Primary Constituent Elements (PCE) for riverine habitat are sparsely vegetated channel sandbars, sand and gravel beaches on sandbars, temporary pools on sandbars and interface with the river.

5.6.4 Whooping Crane (*Grus americana*), Endangered

The whooping crane was federally listed as endangered on June 2, 1970. The whooping crane occurs only in North America. Whooping cranes use shallow, sparsely vegetated streams and wetlands to breed, feed and roost during their migration. Whooping cranes feed on blue crabs, clams, frogs, rodents, small birds and berries. These birds mate for life and generally live up to 24 years. There is the potential for whooping cranes to stopover at any given location within the project area as it lies within the migration corridor.

5.6.5 Eskimo Curlew (*Numenius borealis*), Endangered

The Eskimo curlew was federally listed as endangered in 1967. The Eskimo curlew is a medium-sized shorebird with a slender, slightly downcurved bill. This shorebird feeds in open natural grassland and tundra, burned prairies, meadows and pastures. In spring, Eskimo curlews migrate north overland through the prairies of the United States and Canada before returning to

the arctic to breed. Unrestricted market hunting, extinction of the Rocky Mountain grasshopper, a primary food source, and loss of habitat primarily due to cultivation and grazing contributed to the curlew's decline. According to the USFWS, the species is considered likely extinct with the last documented sighting in Barbados in 1963. Later sightings, as recently as 2006, have not been confirmed by physical evidence (USFWS, 2011).

5.6.6 Topeka Shiner (*Notropis topeka*), Endangered

The Topeka shiner was federally listed as endangered in 1998. Topeka shiners are found in small prairie streams and creeks that exhibit perennial or nearly perennial flow. The Topeka shiner prefers open pools near the headwaters of streams that maintain a stable water level due to weak springs or percolation through riffles. These fish spawn from late May to July and the young mature in one year. The maximum life span is 2 to 3 years. Their diet consists of insects and zooplankton.

5.6.7 Scaleshell Mussel (*Leptodea leptodon*), Endangered / Higgins Eye Pearlymussel, (*Lampsilis higginsii*), Endangered

The scaleshell mussel was listed as an endangered species in 2001. This mussel species is a relatively small freshwater mussel with a thin, fragile shell and faint green rays. It grows to about one to four inches in length. Scaleshells live in medium-sized and large rivers with stable channels and good water quality. They bury themselves in the sand and gravel on the bottom with only the edge of their partially opened shells exposed. Their habitat can be degraded by changes in sedimentation, temperature, flow patterns and fish migration, all of which are now influenced by dams and changes in land use (NPS, 2012a). The general consensus at the 2006 Mussel Roundtable was that the scaleshell mussel may potentially have a small population near Gavins Point Dam.

The Higgins eye was listed as endangered in 1978. The Higgins eye is a freshwater mussel with a rounded to slightly elongate smooth-textured shell that is usually yellowish brown with green rays. This mussel species is a freshwater mussel of larger rivers where it is usually found in deep water with moderate currents. The animals bury themselves in sand and gravel river bottoms with just the edge of their partially opened shells exposed. Much of their historic habitat has been changed from free-flowing river systems to impounded river systems, which in turn, affect how Higgins eye feed, live, and reproduce (USFWS, 2004). Agency experts at the 2006 Mussel Roundtable thought it unlikely there would be a population of Higgins eye pearlymussel in the Missouri River; however, a fresh dead shell of a Higgins eye mussel was found below Gavins Point Dam in 2004. Shells of these species have been found, but no populations have been located.

5.6.8 Western Prairie Fringed Orchid (*Platanthera praeclara*), Threatened

The western prairie fringed orchid was listed as threatened on September 28, 1989. This orchid is a single-stemmed plant with up to 24 white showy flowers and blooms from early June to late July. The western prairie fringed orchid is known to occur only west of the Mississippi River, and is found most often in mesic to wet unplowed tallgrass prairies and meadows but has been

found in old fields and roadside ditches. The decline of the western prairie fringed orchid is primarily linked to the conversion of habitat to cropland (USFWS, 1996).

5.6.9 American Burying Beetle (*Nicrophorus americanus*), Endangered

The American burying beetle was listed as an endangered species in August 1989. This carrion beetle is a large black insect about 1.5 inches long with two distinct orange bands on each wing cover, orange coloration on its pronotum (i.e., plate-like structure that covers all or part of the thorax in insects). Habitats in Nebraska where these beetles have been recently found consist of grassland prairie, forest edge and scrubland, although specific habitat requirements are unknown. Today, the American burying beetle seems to be largely restricted to areas most undisturbed by human influence (e.g., Nebraska sandhills) (Ratcliffe, 1997).

5.6.10 Black-Footed Ferret (*Mustela nigripes*), Endangered

The black-footed ferret has been listed as endangered since 1967. This ferret is 18 to 24 inches long, including a 5 to 6-inch tail. It weighs only 1.5 to 2.5 pounds and is well adapted to its prairie environment. It is a slender, wiry animal with a black face mask, black feet, and a black-tipped tail. Black-footed ferrets are native to the North American shortgrass and mixed grass prairie. Prairie dogs make up over 90 percent of the black-footed ferrets diet. The primary threat to the ferret has been loss of prairie dog colonies and complexes due to grassland conversion and disease (BFFRIT, 2011).

5.7 State Threatened and Endangered Species

5.7.1 South Dakota State-listed Species

A letter describing the proposed project activities was sent to the SDGFP on April 30, 2012. While no response was received regarding the proposed vegetation removal and control activities, SDGFP previously identified a state-listed threatened species, the false map turtle (*Graptemys pseudogeographica*) that may occur within the project area (Corps, 2010). In the Missouri River basin, these turtles are active during the period of April to September. Nesting takes place during the late spring and summer months. Nests in the Missouri River are typically established in sandy banks or on emergent sandbars and turtle basking is typically restricted to inter-channel snags, rocks and sandbars. False map turtles generally hibernate in soft sediments on the river bottom from October to April. Mussels are their main source of food (SDGFP, 2007).

5.7.2 Nebraska State-listed Species

A letter describing the proposed project activities was sent to the NGPC on April 30, 2012. While no response was received, the NGPC previously provided information on state-listed species that have the potential to be affected by the proposed project (Corps, 2010). The NGPC identified four fish species that were of state concern: the endangered sturgeon chub (*Macrhybopsis gelida*), threatened lake sturgeon (*Acipenser fulvescens*), and "at-risk" species blue sucker (*Cycleptus elongatus*) and sicklefin chub (*Macrhybopsis meeki*).

Lake sturgeon are believed to have similar habitat requirements as the pallid sturgeon, utilizing gravel bars for spawning and using a variety of large river features including backwaters, chutes, sloughs, islands and sandbars during different life stages. NGPC has records of lake sturgeon occurrence near Gavins Point Dam and downstream of Sioux City, IA but has no documented occurrence of the species in the immediate vicinity of the proposed project sites.

Sicklefin and sturgeon chubs are members of the minnow family that are well adapted to large turbid rivers and utilize a variety of habitats including submerged sandbars and gravel bars. These species have been collected in side chutes and backwaters which are thought to provide spawning habitat for these species. These two species were proposed for federal listing in 2000; however, USFWS found that populations of these two species in the Missouri River basin were more widespread than previously thought. Self-sustaining populations of both species were found in three locations: the Missouri River above Fort Peck reservoir, the Yellowstone-Missouri River confluence and the lower Missouri from St. Joseph, MO to the Mississippi River confluence. Additionally, sturgeon chub populations exist in 11 other tributaries of the Missouri and Yellowstone Rivers. According to USFWS range maps, the project area is within the current range of the sicklefin chub but outside the current range of the sturgeon chub (USFWS, 2012b).

Adult blue suckers prefer deep water with moderate current while younger fish utilize shallower, less swift water. It is believed that blue sucker juveniles in this reach drift into the Missouri River from the James River near RM 800.0. Juvenile fish are also thought to use backwaters as nursery areas (Berry & Young, 2004).

5.8 Fish and Wildlife

5.8.1 Birds

The Missouri River in the vicinity of the proposed project 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 (NPS, 2012b).

5.8.2 Mammals

There are 48 species of mammals that have been documented in the project area with small mammals including mice, voles, bats, moles, rats and ground squirrels making up about 60 percent of the species (NPS, 1999). The variety of mammals common to the project area includes opossums (*Didelphis virginiana*), woodchucks (*Marmota monax*), beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), raccoons (*Procyon lotor*) and mink (*Neovison mustela*) (NPS, 2012c).

5.8.3 Fish

Sampling of fisheries on the MNRR portion of the Missouri River was conducted during the late summers of 1996, 1997 and 1998, with a total of 53 species captured. There were 45 species in the Fort Randall reach and 53 species in the Gavins Point reach. All species found in the Fort Randall reach were also found in the Gavins Point reach. A total of 20 of the species were non-native. Combining these species with lists compiled from other surveys done annually by state agencies, it was determined that 92 different species of fish can be found on the MNRR (Berry & Young, 2004).

Some of the most commonly captured species in the project areas included: Channel catfish (*Ictalurus punctatus*), common carp (*Cyprinus carpio*), emerald shiner (*Notropis atherinoides*), quillback (*Carpiodes cyprinus*), river carpsucker (*Carpiodes carpio*), spotfin shiner (*Cyprinella spiloptera*), smallmouth bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*), and white crappie (*Pomoxis annularis*) (Berry & Young, 2004).

5.8.4 Macroinvertebrates

The term macroinvertebrate describes those animals that have no backbone and can be seen with the naked eye. These animals live in the water for all or part of their lives and are significant within the food chain as larger animals such as fish and birds rely on them as a food source, including the piping plover, least tern, and the endangered pallid sturgeon. Hay et al., (2008) studied macroinvertebrates in the Missouri River from Fort Randall Dam to the mouth of the Little Nemaha River, Nebraska. The study examined drift densities for these two reaches as well as sections downstream of Gavins Point reach. Drift is the primary mechanism for redistribution of aquatic macroinvertebrates and a measure of emigration and immigration. Aquatic flies (order Diptera) are the most common order found in the drift of the Fort Randall and Gavins Point reaches with 54.9 percent and 69.3 percent respectively. Midges (*Chironomidae* sp.) were the most abundant dipterans. Fort Randall also had a large portion of the drift density containing true bugs (order Hemiptera) at 20.7 percent. Drift density tends to increase moving downstream with 50,948 individuals (includes aquatic and terrestrial macroinveterbrate) captured in the Fort Randall reach and 89,561 individuals captured in the Gavins Point reach. Researchers collected almost 140,000 individuals in the section downstream of the Gavins Point reach. Higher drift densities were correlated with lower discharges and higher temperatures (Hay et al., 2008).

5.8.5 Mussels

In addition to the two endangered mussel species (i.e., scaleshell and Higgens eye pearlymussel), a collaborative study with the Corps and the SDGFP was conducted in 1999 along the MNRR to determine present unionids. A total of 16 species were identified, with the highest diversity found at the mouth of the James River and the highest abundance found in the stretch immediately downstream of Gavins Point. The most common species found were the white heelsplitter (*Lasmigona complanata*), the fragile papershell (*Leptodea fragilis*), the pink heelspliter (*Potamilus alatus*), the pink papershell (*Potamilus ohiensis*), and the giant floater (*Pyganodon grandis*). These five species, along with the deertoe (*Truncilla truncata*) are considered to be thriving (Perkins and Backlund, 2000).

Data from this study concluded that there are 19 species present on the 59-mile district and seven species present on the 39-mile district.

Zebra mussels (*Dreissena polymorpha*), a highly aggressive, invasive species, was documented in 2003 below Gavins Point and Fort Randall Dams while the Asian clam (*Corbicula fluminea*) was documented in 2003 below Gavins and is now considered present throughout the entire 59-mile district (SDGFP, no date). Zebra mussels out-compete native species by quickly colonizing an area and forming dense clusters on live mussels, thus preventing feeding, reproduction, respiration, movement and growth (Benson, 2013). Asian clams may also out-compete native species through the same mechanisms and are often economically destructive by clogging intake pipes such as those associated with power and water industries (Foster et al., 2013). Both species are a serious threat to native diversity and current invasive control measures are only through means such as public education and vigilance.

5.8.6 Amphibians and Reptiles

Amphibians and reptiles can be found in almost all habitat types, including river sandbars. Many species use different habitat during different times of the year (i.e., aquatic and terrestrial phase). For example, some turtles live in water but must travel onto land to lay their eggs. Sandbars, beaches, and other open moist areas along the shoreline provide important basking and nesting sites for a variety of these species. Turtles in particular, prefer sandy substrates, but muddy bottoms are used as well (NRCS, 2006). Amphibians generally breed and lay eggs in wetlands and other aquatic habitats, some of which exist for only short periods during the year (after rains or snowmelt), and then move to terrestrial areas to over winter (NRCS, 2006). Some reptiles live and forage in aquatic habitats most of the year but move to upland habitats to nest or overwinter (NRCS, 2006). In general, reptiles require habitats that provide thermal gradients ranging from cool shelters to warm basking areas that receive exposure to the sun. Nesting habitat for turtles may be found within areas of loose or sandy soil exposed to full sun and protected from flooding (NRCS, 2006)

Along the MNRR there are seven species of frogs, which include the bullfrog (*Rana catesbeiana*), the western chorus frog (*Pseudacris triseriata*), and Cope's gray treefrog (*Hyla chrysoscelis*). There is also two species of toad, the great plains toad (*Bufo cognatus*) and the woodhouse's toad (*Bufo woodhousii*), along with one salamander, the tiger salamander (*Ambystoma tigrinum*) (NPS, 2013a).

Reptiles located in the MNRR include a variety of snakes and turtles and two species of lizard, the prairie skink (*Eumeces septentrionalis*) and the six-lined racerunner (*Cnemidophorus sexlineatus*). There are 12 species of snake, only one of which is venomous, the prairie rattlesnake (*Crotalus viridis*); however, these rattlesnakes are found 10 to 20 miles east of the Missouri River and throughout western South Dakota. The remaining 11 species are members of the Colubridae family, and include the common garter snake *(Thamnophis sirtalis) and plains garter snake (Thamnophis radix)* (NPS, 2013b). In addition to the state endangered false map turtle *(Graptemys pseudogeographica)*, five other species of turtle are also located in the MNRR; some common species are the snapping turtle (*Chelydra serpentine)*, painted turtle(*Chrysemys*

picta), smooth softshell turtle (Apalone mutica) and spiny softshell turtle (*Apalone spinifera*) (NPS, 2013b).

A final report composed by Fogell and Cunningham (2005) focused on a herpetofaunal inventory conducted on the MNNR and the Niobrara National Scenic River from data collected in 2003 and 2004. Data collected on amphibians and reptiles was based on a series of road surveys, pitfall traps, call surveys, turtle traps, seining, and drift fences. Of the 29 expected herpetofaunal species 26 species were detected through the varying sample methods. The only three species not found that were expected were the milk snake (*Lampropeltis triangulum*), the northern water snake (*Nerodia sipedon*), and the tiger salamander. Two species that were not expected to be found in the area were detected, the ornate box turtle (*Terrapene ornate*) and the prairie rattlesnake (Fogell and Cunningham, 2005).

5.9 Air Quality

All counties of Nebraska and South Dakota within the project area 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 (EPA, 2012b).

5.10 Noise

Ambient human-generated noise levels within the proposed project area are generally low. Sources of noise near the project area may result from agricultural activities, or recreational activities such as boating and hunting. Background noise levels in the proposed project sites are generally low.

5.11 Socioeconomics

The following tables (Tables 2-4) represent relevant demographic and economic data for the counties bordering the project area (U.S. Census Bureau, 2010).

Table 2. Population and Income Data for Project Counties

Nebraska	Population	Change since 2000	Largest Population Center	Per Capita Income	Median Household Income
Boyd	2,099	-13.9%	Spencer (459)	$21,003	$34,906
Cedar	8,852	7.9%	Hartington (1,475)	$20,595	$40,497
Dixon	6,000	-5.3%	Wakefield (1,141)	$20,478	$42,388
Knox	8,701	-7.2%	Creighton (1,108)	$19,894	$36,798

South Dakota	Population	Change since 2000	Largest Population Center	Per Capita Income	Median Household Income
Bon Homme	7,070	-2.6%	Springfield (1,474)	$20,074	$41,107
Charles Mix	9,129	-2.4%	Wagner (1,506)	$17,403	$35,808
Clay	13,864	2.4%	Vermillion (10,417)	$19,518	$37,198
Gregory	4,271	-10.9%	Gregory (1,158)	$21,311	$33,940
Union	14,399	14.4%	North Sioux City (2,601)	$33,783	$59,889
Yankton	22,438	3.6%	Yankton (13,866)	$24,776	$47,124

Table 3. Ethnic Data for Project Counties

Nebraska	White Persons	Black Persons	American Indian and Alaska Native Persons	Asian Persons	Native Hawaiian and Other Pacific Islander Persons
Boyd	97.0%	0.0%	0.6%	0.8%	0.1%
Cedar	98.3%	0.1%	0.2%	0.1%	Z
Dixon	92.5%	0.3%	0.4%	0.2%	Z
Knox	89.1%	0.1%	9.0%	0.2%	0.0%
South Dakota	**White Persons**	**Black Persons**	**American Indian and Alaska Native Persons**	**Asian Persons**	**Native Hawaiian and Other Pacific Islander Persons**
Bon Homme	89.8%	1.0%	7.1%	0.1%	0.0%
Charles Mix	91.1%	0.1%	31.7%	0.2%	0.0%
Clay	65.0%	1.3%	3.1%	1.7%	Z
Gregory	89.6%	z	7.5%	0.3%	0.0%
Union	95.5%	0.7%	0.6%	0.9%	Z
Yankton	92.8%	1.5%	2.5%	0.5%	Z

Z: Value greater than zero but less than half unit of measure shown

Table 4. Poverty Data for Project Counties

Nebraska	Persons below poverty level (percent) 2006-2010
Boyd	8.3%
Cedar	10.6%
Dixon	10.3%
Knox	13.7%
South Dakota	**Persons below poverty level (percent) 2006-2010**
Bon Homme	12.4%
Charles Mix	24.0%
Clay	24.0%
Gregory	16.0%
Union	4.9%
Yankton	11.2%

5.12 Cultural Resources

In addition to review under NEPA, consideration of impacts to cultural resources is mandated under Section 106 of the NHPA as implemented by 36 CFR Part 800. Section 106 requires consideration of certain cultural resources (historic and archaeological) that meet specific criteria. Requirements include the need to identify significant historic properties that may be impacted by the proposed action or alternatives within the Area of Potential Effect (APE). The APE is the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties. Historic properties are defined as archaeological sites, standing structures, or other historic resources listed in or determined eligible for listing in the National Register of Historic Places (NRHP) (36 CFR 60.4).

A Corps archeologist reviewed the sandbar locations within the proposed project area, and a literature and cultural resources file search was conducted. The search revealed no recorded historic properties within the proposed project area. Although no recorded historic properties were identified in the proposed project area, the 2011 flood event unearthed paleontological resources that were previously unexposed, washing them up on sandbars. In particular, old bison bones, including bison skulls were discovered on several sandbars in the Missouri River in South Dakota.

5.13 Missouri National Recreational River

The 39-mile segment of the Missouri River known as the Fort Randall reach and the 59-mile segment of the Missouri River known as the Gavins Point reach have both been designated as Recreational River segments of the Wild and Scenic Rivers System and are collectively referred to as the Missouri National Recreational River (MNRR). Objectives for these two segments include landscape preservation, recreation and visitor use, preservation and restoration of natural resources and inventory and protection of cultural resources.

5.14 Recreation

Large portions of the proposed project area fall within the MNRR managed by the NPS. Common recreational activities include bird watching, camping, fishing, canoeing/kayaking, hunting, hiking and photography. Figure 15 shows the annual visitor numbers for the MNRR since 2004. The largest numbers of visitors to the MNRR occur during the months of May through August (NPS, 2011).

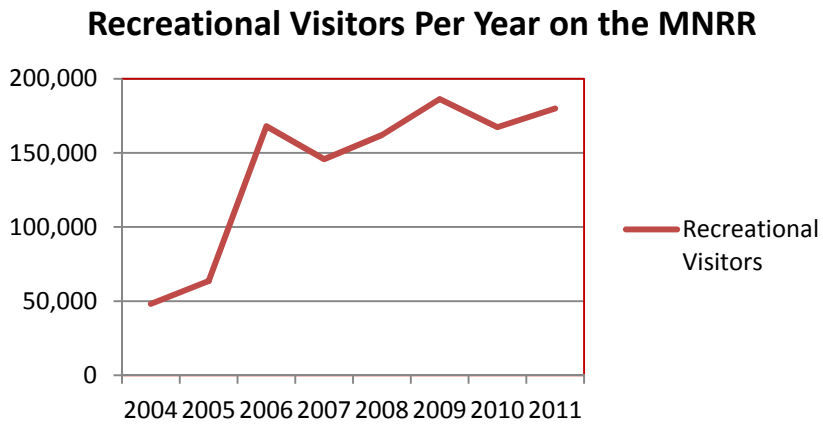

Figure 15. Recreational visitors per year on the MNRR (NPS, 2011)

6.0 ENVIRONMENTAL CONSEQUENCES

6.1 Geology/Physiography

6.1.1 Alternative 1 - No Action

The No Action alternative would have no impacts to the area's geology/physiography.

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 effects would not be considered significant.

6.2 Climate

6.2.1 Alternative 1 - No Action

The No Action alternative would have no impacts to the area's climate.

6.2.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

No change in climatic conditions is expected due to the proposed project.

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 sand, riverine wash or water (areas covered most of the year by water). Disturbance to soils would be limited to the surface and would be caused by disking or raking, or by tracks from machinery working on the sandbars. No prime farmland exists within the river channel where the sandbars are located; therefore, no prime farmland would be impacted. A Farmland Conversion Impact Rating Form (AD-1006) was not required.

6.4 Water Quality

6.4.1 Alternative 1 - No Action

No impacts to the water quality 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 such as regularly checking equipment, placing safety measures to minimize the risk of spills, avoiding sensitive resources (e.g., wetlands), and maintaining an appropriate distance from water would be used to minimize any release of fuels or lubricants from equipment, including refueling/reloading activities. The herbicides imazapyr and glyphosate will be used as a pre-and post-emergent treatment and would be sprayed on relatively bare sand or growing vegetation. The desired outcome is that the herbicides would remain within the sand in order to effectively slow or eliminate vegetative growth; however, an insignificant amount may enter the water column due to runoff. Potential impacts to water quality are expected to be minimal. Appendix B contains EPA fact sheets and MSDS documents for imazapyr and glyphosate.

In 1974, Congress passed the Safe Drinking Water Act (SDWA) which requires EPA to determine the level of contaminants in drinking water at which no adverse health effects are likely to occur. Contaminants are any physical, chemical, biological or radiological substances or matter in water. In EPA's Reregistration Eligibility Decision for Imazapyr report (EPA, 2005), EPA considered the exposure to imazapyr from drinking water resulting from aquatic applications. Health-Based Screening Levels (HBSLs) are benchmark concentrations of contaminants in water that may be of potential concern for human health, if exceeded. The HBSL established for imazapyr is 20,000 µg/L (micrograms per liter). The estimated drinking water concentrations (EDWCs) for both surface and ground water from direct application to surface water are both 61 µg/L (EPA, 2012a).

Based on EPA's determination, the dietary and aggregate risks (food, drinking water and residential exposure) for imazapyr are below EPA's level of concern (EPA, 2012a).

For glyphosate, EPA set a maximum contaminant level goal (MCLG) at 0.7 mg/L or 700 ppb. This level of protection is based on the best available science to prevent potential health problems. EPA has set an enforceable regulation for glyphosate, called a maximum contaminant level (MCL), at 0.7 mg/L or 700 parts per billion (ppb). The MCL equals the MCLG, because analytical methods or treatment technology do not pose any limitation. As part of a six-year review, the EPA determined that 0.7 mg/L or 700 ppb MCL for glyphosate are still protective of human health (EPA, 2012a). For a 10-kg (22 lb.) child consuming one liter of water per day, up to a 10-day exposure to 20 mg/L, is considered safe (EPA, 2012a).

On October 31, 2011, EPA issued a final National Pollutant Discharge Elimination System (NPDES) Pesticide General Permit (PGP) for point source discharges from the application of pesticides to waters of the United States. Section 402 of the CWA implements the NPDES and requires a permit for all discharges of pollutants from a point source into waters of the United States. The U.S. Sixth Circuit Court of Appeals held that CWA permits are required for all biological pesticide applications and chemical pesticide applications that leave a residue in water when such applications are made into, around and over waters of the United States.

NPDES permits are required for any point source discharge to waters of the United States from the application of biological and chemical pesticides that leave a residue. NPDES permits for pesticide discharges to waters of the United States are required under Section 402 of the CWA. In addition to NPDES permits, the user of the pesticide must follow the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) label.

Section 401, Water Quality Certification (WQC) applies to federal licenses and permits including CWA Section 402 NPDES permits in states where the EPA administers the permit program. The NDEQ and SDDENR administer the CWA Section 402 Permit Programs in their respective states. The states assume authority for issuing Section 401WQC on Section 402, NPDES permits. All appropriate permits would be acquired prior to commencement of any herbicide application activities.

6.5 Vegetation

6.5.1 Alternative 1 - No Action

In the absence of spray treatment, exposed sandbars that are not subjected to high river flows will have the opportunity to establish and colonize; however, this would pose a negative impact on the amount of available habitat for the tern and plover. Potential adverse impacts to cottonwoods caused from herbicide spraying for vegetation removal for the purpose of ESH would not occur; however, new growth cottonwood and other vegetation on sandbars would still be susceptible to natural scouring and erosion of sandbars.

6.5.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

6.5.2.1 Wetlands

Sandbars are highly vulnerable to undercutting and erosion throughout the year with vegetative communities often short-lived due to disturbance by flooding or from succession. The vegetation is quite variable depending on soil texture and level of inundation. Each growing season a sandbar is exposed to vegetation encroachment and the establishment of seed banks (Corps, 2009). Recently exposed sandbars are devoid of vegetation but are soon colonized with young sandbar willow (*Salix interior*), peachleaf willow (*Salix amygdaloides*), and cottonwood (*Populous deltoides*) that typically occur along the margins and low-lying portions of sandbars (Corps, 2004). This early seral stage is strongly influenced by fluctuation in river flow as low flows allow for the establishment of early successional communities and annual vegetation and high flows cause scouring of vegetation and redepositing or shifting of sediment (Corps, 2004). The hydrologic factors (e.g., river elevation, flooding, inundation duration) in a particular year will determine the amount of vegetation to be removed from sandbars and will most likely vary year to year.

New willow and cottonwood stands are established on fresh alluvium around the periphery or lowest elevation of sandbars. As a result of vegetation removal, some temporary impacts would occur to wetland vegetation on the sandbars but are not expected to exceed one growing season, and as such, adverse impacts to wetlands are not anticipated as once spraying would cease, vegetation would establish. No threatened or endangered plant species were identified in the project area. No fill or discharged material would be placed into waters of the United States; therefore a Section 404 of the CWA or Section 10 of the Rivers and Harbors Act permit would not be required. Nearly 4,000 acres of sandbar within the Fort Randall and Gavins Point reaches have been excluded from vegetation removal activities for the purpose of cottonwood regeneration. Cottonwoods are facultative wetland species, which in turn will provide wetland areas for the species that depend on them.

In addition, adverse impacts to non-target species would be minimal with implementation of BMP's and the herbicide additives (i.e., adjuvants) that help reduce drift and retain the herbicide on the target vegetation. Aerial spraying would implement BMPs to minimize any drift potential on non-target species. The extent of any non-target vegetation loss would depend on closeness of desirable species to treated vegetation, method and rate of herbicide application, formulation of the herbicide, and herbicide used. Herbicides would not be applied when weather conditions would defeat their effectiveness or when controlling the treatment would be problematic.

6.5.2.2. Noxious and Invasive Species

Noxious and/or invasive weed species, such as purple loosestrife and thistle, that have established on sandbars identified for treatment would most likely be damaged or killed with the proposed vegetation treatments and removal methods on river sandbars. Mowing would mainly decrease the amount of seed production of noxious weed and weaken root and rhizome systems. Implementing the proposed project would contribute to the on-going effort by the Corps and

other agencies (e.g., NPS and NGPC) to control noxious weeds and invasive species, particularly in the MNRR.

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 for least terns and piping plovers. If noxious or invasive species are identified in the project area, Corps staff or hired contractors would apply spot chemical treatments or hand pull to control noxious weeds that have established on sandbars within the project area.

In compliance with Aquatic Nuisance Species (ANS) rules, several preventative measures must be undertaken to control the spread of undesirable plant species. Required measures include cleaning equipment by removing any and all aquatic vegetation from vessels, motors, trailers, ATVs/ASVs or other equipment, and draining water from bilge or confined spaces on vessels and boat motors.

6.5.2.3 Cottonwoods

With the intent of preserving and restoring essential nesting and wintering habitat for the bald eagle, the USFWS BiOp requires that the Corps fulfill three Reasonable and Prudent Measures (RPMs) to minimize the "take" of bald eagles under Section 7 of the ESA: (1) map the health of the remaining cottonwood forests, (2) create a cottonwood regeneration plan and (3) ensure that no more than 10 percent of the cottonwood forest that is suitable bald eagle habitat is lost as eagle habitat. While the region of concern includes the entire Missouri River, the USFWS BiOp identified several moderate and high priority segments of the Missouri River for cottonwood preservation and/or restoration, including Fort Randall Dam to Niobrara River (RM 880.0 – RM 845.0); Niobrara River to Lewis and Clark Lake, including the lake (RM 845.0 – RM 811.1), and Gavins Point Dam to Ponca, Nebraska (RM 811.1 – RM 753.0).

A Cottonwood Management Plan /Final Programmatic Environmental Assessment was completed in February 2011. The purpose of the CMP/EA is to guide management actions along the Missouri River to provide a diverse age-class of cottonwood stands, to the extent possible, over the natural range of cottonwood forests. The Corps, in collaboration with NPS, is proposing to leave untreated approximately 4,000 acres of sandbar that have been identified as cottonwood regeneration sites to vegetate naturally, which in turn would promote natural cottonwood regeneration. These cottonwood sites will be evaluated on an annual basis to determine their success in establishing cottonwood. In addition, natural succession would resume if a treated sandbar was excluded from further vegetation control and removal activities.

Sandbars selected for treatment may involve repeated removal of cottonwoods that have begun to establish since the previous year and as a result, adverse impacts may occur to new growth cottonwoods on those sandbars selected for treatment. Potential impacts of removing vegetation, including cottonwoods, are anticipated to be minimal in comparison to the overall amount of cottonwoods remaining on sandbars left untreated (i.e., ~4,000 acres). Some sandbar vegetation needs to be removed in order to maintain suitable habitat for the tern and plover. Without large

annual floods, scouring of vegetation on sandbars is severely limited allowing vegetation encroachment to continue, which in turn reduces open sandbar habitat.

6.6 Federally-listed Threatened and Endangered Species

6.6.1 Alternative 1 - No Action

Besides naturally occurring disturbances or as a result of current land use, no direct impacts to federally-listed threatened and endangered species within the area would occur. However, the absence of vegetation control in conjunction with the absence of natural flow variations would likely result in a rapid decline in least tern and piping plover nesting habitat quantity and quality due to vegetation encroachment on the sandbars.

6.6.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

The determination of direct effects of the proposed project on threatened and endangered species was based on species presence or 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 adverse impacts were identified unless a "no affect" was determined. Table 5 provides a summary of the determination for each species.

"No affects" are expected for the Topeka shiner, scaleshell mussel, Higgins eye pearlymussel, western prairie fringed orchid, or the American burying beetle because suitable habitat is not present in the proposed 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 would 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) has left the area. Eskimo curlews are rare (if not extinct) and less likely to use the proposed project area than whooping cranes, however, in the unlikely event that an Eskimo curlew is discovered during vegetation removal activities, the same consultation procedures described for the whooping crane would be used. Pallid sturgeons are native to the Missouri River and may be found within the channel adjacent to the project location. 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 BMPs for helicopter spraying of large areas. All-terrain vehicles and/or backpack sprayers would be used to apply herbicides to smaller areas of 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 effect determination used by the USFWS, even if effects 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.

Table 5. Summary of Effects to Federally-listed Threatened and Endangered Species

Common Name (Scientific Name)	Habitat Availability within Project Area/Rationale	Determination	Mitigation
American burying beetle (*Nicrophorus americanus*)	American burying beetles are not known to use sandbars within the active channel of the Missouri River.	No affect	---
Black-footed ferret (*Mustela nigripes*)	Vegetation removal activities would not affect potential habitat.	No affect	---
Eskimo curlew (*Numenius borealis*)	Eskimo curlews would not be expected to utilize the proposed project area but could potentially be migrating through the project area although they prefer more upland, grassy habitats.	May affect /Not likely to adversely affect	In the unlikely event that an Eskimo curlew is sited, work would stop and the USFWS would be contacted.
Interior least tern (*Sternula antillarum*)	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.	May affect /Not likely to adversely affect	Restoration of suitable nesting habitat may increase productivity.
Pallid sturgeon (*Scaphirhynchus albus*)	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.	May affect /Not likely to adversely affect	Use BMPs for helicopter spraying. Use ATV and backpack sprayers to minimize herbicide overspray.
Piping plover (*Charadrius melodus*)	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.	May affect /Not likely to adversely affect	Restoration of suitable nesting habitat may increase productivity.

Common Name (Scientific Name)	Habitat Availability within Project Area/Rationale	Determination	Mitigation
Scaleshell mussel (*Leptodea leptodon*) Higgins eye pearlymussel (*Lampsilis higginsii*)	Very low likelihood of occurrence in project area for either mussel species. Vegetation removal activities would not affect potential habitat.	No affect	----
Topeka shiner (*Notropis topeka*)	Topeka shiners may utilize Missouri River tributaries but they are not known to inhabit the proposed project area. In addition, proposed project activities would not impact Topeka shiner habitat.	No affect	----
Western prairie fringed orchid (*Platanthera praeclara*)	The western prairie fringed orchid is found in tallgrass prairie communities. No potential orchid habitat of this type is known to occur in the proposed project area.	No affect	----
Whooping crane (*Grus americana*)	Whooping cranes could potentially be migrating through the project area and make stopovers along the banks and sandbars of the Missouri River. Vegetation treatment and removal activities have the potential to occur during the migration season.	May affect /Not likely to adversely affect	Sandbars will be monitored for the presence of whooping cranes prior to treatment and to observe the herbicide application for unexpected effects. If sighted, work would stop and the USFWS would be contacted.

6.7 State-Listed Species

6.7.1 South Dakota State-Listed Species

False map turtles (*Graptemys pseudogeographica*) often nest on ESH. Nesting typically occurs from mid-May through late July. Vegetation removal and control activities would take place

outside of the primary nesting season for the turtles. Springtime herbicide application and vegetation removal activities would occur in March or April, and fall herbicide application and vegetation removal activities would occur in late August or early September. Because vegetation removal and control activities would take place outside of the false map turtle's primary nesting season, the proposed project is not likely to adversely affect this species.

6.7.2 Nebraska State-Listed Species

No significant impacts to the sicklefin chub, lake sturgeon, sturgeon chub, or blue sucker are likely to occur as a result of the proposed project. All of the proposed work would occur on the surface of sandbars, and fish habitat would not be affected. Therefore, the proposed project is not likely to adversely affect any of the state listed fish species in Nebraska.

6.8 Fish and Wildlife

6.8.1 Alternative 1 - No Action

The No Action alternative would not be implemented, and as such, no impacts to fish and wildlife within the area would occur due to vegetation removal and control activities, 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 spray treatment period. It is expected that most species (i.e. medium to large mammals and birds) would disperse from project areas during spraying activities and re-enter the area following completion of activities. The sandbars will be surveyed before ground application for any mammals, birds, or aquatic species that may be present on the sandbar.

In general, the herbicides recommended to treat the sandbars, glyphosate and imazapyr, are aquatically approved by the EPA. In addition, the adjuvants (surfactant and drift retardant) that will be mixed with the herbicides are approved for aquatic use with herbicides that are registered for use in aquatic environments. BMPs will be implemented to minimize the amount of herbicide application, and only those areas of the sandbar with vegetation will be targeted for treatment, which should help in minimizing the amount of herbicide that fish, wildlife, and other aquatic species may be subjected to.

6.8.2.1 Birds

EPA has determined there are no risks of concern as neither imazapyr and glyphosate are highly toxic to birds (EPA, 2005; EPA, 1993). Minimal, if any, impacts are expected for migratory birds as all project activity would occur before or after the spring and/or fall migration and nesting seasons. The area will be examined for nests of raptors or other migratory birds before activity within the project area. No wetlands or crucial/unique wildlife habitats would be impacted for any significant length of time.

6.8.2.2 Mammals

Glyphosate inhibits protein synthesis by blocking the shikimic acid pathway that is present in plants, bacteria, and fungi, but not in animals, including vertebrates and invertebrates (Linz and Homan, 2010). Glyphosate by itself is of relatively low toxicity to mammals (Tu et al., 2001). EPA has determined there are no risks of concern as imazapyr is not highly toxic to mammals and studies indicate imazapyr is excreted by mammalian systems rapidly with no bioaccumulation (build-up) (EPA, 2005; Tu et al., 2001).

6.8.2.3 Fish

For aquatic organisms, available acute and chronic toxicity data indicate that imazapyr acid and salt are practically non-toxic to fish and as such, pose a minimal risk (EPA 2005). It has a low toxicity to algae and submersed vegetation are not affected (EPA, 2005). Glyphosate is practically non-toxic to fish (EPA, 1993; Tu et al., 2001).

6.8.2.4 Macroinvertebrates

For aquatic organisms, available acute and chronic toxicity data indicate that imazapyr acid and salt are practically non-toxic to fish, invertebrates, and non-vascular aquatic plants and as such, pose a minimal risk (EPA 2005). It has a low toxicity to algae and submersed vegetation are not affected (EPA, 2005). Glyphosate inhibits protein synthesis by blocking the shikimic acid pathway that is present in plants, bacteria, and fungi, but not in animals, including vertebrates and invertebrates (Linz and Homan, 2010). It is anticipated that no adverse impacts would occur to the mussel populations within the proposed project location.

6.8.2.5 Mussels

For aquatic organisms, available acute and chronic toxicity data indicate that imazapyr acid and salt are practically non-toxic to invertebrates and non-vascular aquatic plants and as such, pose a minimal risk (EPA 2005). It has a low toxicity to algae and submersed vegetation are not affected (EPA, 2005). Glyphosate inhibits protein synthesis by blocking the shikimic acid pathway that is present in plants, bacteria, and fungi, but not in animals, including vertebrates and invertebrates (Linz and Homan, 2010). No published studies could be found on negative effects of glyphosate (i.e., Rodeo) on mussel populations, however a study in 2007 concluded AquaStar was not "acutely toxic" to the fatmucket (*Lampsilis siliquoidea*) which was the study's target species (Bringolf et al. 2007). It is assumed since Rodeo is aquatically approved by the EPA (see Appendix B), it is anticipated that no adverse impacts would occur to the mussel populations within the proposed project location.

6.8.2.6 Amphibians and Reptiles

Missouri River sandbars and other open moist areas along the shoreline provide important basking and nesting sites for certain species of amphibians and reptiles that inhabit the MNRR. Amphibians are present in damp wetland habitats, occurring at the edges of sandbars, and have both aquatic and terrestrial life stages.

According to studies conducted by the EPA, glyphosate is not expected to bioconcentrate in aquatic organisms and the EPA has determined that the effects of glyphosate on amphibians and reptiles are minimal (EPA, 1993). Glyphosate inhibits protein synthesis by blocking the shikimic acid pathway that is present in plants, bacteria, and fungi, but not in animals, including vertebrates and invertebrates (Linz and Homan, 2010).

The ability to characterize imazapyr exposure for amphibians and reptiles is limited because of lack of studies pertaining to the effect of imazapyr on these aquatic species; however, the bioconcentration and bioaccumulation of imazapyr in aquatic organisms is extremely low due to the compounds high water solubility and low lipid solubility (Fisher et al., 2003). In view of the lack of data, U.S. EPA Pollution Prevention and Toxics (OPPT), uses the toxicity values in fish in the risk characterization of aquatic amphibians (Durkin, 2011), and as mentioned above, imazapyr acid and salt are practically non-toxic to fish and as such, pose a minimal risk (EPA 2005). EPA researchers conducted a risk assessment (Hurley & Shanaman, 2007) to evaluate potential impacts of imazapyr to the federally-listed California red-legged frog (*Rana aurora draytonii*). The risk assessment for the California red-legged frog indicated that no direct effects are expected on the frog, including food sources.

It is not anticipated that ground or aerial spraying would significantly impact amphibians and reptiles that may be occupying the sandbar at the time of vegetation treatment. With ground spraying there is the potential that these species will vacate the area during activities, and return once equipment and people have left the sandbar. Aerial spraying has the potential to affect amphibians and reptiles that could potentially inhabit targeted sandbars at the time of spraying. To minimize risks to these species, sandbars will be surveyed for the presence of any amphibian or reptile species prior to any vegetation treatment and removal activities.

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

There is the potential for a temporary and local increase in particles in the air around the sandbars caused by dispersal of the herbicides; however, the herbicide should settle out of the air within minutes. Minor and temporary increases in dust and equipment exhaust are expected during the use of equipment needed to control vegetation on the proposed sandbars (e.g., helicopters, ASVs, ATVs and watercraft). Due to the relatively short estimated time it would take to complete vegetation removal activities, emissions would not be expected to have a significant effect 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

Short-term temporary impacts to noise in the vicinity of the proposed project area may occur. Sources of potential elevated noise level include the helicopter taking off and landing, and land equipment used for vegetation removal and ground-spraying activities. Noise would be intermittent and of short duration during normal work hours. Appropriate measures will be taken to keep the noise level within compliance levels (e.g., performing project activities during daylight hours, avoiding idling of machinery when not in use, etc.). The proposed action would not impact short or long-term ground noise levels for any long-term duration.

6.11 Socioeconomics

6.11.1 Alternative 1 - No Action

No effect on socioeconomic resources would be expected with the No Action alternative.

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 effects to the local population would not be expected to disproportionately affect low income or minority components of the population.

6.12 Cultural Resources

6.12.1 Alternative 1 - No Action

With the No Action alternative, no impacts to cultural resources within the area would occur.

6.12.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

A review of the proposed project area and project activities conducted by a Corps Cultural Resource Specialist on September 17, 2012 determined that no affects to cultural resources are expected as the cultural resources files search revealed no recorded sites within the APE and work will be limited to spraying and vegetation removal with only shallow surface disturbance as a result of disking or raking. Staging areas will be limited to existing river or lake access points. In addition, the sediments in the channel have been primarily deposited in recent times. It is therefore highly unlikely that any cultural resources will be unearthed during the proposed

activities, and the Corps believes that the proposed work will have no potential to affect historic properties.

In the event that unanticipated historic properties are uncovered, work will be halted immediately and the District Archeologist will be notified. The work will not continue until the area is inspected by a staff archeologist. If he or she determines that the discovery requires further consultation, the appropriate State Historic Preservation Office (SHPO) from Nebraska or South Dakota would be notified.

6.12.2.1 Paleontological Resources

Although at present there is no federal legislation specifically regulating paleontological resources located on public or private lands, the Paleontological Resources Preservation Act (PRPA) signed in 2009 directs federal land management agencies, such as the NPS, to manage and protect paleontological resources on federal land. One component of the act is the requirement for NPS to manage and protect paleontological resources using scientific principles and expertise, and to implement the act's criminal and civil enforcement. The NPS CFR, found under Title 36, Part 2.1(a)(iii) (1992), states the NPS will provide that "nonfossilizied and fossilized paleontological specimens... or the parts thereof" may not be possessed, disturbed, injured or removed without a permit. A permit may be issued only to reputable scientific or educational institutions or a state or federal agency under certain conditions. In addition, South Dakota Law Title 5, Chapter 1-18 states that "any paleontological resources found in the bed or channel of the Missouri River are considered State property;" and Chapter 1-17 states that "no person may remove from the state, any specimen from lands under the jurisdiction of the commissioner of school and public lands, without permission from the commissioner, after consultation with the lessee and any other agencies managing other interests in the land."

Before any vegetation removal activities would take place, a pedestrian survey would be conducted on each sandbar selected for treatment to locate any paleontological resources (e.g., bison skull, teeth, and bones) that may have been deposited on the sandbar. No paleontological resources would be removed from the sandbars and objects would be flagged and appropriate actions taken to avoid disturbance during vegetation removal activities. The NPS will be notified if paleontological resources have been identified on a particular sandbar, providing them the opportunity to conduct further investigation if needed. To deter potential looting or vandalism of these resources by the public, flags will be removed once vegetation removal activities have been completed.

6.13 Missouri National Recreational River

6.13.1 Alternative 1 - No Action

No impacts to the MNRR would occur as a result of the No Action alternative.

6.13.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

The primary focus for management of the MNRR segments is to "protect and enhance" the Outstandingly Remarkable Values (ORVs) for which the segments were designated. ORVs are defined by the Wild and Scenic River Act (WSRA) as the characteristics that make a river worthy of special protection. The MNRR contains the following ORVs: cultural, ecological, fish and wildlife, geological, recreational and scenic. As a "fish and wildlife value," the MNRR provides one of the most important remaining complexes of natural sandbar and shallow foraging habitats on the Missouri River for the federally-endangered interior least tern and threatened piping plover. The purpose of the proposed vegetation removal and control activities is to maintain suitable habitat for the endangered least tern and the threatened piping plover. These species were included in the pre-listing document for the 59-mile segment, which studied the inclusion of the MNRR as a segment of the National Wild and Scenic Rivers System, even before the birds were listed (Corps, 1977). These birds are "values" for which the river was designated, within the "fish and wildlife" general value. The proposed project is consistent with the desired future conditions identified in the General Management Plans for the two MNRR segments. In addition, the Corps and NPS are working collaboratively to identify cottonwood regeneration sites and leave them as non-ESH to determine if cottonwood establishment will be successful.

6.14 Recreation

6.14.1 Alternative 1 - No Action

No impacts to recreation would occur as a result of the No Action alternative.

6.14.2 Alternative 2 - Remove Vegetation on Sandbars and Apply Herbicide

Herbicide application and vegetation removal activities would only occur during a brief one to two-week period in the early spring and a second one to two-week period in the late summer or early fall. Prior to the commencement of vegetation control activities, all sandbars to be treated would be checked to make sure they were not currently occupied by members of the recreating public. If anyone is found using a sandbar scheduled for treatment that day, treatment of the sandbar would be delayed until the people have left the sandbar. The proposed project is not likely to adversely affect recreation on the MNRR because the two windows for vegetation control and removal are very short, and all sandbars would be checked to make sure they are not occupied by people prior to commencement of work. Recreational use of cleared areas could potentially increase on the newly formed sand beaches, but would be restricted by protection efforts (e.g., posted signs and fencing) for the terns and plovers.

6.15 Cumulative Effects

The combined incremental effects of human activity are referred to as cumulative impacts (40 CFR 1508.7). While these incremental effects 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.

It is reasonably foreseeable that operation of the mainstem dams and reservoirs will be on-going and that natural processes will continue to be disrupted. Reduced flood frequency and flow variability limits natural sandbar formation and scouring of vegetation by periodic high flows. The program of restoring ESH on the Missouri River was initiated as early as 1988. Early efforts were small in size and largely experimental. This program continued into the mid-1990s. After the high water years of 1993-1998, a large amount of ESH was available on the river system and both bird populations responded to the increase in nesting habitat. With the amount of naturally created sandbar habitat available as a result of the 2011 flood, mechanical creation of ESH is not needed at this time to supplement natural sandbars. In addition, it is anticipated that reproductive success for both species will result in increased populations on the MRMS as occurred following the high flows of 1997; however, the amount of suitable habitat available in a given year may contribute to potential fluctuations in bird populations.

Under the current ESH program and by implementing BMPs (e.g., spraying outside nesting season, controlling wind drift), it is possible to avoid or minimize impacts to most resources on the river system, thereby eliminating any significant or cumulative impacts to non-target resources. There may potentially be temporary increases in noise or air pollution at the time of the spraying and/or vegetation removal activities; however, these increases would be minor and would only occur within the spraying and removal period.

There would be no cumulative effect to wetlands as the Corps proposes to leave nearly 4,000 acres to vegetate naturally (i.e., cottonwood sites). Temporary wetland impacts would occur to those sandbars being treated; however, nature would resume its natural course and establish cottonwood and willow seedlings on exposed sandbars as soon as work was completed. If left untreated, vegetation would begin to re-establish on the sandbars and eventually colonize. It is not anticipated that non-target vegetation would incur cumulative impacts, as plants in proximity of the treatment site would most likely consist of the same vegetation being treated. No threatened or endangered plant species have been identified in the project area. Aerial spraying would implement BMPs to minimize any drift potential on non-target species and as such, cumulative impacts to non-target species in not anticipated.

The herbicides to be used (imazapyr and glyphosate) are registered by the EPA for aquatic use. Registration includes EPA's determination that when used in the proper manner, the herbicide will not present an unreasonable risk of adverse effects to humans or to the environment. The herbicides were developed for use in aquatic environments with minimal impact to fish, wildlife

and water quality. Herbicides will be applied within the prescribed environmental conditions and strictly comply with the manufacturers' label restrictions. Application of herbicides would be done in a manner consistent with federal and state regulations. The BMP's and additional precautions to be used with the spraying operation and vegetation removal (see Section 4.1.2.3.2) will protect resources in the areas proposed for treatment and further minimize any direct, indirect, or cumulative effects of the project. Vegetation treatment and removal methods have been used in the past in other reaches of the Missouri River without significant impacts to the areas treated.

Herbicide persistence is directly related to how quickly the product decomposes and its availability for plant uptake. Microbes, chemical reactions, and exposure to light affect decomposition, while soil adsorption and leaching in soil water determine availability. It is not anticipated that residual effects of either herbicide would linger in the system and culminate over the period of time that treatments are proposed (annual spring and/or fall spray; 2013-2017). Vegetation treatment would be conducted on an 'as needed' basis, so only a spring or a fall treatment may be applied in a given year. In these instances, there would be minimal to no residual effects as the time between single yearly treatments surpasses the half-life of glyphosate or imazapyr for soil or water. Based on studies and using the higher end of the average half-life in soils and water for glyphosate (soil-141 days; water-70 days) and for imazapyr (soil-150 days; water-5 days), residual of either herbicide would be nearly dissipated when the next treatment would be applied, so cumulative impacts due to glyphosate or imazapyr residue would not be expected (see Section 4.1.2.3.1). For example, if only an annual fall spray were implemented, the time between the fall spray and the spring or fall spray in the following year would be more than the half-life for either herbicide. Some research has show that herbicides are more effective in the fall by penetrating the root and moving throughout the plant as the plant begins to increase root uptake to store nutrients and water, and by preventing the germination of seed in the spring.

In years where both spring and fall spraying would be conducted, residual would depend on the timing of the herbicide application and application rate. Studies are not conclusive as to the half-life of glyphosate in the soil; however, using a maximum of 141 days (some studies have resulted in a half-life of 30 days) for glyphosate, and 150 days (5 months) for imazapyr, the residue in the soil would be nearing or surpassing its half-life by the time the next spraying would occur (either early April or late September). Both herbicides rapidly dissipate in water and residue accumulation in water is not expected. In addition, only those portions of the sandbar with visible vegetation would be sprayed, reducing the amount of herbicide applied in a given area. Cumulative impacts due to residue buildup of either glyphosate or imazapyr in water or soil is not anticipated.

6.15.1 Conclusion

The application of either an imazapyr- or glyphosate-based herbicide with additives will accomplish the objective of creating interior least tern and piping plover habitat quickly, economically, and with minimal impacts on the aquatic environment surrounding the sandbars proposed for treatment. The herbicides are aquatically approved by EPA and were developed for us in aquatic environments with minimal impact to fish, wildlife, and water quality. The

precautions to be used with spraying operation and vegetation removal (e.g., assessing sites for wildlife before activities, loading fuel and pesticides away from water, and spraying during periods when the birds are not nesting) will protect resources in the project area and further minimize the impacts of the project. Vegetation treatment and removal methods have been used in the past without significant impacts to the areas treated.

7.0 CONSULTATION AND COORDINATION

Scoping letters were sent out in April, 2012 to the agencies listed below. Five comments were received within the scoping review period and are summarized in Table 6. Responses received are included in Appendix C. In addition, the draft EA was placed on the Corps public website and a press release was distributed to local media to inform the agencies and the public that the draft EA was available for review (Appendix A). No public comments were received. Comments on the draft EA received from agencies were addressed and incorporated into the final EA.

Tribes located within the project area are the Yankton Sioux Tribe of South Dakota and Santee Sioux Tribe of Nebraska. Tribal consultation has been addressed as part of the overall MRRP effort, starting in 2005. In November 2010, the Draft PEIS was distributed to the designated points of contact for the 2005 Programmatic Agreement (PA). This included the BIA, ACHP, National Trust, State and Tribal Historic Preservation Offices (THPOs), and other Tribes not having THPOs. A 30-day comment period on the Final PEIS was conducted May 20 to June 20, 2011 and each Tribe offered the opportunity for formal Consultation concerning the ESH Program or the Final PEIS. No requests were received. The BIA provided comments in general support of efforts to support the terns and plover, but requested that treatment of cultural resources utilize the best available science. The Yankton Sioux Tribe did provide comment, included in the PEIS, that they were in support of creating and maintaining habitat for tern and plover. No further comments were received from any tribe or other interested party.

In accordance with the National Environmental Policy Act, the Fish and Wildlife Coordination Act, the National Historical Preservation Act, and Executive Order 13175 (Consultation and Coordination with Indian Tribal Governments), agencies and Tribes were contacted for information and comments during the development of this project and the resulting EA.

Table 6. Summary of EA Review and Comments

Agency Contact	Agency Comments
National Park Service Mr. Steven Mietz	NPS will coordinate with the Corps on selection of sandbars for ESH and cottonwood regeneration.
Izaak Walton League of America Mr. Paul Lepisto, Regional Conservation Coordinator	No Response
U.S. Fish and Wildlife Service Ms. Carol Aron	No comments on proposed project other than a reminder to comply with other federal laws.
Missouri River Natural Resources Committee Mr. Jim Riis, Chairman	No Response
Missouri Sedimentation Action Coalition Ms. Sandra Korkow	No Response
Nebraska Department of Agriculture Mr. Merlyn Carlson, Director	No Response
Nebraska Department of Environmental Quality Mr. Mike Linder, Director	No Response

Agency Contact	Agency Comments
Nebraska Department of Natural Resources Mr. Brian Dunnigan	Avoid impacting surface water rights. Avoid impacting wells. Ensure local floodplain regulations are complied with.
Nebraska Game and Parks Commission Mr. Frank Albrecht Ms. Carey Grell Mr. Joel Jorgensen, Non-Game Biologist Mr. Gerald Mestl, Fisheries Biologist Mr. Clayton Stalling, District Manager, Habitat Partners Section Ms. Kristal Stoner	NGPC has no objections to the proposed project; however, they would like to see some of the new sandbars left alone to vegetate naturally. They also requested that the large sandbar in front of Ponca State park be left alone and allowed to vegetate naturally.
Papio-Missouri River NRD	
Mr. Jim Becic	No Response
South Dakota Department of Agriculture Mr. Kevin Fridley	No Response
South Dakota Department of Environment and Natural Resources Mr. Steven M. Pirner, Secretary Mr. John Miller, Water Quality Standards Mr. Brad Schultz, Air Quality Standards	There will be little to no impact on waste management.
South Dakota Game, Fish and Parks Mr. Paul Coughlin	No Response
South Dakota Wildlife Federation Chris Hesla, Executive Director	No Response
U.S. Department of Agriculture, Natural Resources Conservation Service Mr. Craig Derickson, State Conservationist, Nebraska Ms. Janet Oertly, State Conservationist, South Dakota Mr. Steve Grube, Lewis and Clark Natural Resources District Conservationist, Nebraska	No Response
U.S. Dept. of Homeland Security, U.S. Coast Guard Auxiliary Mr. Larry Hintge	No Response
U.S. Department of Interior, Bureau of Indian Affairs Mr. William Benjamin, Regional Director	No Response

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. A September 17, 2012 cultural resources files search performed by Ms. Sandra Barnum, Cultural Resources Specialist with the U.S. Army Corps of Engineers – Omaha District revealed no recorded sites within the APE. In addition, because the project would involve little or no ground disturbance in an area of accreted sediments, the proposed project was determined to have no potential to affect cultural properties.

If a discovery is made during vegetation spraying and removal activities, all activity would be halted around the discovery site and a Corps archaeologist would inform the appropriate SHPO of the discovery. The Corps archaeologist would examine the discovery area as soon as possible and then consult with the SHPO about the nature of the discovery and NRHP 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 vegetation removal 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 vegetation removal activities associated with the proposed 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. Because the proposed project does not involve the discharge of fill material into waters of the United States, no Section 404 permit or 401 water quality certification is required. However, Section 402 of the Clean Water Act does apply to the use of pesticides near bodies of water. A NPDES permit has been obtained from the state of Nebraska for the work that would occur in 2012. New NPDES permits would be acquired from the appropriate states each year that herbicides are used in association with the proposed project activities.

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. A Biological Assessment is not required for this project as the proposed actions are being performed in response to a Biological Opinion from the USFWS. Personnel from the USFWS have been included as part of the PDT for this project, and an email dated June 29, 2012 stated that they had no comments on the proposed project.

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 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.

Federal Water Project Recreation Act, as amended, 16 U.S.C. 460-1(12), et seq. In compliance. The removal of vegetation from sandbars would maintain current recreational use.

Fish and Wildlife Coordination Act, 16 U.S.C. 661 et seq. In compliance. The USFWS, the NGPC and the SDGFP were all part of the PDT that formulated the plan for the proposed project. They were also sent letters providing them with an opportunity to comment on the proposed project. In a June 29, 2012 email, the USFWS stated that they had no comments, and the NGPC sent an email dated August 23, 2012 stating that they had no objections to the proposed project. The NGPC asked if we could avoid spraying a large sandbar located in front of Ponca State Park in Nebraska. No comments were received from SDGFP.

Floodplain Management (E.O. 11988). In compliance. No rise or risk to the floodplain would result from vegetation modification on existing sandbars within the channel of the Missouri River.

Migratory Bird Treaty Act (MBTA) of 1918 as amended, 16 U.S.C. 703-711, et seq. In compliance. The 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. Spraying and vegetation removal activities would occur outside of the least tern and piping plover nesting season, which coincides with the primary breeding season of other migratory birds. Although unlikely, project activities that may occur during the primary nesting season of migratory birds in Nebraska and South Dakota, would begin only after surveys have been conducted of trees, shrubs and herbaceous vegetation that have the potential 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. Consultation with the USFWS would be initiated as needed.

National Environmental Policy Act (NEPA), as amended, 42 U.S.C. 4321, et seq. In compliance. This environmental assessment has been prepared to determine if a FONSI is the appropriate decision document and the proposed action can proceed or if an EIS will be prepared.

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 would temporarily increase above current levels due to vegetation removal equipment; however, appropriate measures will be taken to keep the noise level within compliance levels (e.g., perform project activities during daylight hours, avoid 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. In compliance. Best Management Practices will be implemented to minimize the potential of erosion and sedimentation to negatively impact water resources.

Wild and Scenic Rivers Act, as amended, 16 U.S.C. 1271, et seq. In compliance. The proposed project includes two segments of the Wild and Scenic River System. The NPS has been part of the PDT for this project and will be given an opportunity to review the proposed project and provide the Corps with a Section 7(a) determination as required by the WSRA.

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APPENDIX A

PROPOSED SANDBARS & LOCATION MAPS

Systematic Site Selection

- A multi step process used to annually select sandbars for treatment.
- First, remote sensing data used to calculate annual ESH estimates.
    - These estimates will be compared to habitat goals to determine how much habitat will need to be treated to achieve the habitat goals.
- Second, remote sensing and field observations used to identify sandbars that have vegetation and require treatment.
    - Other characteristics such as connectivity to the shoreline, distance from trees, or cottonwood recruitment site may be considered in site identification.
- Finally sandbars will be systematically assigned a treatment at a frequency to achieve acres goals.
    - We will start at the uppermost sandbar on each reach and assign treatment or no treatment to each sandbar going down the river. The order in which to assign treatment and no treatment (control) will be randomly determined and the frequency of each will be done in a way to achieve acres goals.

Column Headers

- River Mile
    - Used to name individual sites
- Acres
    - Acres of an entire site (includes bare sand and vegetation)
- ESH Acres
    - Acres of Dry Sand, Dry Sand Sparse Veg, Wet Sand and Wet Sand Sparse Veg Landcover Classes
- Treatable Vegetation
    - Vegetation classes easily treated (includes Dry Sand Spares Veg and Wet Sand Sparse Veg)
- ESH Treated
    - Acres of Dry Sand Sparse Veg and Wet Sand Sparse Veg Landcover Classes to be treated
- Hard to Treat Vegetation
    - Acres of large, dense vegetation that requires larger equipment to treat (not included in treatment totals)
- # of Individual Bars
    - Number of individual bars that make up a site
- # of Nests in "12
    - Number of observed tern and plover nest in 2012
- Connectivity
    - These sites are attached to the shoreline
- Attached to Wooded Island
    - These sites are part of large wooded island
- Used for Line Intercept
    - These sites are being monitored for changes in habitat
- USD Recruitment Study
    - Study by USD looking at cottonwood recruitment
- Sprayed in 2012/Selected for spraying in 2012
    - Spot spray treatment on one sandbar

- Known/possible Landowner Issues
  - Sites around these properties avoided by ESH efforts
- Dam Proximity (Close to Yankton)
  - Sites in proximity to dam avoided by ESH efforts
- NPS on Cottonwoods
  - No work done on cottonwood regeneration sites identified by NPS; will be evaluated on annual basis
- USD Cottonwood Study
  - No work done on cottonwood recruitment study areas; to be completed in 2014
- USD Cottonwood / Recruitment Study
  - Study by USD looking at cottonwood persistence
- Recommended for Treatment
  - All sites selected for treatment based on criteria
- Comment
  - Comments about individual sites

Treatment Scenarios

- Treatment 1 (Every Third)
  - Starting at the top of the list, select one treatment and two controls skipping non recommended sites.
- Treatment 2 (Every Other)
  - Starting at the top of the list, select one treatment and one control skipping non recommended sites.
- Treatment 3 (Two out of Three)
  - Starting at the top of the list, select two treatments and one control skipping non recommended sites.
- Treatment 4 (Three out of four)
  - Starting at the top of the list, select three treatments and one control skipping non recommended sites.
- Treatment 5 (Modified Every Third)
  - Starting at the top of the list, select one treatment and two controls skipping non recommended sites for treatments but using them as controls if they fall in order.
- Treatment 6 (Modified Every Other)
  - Starting at the top of the list, select one treatment and one control skipping non recommended sites for treatments but using them as controls if they fall in order.
- Treatment 7 (Modified Two out of Three)
  - Starting at the top of the list, select two treatments and one control skipping non recommended sites for treatments but using them as controls if they fall in order.
- Treatment 8 (Modified Three out of four)
  - Starting at the top of the list, select three treatments and one control skipping non recommended sites for treatments but using them as controls if they fall in order.
- Treatment 9 (All)
  - With no controls, bird usage cannot be tied back into treatment success. Used as an example of Max effort.

Treatment Totals

- Number of Sites Treated

- Area of Treated Sites
    - Total area of site to include vegetated & non-vegetated areas
- Acres of Vegetation Treated
    - Vegetation at a site to be treated including sparse veg areas
- Acres of Treated ESH
    - Area of dry sand sparse veg and wet sand sparse veg
- Total ESH Before and After Treatment
    - Total amount of dry sand, dry sand sparse veg, wet sand and wet sand sparse veg before and after treatments
- Added ESH*
    - Difference between ESH amounts before and after treatments

*Although only some portion of vegetation will be converted to ESH, all sparse vegetation will be prevented from becoming too vegetated to count as ESH.

GAVINS POINT REACH

River Mile	Acres	ESH Acres	Treatable Vegetation	ESH Treated	Hard to Treat Vegetation	# of Individual Bars	# of Nests in '12	Connectivity	Attached to Wooded Island	Used for Line Intercept	Used for Substrate Polygons	Sprayed in '12	Selected to be Sprayed in '12	Known/Possible Landowner Issues	Dam Proximity (Close to Yankton)	NPS on Cottonwoods (No= no work)	USD Recruitment Study	USD Cottonwood Study	Recommended for Treatment	Comment	Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
810	8.4	3.1	4.6	2.0	2.7	2		Yes						Yes	No														
807.9	22.8	7.6	10.7	4.2	4.4	2		Yes						Yes	No														
807.8	7.2	4.3	4.6	3.0	1.1	3								Yes	No														
807.3	1.9	1.8	0.6	0.6	0.0	1								Yes	No														
807.1	141.3	65.1	66.5	33.7	43.2	4	2		Yes					Yes	No			Yes											
806.2	42.6	19.0	15.5	8.3	16.3	2			Yes					Yes	No														
805.7	1.0	0.5	0.4	0.2	0.4	1		Yes						Yes	No														
804.1A	89.0	88.2	60.5	60.5	0.0	7							Yes	Yes		Yes			Yes	Spot spray, avoid USD recruitment study	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
804.1	84.4	25.7	44.5	17.7	32.2	2	16		Yes				Yes	Yes	No	Yes	Yes							Cnt	Cnt				
803.4	46.9	44.5	24.2	23.4	0.1	1	3	Yes					Yes	Yes	No	Yes								Cnt					
802.5	11.3	8.0	5.8	4.4	1.3	1		Yes							No														
802.4	4.3	4.2	2.7	2.7	0.0	1									No														
802.2	39.5	34.3	12.1	9.7	2.2	1		Yes			Yes								Yes	Spot spray	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
801.3	2.9	2.9	1.8	1.8	0.0	1													No	Small with landowner issues					Cnt	Cnt	Cnt		
801.2	3.1	3.1	1.1	1.1	0.0	3									No										Cnt				
800.8	231.7	197.8	59.5	34.3	6.8	2	7	Yes		Yes				Yes		No		Yes											
800.7	1.5	1.5	0.3	0.3	0.0	1					Yes			Yes		No	Yes												
800.6	1.6	1.6	1.6	1.6	0.0	1								Yes		No													
800.5	10.9	10.8	4.1	4.0	0.1	5			Yes	Yes				Yes		No	Yes												
800.4	2.4	2.3	2.1	2.0	0.0	1								Yes		No													
800.3	2.3	0.3	1.0	0.3	1.3	2										No													
799.9	5.1	1.9	3.4	1.9	1.7	1		Yes								No													
799.6	51.8	47.3	13.0	10.7	0.5	1		Yes								No	Yes												
799.4	0.2	0.2	0.2	0.2	0.0	1										No													
798.8	29.7	29.6	15.3	15.3	0.0	3	6			Yes				Yes			Yes			Yes	Spot spray, avoid USD recruitment study	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
798.6	41.2	40.3	2.8	2.2	0.1	1			Yes							No		Yes							Cnt	Cnt		Cnt	
797.6	13.3	11.8	12.3	11.7	1.0	1		Yes								No									Cnt				
797.2	20.0	19.3	7.1	7.0	0.3	1	1	Yes			Yes					No													
796.3	89.8	69.8	24.1	18.0	6.8	4		Yes			Yes			Yes		No		Yes											
795.8	33.9	5.5	17.9	5.4	15.8	2		Yes						Yes		No		Yes											
795.7	5.7	5.7	0.4	0.4	0.0	2	1												Yes	Spot spray	Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
795.6	5.1	5.0	0.1	0.1	0.0	2		Yes								No										Cnt	Cnt	Cnt		
795.4	37.6	37.6	0.4	0.4	0.0	3	6				Yes								Yes	Spot spray	Cnt	Trt	Trt	Trt	Cnt	Trt	Trt	Trt	Trt
794	140.7	74.9	47.4	16.9	28.7	2		Yes								No		Yes									Cnt			
793.8	3.2	3.2	0.0	0.0	0.0	2													Yes	Spot spray	Cnt	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
793.7	5.6	5.6	0.1	0.1	0.0	2													Yes	Spot spray	Trt	Trt	Trt	Trt	Cnt	Cnt	Cnt	Cnt	Trt
793.6	1.0	0.9	0.0	0.0	0.0	1													Yes	Spot spray	Cnt	Cnt	Trt	Cnt	Cnt	Trt	Trt	Trt	Trt
793.5	35.8	35.7	0.1	0.1	0.0	3	2												Yes	Spot spray	Cnt	Trt	Cnt	Trt	Trt	Cnt	Trt	Trt	Trt
793.4	3.7	3.7	0.1	0.1	0.0	1													Yes	Spot spray	Trt	Cnt	Trt	Trt	Cnt	Trt	Cnt	Trt	Trt
793.3	20.5	17.6	3.4	1.7	1.2	1		Yes											No	May have potential, need more ground-truthing					Cnt	Cnt		Cnt	
793.2	16.7	16.7	0.0	0.0	0.0	3													Yes	Spot spray	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
793.1	3.6	3.6	0.0	0.0	0.0	3				Yes									Yes	Spot spray	Cnt	Cnt	Cnt	Cnt	Cnt	Cnt	Trt	Trt	Trt
792.2	33.2	32.6	1.4	1.0	0.2	1		Yes								No										Cnt		Cnt		
791.3	29.2	29.2	0.1	0.1	0.0	2	19					Yes							No	Taken Out of Study									
791	1.4	1.3	0.0	0.0	0.0	1													Yes	Spot spray	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
790.9	40.7	40.5	0.1	0.1	0.0	4	2			Yes									Yes	Spot spray	Cnt	Cnt	Trt	Trt	Cnt	Cnt	Trt	Cnt	Trt
790.5	1.2	1.2	0.1	0.1	0.0	1													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Cnt	Trt	Cnt	Trt	Trt
790.2	53.9	51.2	3.7	3.1	1.1	1		Yes								No											Cnt			
790.1	22.6	22.6	0.1	0.1	0.0	2													Yes	Spot spray	Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
789.7	27.8	27.7	0.8	0.8	0.0	4	1												Yes	Spot spray	Cnt	Trt	Trt	Trt	Cnt	Cnt	Trt	Trt	Trt
789.1	14.1	14.1	0.2	0.2	0.0	3	1				Yes								Yes	Spot spray	Cnt	Cnt	Cnt	Trt	Cnt	Trt	Cnt	Cnt	Trt
789	26.0	25.4	1.0	0.8	0.1	1		Yes								No											Cnt			
788	87.8	86.6	0.9	0.8	0.1	1	2	Yes		Yes				Yes		No														
787.4	2.0	2.0	0.4	0.4	0.0	2										No														
787.3	2.3	0.8	1.1	0.6	0.7	2		Yes								No														
786	65.2	64.8	0.9	0.9	0.0	2			Yes							No	Yes													

GAVINS POINT REACH

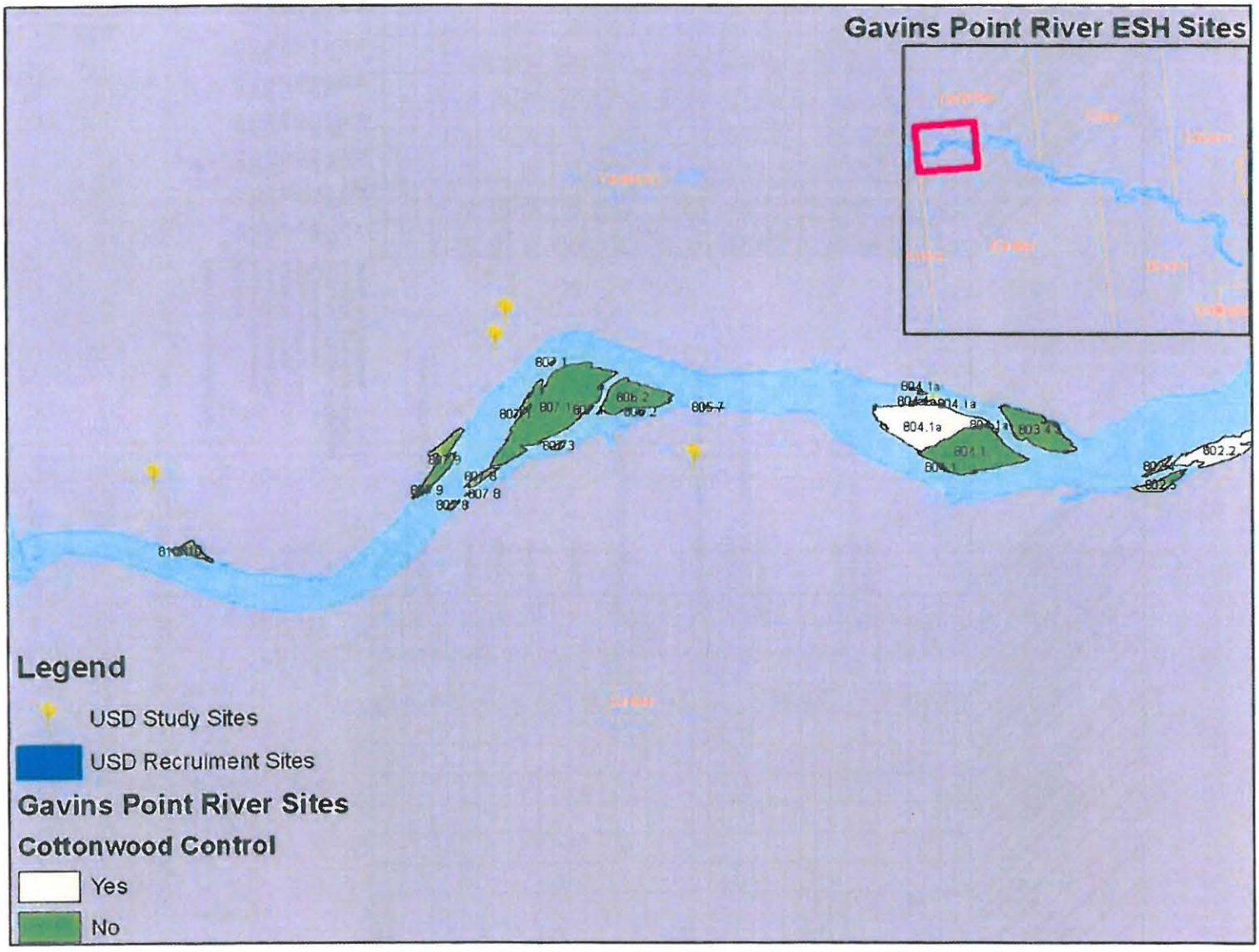
River Mile	Acres	ESH Acres	Treatable Vegetation	ESH Treated	Hard to Treat Vegetation	# of Individual Bars	# of Nests in'12	Connectivity	Attached to Wooded Island	Used for Line Intercept	Used for Substrate Polygons	Sprayed in '12	Selected to be Sprayed in '12	Known/Possible Landowner Issues	Dam Proximity (Close to Yankton)	NPS on Cottonwoods (No= no work)	USD Recruitment Study	USD Cottonwood Study	Recommended for Treatment	Comment	Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
785.9	17.7	17.6	1.2	1.1	0.0	2			Yes							No	Yes												
785	88.9	73.3	18.0	9.2	6.6	1			Yes							No	Yes	Yes											
784.5	204.4	170.4	24.7	18.0	17.5	1	1	Yes			Yes					No	Yes												
783.5	123.3	120.5	2.3	2.0	0.3	1			Yes							No			Yes										
783.1	28.1	27.6	10.1	9.6	0.0	6													Yes	Spot spray	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
783	0.3	0.3	0.2	0.2	0.0	1										No								Cnt	Cnt				
782.9	28.0	28.0	0.7	0.7	0.0	2													Yes	Spot spray	Cnt	Cnt	Trt	Cnt	Cnt	Trt	Trt	Trt	Trt
782.7	1.2	1.2	0.1	0.1	0.0	1										No									Cnt	Cnt			
782.6	8.4	8.4	0.3	0.3	0.0	1													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
782.5	36.6	35.8	0.3	0.3	0.0	1	5					Yes							No	Taken Out of Study					Cnt	Cnt		Cnt	
782.3	1.8	1.1	0.4	0.1	0.4	1		Yes								No									Cnt				
782.2	34.2	34.2	0.6	0.6	0.0	2	1												Yes	Spot spray	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
782	6.7	6.7	0.0	0.0	0.0	1				Yes									Yes	Spot spray	Cnt	Trt	Trt	Trt	Cnt	Cnt	Cnt	Trt	Trt
781.9	3.2	2.3	1.1	0.7	0.5	2		Yes								No									Cnt				
781.6	3.7	3.4	3.6	3.4	0.0	2		Yes								No	Yes												
781.5	179.3	178.9	13.8	13.5	0.0	2	10					Yes							No	Taken Out of Study									
780.5A	99.3	96.0	0.2	0.2	0.0	3													Yes	Spot spray	Cnt	Cnt	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt
780.5	107.1	59.9	38.4	12.9	9.7	2	3		Yes							No									Cnt	Cnt		Cnt	
779.8	7.2	7.2	0.0	0.0	0.0	1													Yes	Spot spray	Trt	Trt	Trt	Trt	Cnt	Trt	Trt	Trt	Trt
779.4	3.0	2.9	0.6	0.5	0.0	1		Yes								No										Cnt	Cnt			
779.3	173.7	164.3	16.3	9.7	1.0	2		Yes			Yes								Yes	Spot spray	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
778.8	43.2	42.7	0.3	0.3	0.0	1	7												Yes	Spot spray	Cnt	Trt	Cnt	Trt	Cnt	Cnt	Trt	Trt	Trt
778.4	3.6	3.5	0.5	0.5	0.0	2													Yes	Spot spray	Trt	Cnt	Trt	Cnt	Cnt	Trt	Cnt	Cnt	Trt
778.2	123.1	121.5	1.8	1.4	0.2	1		Yes								No										Cnt				
777.5	152.8	152.8	3.3	3.3	0.0	1		Yes											Yes	Spot spray	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
777.4	1.7	1.2	1.7	1.2	0.0	1		Yes								No										Cnt	Cnt			
776.7	170.5	157.1	21.8	16.0	0.5	1	1	Yes								No										Cnt				
776.6	0.6	0.6	0.1	0.1	0.0	2										No														
776.3	82.9	10.8	17.4	6.9	2.7	1		Yes								No														
776	86.0	86.0	1.3	1.3	0.0	1	15												No	Taken Out of Study									
774.8	126.4	109.6	24.0	12.6	2.6	1		Yes								No		Yes												
774.6	13.3	10.5	3.9	3.2	1.5	1		Yes								No														
774	136.3	136.2	11.6	11.6	0.0	2	1			Yes									Yes	Spot spray	Cnt	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
773	20.1	15.7	6.6	2.9	0.3	1		Yes								No										Cnt	Cnt	Cnt		
772	119.1	118.4	0.6	0.5	0.0	2	3												Yes	Spot spray	Trt	Trt	Trt	Trt	Cnt	Trt	Trt	Trt	Trt
771.6	78.7	47.8	26.1	8.9	11.7	1		Yes								No											Cnt		Cnt	
771.1	2.4	2.3	1.6	1.5	0.0	2		Yes								No														
770.9	0.8	0.7	0.6	0.4	0.0	2										No														
770.7A	142.2	142.1	1.3	1.2	0.0	3													Yes	Spot spray	Cnt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
770.7	188.1	96.7	41.0	8.8	56.0	2	7		Yes							No		Yes									Cnt	Cnt	Cnt		
770.6	3.7	3.6	0.7	0.5	0.0	1										No											Cnt			
770.3	4.1	4.1	0.7	0.7	0.0	1													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
770.1	111.6	93.4	35.2	22.8	5.4	2		Yes			Yes					No		Yes										Cnt	Cnt		
769.8	3.6	3.5	0.7	0.7	0.0	1							Yes						Yes	Spot spray	Trt	Cnt	Trt	Trt	Cnt	Trt	Trt	Trt	Trt
769.7	2.0	1.7	1.0	0.7	0.0	1													Yes	Spot spray	Cnt	Trt	Trt	Trt	Trt	Cnt	Cnt	Cnt	Trt
769.5	99.4	99.4	0.8	0.8	0.0	2	20												No	Taken Out of Study					Cnt				
768	203.1	186.1	13.0	5.8	9.5	4			Yes							No										Cnt				
767.9	0.4	0.3	0.1	0.1	0.0	1													No	Small									
767.8	1.4	1.4	0.2	0.2	0.0	1		Yes								No														
767.5	9.4	9.2	1.8	1.7	0.0	2													Yes	Spot spray	Cnt	Cnt	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt
767.4	6.5	6.5	0.2	0.2	0.0	1													Yes	Spot spray	Trt	Trt	Trt	Trt	Cnt	Cnt	Trt	Trt	Trt
766.9	97.4	82.3	23.5	13.7	2.2	3		Yes								No										Cnt		Cnt		
766.6	0.7	0.7	0.1	0.1	0.0	1										No														
766.5	1.7	1.7	1.5	1.5	0.0	1										No														
766.4	1.4	1.4	0.1	0.1	0.0	1													Yes	Spot spray	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
766.3	17.4	17.4	0.3	0.3	0.0	2													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Cnt	Cnt	Trt	Cnt	Trt

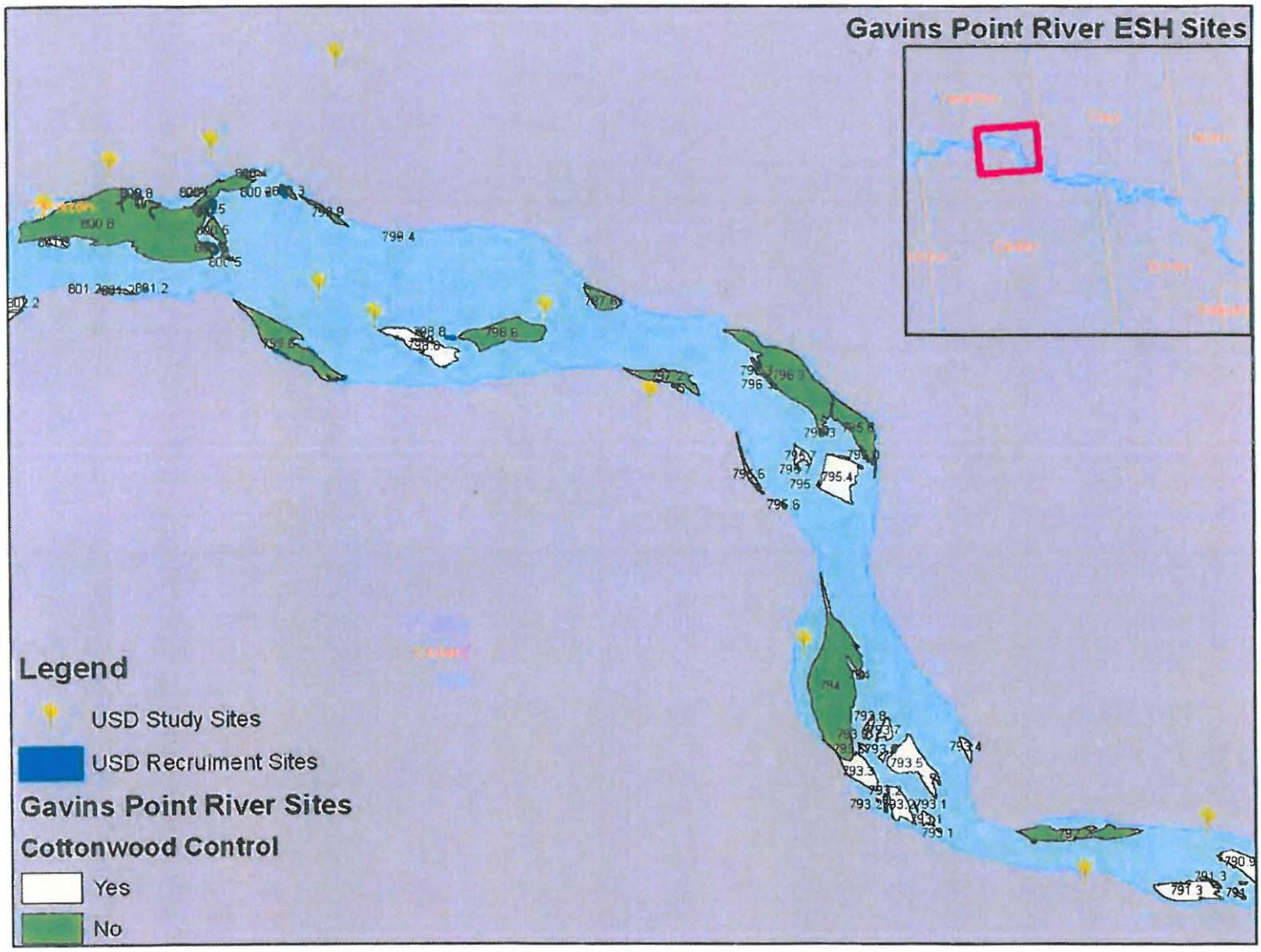
GAVINS POINT REACH

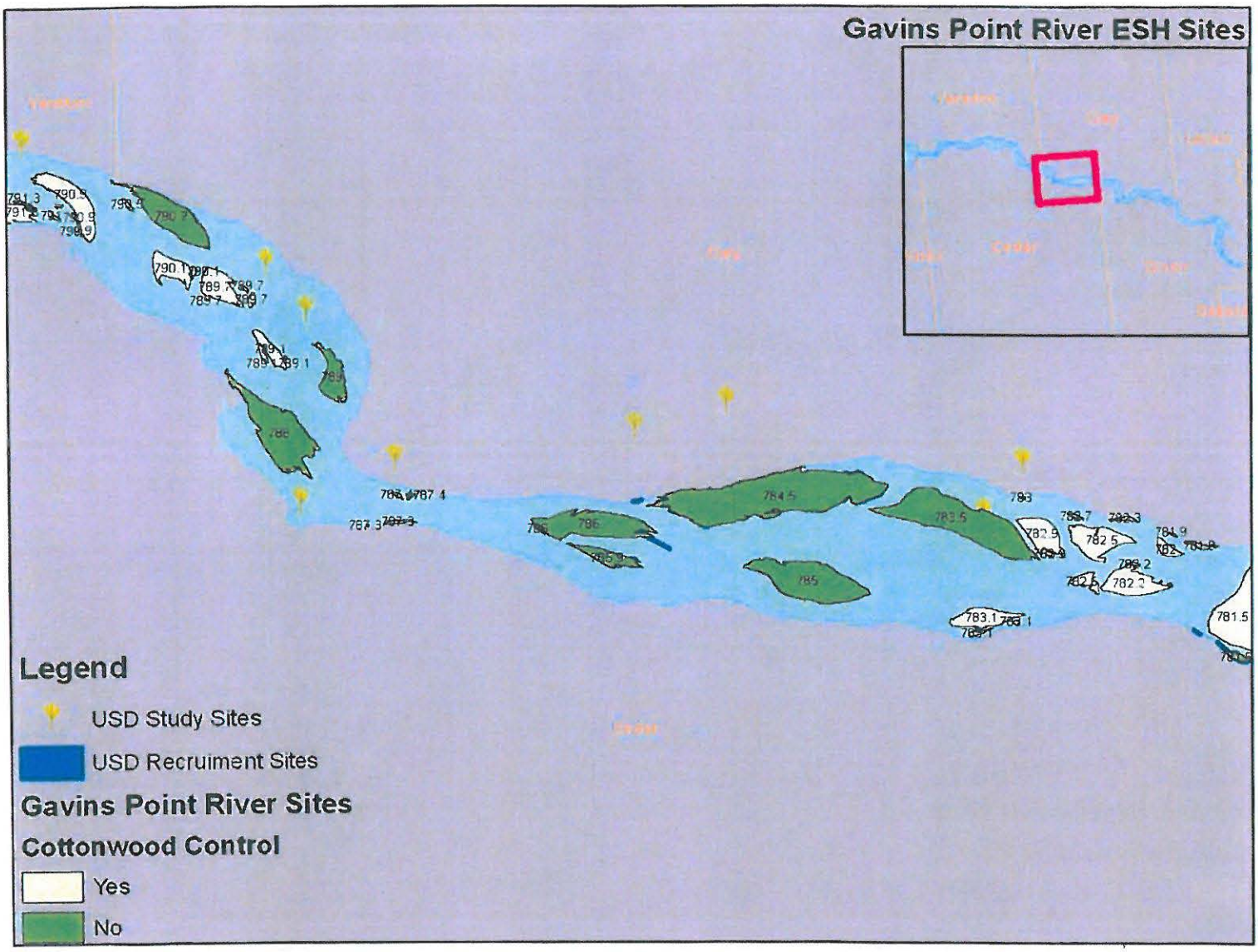
River Mile	Acres	ESH Acres	Treatable Vegetation	ESH Treated	Hard to Treat Vegetation	# of Individual Bars	# of Nests in'12	Connectivity	Attached to Wooded Island	Used for Line Intercept	Used for Substrate Polygons	Sprayed in '12	Selected to be Sprayed in '12	Known/Possible Landowner Issues	Dam Proximity (Close to Yankton)	NPS on Cottonwoods (No= no work)	USD Recruitment Study	USD Cottonwood Study	Recommended for Treatment	Comment	Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
766.2	36.1	8.4	31.8	7.8	2.0	1		Yes							No		Yes							Cnt		Cnt			
766.1	1.5	1.4	0.8	0.8	0.0	3									No														
765.8	121.2	20.6	73.4	9.9	36.9	1		Yes							No		Yes												
765.6	121.7	119.2	7.1	5.7	0.1	1		Yes							No														
765	2.0	1.9	1.6	1.5	0.0	2									No														
764.6	1.1	1.1	0.5	0.5	0.0	3									No														
764.5	5.5	5.3	1.0	0.8	0.0	1													Yes	Spot spray	Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
764.4	14.0	13.9	0.5	0.5	0.0	1										Yes			Yes	Spot spray, avoid USD recruitment study	Cnt	Trt	Trt	Trt	Cnt	Cnt	Trt	Trt	Trt
764.2	21.3	20.5	0.8	0.3	0.4	3	1												Yes	Spot spray	Cnt	Cnt	Cnt	Trt	Cnt	Trt	Cnt	Trt	Trt
763.8	63.9	62.0	2.3	1.5	1.0	1		Yes							No										Cnt		Cnt		
763	25.5	24.7	2.8	2.6	0.3	1		Yes							No														
762.4	0.1	0.1	0.1	0.1	0.0	1									No														
762.1	1.0	1.0	1.0	0.9	0.0	1									No														
762	4.5	4.5	0.5	0.5	0.0	3													Yes	Spot spray	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
761.8	24.5	24.5	2.8	2.7	0.0	1	3					Yes				Yes			Yes	Spot spray, avoid USD recruitment study	Cnt	Cnt	Trt	Cnt	Cnt	Cnt	Trt	Trt	Trt
761.3A	37.1	36.9	0.9	0.8	0.0	1													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Cnt	Trt	Cnt	Trt	Trt
761.3	15.1	15.1	1.4	1.3	0.0	1	1	Yes							No	Yes									Cnt		Cnt		
760.8	36.2	36.1	3.7	3.7	0.0	1										Yes			Yes	Spot spray, avoid USD recruitment study	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
760.7	8.8	8.7	2.2	2.2	0.0	1		Yes							No										Cnt	Cnt			
760.5	0.6	0.4	0.2	0.2	0.2	1		Yes							No										Cnt				
760	7.8	7.7	0.2	0.2	0.0	2									No		Yes												
759.7	64.1	45.8	12.1	4.0	9.6	1		Yes							No		Yes												
759.4	48.9	48.9	2.4	2.4	0.0	1	7			Yes						Yes			Yes	Spot spray, avoid USD recruitment study	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
759.3	7.6	7.5	0.7	0.7	0.0	3									No	Yes									Cnt	Cnt	Cnt		
759.1	5.3	5.3	0.1	0.1	0.0	1									No										Cnt				
759	94.3	94.1	0.3	0.3	0.0	1	6			Yes									Yes	Spot spray	Cnt	Cnt	Cnt	Cnt	Trt	Trt	Trt	Trt	Trt
758.2	147.7	138.9	23.6	18.2	3.0	2		Yes	Yes						No	Yes									Cnt	Cnt		Cnt	
756.5	183.4	181.6	3.0	2.1	0.5	2		Yes							No										Cnt				
755.8	12.1	12.1	0.0	0.0	0.0	1													Yes	Spot spray	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
755.3	0.8	0.3	0.2	0.1	0.3	2		Yes							No										Cnt	Cnt	Cnt		
755.2	15.6	15.6	0.2	0.2	0.0	1	2												Yes	Spot spray	Cnt	Cnt	Trt	Trt	Cnt	Trt	Trt	Trt	Trt
755	37.5	23.5	15.1	8.2	6.1	1		Yes							No		Yes									Cnt			
754.7	22.0	21.5	1.9	1.7	0.3	3													Yes	Spot spray	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
754.6	56.1	9.4	40.4	8.0	14.3	1		Yes							No	Yes									Cnt	Cnt	Cnt	Cnt	
754.5	0.6	0.6	0.6	0.6	0.0	1									No										Cnt				
754	88.9	88.6	3.6	3.5	0.0	14	1		Yes											Issues with rec users, PSP asked for no work									
753.5A	35.2	35.1	0.3	0.3	0.0	1														Issues with rec users									
753.5	20.1	16.5	3.1	2.2	2.6	3		Yes							No														
752.9	5.2	5.1	0.5	0.4	0.0	1		Yes							No														
	6315	5335.9	1105	631	377	271	164																						

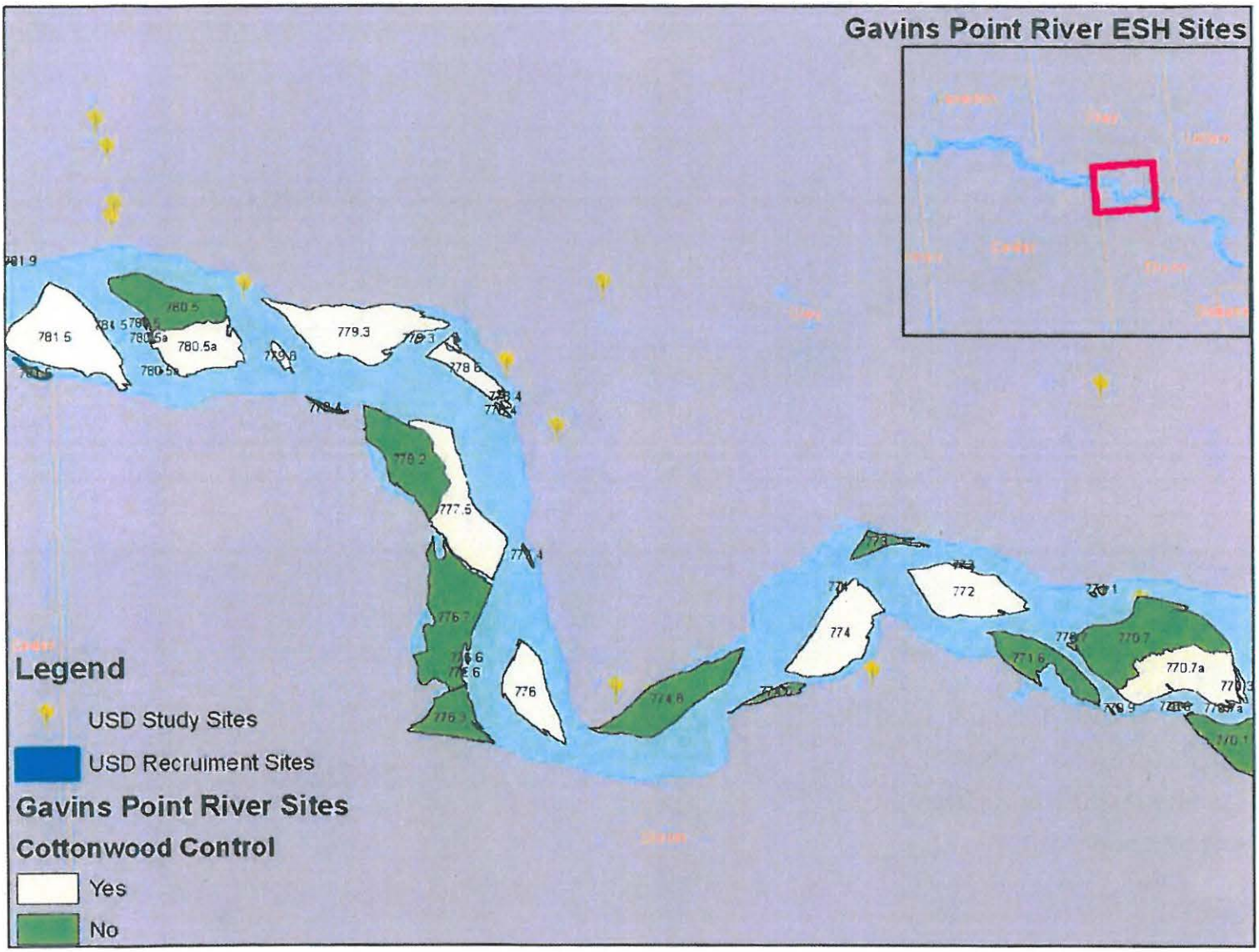
	Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
Number of Sites Treated	17	26	34	39	28	39	42	45	51
Number of Nests on Treated Sites	5	32	26	40	24	35	48	47	50
Percentage of Nests on Treated Sites *	10%	64%	52%	80%	48%	70%	96%	94%	100%
Area of Treated Sites	388	779	1161	1302	1259	1514	1647	1658	1742
Acres of Vegetation Treated	79	100	121	147	146	150	152	154	156
Acres of Treated ESH	78	99	111	136	135	139	142	143	145
Total ESH Before Treatment	5336	5336	5336	5336	5336	5336	5336	5336	5336
Total ESH After Treatment	5337	5337	5346	5347	5347	5347	5346	5347	5347
Added ESH	0.8	1.2	10.2	10.7	10.6	10.8	10.3	10.9	11.2

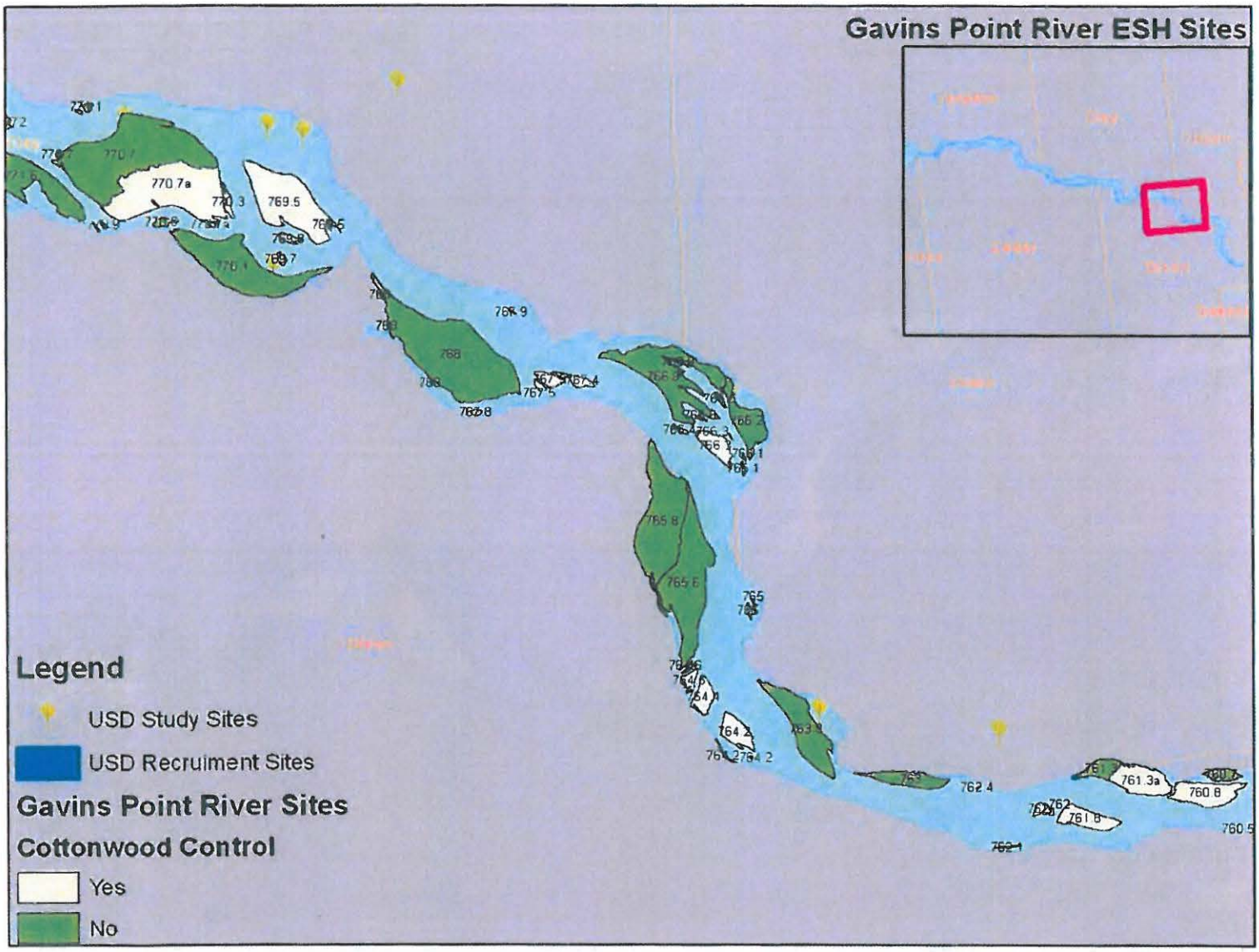
* Of Sites Avalible to be Treated

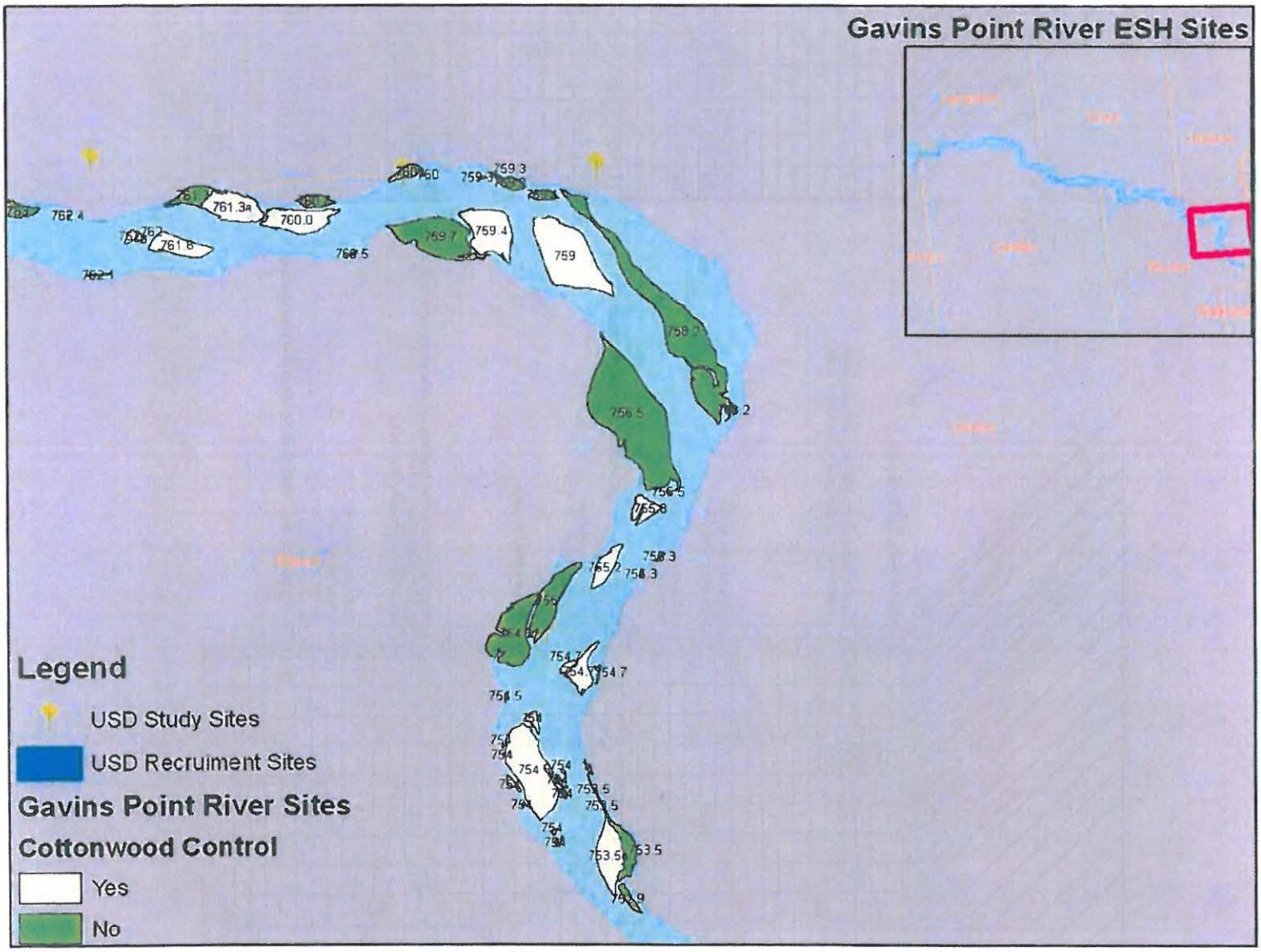

Gavins Point River ESH Sites
804.1a
804.1
802.2
Legend
USD Study Sites
USD Recruiment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No


Gavins Point River ESH Sites
Legend
USD Study Sites
USD Recruiment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No


Gavins Point River ESH Sites
Legend
USD Study Sites
USD Recruiment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No


Gavins Point River ESH Sites
781.9
781.5
780.5
780.5a
780.5a
779.3
778.6
778.2
777.5
776.7
776
774.8
774
772
770.7
770.7a
Legend
USD Study Sites
USD Recruitment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No


Gavins Point River ESH Sites
Legend
USD Study Sites
USD Recruiment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No


Gavins Point River ESH Sites
Legend
USD Study Sites
USD Recruitment Sites
Gavins Point River Sites
Cottonwood Control
Yes
No
762.4
761.3a
760.0
761.8
759.7
759.4
759
758.2
756.5
754.7
753.5

FORT RANDALL REACH

River Mile	Acres	ESH Acres	ESH Treated	Treatable Vegetation	Hard to Treat Vegetation	# of Individual Bars	# of Nests in '12	Connectivity	Attached to Wooded Island	Used for Line Intercept	Used for Substrate Polygons	Selected to be Sprayed in '12	Known/Possible Landowner Issues	Dam Proximity (Within 5 miles of dam)	NPS on Cottonwoods (No= no work)	USD Recruitment Study	USD Cottonwood Study	Recommended for Treatment	Comment	Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
878.3	8.8	8.7	2.3	2.4	0.0	3	2						Yes					No	Close to dam and gets inundated									
877.9	21.4	14.9	8.5	12.9	2.0	1		Yes					Yes	No				No										
876.4	7.8	5.5	2.2	4.0	0.3	2							Yes	No				No										
876	16.1	11.3	4.2	6.4	2.5	3							Yes				Yes	No	Close to dam, has big vegetation, no historic usage									
875.9	2.7	2.4	0.6	0.8	0.1	2							Yes					No	Close to dam, has big vegetation, no historic usage									
875	234.8	53.2	22.1	99.3	102.1	2		Yes					Yes	No	Yes	Yes		No										
874.9	3.6	3.4	1.2	1.4	0.0	2								No				No										
874.7	16.1	11.4	4.4	8.1	1.0	4								No				No										
874.3	5.9	5.7	0.5	0.8	0.0	3								No				No										
874.1	3.8	3.7	0.4	0.4	0.0	2								No	Yes			No										
871.7	47.9	39.1	12.7	19.5	1.8	1		Yes	Yes					No			Yes	No										
870.1	7.6	7.5	2.4	2.4	0.0	1	2			Yes								Yes	Spot spray, landowner	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
870	28.5	28.4	16.2	16.3	0.0	1	5				Yes							Yes	Spot spray, landowner	Cnt	Cnt	Trt	Trt	Cnt	Cnt	Trt	Trt	Trt
869.5	39.8	35.0	13.1	17.1	0.7	2								No			Yes	No					Cnt		Cnt			
869.1	9.6	9.5	0.9	1.0	0.0	2	1				Yes							Yes	Spot spray, landowner	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt	Trt
868.1	1.3	1.3	0.1	0.1	0.0	1												No	Small and gets inundated					Cnt	Cnt		Cnt	
867.5	107.4	23.5	11.7	59.3	33.3	3		Yes	Yes					No				No						Cnt				
867	9.6	5.4	3.6	7.0	0.8	2								No				No										
866.9	31.0	30.6	2.9	3.2	0.0	3	2				Yes						Yes	Yes	Spot spray, tribe, has USD study but may have been reworked	Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
866.3	20.8	20.7	1.9	1.9	0.0	5				Yes								Yes	Spot spray, tribe	Cnt	Trt	Trt	Trt	Cnt	Cnt	Cnt	Trt	Trt
864.8	22.0	21.9	1.9	2.0	0.1	3	6			Yes	Yes							Yes	Spot spray, landowner	Cnt	Cnt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt
863.3	14.3	14.3	2.0	2.0	0.0	3	2											Yes	Spot spray, tribe	Trt	Trt	Trt	Trt	Trt	Cnt	Trt	Cnt	Trt
861.7	3.9	3.7	1.7	1.9	0.0	3								No				No						Cnt		Cnt		
860	5.2	4.3	1.0	1.3	0.5	1								No	Yes			No						Cnt				
858.7	0.2	0.2	0.0	0.0	0.0	1												No	Small and gets inundated									
858	71.8	68.9	7.0	8.6	0.8	2			Yes					No	Yes			No										
857.7	180.7	100.9	32.2	81.6	27.3	9		Yes	Yes					No	Yes			No										
857	321.7	62.7	23.5	101.5	179.5	4			Yes					No			Yes	No										
856.1	15.8	13.2	5.6	7.4	0.4	1		Yes						No				No										
856	57.7	33.5	12.5	30.9	2.9	3			Yes					No	Yes			No										
855	84.3	76.2	6.1	11.5	2.0	1	3			Yes							Yes	Yes	Spot spray, not sure about landowner, avoid upper portion with USD study	Cnt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
853.8	28.5	28.4	0.9	1.0	0.0	1	18			Yes		Yes						Yes	Spot spray, landowner	Cnt	Trt	Cnt	Trt	Cnt	Cnt	Trt	Trt	Trt
853.4	28.5	28.2	1.2	1.4	0.0	1												Yes	Spot spray, not sure about landowner	Trt	Cnt	Trt	Trt	Cnt	Trt	Cnt	Trt	Trt
853	188.4	140.3	18.1	56.5	8.2	5			Yes					No				No							Cnt		Cnt		
852.1	91.9	22.3	5.5	59.7	15.1	3		Yes	Yes					No			Yes	No										
852	4.0	4.0	0.3	0.3	0.0	1												Yes	Spot spray, landowner	Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
851.9	28.2	28.0	1.4	1.5	0.0	6	1											Yes	Spot spray, landowner	Cnt	Cnt	Cnt	Cnt	Cnt	Cnt	Trt	Trt	Trt
851.8	17.1	17.1	0.4	0.5	0.0	2	4											Yes	Spot spray, landowner	Trt	Trt	Trt	Trt	Cnt	Trt	Cnt	Trt	Trt
851.7	16.0	15.8	0.8	1.0	0.0	1	7											Yes	Spot spray, landowner	Cnt	Cnt	Trt	Trt	Trt	Cnt	Trt	Cnt	Trt
851.6	21.8	21.1	0.9	1.1	0.0	2	12										Yes	Yes	Spot spray, landowner, has USD study but may have been reworked	Cnt	Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt
851.4	45.1	20.7	11.8	30.9	4.7	4								No				No						Cnt	Cnt	Cnt		
850.3	53.4	42.7	3.9	11.4	0.4	1		Yes						No				No										
849.2	48.1	29.9	12.4	27.4	2.4	8								No				No										
848.9	87.4	201.3	44.5	129.0	87.6	1		Yes	Yes					No				No										
848.3	6.1	5.6	1.7	2.1	0.1	1								No				No										

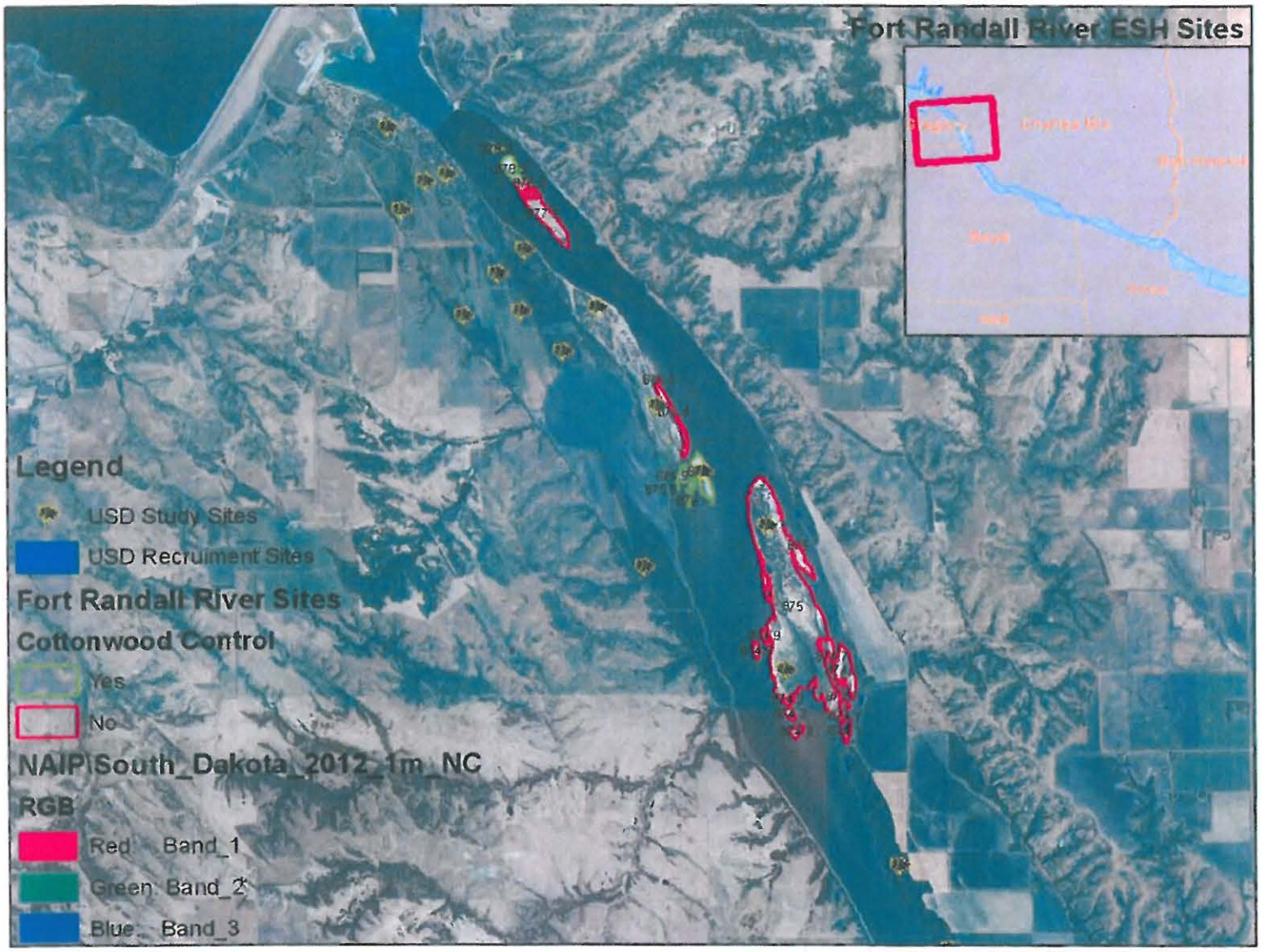
FORT RANDALL REACH

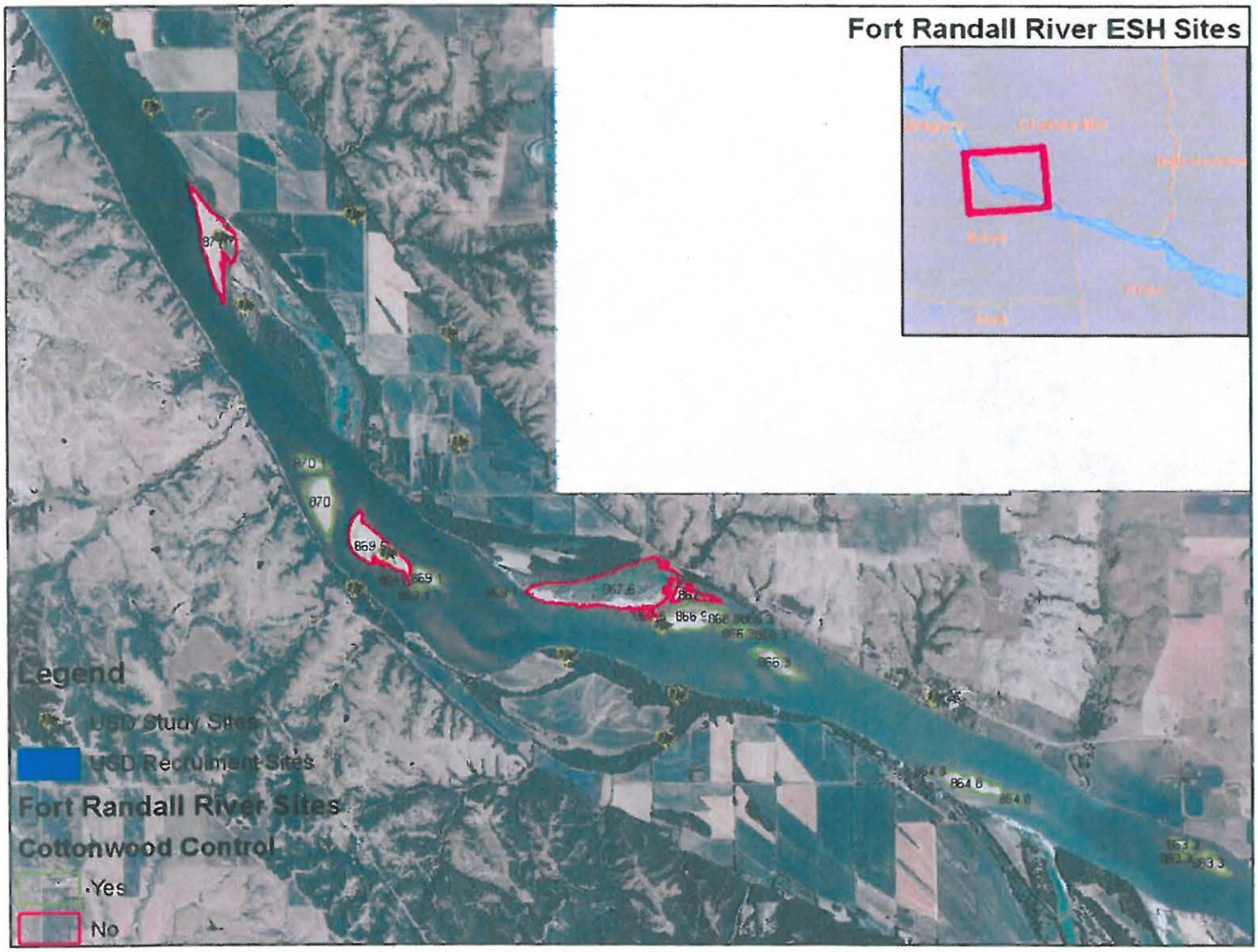
River Mile	Acres	ESH Acres	ESH Treated	Treatable Vegetation	Hard to Treat Vegetation	# of Individual Bars	# of Nests in '12	Connectivity	Attached to Wooded Island	Used for Line Intercept	Used for Substrate Polygons	Selected to be Sprayed in '12	Known/Possible Landowner Issues	Dam Proximity (Within 5 miles of dam)	NPS on Cottonwoods (No= no work)	USD Recruitment Study	USD Cottonwood Study	Recommended for Treatment	Comment
848.2	107.8	106.9	2.9	3.2	0.1	1	10	Yes		Yes		Yes						Yes	Spot spray
848.1	2.1	2.0	0.0	0.0	0.0	1								No				No	
847.7	238.3	36.8	16.3	150.3	65.4	2			Yes					No		Yes		No	
846.9	67.3	66.9	1.7	1.8	0.0	2									Yes			Yes	Possible wetland/poor habitat
846.5	66.9	66.4	3.6	3.8	0.0	3			Yes						Yes			Yes	Possible wetland/poor habitat, landowner
846.3	55.3	208.3	48.4	133.9	87.7	5		Yes						No	Yes	Yes		No	
846.2	29.9	28.6	4.7	5.6	0.1	10			Yes									Yes	Possible wetland/poor habitat, landowner
846.1	2.1	0.3	0.2	1.7	0.3	2		Yes						No				No	
845.7	12.2	12.0	0.5	0.6	0.0	3		Yes										No	Wetland
845	51.9	46.9	18.2	22.6	0.1	10								No	Yes			No	
844.9	4.7	4.5	0.0	0.0	0.0	1								No				No	
844.8	34.9	34.8	1.3	1.4	0.0	4								No	Yes			No	
844.7	313.4	159.7	32.6	135.9	43.4	5			Yes					No	Yes			No	
844.6	155.4	28.2	16.4	108.7	28.2	5			Yes					No				No	
844.5	9.7	7.2	3.3	4.7	1.1	4		Yes						No				No	
844.4	7.7	7.3	0.9	1.2	0.0	1								No				No	
	3226	2143	460	1412	703	172	75												

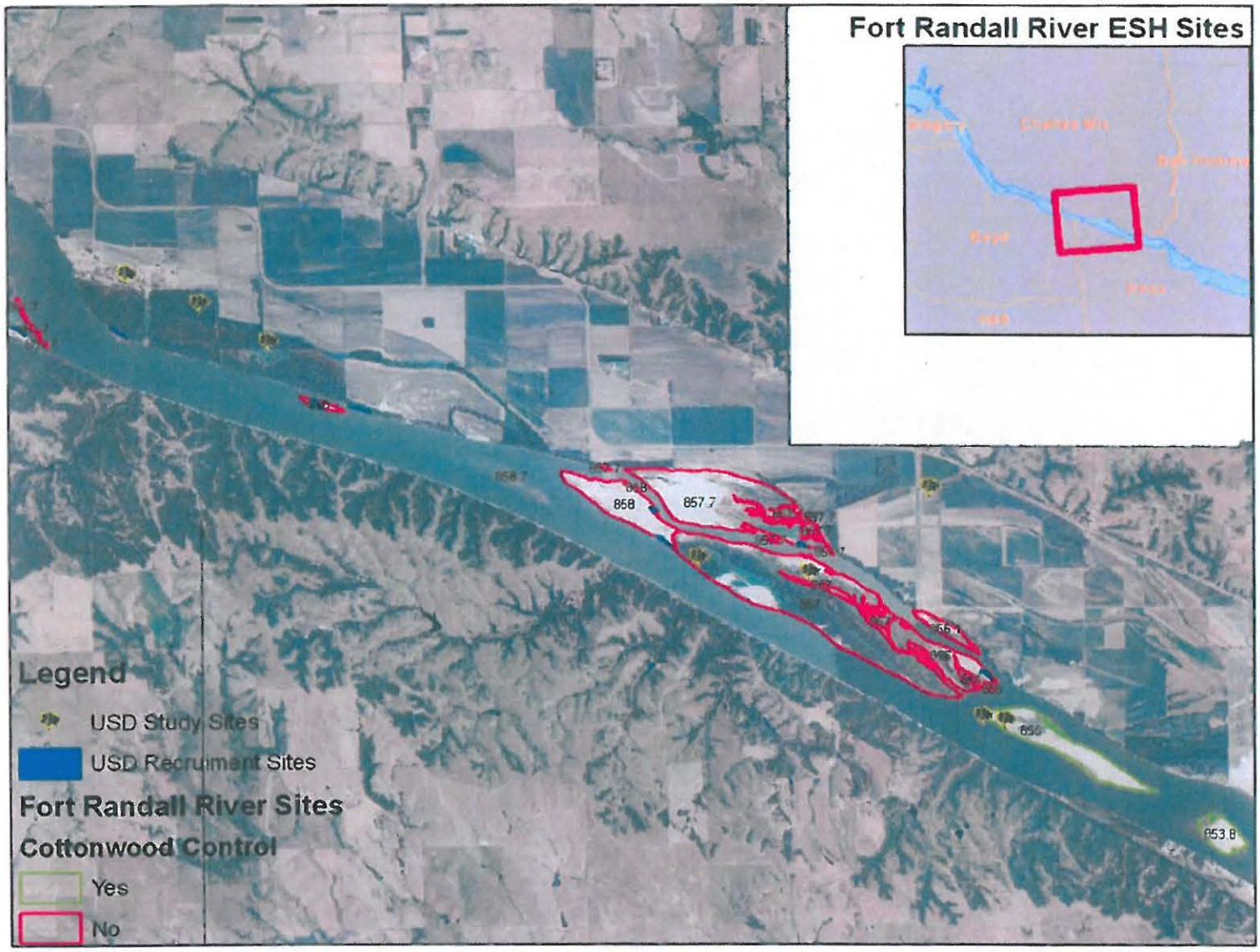
Treatment 1 (Every Third)	Treatment 2 (Every Other)	Treatment 3 (Two Out of Three)	Treatment 4 (Three Out of Four)	Treatment 5 (Modified Every Third)	Treatment 6 (Modified Every Other)	Treatment 7 (Modified Two Out of Three)	Treatment 8 (Modified Three Out of Four)	Treatment 9 (All)
Trt	Cnt	Trt	Cnt	Trt	Trt	Trt	Trt	Trt
				Cnt	Cnt			
				Cnt				
Cnt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
Cnt	Cnt	Cnt	Trt	Cnt	Cnt	Cnt	Cnt	Trt
				Cnt				
Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt	Trt
				Cnt	Cnt			
				Cnt				

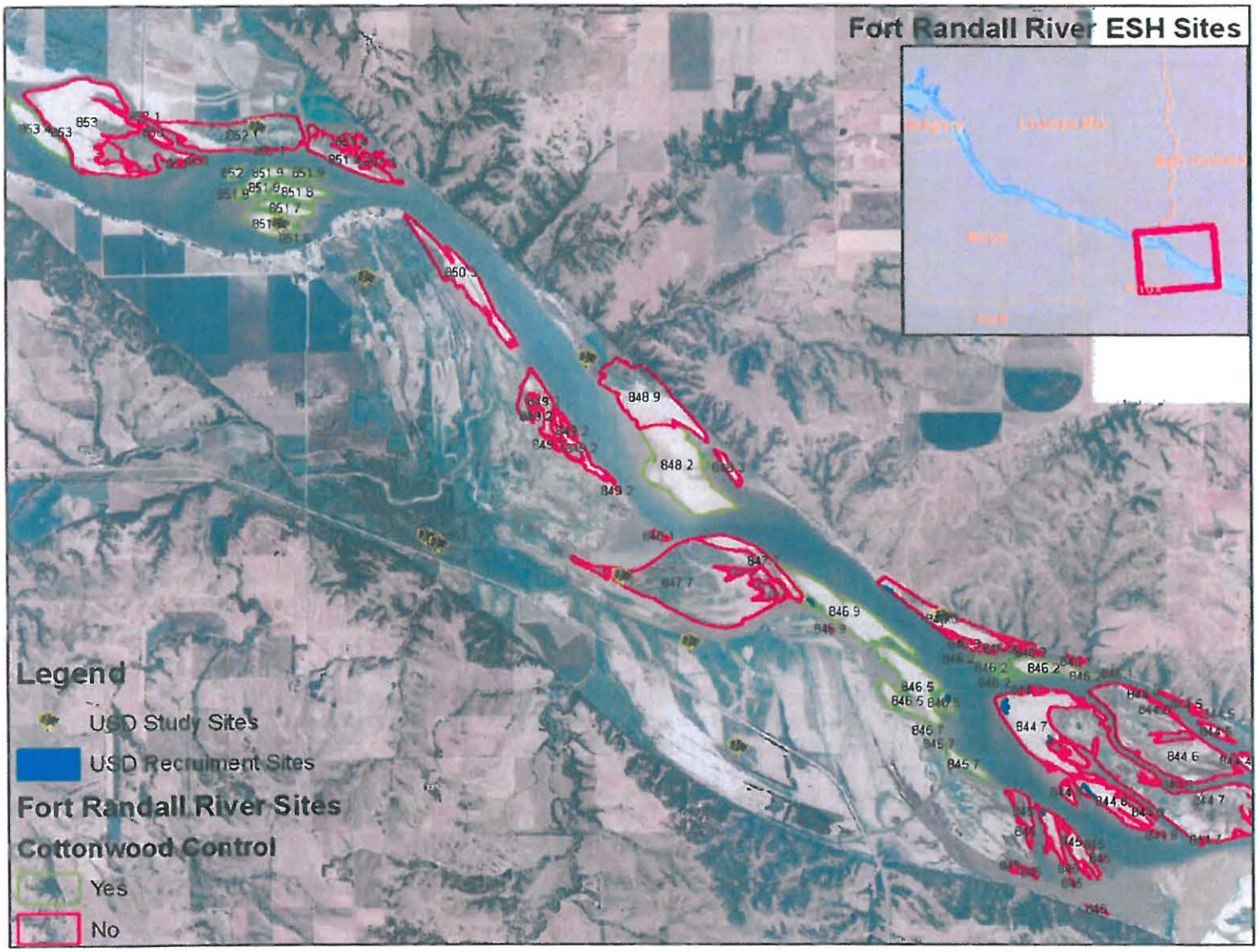
Number of Sites Treated	7	10	13	15	10	12	15	16	19
Number of Nests on Treated Sites	20	39	35	57	27	40	69	64	73
Percentage of Nests on Treated Sites *	27%	53%	48%	78%	37%	55%	95%	88%	100%
Area of Treated Sites	236	221	457	383	372	431	501	537	634
Acres of Vegetation Treated	18	18	51	42	32	34	54	55	61
Acres of Treated ESH	17	16	43	40	25	26	46	47	53
Total ESH Before Treatment	3226	3226	3226	3226	3226	3226	3226	3226	3226
Total ESH After Treatment	3228	3228	3234	3228	3233	3234	3234	3234	3234
Added ESH	1.8	1.5	7.6	2.3	7.4	7.6	7.8	7.9	8.3

* Of Sites Avalible to be Treated


Fort Randall River ESH Sites
Legend
USD Study Sites
USD Recruitment Sites
Fort Randall River Sites
Cottonwood Control
Yes
No
NAIP\South_Dakota_2012_1m_NC
RGB
Red Band_1
Green Band_2
Blue Band_3


Fort Randall River ESH Sites
Legend
USD Study Sites
USD Recruitment Sites
Fort Randall River Sites
Cottonwood Control
Yes
No


Fort Randall River ESH Sites
Legend
USD Study Sites
USD Recruitment Sites
Fort Randall River Sites
Cottonwood Control
Yes
No
858
857.7
853.8


Fort Randall River ESH Sites
Legend
USD Study Sites
USD Recruitment Sites
Fort Randall River Sites
Cottonwood Control
Yes
No

Evaluation of Vegetation Removal and Control Methods to Create Emergent Sandbar Habitat on the Upper Missouri River

Prepared by the U.S. Army Corps of Engineers, Missouri River Recovery Program, Integrated Science Program

In cooperation with the U.S. Fish and Wildlife Service, the National Park Service, U.S Geological Survey Northern Prairie Wildlife Research Center, Virginia Polytechnic Institute, Nebraska Game and Park Commission, South Dakota Department of Game, Fish, and Parks, North Dakota Game and Fish Department, ND State Water Commission, and other federal, state, and tribal agencies.

Background and Justification

Emergent sandbar habitat (ESH) provides important breeding areas for two federally listed bird species (piping plovers [*Charadrius melodus*] and least terns [*Sternula antillarum*]) nesting on the Upper Missouri River. According to the 2000 Biological Opinion (hereafter Opinion) and 2003 Amendment to the Opinion, ESH consists of areas that have smooth topography, well draining substrate (particles ranging in size up to 1 inch diameter), and less than 10 percent vegetation. In 1997 high water releases out of mainstem dams created thousands of acres of ESH within several segments of the upper river. Today much of this habitat has eroded away or become too vegetated to be considered ESH. According to VanderLee 2002 steady flows between study years provided little or no vegetation scouring and vegetation increased 3-fold. While there is little quantitative data since the VanderLee study on the amount of habitat lost to vegetation encroachment it can be assumed that because there has been no substantial spike in flows that would provide a scouring effect on Missouri River sandbars additional encroachment has occurred.

The U.S. Fish and Wildlife Service (FWS) recognized that declines in habitat on the Upper Missouri River decreases the likelihood that recovery goals for the least tern and piping plover would be met therefore a Reasonable and Prudent Alternative was included in the Opinion and 2003 amendment requiring the creation of habitat to supplement losses since 1998. The Corps, through the Emergent Sandbar Habitat (ESH) program, plans to meet these goals by creating habitat through either mechanical construction (e.g., dredge deposits of sand shaped into sandbar complexes with heavy machinery) or modification of existing sandbars.

Projects have been implemented throughout the years to remove vegetation from existing sandbars to create ESH. Individual treatments and combinations of spraying, tilling, disking, and mowing were implemented and evaluated for effectiveness. Most individual treatments generally appeared to be unsuccessful however, past efforts were evaluated based on the response of terns or plovers using these areas rather than on effectiveness of treatments to create suitable habitat. Projects were also not evaluated to ensure sandbar characteristics met desired habitat criteria and inferences were confounded by other biological or environmental factors.

Since 2007, ESH projects have been primarily habitat construction in shallow water areas where no habitat existed previously. Factors such as length of the construction season, high costs for

deployment and construction, as well as environmental factors limit the amount of habitat that can be constructed in one year. Constructed sandbars may also be subject to vegetation encroachment and over time may not meet desired vegetative characteristics.

With the limitations of our current methods to create new sandbars and continued vegetation encroachment on all sandbars available for use by nesting terns and plovers, restoration and maintenance of sandbars to create and maintain ESH could provide a more cost effective and efficient means of meeting goals. It is clear however, that a well planned and designed incremental approach is necessary to determine if ESH could be created or maintained by modifying vegetation on sandbars. First we need to determine if vegetation can be successfully removed from sandbars and sandbars can be maintained vegetation free, second we must ensure that all ESH criteria are met, and third we must determine if the sandbars actually support successful nesting and brood rearing.

The purpose of this study is to implement an experimental strategy to determine if vegetation can be successfully removed from sandbars and desired habitat vegetative characteristics can be maintained and provide for a study with enough statistical rigor to make definitive conclusions. This experimental approach will allow us to test a larger number of treatments without causing larger scale impacts on potential nesting habitat.

Objectives

Goal: Develop a method(s) to successfully remove vegetation from vegetated sandbars and maintain created habitat vegetation free.

This study is designed in two phases: 1) determine if vegetation can be removed from sandbars and 2) determine if vegetation encroachment on sandbars can be prevented or slowed to ensure that ESH will persist over time.

Phase 1 – Removal

Evaluate methods of vegetation removal to determine which treatments are most effective for removing vegetation from sandbars.

Objectives

1. Examine the influence of various vegetation removal treatments on vegetative characteristics of sandbar habitat.
2. Estimate the length of time each successful treatment meets successful criteria.

Phase 2 – Maintenance

Evaluate methods of vegetation maintenance to determine which treatments are most effective for maintaining sandbars to meet desired habitat characteristics.

Objectives

1. Examine the efficacy of various treatments to maintain desired vegetative characteristics of sandbars.
2. Estimate the length of time each successful treatment meets successful criteria.

Design

We have devised an experimental design to meet our objectives and to ensure adequate replication to distinguish important differences among treatments, preexisting habitat types and substrates, creation methods, and annual variation. Our design will allow a test to indicate whether different treatments are needed on different segments or pre-existing habitat conditions of the Missouri River system.

Spatial and Temporal Scope

The Opinion and 2003 Amendment set ESH goals for four river segments including the river segments below Fort Peck Dam, Garrison Dam, Fort Randall Dam, and Gavins Point Dam and 1 reservoir segment; Lewis and Clark Lake. River segments have variability amongst factors such as weather patterns, vegetative communities, flow regulation, etc therefore segment must be included as a fixed effect to account for this variability. River segments where there is potential for habitat to be created utilizing the methods we are developing must be included in the study, therefore the river below Gavins Point Dam, Fort Randall Dam, and the Garrison Dam will be included. The Fort Peck river segment will be excluded from this study because ESH goals were not defined for this segment, this segment supports a small portion of tern and plover populations, and no habitat work is proposed here. The upper portion of Lake Oahe has reverted back to a more riverine function and has been a valuable area for nesting birds during the drought therefore this area will be included in the study.

This study will be implemented on sandbars within each segment of the Missouri River. It is important that the study be conducted in the same types of sandbars where projects will be implemented. Specific sandbars chosen should contain the same characteristics of habitat being targeted for implementation as well as possess other characteristics necessary for successful nesting such as adequate foraging habitat and suitable nesting substrate. Replication of sandbars within segments is important to detect variability among segments; otherwise differences detected among segments are confounded with those among sandbars.

Pre-existing habitat type may affect the response of a treatment. If the methods developed through this study will be implemented on sandbars with multiple habitat types it is important to also include habitat type as a fixed effect in order to determine if different habitat types will require different treatments.

Sandbar habitat characteristics change over time due to factors such as erosion and vegetation encroachment. Each growing season a sandbar is exposed to vegetation encroachment and the establishment of seed banks. The effectiveness of maintenance treatments may vary between bare sand habitats which have been exposed to different numbers of growing seasons therefore it is important to consider exposure time.

Several methods of sandbar creation have already been implemented on the Missouri River and additional methods may be developed through Phase I of this study. Habitat characteristics may vary between habitats created by different means such as seed bank viability, or substrate composition. It is important to include creation method as an additional fixed effect to ensure this variability is accounted for.

Sample unit

Plot sampling is a widely used methodology to intensively study responses of vegetation to various manipulations. Plot samples must be replicated a number of times, in a random way, to ensure that the data represent an unbiased picture of the system and to ensure statistical validity.

Sampling unit configuration

Cain and Castro 1959 described the minimal sampling area as 'the smallest area that provides sufficient space or combination of habitat conditions for a particular segment of a community type to develop its essential combination of species or its characteristic structure and composition'. Plot size to detect differences in the herb layer of a forest is 1x1m as suggested by Oosting 1956. Remote sensing classification of sandbars on the Missouri River has also shown the herb/shrub habitat type is detectable within a 1x1m plot therefore we will sample a 1x1m plot within this study. Due to juxtaposition and potential effects of adjacent plots as well as adjacent undisturbed habitat we will treat a 5x5m plot and sample only the central 1x1m plot. Variation within a

sandbar is also important to consider when sampling. By placing plots in blocks and having multiple replicates of blocks within a sandbar and habitat type as well as multiple replicates of each treatment within each block these variations can be detected and accounted for.

Treatments

Several different treatments have been used to remove vegetation, including burning, herbicide application, mowing, and tilling. Information from previous efforts to remove vegetation, chemical manufacturer specifications, and published studies have provided a basis for selecting a number of treatment combinations that could be effective at removing vegetation from sandbars on the Missouri River.

There are two types of herbicides approved for use by the Corps on the Missouri River, Glyphosate and Imazapyr. Glyphosate is designed to kill postemergent vegetation and moves to the root system to prevent re-growth. It controls most annual and perennial weeds and woody brush and trees (Tu et al. 2001) but must be applied to foliage, green stems, and cut stems because it cannot penetrate woody bark (Carlisle and Trevors 1988). Glyphosate does not have a residual effect because it is strongly bound to soil particles, making it unavailable for absorption by plant roots (Hance 1976). The other approved chemical, Imazapyr, is used for the control of terrestrial annual and perennial grasses and broadleaved herbs, woody species, and riparian and emergent aquatic species. Unlike Glyphosate it is useful in killing large woody species because it is absorbed quickly through plant tissue, can be taken up by roots, and has a slow breakdown in plants. It is useful for total vegetation control because at higher concentrations Imazapyr has a low soil adsorption rate, thus it remains available for plant uptake. Imazapry is most effective on annual weed species when applied as a post-emergent herbicide and most effective on woody species when used as a pre-emergent (Tu et all 2001); however, it appears relatively ineffective on legume species (Fabaceae; (G. Jons, U.S. Army Corps of Engineers, personal communication 2007). The combination of these two herbicides could provide an effective treatment combination.

Treatments conducted in the early 1990's on the Missouri River showed successful use of Glyphosate for killing leafed-out-vegetation, however because Glyphosate does not affect seeds, there was plant re-growth the following spring (Latka et al. 1993). Glyphosate has also been used for vegetation treatments in recent years; in these treatments vegetation was initially killed, but herbaceous annuals re-vegetated the treated sites, possibly due to Glyphosate not having a residual effect (G. Jons, U.S. Army Corps of Engineers, personal communication 2007).

Imazapyr use was tested in 2003 on the Missouri River. Treatments of spraying and a combination of spraying and mowing resulted in zero percent live vegetative ground cover after the sixth week which persisted through the growing season; however spray plots showed much higher visual obstruction due to the remaining dead vegetation (Daum et al. 2003). Imazapyr has been used in post emergent vegetation control in recent years on the Missouri River, however the concentration of chemical mix and application method were probably not adequate to penetrate thick canopy cover and treat the entire plant or affect the underlying vegetation (G. Jons, U.S. Army Corps of Engineers, personal communication 2008). Combinations of spraying imazapyr and mowing were also tried but because consistent habitat data were not collected pre and post treatment the results could not be interpreted. However, anecdotal evidence and photo points suggest that these sites were re-vegetated by herbaceous annuals. Mowing alone also left the sandbars covered with downed woody debris. Table 1 provides a summary of sites, treatments, and bird use of the Corps most recent vegetation removal activities.

Tilling and disking alone were not effective at providing habitat for terns and plovers. Treated sites became re-vegetated the following year (Latka et al 1993). Mowing efforts in recent years on Fort Randall sandbars resulted in re-sprouting of cottonwoods and willows which increased vegetative ground cover on the sites rather than decreasing it.

Latka et al. (1993) noted that fall hand-cutting or pulling of 3-6 yr perennials and cottonwoods was effective; however, it is unclear what metrics were used to evaluate effectiveness or how long these areas persisted in a non-vegetated state. Hand pulling of woody stems occurs on an annual basis at John Martin Reservoir in Colorado to prolong habitat that was previously mowed and sprayed. These areas have shown a marked increase in adult plovers from 1 pair to 80 pairs in 11 years (D. Nelson, US Army Corps of Engineers, personal communication, 2007).

Methods

Phase I – Removal

Spatial and temporal scale – Phase I will be conducted on the following river segments: Gavins Point, Lewis and Clark Lake, Fort Randall, the headwaters of Lake Oahe, and Garrison. Three sandbars on each segment were selected for this experiment (see below). Two blocks, consisting of 10 plots, will be placed in each of two habitat types (sparse vegetation and mixed vegetation) on each sandbar.

Gavins Point; 802.5, 775.0, 765.0
Lewis and Clark Lake; 836.8, 839.7, 841.5
Fort Randall River; 876.1, 874.9, 871.8
Lake Oahe Riverine Segment; 1288.0, 1294.4, 1277.5
Garrison River; 1369.0, 1353.5, 1338.1

Experimental unit - Plots

Experimental unit configuration – Plots will be 5x5m and will be laid out in blocks containing two replicates of each treatment and two controls.

Treatments
1) Fall glyphosate / Fall root-rip / Spring imazapyr
2) Fall glyphosate / Fall mow / Fall debris removal / Spring imazapyr
3) Fall glyphosate / Fall mow / Fall overtop / Spring imazapyr
4) Fall mow / Fall debris removal / Spring imazapyr
5) Control: no treatment

Schedule
Treatments will be applied to test blocks during the fall of 2008 and spring of 2009 and will be evaluated through two growing seasons. After the first growing season any treatments which show improvement in habitat condition but cannot be considered successful will be retreated with the same treatment and evaluated for an additional two years. We will continue to monitor all successful treatments to determine length of time a treatment can be considered successful.

Phase II – Maintenance

Spatial and temporal scale – Phase II will be conducted on the following river segments: Gavins Point, Lewis and Clark Lake, Fort Randall, the headwaters of Lake Oahe, and Garrison. Created habitat will be utilized on each segment as it becomes available provided more than one area of ESH created by a single method is available for experimentation. Two blocks, consisting of 12 plots, will be placed in each habitat type classified prior to construction of the site. Additional blocks will also be placed at multiple elevations and along slopes to capture information about treatment effects on vegetation at different elevations.

Currently, there are several sandbars below the Gavins Point Dam that provide appropriate created habitat that we will utilize for testing the timing of maintenance component of this task. Sandbars that were mechanically created prior to the 2008 nesting season (Age 1 sandbars) include 777.7 and 791.5 and sandbars that were mechanically created prior to the 2009 nesting

season (Age 0 sandbars) include 795.5 and 774.0. Additional constructed sandbars will be added to the experiment as sandbars are created and enough sandbars have been experiment on to provide the statistical rigor necessary to provide a valid evaluation of our treatments on all river segments.

Implementation of vegetation removal on natural sandbars will be necessary to fully examine the first objective of this phase (i.e., examine the efficacy of various treatments to maintain desired vegetative characteristics of sandbars). Natural sandbars created through flow events as well as sandbars created utilizing successful removal treatments will be included in the experiment provided they are available and meet the replication and habitat type criteria as laid out in this study plan.

Experimental unit - Plots

Experimental unit configuration – Similar to Phase I, we will use a block and plot design to evaluate various techniques to maintain desired habitat characteristics on sandbars. Plots will be 5x5m and will be laid out in blocks containing two replicates of each treatment and two controls placed randomly within each pre-creation habitat classification.

Treatments
1. Fall spray glyphosate
2. Fall mow
3. Spring spray with imazapyr and fall spray glyphosate
4. Hand pulling
5. Control: No Treatment

Additional treatments may be added over time as unsuccessful treatments are dropped and alternative methods are identified.

Schedule
Treatments will be applied on constructed sandbars beginning the fall of 2009 after bird departure. Treatments will be applied to additional constructed sandbars as well as natural and modified sandbars as they become available through flow creation or ESH creation efforts provided sandbars contain the appropriate per-creation habitat type criteria and enough are available within each segment to allow for replication.

Monitoring and evaluation of Phase II treatments will continue for two years to identify a successful maintenance treatment. Monitoring and evaluation of Phase II maintenance treatments on natural sandbars will continue for two years to identify a successful treatment. Once successful treatments have been identified monitoring and evaluation of treated habitats will continue through the ESH Evaluation Program.

Monitoring and Analysis

A Before-After-Control-Impact approach will be taken to monitor each phase. This approach has been outlined in the Monitoring Plan (Sherfy et al 2007) but will be altered slightly to accommodate the difference in experimental unit. Experimental units for treatment effects are plots with different treatments rather than sampling segments.

Terrestrial habitat conditions at each plot will be quantified pre treatment by measuring a suite of habitat variables at a single centered sampling point within each plot. Each of the following habitat variables within the quadrat will be recorded; study area, block id, point id, visual coverage estimates for each type of vegetation, stem counts for woody vegetation, approximate mean height of vegetation, maximum height of vegetation, dominant species and visual coverage

estimates of each dominant species for each vegetation type, visual coverage estimates for each type of substrate, visual coverage estimate for each type of debris, sample date, sample time (USACE 2008).

Efficacy of treatments to provide desired vegetative habitat characteristics will be evaluated by comparing habitat characteristics at plots to those of desired habitat characteristics of tern and plover nests on the Missouri River. Data collected through ESH Evaluation will be utilized to determine desired habitat characteristics of tern and plover nests. For Phase I improvement in habitat condition will be defined as a decrease in visual cover of vegetation classes and decrease in mean vegetation from pre-treatment conditions.

In order to determine length of time treatments remain effective habitat measurements will be repeated post treatment during each subsequent growing season and will be repeated until individual treatments no longer produce desired habitat characteristics. Once successful treatments have been identified monitoring and evaluation of treated habitats will continue through the ESH Evaluation Program. Length of time of treatment efficacy will continue to be evaluated through the ESH Evaluation project to determine appropriate timing for re-treatment.

Products and Schedule

Annual updates will be provided at the conclusion of each field season detailing work completed and if available will include information gained from the study. Annual work plans will be developed prior to each field season and will include information about additional sites included in the study as well as the addition of treatments to the maintenance phase. A final report will be compiled upon the completion of this study and will include recommendations to the ESH PDT on methodology for vegetation removal and maintenance to create ESH.

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Table 1. Historic bird use of islands previously modified by vegetation removal treatments.

	Acres		Terns				Plovers				Combined		
Year/Site	Treated	available	Adults	Chicks	Fledge	Density	Adults	Chicks	Fledge	Density	Fledge	Density	Treatment
2005	**73.7**	**53.8**	**56**	**33**	**1.18**	**1.04**	**30**	**22**	**1.47**	**0.56**	**1.28**	**1.60**	
781.5	35.0	25.0	54	31	1.15	2.16	20	18	1.80	0.80	1.32	2.96	Fall04 Gylphosate, Spring05 Mow
756.6	38.7	28.8	2	2	2.00	0.07	10	4	0.80	0.35	1.00	0.42	Fall04 Gylphosate, Spring05 Mow
2006	**104.1**	**41.1**	**14**	**1**	**0.14**	**0.34**	**27**	**0**	**0.00**	**0.66**	**0.05**	**1.00**	
800.8	81.3	30	9	1	0.22	0.30	6	0	0.00	0.20	0.13	0.50	Fall05 Imazapyr, Spring06Mow
759.0	10.1	10.1	5	0	0.00	0.50	21	0	0.00	2.08	0.00	2.57	Fall05 Imazapyr, Spring06Mow
757.2	12.7	1											Fall05 Imazapyr, Spring06Mow
2007	**302.2**	**62.1**	**71**	**26**	**0.73**	**1.14**	**31**	**4**	**0.26**	**0.50**	**0.59**	**1.64**	
799.0	31.7	31.7											Fall05 Imazapyr, Spring07Mow
797.5	4.7	4.7											Fall05 Imazapyr, Spring07Mow
796.8	6.0	6.0											Fall05 Imazapyr, Spring07Mow
796.5	23.7	23.7											Fall05 Imazapyr, Spring07Mow
795.3	7.4	5.0	7	2	0.57	1.40	7	2	0.57	1.40	0.57	2.80	Fall05 Imazapyr, Spring07Mow
793.6	19.8	19.8											Fall05 Imazapyr, Spring07Mow
793.4	13.1	13.1											Fall05 Imazapyr, Spring07Mow
790.8	5.2	5.2											Fall05 Imazapyr, Spring07Mow
790.2	36.3	36.3											Fall05 Imazapyr, Spring07Mow
786.0	15.1	14.0	11	1	0.18	0.79	2	0	0.00	0.14	0.15	0.93	Fall05 Imazapyr, Spring07Mow
785.2	27.0	27.0											Fall05 Imazapyr, Spring07Mow
784.5	29.1	29.1											Fall05 Imazapyr, Spring07Mow
783.3	5.6	5.6											Fall05 Imazapyr, Spring07Mow
782.5	8.7	8.7	23	9	0.78	2.64	6	2	0.67	0.69	0.76	3.33	Fall05 Imazapyr, Spring07Mow
778.8	6.8	6.8					2	0	0.00	0.30	0.00	0.30	Fall05 Imazapyr, Spring07Mow
777.7	22.9	22.9	30	14	0.93	1.31	13	0	0.00	0.57	0.65	1.88	Fall05 Imazapyr, Spring07Mow
773.0	39.2	4.7					1	0	0.00	0.21	0.00	0.21	Fall05 Imazapyr, Spring07Mow
2008			**73**	**30**	**0.82**		**91**	**68**	**1.49**				
799.0			1	0	0.00		6	2	0.67				none
795.3			5	4	1.60		12	5	0.83				none
786.0			2	0	0.00								none
782.5			5	0	0.00		9	1	0.22				none
778.8													none
777.7			60	26	0.87		64	60	1.88				none
773.0													none
Total	480	156.95	141	60	0.85	0.90	88	26	0.59	0.56	0.75	1.46	

APPENDIX B

HERBICIDE FACT SHEETS

United States Environmental Protection Agency | Prevention, Pesticides And Toxic Substances (7508W) | EPA-738-F-93-011 September 1993

EPA

R.E.D. FACTS

Glyphosate

Pesticide Reregistration

All pesticides sold or distributed in the United States must be registered by EPA, based on scientific studies showing that they can be used without posing unreasonable risks to people or the environment. Because of advances in scientific knowledge, the law requires that pesticides which were first registered years ago be reregistered to ensure that they meet today's more stringent standards.

In evaluating pesticides for reregistration, EPA obtains and reviews a complete set of studies from pesticide producers, describing the human health and environmental effects of each pesticide. The Agency imposes any regulatory controls that are needed to effectively manage each pesticide's risks. EPA then reregisters pesticides that can be used without posing unreasonable risks to human health or the environment.

When a pesticide is eligible for reregistration, EPA announces this and explains why in a Reregistration Eligibility Decision (RED) document. This fact sheet summarizes the information in the RED document for glyphosate.

Use Profile

Glyphosate is a non-selective herbicide registered for use on many food and non-food field crops as well as non-crop areas where total vegetation control is desired. When applied at lower rates, glyphosate also is a plant growth regulator.

Glyphosate is among the most widely used pesticides by volume. It ranked eleventh among conventional pesticides used in the U.S. during 1990-91. In recent years, approximately 13 to 20 million acres were treated with 18.7 million pounds of glyphosate annually. The largest use sites include hay/pasture, soybeans and field corn.

Three salts of glyphosate are used as active ingredients in registered pesticide products. Two of these active ingredients, plus technical grade glyphosate, are contained in the 56 products that are subject to this RED.

The isopropylamine salt, an active ingredient in 53 registered products, is used as a herbicide to control broadleaf weeds and grasses in many food and non-food crops and a variety of other sites including ornamentals, lawns and turf, residential areas, greenhouses, forest plantings and industrial rights-of-way. It is formulated as a liquid, solid or pellet/tablet, and is applied using ground or aerial equipment.

The sodium salt of glyphosate, an active ingredient in two registered pesticide products, is used as a plant growth regulator for peanuts and sugarcane, to modify plant growth and hasten the ripening of fruit. It is applied as a ground spray to peanut fields and as an aerial spray to sugarcane. Preharvest intervals are established for both crops.

The monoammonium salt of glyphosate is an active ingredient in an additional seven herbicide/growth regulator products. This form of glyphosate was initially registered after November 1984, so it is not subject to reregistration or included in this RED. However, in reassessing the existing glyphosate tolerances (maximum residue limits in or on food and feed), EPA included those for the monoammonium salt.

Regulatory History

EPA issued a Registration Standard for glyphosate in June 1986 (NTIS PB87-103214). The Registration Standard required additional phytotoxicity, environmental fate, toxicology, product chemistry and residue chemistry studies. All of the data required have been submitted and reviewed, or were waived.

Human Health Assessment

Toxicity

Glyphosate is of relatively low oral and dermal acute toxicity. It has been placed in Toxicity Category III for these effects (Toxicity Category I indicates the highest degree of acute toxicity, and Category IV the lowest). The acute inhalation toxicity study was waived because glyphosate is non-volatile and because adequate inhalation studies with end-use products exist showing low toxicity.

A subchronic feeding study using rats showed blood and pancreatic effects. A similar study with mice showed reduced body weight gains in both sexes at the highest dose levels. A dermal study with rabbits showed slight reddening and swelling of the skin, decreased food consumption in males and decreased enzyme production, at the highest dose levels.

Several chronic toxicity/carcinogenicity studies using rats, mice and beagle dogs resulted in no effects based on the parameters examined, or resulted in findings that glyphosate was not carcinogenic in the study. In June 1991, EPA classified glyphosate as a Group E oncogen--one that shows evidence of non-carcinogenicity for humans--based on the lack of convincing evidence of carcinogenicity in adequate studies.

In developmental toxicity studies using pregnant rats and rabbits, glyphosate caused treatment-related effects in the high dose groups including diarrhea, decreased body weight gain, nasal discharge and death.

One reproductive toxicity study using rats showed kidney effects in the high dose male pups; another study showed digestive effects and decreased body weight gain. Glyphosate does not cause mutations.

In one metabolism study with rats, most of the glyphosate administered (97.5 percent) was excreted in urine and feces as the parent compound; less than one percent of the absorbed dose remained in tissues and organs, primarily in bone tissue. Aminomethyl phosphonic acid (AMPA) was the only metabolite excreted. A second study using rats showed that very little glyphosate reaches bone marrow, that it is rapidly eliminated from bone marrow, and that it is even more rapidly eliminated from plasma.

Dietary Exposure

The nature of glyphosate residue in plants and animals is adequately understood. Studies with a variety of plants indicate that uptake of glyphosate or AMPA from soil is limited. The material which is taken up is readily translocated throughout the plant and into its fruit. In animals, most glyphosate is eliminated in urine and feces. Enforcement methods are available to detect residues of glyphosate and AMPA in or on plant commodities, in water and in animal commodities.

85 tolerances have been established for residues of glyphosate and its metabolite, AMPA, in or on a wide variety of crops and crop groups, as well as in many processed foods, animal feed and animal tissues (please see 40 CFR 180.364, 40 CFR 185.3500 and 40 CFR 186.3500). EPA has reassessed the existing and proposed tolerances for glyphosate. Though some adjustments will be needed, no major changes in existing tolerances are required. EPA also has compared the U.S. tolerances with international Codex maximum residue limits (MRLs), and is recommending certain adjustments to achieve greater compatibility.

EPA conducted a dietary risk assessment for glyphosate based on a worst-case risk scenario, that is, assuming that 100 percent of all possible commodities/acreage were treated, and assuming that tolerance-level residues remained in/on all treated commodities. The Agency concluded that the chronic dietary risk posed by glyphosate food uses is minimal.

A reference dose (RfD), or estimate of daily exposure that would not cause adverse effects throughout a lifetime, of 2 mg/kg/day has been proposed for glyphosate, based on the developmental toxicity studies described above.

Occupational and Residential Exposure

Occupational and residential exposure to glyphosate can be expected based on its currently registered uses. However, due to glyphosate's low acute toxicity and the absence of other toxicological concerns (especially carcinogenicity), occupational and residential exposure data are not required for reregistration.

Some glyphosate end-use products are in Toxicity Categories I or II for primary eye irritation or skin irritation. In California, glyphosate ranks high among pesticides causing illness or injury to workers, who report numerous incidents of eye and skin irritation from splashes during mixing and loading.

EPA is not adding any personal protective equipment (PPE) requirements at this time, but any existing PPE label requirements must be retained.

The Worker Protection Standard (WPS) for Agricultural Pesticides (please see 40 CFR 156 and 170) established an interim restricted entry interval (REI) of 12 hours for glyphosate. The Agency has decided to retain this REI as a prudent measure to mitigate risks to workers. During the REI, workers may reenter areas treated with glyphosate only in the few, narrow exceptions allowed in the WPS. The REI applies only to glyphosate uses within the scope of the WPS, so homeowner and commercial uses are not included.

Human Risk Assessment

EPA's worst case risk assessment of glyphosate's many registered food uses concludes that human dietary exposure and risk are minimal. Existing and proposed tolerances have been reassessed, and no significant changes are needed to protect the public.

Exposure to workers and other applicators generally is not expected to pose undue risks, due to glyphosate's low acute toxicity. However, splashes during mixing and loading of some products can cause injury, primarily eye and skin irritation. EPA is continuing to recommend PPE, including protective eye wear, for workers using end-use products that are in Toxicity Categories I or II for eye and skin irritation. To mitigate potential risks associated with reentering treated agricultural areas, EPA is retaining the 12 hour REI set by the WPS.

Environmental Assessment

Environmental Fate

Glyphosate adsorbs strongly to soil and is not expected to move vertically below the six inch soil layer; residues are expected to be immobile in soil. Glyphosate is readily degraded by soil microbes to AMPA, which is degraded to carbon dioxide. Glyphosate and AMPA are not likely to move to ground water due to their strong adsorptive characteristics. However, glyphosate does have the potential to contaminate surface waters due to its aquatic use patterns and through erosion, as it adsorbs to soil particles suspended in runoff. If glyphosate reached surface water, it would not be broken down readily by water or sunlight.

Ecological Effects

Glyphosate is no more than slightly toxic to birds and is practically non-toxic to fish, aquatic invertebrates and honeybees. Due to the presence of a toxic inert ingredient, some glyphosate end-use products must be labeled, "Toxic to fish," if they may be applied directly to aquatic environments. Product labeling does not preclude off-target movement of glyphosate by drift. EPA therefore is requiring three additional terrestrial plant studies to assess potential risks to nontarget plants.

EPA does not expect that most endangered terrestrial or aquatic organisms will be affected by the registered uses of glyphosate. However,

many endangered plants as well as the Houston toad (due to its habitat) may be at risk. EPA is deferring any use modifications or labeling amendments until it has published the Endangered Species Protection Plan and has given registrants guidance regarding endangered species precautionary labeling.

Ecological Effects Risk Assessment

Based on current data, EPA has determined that the effects of glyphosate on birds, mammals, fish and invertebrates are minimal. Under certain use conditions, glyphosate may cause adverse effects to nontarget aquatic plants. Additional data are needed to fully evaluate the effects of glyphosate on nontarget terrestrial plants. Risk reduction measures will be developed if needed, once the data from these studies are submitted and evaluated.

Additional Data Required

EPA is requiring three generic studies (Tier II Vegetative Vigor, Droplet Size Spectrum, and Drift Field Evaluation) which are not part of the target data base and do not affect the reregistration eligibility of glyphosate. The Agency also is requiring product-specific data including product chemistry and acute toxicity studies, as well as revised Confidential Statements of Formula and revised labeling.

Product Labeling Changes Required

All end-use glyphosate products must comply with EPA's current pesticide product labeling requirements. In addition:

- **Protection of Aquatic Organisms**

Non-Aquatic Uses - End-use products that are not registered for aquatic uses must bear the following label statement:

Do not apply directly to water, to areas where surface water is present or to intertidal areas below the mean high water mark. Do not contaminate water when disposing of equipment washwaters and rinsate.

Aquatic Uses - End-use products registered for aquatic uses must bear the following label statement:

Do not contaminate water when disposing of equipment washwaters and rinsate. Treatment of aquatic weeds can result in oxygen loss from decomposition for dead plants. This loss can cause fish kills.

- **Worker Protection Standard (WPS) Requirements**

Any product whose labeling permits use in the production of an agricultural plant on any farm, forest, nursery or greenhouse must comply with the labeling requirements of:

- PR Notice 93-7, "Labeling Revisions Required by the Worker Protection Standard (WPS)," and

- PR Notice 93-11, "Supplemental Guidance for PR Notice 93-7."

Unless specifically directed in the RED, all statements required by these two PR Notices must appear on product labeling exactly as instructed in the Notices. Labels must be revised by April 21, 1994, for products distributed or sold by the primary registrant or supplementally registered distributors, and by October 23, 1995, for products distributed or sold by anyone.

- **Personal Protective Equipment (PPE)**

No new PPE requirements must be added to glyphosate labels. However, any existing PPE requirements on labels must be retained.

- **Entry Restrictions**

Products Not Primarily Intended for Home Use:

- Uses Within the Scope of the WPS - A 12-hour restricted entry interval (REI) is required for all products with uses within the scope of the WPS, except products intended primarily for home use. The PPE for early entry should be that required for applicators of glyphosate, except any applicator requirement for an apron or respirator is waived. This REI and PPE should be inserted into the standardized statements required by PR Notice 93-7.
  - Sole Active Ingredient End-Use Products - Labels must be revised to adopt the entry restrictions set forth in this section. Any conflicting entry restrictions on current labeling must be removed.
  - Multiple Active Ingredient Products - Registrants must compare the entry restrictions set forth in this section to those on their current labeling and retain the more protective. A specific time period in hours or days is considered more protective than "until sprays have dried" or "dusts have settled."

- Uses Not Within the Scope of the WPS - No new entry restrictions must be added. However, any entry restrictions on current product labeling with these uses must be retained.

Products Primarily Intended for Home Use:

- No new entry restrictions must be added. However, any entry restrictions on current product labeling must be retained.

Regulatory Conclusion

The use of currently registered pesticide products containing the isopropylamine and sodium salts of glyphosate in accordance with the labeling specified in this RED will not pose unreasonable risks or adverse effects to humans or the environment. Therefore, all uses of these products are eligible for reregistration.

These glyphosate products will be reregistered once the required product-specific data, revised Confidential Statements of Formula and revised labeling are received and accepted by EPA.

Products which contain active ingredients in addition to glyphosate will not be reregistered until all their other active ingredients also are eligible for reregistration.

For More Information

EPA is requesting public comments on the Reregistration Eligibility Decision (RED) document for glyphosate during a 60-day time period, as announced in a Notice of Availability published in the Federal Register. To obtain a copy of the RED document or to submit written comments, please contact the Pesticide Docket, Public Response and Program Resources Branch, Field Operations Division (7506C), Office of Pesticide Programs (OPP), US EPA, Washington, DC 20460, telephone 703- 305-5805.

Following the comment period, the glyphosate RED document will be available from the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161, telephone 703-487-4650.

For more information about EPA's pesticide reregistration program, the glyphosate RED, or reregistration of individual products containing glyphosate, please contact the Special Review and Reregistration Division (7508W), OPP, US EPA, Washington, DC 20460, telephone 703-308-8000.

For information about the health effects of pesticides, or for assistance in recognizing and managing pesticide poisoning symptoms, please contact the National Pesticides Telecommunications Network (NPTN). Call toll-free 1-800-858-7378, between 8:00 am and 6:00 pm Central Time, Monday through Friday.

MATERIAL SAFETY DATA SHEET

Dow AgroSciences

Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

RODEO* HERBICIDE

Effective Date: 3/23/04
Product Code: 84825
MSDS: 006694

1. PRODUCT AND COMPANY IDENTIFICATION:

PRODUCT: Rodeo* Herbicide

COMPANY IDENTIFICATION:
Dow AgroSciences LLC
9330 Zionsville Road
Indianapolis, IN 46268-1189

2. COMPOSITION/INFORMATION ON INGREDIENTS:

Glyphosate IPA: N-(phosphono-methyl) glycine, Isopropylamine Salt	CAS # 038641-94-0	53.8%
Balance, Total		46.2%

3. HAZARDOUS IDENTIFICATIONS:

EMERGENCY OVERVIEW

Clear, pale yellow liquid. May cause eye irritation. Slightly toxic to aquatic organisms.
EMERGENCY PHONE NUMBER: 800-992-5994

4. FIRST AID:

EYE: Flush eyes thoroughly with water for several minutes. Remove contact lenses after initial 1-2 minutes and continue flushing for several additional minutes. If effects occur, consult a physician, preferably an ophthalmologist.

SKIN: Wash skin with plenty of water.

INGESTION: No emergency medical treatment necessary.

INHALATION: Remove person to fresh air; if effects occur, consult a physician.

NOTE TO PHYSICIAN: No specific antidote. Treatment of exposure should be directed at the control of symptoms and the clinical condition of the patient.

5. FIRE FIGHTING MEASURES:

FLASH POINT: >214°F (>101°C)
METHOD USED: Setaflash

FLAMMABLE LIMITS:
LFL: Not applicable
UFL: Not applicable

EXTINGUISHING MEDIA: Foam, CO_2, Dry Chemical

FIRE AND EXPLOSION HAZARDS: Foam fire extinguishing system is preferred because uncontrolled water can spread possible contamination. Toxic irritating gases may be formed under fire conditions.

FIRE-FIGHTING EQUIPMENT: Use positive-pressure, self-contained breathing apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES:

ACTION TO TAKE FOR SPILLS: Absorb small spills with an inert absorbent material such as Hazorb, Zorball, sand, or dirt. Report large spills to Dow AgroSciences on 800-992-5994.

7. HANDLING AND STORAGE:

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep out of reach of children. Do not swallow. Avoid contact with eyes, skin, and clothing. Avoid breathing vapors and spray mist. Handle concentrate in ventilated area. Wash thoroughly with soap and water after handling and before eating, chewing gum, using tobacco, using the toilet or smoking. Keep away from food, feedstuffs, and water supplies. Store in original container with the lid tightly closed. Store above 10°F (-12°C) to keep from crystallizing.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION:

These precautions are suggested for conditions where the potential for exposure exists. Emergency conditions may require additional precautions.

EXPOSURE GUIDELINES: None established

ENGINEERING CONTROLS: Good general ventilation should be sufficient for most conditions. Local exhaust ventilation may be necessary for some operations.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

EYE/FACE PROTECTION: Use safety glasses.

SKIN PROTECTION: No precautions other than clean body-covering clothing should be needed.

RESPIRATORY PROTECTION: For most conditions, no respiratory protection should be needed; however, if discomfort is experienced, use a NIOSH approved air-purifying respirator.

APPLICATIONS AND ALL OTHER HANDLERS: Please refer to the product label for personal protective clothing and equipment.

9. PHYSICAL AND CHEMICAL PROPERTIES:

APPEARANCE: Clear, pale yellow liquid
DENSITY: 10.0 - 10.5 lbs/gal
pH: 4.8 – 5.0
ODOR: None
SOLUBILITY IN WATER: Miscible
SPECIFIC GRAVITY: 1.21 gm/L
FREEZING POINT: -7°F - -10°F (-21°C - -25°C)

10. STABILITY AND REACTIVITY:

STABILITY: (CONDITIONS TO AVOID) Stable under normal storage conditions.

INCOMPATIBILITY: (SPECIFIC MATERIALS TO AVOID) Galvanized or unlined steel (except stainless steel) containers or spray tanks may produce hydrogen gas which may form a highly combustible gas mixture.

HAZARDOUS DECOMPOSITION PRODUCTS: None known.

HAZARDOUS POLYMERIZATION: Not known to occur.

11. TOXICOLOGICAL INFORMATION:

EYE: May cause slight temporary eye irritation. Corneal injury is unlikely.

SKIN: Essentially non-irritating to skin. Prolonged skin contact is unlikely to result in absorption of harmful amounts. The LD_{50} for skin absorption in rabbits is >5000 mg/kg. Did not cause allergic skin reactions when tested in guinea pigs.

INGESTION: Very low toxicity if swallowed. Harmful effects not anticipated from swallowing small amounts. The oral LD_{50} for rats is >5000 mg/kg.

INHALATION: Brief exposure (minutes) is not likely to cause adverse effects. The aerosol LC_{50} for rats is >6.37 mg/L for 4 hours.

SYSTEMIC (OTHER TARGET ORGAN) EFFECTS: For a similar material, glyphosate, in animals, effects have been reported on the following organ: liver.

CANCER INFORMATION: A similar material, glyphosate, did not cause cancer in laboratory animals.

TERATOLOGY (BIRTH DEFECTS): For glyphosate IPA, available data are inadequate for evaluation of potential to cause birth defects.

REPRODUCTIVE EFFECTS: For glyphosate IPA, available data are inadequate to determine effects on reproduction.

MUTAGENICITY: For a similar material, glyphosate, in-vitro and animal genetic toxicity studies were negative.

12. ECOLOGICAL INFORMATION:

ENVIRONMENTAL DATA:

ECOTOXICOLOGY:
Material is practically non-toxic to aquatic organisms on an acute basis (LC_{50} or EC_{50} is >100 mg/L in most sensitive species tested).
Acute LC_{50} for rainbow trout *(Oncorhynchus mykiss)* is >2500 mg/L.
Acute immobilization EC_{50} in water flea *(Daphnia magna)* is 918 mg/L.
Material is practically non-toxic to birds on an acute basis (LD_{50} is >2000 mg/kg).
Acute oral LD_{50} in bobwhite *(Colinus virginianus)* is >2000 mg/kg.
The LC_{50} in earthworm Eisenia foetida is >1000 mg/kg.
Acute contact LD_{50} in honey bee *(Apis mellifera)* is >100 µg/bee.
Acute oral LD_{50} in honey bee *(Apis mellifera)* is >100 µg/bee.
Growth inhibition EC_{50} in green alga *(Selenastrum capricornutum)* is 127 mg/L.
Growth inhibition EC_{50} in duckweed *(Lemna sp.)* is 24.4 mg/L.

13. DISPOSAL CONSIDERATIONS:

DISPOSAL METHOD: If wastes and/or containers cannot be disposed of according to the product label directions, disposal of this material must be in accordance with your local or area regulatory authorities.

MATERIAL SAFETY DATA SHEET

Emergency Phone: 800-992-5994
Dow AgroSciences LLC
Indianapolis, IN 46268

Dow AgroSciences

RODEO* HERBICIDE

Effective Date: 3/23/04
Product Code: 84825
MSDS: 006694

This information presented below only applies to the material as supplied. The identification based on characteristic(s) or listing may not apply if the material has been used or otherwise contaminated. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste identification and disposal methods in compliance with applicable regulations.

If the material as supplied becomes a waste, follow all applicable regional, national and local laws and regulations.

14. TRANSPORT INFORMATION:

U.S. DEPARTMENT OF TRANSPORTATION (DOT) INFORMATION:

For all package sizes and modes of transportation:
This material is not regulated for transport.

15. REGULATORY INFORMATION:

NOTICE: The information herein is presented in good faith and believed to be accurate as of the effective date shown above. However, no warranty, express or implied, is given. Regulatory requirements are subject to change and may differ from one location to another; it is the buyer's responsibility to ensure that its activities comply with federal, state or provincial, and local laws. The following specific information is made for the purpose of complying with numerous federal, state or provincial, and local laws and regulations.

U.S. REGULATIONS

SARA 313 INFORMATION: To the best of our knowledge, this product contains no chemical subject to SARA Title III Section 313 supplier notification requirements.

SARA HAZARD CATEGORY: This product has been reviewed according to the EPA "Hazard Categories" promulgated under Sections 311 and 312 of the Superfund Amendment and Reauthorization Act of 1986 (SARA Title III) and is considered, under applicable definitions, to meet the following categories:

Not to have met any hazard category

TOXIC SUBSTANCES CONTROL ACT (TSCA): All ingredients are on the TSCA inventory or are not required to be listed on the TSCA inventory.

STATE RIGHT-TO-KNOW: This product is not known to contain any substances subject to the disclosure requirements of

New Jersey
Pennsylvania

OSHA HAZARD COMMUNICATION STANDARD: This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.

COMPREHENSIVE ENVIRONMENTAL RESPONSE COMPENSATION AND LIABILITY ACT (CERCLA, or SUPERFUND): To the best of our knowledge, this product contains no chemical subject to reporting under CERCLA.

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA) RATINGS:

CATEGORY	RATING
Health	1
Flammability	1
Reactivity	0

16. OTHER INFORMATION:

MSDS STATUS: Revised Sections: 3,4,11,12,13,14 & 15
Reference: DR-0361-8028
Replaces MSDS Dated: 1/12/00
Document Code: D03-148-002
Replaces Document Code: D03-148-001

The Information Herein Is Given In Good Faith, But No Warranty, Express Or Implied, Is Made. Consult Dow AgroSciences For Further Information.

United States
Environmental Protection
Agency

Prevention, Pesticides
and Toxic Substances
(7508C)

EPA 738-R-06-007
2006
OPP-2005-0495

Reregistration Eligibility Decision for Imazapyr

Reregistration Eligibility Decision (RED) Document for Imazapyr

List C

Case Number 3078

Approved by: _____ Date: _____

Debra Edwards, Ph. D.
Director
Special Review and Reregistration Division

Table of Contents

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Glossary of Terms and Abbreviations

AGDCI	Agricultural Data Call-In
ai	Active Ingredient
aPAD	Acute Population Adjusted Dose
BCF	Bioconcentration Factor
CFR	Code of Federal Regulations
cPAD	Chronic Population Adjusted Dose
CSF	Confidential Statement of Formulation
CSFII	USDA Continuing Surveys for Food Intake by Individuals
DCI	Data Call-In
DEEM	Dietary Exposure Evaluation Model
DFR	Dislodgeable Foliar Residue
DNT	Developmental Neurotoxicity
EC	Emulsifiable Concentrate Formulation
EDWC	Estimated Drinking Water Concentration
EEC	Estimated Environmental Concentration
EPA	Environmental Protection Agency
EUP	End-Use Product
FDA	Food and Drug Administration
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
FFDCA	Federal Food, Drug, and Cosmetic Act
FQPA	Food Quality Protection Act
GLN	Guideline Number
IR	Index Reservoir
LC_{50}	Median Lethal Concentration. A statistically derived concentration of a substance that can be expected to cause death in 50% of test animals. It is usually expressed as the weight of a substance per weight or volume of water, air, or feed, e.g., mg/l, mg/kg, or ppm.
LD_{50}	Median Lethal Dose. A statistically derived single dose that can be expected to cause death in 50% of the test animals when administered by the route indicated (oral, dermal, inhalation). It is expressed as a weight of substance per unit weight of animal, e.g., mg/kg.
LOC	Level of Concern
LOAEL	Lowest Observed Adverse Effect Level
MATC	Maximum Acceptable Toxicant Concentration
µg/g	Micrograms Per Gram
µg/L	Micrograms Per Liter
mg/kg/day	Milligram Per Kilogram Per Day
mg/L	Milligram Per Liter
MOE	Margin of Exposure
MRID	Master Record Identification Number. EPA 's system for recording and tracking studies submitted.
MUP	Manufacturing-Use Product
NOAEL	No Observed Adverse Effect Level
OPP	EPA Office of Pesticide Programs
OPPTS	EPA Office of Prevention, Pesticides, and Toxic Substances
PAD	Population Adjusted Dose
PCA	Percent Crop Area
PDP	USDA Pesticide Data Program
PHED	Pesticide Handler's Exposure Data
PHI	Pre-harvest Interval
ppb	Parts Per Billion
PPE	Personal Protective Equipment
ppm	Parts Per Million
PRZM/EXAMS	Tier II Surface Water Computer Model
RAC	Raw Agriculture Commodity

RED	Reregistration Eligibility Decision
REI	Restricted Entry Interval
RfD	Reference Dose
RQ	Risk Quotient
SCI-GROW	Tier I Ground Water Computer Model
SAP	Science Advisory Panel
SF	Safety Factor
SLC	Single Layer Clothing
TGAI	Technical Grade Active Ingredient
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UF	Uncertainty Factor
UV	Ultraviolet
WPS	Worker Protection Standard

Abstract

This document presents the Environmental Protection Agency's (hereafter referred to as EPA or the Agency) decision regarding the reregistration eligibility of the registered uses of imazapyr. The Agency has determined that imazapyr-containing products are eligible for reregistration, provided that the risk mitigation measures identified in this document are adopted and label amendments are made to reflect these measures. Imazapyr is a systemic, non-selective herbicide used for the pre- and post-emergence control of a broad range of terrestrial and aquatic weeds. There are currently twenty-four tolerances established in 40 CFR §180.500 for residues of the herbicide imazapyr, applied as the acid or ammonium salt which were reassessed in 2003 when new food uses were established. The Agency has conducted human health and environmental fate and ecological effect risk assessments for imazapyr and reassessed all the existing tolerances. The risk conclusions of these assessments are summarized below.

In the human health risk assessment, dietary risks (food and drinking water) are below the Agency's level of concern. Residential handler dermal and inhalation risks for all scenarios are below the Agency's level of concern, as are residential post-application exposures (including incidental oral exposure to toddlers and oral and dermal exposure from swimming activities in treated lake water). Aggregate risks (food, drinking water, and residential exposure) are also below the Agency's level of concern.

There is a potential for exposure to workers through handling and applying imazapyr as well as exposure to post-application residues. For workers, short- and intermediate-term risks from mixing, loading, and applying imazapyr do not exceed the Agency's level of concern at either baseline clothing, or with the addition of gloves. There are no dermal post-application risks to workers, and inhalation post-application risks are considered negligible; however, the Agency has determined that imazapyr is a Toxicity Category I primary eye irritant. The restricted entry interval (REI) on current imazapyr labels is 12 hours. Under the Worker Protection Standard (WPS; 40 CFR Part 170), a 48-hour REI is required for Category I eye irritants. The WPS also requires that coveralls, shoes and socks, chemical resistant gloves, and protective eyewear be used for early entry.

There are no risks of concern to terrestrial birds, mammals, and bees, or to aquatic invertebrates and fish. However, there are ecological risks of concern associated with the use of imazapyr for non-target terrestrial plants and aquatic vascular plants, and potential risks to federally listed threatened and endangered species ("listed species") which include aquatic vascular plants, terrestrial and semi-aquatic monocots and dicots that cannot be precluded at this time. Imazapyr use at the labeled rates on non-crop areas when applied as a spray or as a granular to forestry areas present risks to non-target plants located adjacent to treated areas. Imazapyr use at the labeled rates on Clearfield™ corn, which is resistant to imidazolinone herbicides, also present risks of concern to non-target plants located adjacent to treated areas.

Because imazapyr is an herbicide and may therefore harm non-target plants exposed via drift, the Agency is requiring strict use restrictions to be placed on the labels for all imazapyr products to help minimize spray drift. The Agency has determined that the specific drift language amendments specified in this RED will substantially reduce, though may not completely eliminate, the risks of imazapyr use to non-target plants.

I. Introduction

The Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA) was amended in 1988 to accelerate the reregistration of products with active ingredients registered prior to November 1, 1984, and amended again by the Food Quality Protection Act of 1996 (FQPA) and the Pesticide Registration Improvement Act of 2003 (PRIA) to set time frames for the issuance of Reregistration Eligibility Decisions. FIFRA calls for the development and submission of data to support the reregistration of an active ingredient, as well as a review of all data submitted to the U.S. Environmental Protection Agency. Reregistration involves a thorough review of the scientific database underlying a pesticide's registration. The purpose of the Agency's review is to reassess the potential hazards arising from the currently registered uses of a pesticide, to determine the need for additional data on health and environmental effects, and to determine whether or not the pesticide meets the "no unreasonable adverse effects" criteria of FIFRA.

On August 3, 1996, the Food Quality Protection Act of 1996 (FQPA) was signed into law. This Act amended FIFRA and the Federal Food Drug and Cosmetic Act (FFDCA) to require reassessment of all existing tolerances for pesticides in food. FQPA also requires the Agency to review all tolerances in effect on August 2, 1996, by August 3, 2006. When the Agency reassessed the imazapyr tolerances in 2003, the Agency considered, among other things, aggregate risks from non-occupational sources of pesticide exposure, whether there is increased susceptibility among infants and children, and the cumulative effects of pesticides that have a common mechanism of toxicity. When the Agency determines that aggregate risks are not of concern and concludes that there is a reasonable certainty of no harm from aggregate exposure, the tolerances are considered reassessed. The Agency decided that, for those chemicals that have tolerances and are undergoing reregistration, tolerance reassessment will be accomplished through the reregistration process.

As mentioned above, FQPA requires the Agency to consider available information concerning the cumulative effects of a particular pesticide's residues and "other substances that have a common mechanism of toxicity" when considering whether to establish, modify, or revoke a tolerance. Unlike other pesticides for which the Agency has followed a cumulative risk approach based on a common mechanism of toxicity, the Agency has not made a common mechanism of toxicity finding for imazapyr with any other substances. Therefore, for the purposes of tolerance reassessment, which was completed in 2003, the Agency did not assume that imazapyr shared a common mechanism of toxicity with any other compound. In the future, if additional information suggests imazapyr shares a common mechanism of toxicity with other compounds, additional testing may be required and a cumulative assessment may be necessary. For information regarding the Agency's efforts to determine which chemicals have a

common mechanism of toxicity and to evaluate the cumulative effects of such chemicals, see the policy statements released by the Agency's Office of Pesticide Programs concerning common mechanism determinations and procedures for cumulating effects from substances found to have a common mechanism on EPA's website at http://EPA.gov/pesticides/cumulative/.

This document presents a summary of the Agency's revised human health and ecological risk assessments, its progress toward tolerance reassessment, and the reregistration eligibility decision for imazapyr. The document consists of six sections. Section I contains the regulatory framework for reregistration and tolerance reassessment. Section II provides a profile of the use and usage of the chemical. Section III gives an overview of the revised human health and ecological risk assessments based on data, public comments, and other information received in response to the preliminary risk assessments. Section IV presents the Agency's reregistration eligibility and risk management decisions. Section V summarizes label changes necessary to implement the risk mitigation measures outlined in Section IV. Section VI provides information on how to access related documents and contains the appendices that list related information and supporting documents. The preliminary and revised risk assessments for imazapyr are available in the Public Docket, under docket number OPP-2005-0495 and on EPA's web page, http://www.regulations.gov.

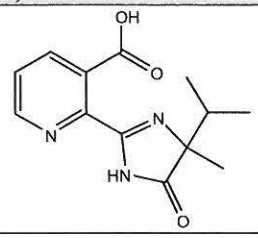
II. Chemical Overview

Imazapyr is part of the imidazolinone chemical class. Imazapyr is a systemic, non-selective, pre- and post-emergent herbicide used for the control of a broad range of terrestrial and aquatic weeds, and controls plant growth by preventing the synthesis of branched-chain amino acids. Imazapyr is applied either as an acid or as the isopropylamine salt.

A. Chemical Background

Imazapyr technical was first registered in 1985; however, a non-crop end use product had been previously registered in July 1984. The first food use on corn was registered in April 1997. In 2003, the aquatic and grassland uses were registered which resulted in the establishment of additional tolerances. Currently there are 24 tolerances listed in 40 CFR § 180.500 for residues of the herbicide imazapyr, applied as the acid or isopropylamine salt, which were reassessed in 2003.

B. Imazapyr Acid and Salt Nomenclature:

Imazapyr, acid	
Structure	
Molecular Formula	$C_{13}H_{15}N_3O_3$
IUPAC Name	[2-(4-isopropyl-4-methyl-5-oxo-2-imidazolin-2-yl)-nicotinic acid]
CAS Number	81334-34-1
PC Code	128821

Imazapyr, salt	
Molecular Formula	$C_{13}H_{15}N_3O_3C_3H_9N$
IUPAC Name	2-Propanamine, 2-(4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1*H*-imidazol-2-yl]-3-pyridinecarboxylate
CAS Number	81334-34-1
PC Code	128821

C. Use Sites:

- Imazapyr is used for pre- and post-emergence control of a broad range of weeds, including terrestrial annual and perennial grasses, broad-leaved herbs, woody species, and riparian and emergent aquatic species.

- Agricultural uses of imazapyr include field corn and grass. Tolerances are established for imazapyr residues in field corn and its forage and stover, and in grass forage and hay. Tolerances are also established for secondary residues of imazapyr in milk, meat, fish, and shellfish.

- Imazapyr is also registered for use on a variety of commercial and residential use sites, including forestry sites, rights-of-way, fence rows, hedge rows, drainage systems, outdoor industrial areas, outdoor buildings and structures, domestic dwellings, paved areas, driveways, patios, parking areas, walkways, various water bodies (including ponds, lakes, streams, swamps, wetlands, stagnant water, and urban areas).

- Imazapyr may also be used as a spot treatment in recreation areas, athletic fields, and golf course roughs.

D. Formulations:

- Imazapyr is formulated as a liquid, a wettable powder (in water soluble bags only), and a granular.

E. Methods of Application:

- Aquatic applications of imazapyr can be made as a liquid. Application methods include aerial and application to water via boat. Aqueous imazapyr formulations may be mixed with surfactants or oils for application. Applications to smaller areas may be made with handheld equipment, including backpack sprayers, sprinkling cans, and handgun sprayers.

- Terrestrial applications of imazapyr consist of ground and aerial spray, as well as granular broadcast applications. Granular formulations may also be mixed with fertilizers, surfactants or oils for application. Applications to smaller areas may be made with handheld equipment, including low-pressure handwand sprayers, high-pressure/volume handwand sprayers, push-type granular spreaders, backpack granular spreaders, sprinkling cans, and handgun sprayers. Aqueous imazapyr formulations may be mixed with surfactants or oils for application as well as mixed with other herbicides and fertilizers.

F. Use rates:

- Application rates of imazapyr range from 0.014 pounds acid equivalent per acre (lbs a.e./acre) on corn to 1.5 lbs a.e./acre on non-crop areas and aquatic sites.

G. Annual usage:

- For terrestrial agricultural uses of imazapyr, the use on corn is approximately 20,000 lbs/year, and the use on pastures and rangeland is approximately 2,000 lbs/year. The average percent crop treated is less than one percent for both uses.

H. Technical Registrant:

- BASF Corporation.

III. Summary of Risk Assessment

The following is a summary of the Agency's revised human health effects and ecological risk assessment for imazapyr, as presented fully in the documents, *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document,* dated December 8, *2005*, and *Screening Level Ecological Risk Assessment for the Reregistration Eligibility Decision Document for Imazapyr,* dated December 9, 2005. The purpose of this summary is to assist the reader by identifying key features and findings of these risks assessments, and to help the reader better understand the conclusions reached in the assessments.

The human health and ecological risk assessment documents and supporting information listed in Appendix C were used to reach the regulatory decisions for imazapyr. While the risk assessments and related addenda are not included in this document, they are available in the Public Docket, under docket number OPP-2005-0495 and on the internet at http://www.regulations.gov. Hard copies of these documents may be found in the OPP public docket under this same docket number.

A. Human Health Risk Assessment

The Agency has conducted a human health assessment for imazapyr for the purposes of making a reregistration decision. The Agency evaluated toxicological and chemistry studies submitted for imazapyr and determined that the data are adequate to support a reregistration decision. In addition, the Agency has conducted dietary, drinking water, residential, aggregate, and worker assessments to determine the potential risks associated with the use of imazapyr. More in-depth details of the health effects of imazapyr are provided in the human health risk assessment.

For a complete discussion, see Section 6.0 of *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005.

1. Hazard Profile

The toxicological database for imazapyr is complete. Imazapyr has low acute toxicity via the oral (Toxicity Category IV) and dermal (Toxicity Category III) routes of exposure. Imazapyr has been placed in acute Toxicity Category II for the inhalation route of exposure. It is not irritating to the skin, and is negative for dermal sensitization; however, imazapyr results in irreversible eye damage (Toxicity Category I) as seen in Table 1. Normally, an acute hazard value is chosen from acute (non-lethal), subchronic, or developmental toxicity studies from which there is reasonable evidence that a single exposure can lead to a potential effect. The available data suggest that a single exposure to imazapyr does not result in an effect of concern for risk assessment purposes.

Table 1. Acute Toxicity Data for Imazapyr

Guideline Number Study Type	MRID Numbers	Toxicity Category
870.1100 Acute Oral Toxicity	41551002 93048016	IV
870.1200 Acute Dermal Toxicity	41551003 93048017	III
870.1300 Acute Inhalation Toxicity	00132032 93048018	II
870.2400 Acute Eye Irritation	41551001 93048019	I Tested with 99.3% technical fine powder
870.2500 Acute Dermal Irritation	41551004 93048020	IV
870.2600 Skin Sensitization	00131607 93048021	Negative

Most of the toxicity studies with imazapyr showed no effects to minimal effects, even at the HDT (highest dose tested). There is no evidence of acute or chronic neurotoxicity resulting from exposure to imazapyr. No developmental toxicity was observed in rabbits or rats up to the HDT; however, maternal toxicity, based on salivation, was observed in rats at the mid-dose (300 mg/kg/day). Neither the rat nor the rabbit study showed an increased susceptibility of the fetus to imazapyr administered pre-natally or post-natally. In addition, a 2-generation reproduction rat study did not show increased susceptibility to offspring at doses up to the HDT. There were no compound-related effects in a one-year dietary toxicity study in beagle dogs up to the HDT. Imazapyr was classified by the Agency in October 1995 as a "Group E" chemical, with no evidence of carcinogenicity in at least 2 adequate studies in the rat and mouse. This decision was reaffirmed on May 22, 2003 by a subcommittee of the Cancer Assessment Review Committee (CARC). Imazapyr is negative for mutagenic potential and a quantitative cancer risk assessment is not required.

The Agency selected NOAELs and endpoints for risk assessment purposes in February 2003. A 1-year dog feeding study with a NOAEL of 250 mg/kg/day was selected for calculating the chronic RfD because it was the lowest NOAEL in the imazapyr database. Actually, the 250 mg/kg/day dose in the dog study was both the NOAEL and the highest dose tested for that study. Because there were no adverse effects seen in the dog study or in any of the imazapyr toxicity studies, EPA relied on a structural analog, the pesticide imazapic (Cadre®), to choose an endpoint. Imazapic causes skeletal muscle effects in dogs at 5000 ppm (137 mg/kg/day in males and 180 mg/kg/day in females). Despite imazapyr's structural similarity to imazapic, as well as its similarity to the pesticides, imazethapyr and imazamethabenz-methyl (Assert®), the available data do not support the conclusion that these pesticides share a common mechanism of toxicity such that combined exposure to them would result in cumulative effects. First, as noted, the toxicity data for imazapyr show no adverse effects, including no skeletal muscle effects. Second, the toxic endpoints for the three structurally similar pesticides are quite varied: imazapic (skeletal muscle effects); imazethapyr (an increased incidence of clinical signs during gestation, ulcerations in the mucosal layer of the stomach and gall bladder, increased abortions, maternal deaths, decrements in body weight gain) and

imazamethabenz-methyl (transient decreased body weight, mild liver effects, slight increase in a common kidney lesion). Accordingly, for the purposes of this RED, EPA has not assumed that imazapyr has a common mechanism of toxicity.

Non-cancer risk estimates are expressed as a margin of exposure (MOE) that is a ratio of the dose from a toxicological study selected for risk assessment, typically a NOAEL, to the predicted exposure. Estimated MOEs are compared to a level of concern that reflects the dose selected for risk assessment and uncertainty factors (UFs) applied to that dose. The standard UF is 100X and includes a 10X for interspecies extrapolation (to account for differences between laboratory animals and humans) and a 10X for intraspecies variation (to account for differences between humans). Additional uncertainty or safety factors may also be applied. In the case of imazapyr, the Agency's level of concern is an MOE of 100 which includes a factor of 10X for interspecies extrapolation and 10X for intraspecies variation. The Special FQPA Safety Factor has been reduced to 1X because there are no residual exposure uncertainties, no increased sensitivity to infants and children, and the toxicity database is essentially complete. Table 2 shows the endpoints selected to assess risks for imazapyr.

Table 2. Summary of Toxicological Doses and Endpoints for Imazapyr Used in the Human Health Risk Assessment

Exposure Scenario	Dose Used in Risk Assessment, UF	Special FQPA SF and Level of Concern (LOC) for Risk Assessment	Study and Toxicological Effects and MRID No.
Acute Dietary (Females 13-50 years of age and General population including infants and children)	An acute dietary endpoint was not selected based on the absence of an appropriate endpoint attributable to a single dose.		
Chronic Dietary (All populations)	NOAEL= **250** mg/kg/day UF = **100** **Chronic RfD** = **2.5** mg/kg/day	FQPA SF = **1x** **cPAD** = chronic RfD / FQPA SF = **2.5** mg/kg/day	**1-Year Dog** [feeding] **Study** No LOAEL was demonstrated with imazapyr at doses up to 250 mg/kg/day (HDT; MRID 41039502). [HIARC assumed this dose as an endpoint for RA for imazapyr, based on skeletal muscle effects seen in dogs with structural analog imazapic.]
Short and Intermediate Term Incidental Oral (1-30 days and 1-6 months)	NOAEL= **250** mg/kg/day	**Residential** LOC for MOE =100)	**1-Year Dog** [feeding] **Study** No LOAEL was demonstrated with imazapyr at doses up to 250 mg/kg/day (HDT; MRID 41039502). [HIARC assumed this dose as an endpoint for RA for imazapyr, based on skeletal muscle effects seen in dogs with structural analog imazapic.]

Short and Intermediate and Long-Term Dermal (1 to 30 days, 1 to 6 months, >6 months)	Oral study NOAEL= **250** mg/kg/day (dermal absorption rate = **100 %**)	**Occupational** LOC for MOE = **100** (**Residential** LOC for MOE = **100**)	**1-Year Dog** [feeding] **Study** No LOAEL was demonstrated with imazapyr at doses up to 250 mg/kg/day (HDT; MRID 41039502). [HIARC assumed this dose as an endpoint for RA for imazapyr, based on skeletal muscle effects seen in dogs with structural analog imazapic.]
Short- and Intermediate and Long-Term Inhalation (1 to 30 days, 1 to 6 months, >6 months)	Oral study NOAEL= **250** mg/kg/day (inhalation absorption rate = **100%**)	**Occupational** LOC for MOE = **100** (**Residential** LOC for MOE = **100**)	**1-Year Dog** [feeding] **Study** No LOAEL was demonstrated with imazapyr at doses up to 250 mg/kg/day (HDT; MRID 41039502). [HIARC assumed this dose as an endpoint for RA for imazapyr, based on skeletal muscle effects seen in dogs with structural analog imazapic.]
Cancer	Classified as Group E. No evidence of carcinogenicity; risk assessment not required.		

UF = uncertainty factor, FQPA SF = Special FQPA safety factor, NOAEL = no observed adverse effect level, LOAEL = lowest observed adverse effect level, PAD = population adjusted dose (a = acute, c = chronic),RfD = reference dose, MOE = margin of exposure, LOC = level of concern.

2. Dietary Risk (Food)

Dietary risk assessment incorporates both exposure to and toxicity of a given pesticide. Dietary risk is expressed as a percentage of a level of concern. The level of concern is the dose predicted to result in no unreasonable adverse health effects to any human population subgroup, including sensitive members of such population subgroups. This level of concern is referred to as the population-adjusted dose (PAD), which reflects the reference dose (RfD), acute or chronic, adjusted to account for the FQPA safety factor.

Estimated risks that are less than 100% of the PAD are below EPA's level of concern. The acute PAD (aPAD) is the highest predicted dose to which a person could be exposed on any given day with no adverse health effects expected. The chronic PAD (cPAD) is the highest predicted dose to which a person could be exposed over the course of a lifetime with no adverse health effects expected. For imazapyr, a chronic RfD of 0.25 mg/kg/day is used in estimating the dietary risk. The RfD includes a 10x for interspecies extrapolation and a 10x for intraspecies variation. Because the Special FQPA Safety Factor has been reduced to 1X, the PAD is equivalent to the RfD. The imazapyr dietary risk assessment uses was performed using the Dietary Exposure Evaluation Model (DEEM^{TM}).

For a complete discussion, see Section 6.0 of *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005.

a. Acute Dietary Risk (Food))

As noted above, an acute dietary exposure assessment was not necessary because no toxic effects resulting from acute exposures were seen in the imazapyr acute toxicity database. The Agency does not expect acute risks resulting from dietary exposure.

b. Chronic Dietary Risk (Food)

For the chronic dietary exposure assessment, an estimate of the residue level in each food or food-form on the food commodity residue list is multiplied by the average daily consumption estimate for that food/food-form. The resulting residue consumption estimate is summed with the residue consumption estimates for all other food/food forms on the commodity residue list to arrive at the total average estimated exposure. Exposure is expressed in mg/kg body weight/day and risk is expressed as a percent of the chronic PAD (cPAD).

Food items may be exposed to residues of imazapyr in three ways: via direct application, via irrigation water previously treated with imazapyr, or via livestock ingestion of treated commodities resulting in secondary residues. To assess risks resulting from residues on food, a screening level assessment was performed using the Dietary Exposure Evaluation Model (DEEM^{TM}).

The results of the DEEM^{TM} analysis show that all population subgroups' dietary exposure to imazapyr residues in food comprises less than 0.1% of the cPAD. These results are based on tolerance level residues, 100% crop treated, and default processing factors, all of which are considered to be conservative estimates of potential chronic dietary risk. Table 3 shows exposure levels for the general population and children one to two years old, the most highly exposed population subgroup.

For a complete discussion of the health effects to imazapyr, please see *Imazapyr: Chronic Dietary Exposure Assessment for the Reregistration Eligibility Decision*, dated March 26, 2003.

Table 3. Summary of Food Chronic Dietary Exposure and Risk from Imazapyr

Population Subgroup	Dietary Exposure mg/kg/day	% cPAD
General U.S. Population	0.000340	<0.1
Children 1-2 years old	0.000828	<0.1

3. Cancer Dietary Risk (Food)

A cancer dietary exposure assessment is not required because imazapyr is classified as a Group E chemical, "not likely to be carcinogenic."

4. Drinking Water Dietary Exposure

Drinking water exposure to pesticides can occur through groundwater and surface water contamination. The Agency considers both acute (one day) and chronic (lifetime) drinking water risks and uses either modeling or actual monitoring data, if available, to estimate those risks. For imazapyr, non-cancer chronic concentration in drinking water was estimated. A cancer concentration in drinking water was not estimated because imazapyr is considered "not likely to be carcinogenic in humans."

To estimate drinking water concentrations resulting from the use of imazapyr, screening level models were used. Non-crop uses with high and low application rates, and corn uses were modeled to represent the labeled imazapyr uses (1.5, 0.9, and 0.014 lbs. a.i./acre, respectively). The highest labeled rate for imazapyr is 1.5 lbs. a.i./acre.

The Agency has determined that the residue of concern for imazapyr in drinking water is parent only. Environmental fate data suggest that imazapyr is mobile and persistent. Except for photolysis in water, imazapyr was stable under the conditions and duration of the submitted fate studies. In the photolysis study, imazapyr degraded with half-lives of approximately 3 to 5 days.

To predict concentrations of imazapyr that may be present in surface water as a result of the terrestrial uses, Tier I FQPA Index Reservoir Screening Tool (FIRST) exposure modeling was performed. The modeled estimates of drinking water concentrations (EDWCs) of imazapyr in surface water for chronic durations range from 0.34 to 79µg/L. These values were established by modeling imazapyr use on corn and non-crop uses with high and low application rates.

To predict concentrations of imazapyr in ground water as a result of terrestrial uses, Tier I Screening Concentration in Ground Water (SCI-GROW) exposure modeling was performed. The modeled concentrations of imazapyr in ground water are not expected to exceed 36µg/L. This value was established by modeling imazapyr non-crop uses at the highest maximum application (1.5 lbs a.i./A).

Exposure to imazapyr from drinking water resulting from aquatic applications is also possible. The EDWC's for both surface and ground water from direct application to surface water are both 61 µg/L. This does not take into account the current imazapyr label requirement of a one-half mile setback from drinking water intakes because the Agency does not currently have an approved methodology for calculating EDWCs in water bodies where pesticides are applied with a setback distance from drinking water intakes. As a result, the EDWC is more conservative than had setback distances been considered. Direct applications to water were modeled assuming uniform application over an entire reservoir at the maximum labeled rate.

For a complete discussion, see Section 6.2 of the *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005.

5. Chronic Risk from Food and Drinking Water

To assess chronic risk from food plus drinking water, exposure estimates from chronic dietary (food) and chronic drinking water assessments were combined in the DEEM™ modeling program. The modeled EDWC of imazapyr in surface water of 79μg/L was used in the chronic dietary (food plus water) assessment. This value was established by modeling imazapyr non-crop uses at the highest maximum application. The combined chronic exposure for the general U.S. population and all population subgroups is <0.1% of the cPAD. The most highly exposed population subgroup is infants <1 year old (Table 4). These values are below the Agency's level of concern.

Table 4. Summary of Food and Water Dietary Exposure and Risk

Population Subgroup	Dietary Exposure mg/kg/day	% cPAD (Food + Water)
General U.S. Population	0.002005	0.1
All Infants <1 year old	0.005732	0.1

6. Residential Risk

Residential exposure to a pesticide can occur while mixing, loading, or applying (handling) a pesticide, or after entering areas where the pesticide had previously been applied. Residential non-cancer risk estimates are expressed as a margin of exposure (MOE), which is a ratio of the dose from a toxicological study selected for risk assessment, typically a NOAEL, to the predicted exposure. Estimated MOEs are compared to a level of concern that reflects the dose selected for risk assessment and UFs applied to that dose. The standard UF is 100X and includes a 10X for interspecies extrapolation (to account for differences between laboratory animals and humans) and a 10X for intraspecies variation (to account for differences between humans). Additional uncertainty or safety factors may also be applied. In the case of imazapyr, the Agency's level of concern for inhalation, dermal, and incidental oral is an MOE of 100 that includes a factor of 10X for interspecies extrapolation and 10X for intraspecies variation. The Special FQPA Safety Factor has been reduced to 1X because there are no residual exposure uncertainties, no increased sensitivity to infants and children, and the toxicity database is essentially complete.

Short-term exposures were assessed for residential handlers and residential post-application exposures based on use and exposure patterns of registered imazapyr products. Based on the current use pattern for imazapyr and the fact that endpoints are the same across all durations of exposure, the Agency does not expect that intermediate or long-term residential exposures will be higher than those for short-term exposures. Inhalation, dermal, and incidental ingestion were considered to be the routes of exposure for persons exposed to imazapyr. The maximum labeled rates were used for the non-cancer residential handler and non-cancer residential post-application risk assessments.

For a complete discussion, see Section 6.3 of the *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005.

a. Residential Handler Summary

Residential handler assessments are based on the assumptions that individuals complete all tasks associated with the use of imazapyr (mixing, loading, and application), up to 1,000 square feet are treated, and individuals are wearing shorts, short-sleeved shirts, socks, and shoes. The residential handler exposure scenarios consider dermal and inhalation exposure to adult pesticide handlers. The two residential handler scenarios were assessed: 1) mixing/loading/applying emulsifiable concentrates with low-pressure handwand, and 2) mixing/loading/applying emulsifiable concentrates with hose-end sprayer. The risks for these scenarios are below the Agency's level of concern with MOEs well above the target MOE of 100, at 25,000 and 85,000, respectively.

b. Residential Post-application Summary

Residential post-application exposure scenarios are also considered to be short-term and consider exposures to individuals that occur as a result of an area previously treated with imazapyr. The residential post-application assessment considers dermal exposure to children and adults, as well as incidental oral ingestion exposures to toddlers. A series of assumptions and exposure factors served as the basis for completing the residential postapplication risk assessments. The assumptions and factors used in the risk calculations are consistent with current Agency policy for completing residential exposure assessments (i.e., Standard Operating Procedures for Residential Exposure Assessment). The scenarios included in the residential post-application exposure assessment were: (1) adult dermal exposure/residential turf (high contact activities); (2) toddler dermal exposure/residential turf (high contact activities); (3) toddler oral exposure/hand-to-mouth activity on turf; (4) toddler oral exposure/object-to-mouth activity on turf; (5) toddler oral exposure/incidental soil ingestion; and (6) toddler oral exposure/incidental ingestion of granules. Post-application residential risks to adults and toddlers are below the Agency's level of concern for all scenarios assessed with MOEs of 720 and 430, respectively, on the day of application.

c. Combined Post-application Residential Summary

Additionally, combined residential risks resulting from the combining of separate post-application exposure scenarios, when it is likely they can occur simultaneously, do not exceed the Agency's level of concern with MOEs greater than 100 on the day of application. These combined post-application exposure scenarios for toddlers are: dermal, hand-to-mouth, object-to-mouth, and incidental soil ingestion. The combined non-dietary MOE for toddlers using the turf spray scenario is 410.

d. Recreational Uses

Imazapyr may be applied by broadcast application to aquatic freshwater sites to control floating or emergent aquatic vegetation. Adults and children may be exposed when swimming in treated water bodies following application of imazapyr. The potential for postapplication incidental ingestion and dermal exposure to adults, children, and toddlers as a result of swimming in treated waters immediately following application has also been assessed. Post-application risks to adults, children, and toddlers swimming in treated waters following application of imazapyr are below the Agency's level of concern with MOEs ranging from 68,000 to 1,000,000.

7. Aggregate Risk

Aggregate risk combines exposure from food, drinking water, and, if applicable, residential exposure. For imazapyr, the following aggregate risk assessments were conducted: short-term aggregate (food + drinking water + short-term residential) and long-term aggregate risk assessment (food + drinking water only). Based on the current use patterns of imazapyr, the Agency does not expect exposure durations that would result in intermediate- or long-term residential exposures; therefore long-term aggregate risk assessment consists of exposure from food and drinking water only. A cancer aggregate risk assessment is not required because imazapyr is classified as a Group E chemical, "not likely to be carcinogenic".

For adult short-term aggregate exposure, the Agency aggregated chronic food and drinking water exposures with residential handler and post-application exposures. The adult residential exposure scenarios resulting from application and post-application activities on turf were used. For short-term aggregate exposure to children, the Agency aggregated chronic food and drinking water exposures for toddlers (1-2 years of age) and combined these with post-application dermal and incidental oral exposures (combined hand-to-mouth, object-to-mouth, and soil ingestion) from activity on turf. The estimated MOEs are above 100, with values of 410 for children and 720 for adults. Therefore, short-term aggregate risks are below the Agency's level of concern.

Because the Agency does not expect chronic residential exposure, long-term aggregate risks are equal to chronic dietary risks (food plus water). As described above in Section 5, these risks are below the Agency's level of concern.

For a complete discussion, see Section 7.0 of the *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005.

8. Occupational Risk

Workers can be exposed to a pesticide while mixing, loading, or applying a pesticide, and when entering a treated site. Non-cancer worker risk estimates are expressed as a margin of exposure (MOE) that is a ratio of the dose from a toxicological study selected for risk assessment, typically a NOAEL, to the predicted exposure. Estimated MOEs are compared to a level of concern that reflects the dose selected for risk assessment and uncertainty factors (UFs) applied to that dose. The standard UF is

100X and includes a 10X for interspecies extrapolation (to account for differences between laboratory animals and humans) and a 10X for intraspecies variation (to account for differences between humans). Additional uncertainty or safety factors may also be applied. In the case of imazapyr, the NOAEL is 250 mg/kg/day taken from the 1-year dog feeding study and an MOE of 100 is considered protective for worker risks.

The Agency initially calculates the handler risks using the least protective measures. This is called the baseline assessment, and assumes normal work clothing and no personal protective equipment (PPE). If there is a risk concern at this level, the Agency considers the use of protective measures (e.g., personal protective equipment and engineering controls) to lower the risk. PPE can include an additional layer of clothing, chemical-resistant gloves, and a respirator. Common examples of engineering controls include: enclosed tractor cabs, closed loading systems, and water-soluble packaging.

For a complete discussion, see the *Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision Document for Imazapyr*, dated August 31, 2005.

a. Occupational Handler Summary

The Agency has determined that workers may be exposed to imazapyr while mixing, loading, and applying, as well as flagging for aerial applications. In the absence of chemical-specific monitoring data for imazapyr, exposure analyses were performed using surrogate data from the Pesticide Handlers Exposure Database (PHED) and the Outdoor Residential Exposure Task Force (ORETF). For information on the scenarios that use ORETF data, please see the *Occupational and Residential Exposure Assessment and Recommendations for the Reregistration Eligibility Decision Document for Imazapyr*, dated August 31, 2005. The MOEs for occupational exposures were calculated for short-term and intermediate-term exposures because these durations of exposures are likely based on current labels. Long-term handler exposures are not expected to occur for imazapyr.

For all scenarios, short- and intermediate-term risks do not exceed the Agency's level of concern (i.e., the MOEs are greater than 100) at either baseline PPE (long-sleeved shirt, long pants, no gloves, and no respirator), or with the addition of gloves. MOEs ranged from 10 to 1,100,000. Scenarios that require the addition of chemical resistant gloves include mixing and loading liquid formulations for aerial applications to aquatic sites, terrestrial non-crop sites, forestry sites, and areas grazed or cut for hay. The addition of chemical resistant gloves are also required for workers that are mixing, loading, and applying liquid and granular formulations via handwands, backpack spreaders and sprayers, and handgun sprayers for non-crop and aquatic uses. MOEs for these scenarios with the addition of chemical resistant gloves ranged from 460 to 22,000.

b. Post-application Occupational Summary

The Agency has determined that individuals may be exposed to imazapyr by working in areas that have previously been treated. Both short-term and intermediate-term occupational postapplication dermal exposure may occur. Inhalation exposures are

expected to be negligible in outdoor postapplication scenarios because imazapyr has a low vapor pressure and due to the dilution with ambient air expected after outdoor application. As such, inhalation postapplication exposures are not considered in this assessment.

All risks calculated for short-term and intermediate-term dermal postapplication exposure to workers resulting from scouting, hand weeding, irrigation, detasseling, and hand-harvesting are below the Agency's level of concern (MOEs range from 4,100 to 700,000) on day zero approximately 12 hours following application. Although the MOEs are greater than 100 for post-application workers, the restricted-entry level (REI) must be set at 48-hour REI because imazapyr has high acute toxicity (Category I for eye irritation).

9. Incident Reports

Approximately 20 incidents involving human exposure to imazapyr have been reported. However, none were listed under the "definite," "probable," or "possible" certainty categories. In general, medical care was less frequently used in all cases compared to other pesticide-related incidents, and not a single case required hospitalization or treatment in a critical care unit. The most common symptom reported was eye irritation, which was four times more prevalent than any other symptom. Additional health effects included: dermal irritation, throat irritation, nausea, and coughing or choking.

For a complete discussion, see the *Review of Imazapyr Incident Reports*, dated February 23, 2006.

B. Ecological Risk Assessment

The Agency has conducted an environmental assessment for imazapyr for the purposes of making a reregistration decision. The Agency evaluated environmental fate and ecological studies submitted for imazapyr and determined that the data are adequate to support a reregistration decision. More in-depth details of the environmental fate and persistence of imazapyr are provided in the environmental risk assessment.

For a complete discussion, see the *Screening Level Ecological Risk Assessment for the Reregistration Eligibility Decision Document for Imazapyr*, dated December 9, 2005.

1. Environmental Fate and Transport

The herbicide imazapyr is an anionic, organic acid that is non-volatile and is both persistent and mobile in soil. Commercial formulations contain either imazapyr acid or the imazapyr isopropylamine salt, both of which are dissolved in a water solution. Imazapyr is mainly in anionic form at typical environmental pH levels, and the behavior of the acid and salt forms are expected to be similar. Laboratory studies show imazapyr is essentially stable to hydrolysis, aerobic and anaerobic soil degradation, as well as aerobic and anaerobic aquatic metabolism. Field dissipation study observations are consistent with imazapyr's intrinsic ability to persist in soils and move via runoff to surface water and to leach to groundwater.

Upon direct application, or indirect release into surface water, photolysis is the only identified mechanism for imazapyr degradation in the environment. The half-life of imazapyr is approximately 3 to 5 days in surface water. The major identified metabolites were pyridine hydroxy-dicarboxylic acid, pyridine dicarboxylic acid, and nicotinic acid. Under laboratory aerobic aquatic conditions, the aerobic aquatic metabolism half-lives for hydroxy-dicarboxylic acid and pyridine dicarboxylic acid were in the range of 3 to 8 days in two different sediment/water systems. Metabolites hydroxy-dicarboxylic acid and pyridine dicarboxylic acid are expected to be more polar, thus more rapidly excreted than imazapyr, and no more toxic than the parent compound. Additionally, pyridine hydroxy-dicarboxylic acid is considered to be less stable than the parent compound. Nicotinic acid is a possible neurotoxin at high dose levels, but there is no concern for low exposures. Nicotinic acid (also called Niacin and referred to as Vitamin B3) is considered an essential nutrient. Imazapyr is not expected to bioaccumulate in aquatic organisms because it exists as an anion at typical environmental pHs.

2. Ecological Risk Assessment

To estimate potential ecological risk, the Agency integrates the results of exposure and ecotoxicity studies using the risk quotient method. Risk quotients (RQs) are a screening level measure for potential risk and are calculated by dividing exposure estimates by ecotoxicity values, both acute and chronic, for various wildlife species. RQs are then compared to levels of concern (LOCs).

Table 5 lists the LOCs used in the risk assessment. Generally, the higher the RQ, the greater the potential risk. Risk characterization provides further information on the likelihood of adverse effects occurring by considering the fate of the chemical in the environment, communities and species potentially at risk, their spatial and temporal distributions, and the nature of the effects observed in studies.

Table 5. Levels of Concern for Ecological Risk

If RQ > LOC value given below...			Then EPA presumes...
Terrestrial Organisms	**Aquatic Organisms**	**Plants**	**Risk Presumption**
0.5	0.5	1	**Acute Risk**- there is potential for acute risk; regulatory action may be warranted
0.1	0.05	1	**Acute Endangered Species**- regulatory action may be warranted; further analysis is needed
1	1	N/A	**Chronic Risk**-there is potential for chronic risk; regulatory action may be warranted

The Agency has determined that there are no risks of concern to terrestrial birds, mammals, and bees, or to aquatic invertebrates and fish. For terrestrial organisms, available acute and chronic toxicity data indicate that imazapyr acid and salt are practically non-toxic to birds, mammals, and honeybees. Acute risks to both mammals and birds were not calculated because LC_{50}/LD_{50} (Median Lethal Concentration/Median Lethal Dose) values were greater than highest concentration tested. Chronic LOC's were also not exceeded for these organisms. In addition, imazapyr shows low toxicity to bees. Therefore, there is minimal risk to birds, mammals, and honeybees.

For aquatic organisms, available acute and chronic toxicity data indicate that imazapyr acid and salt are practically non-toxic to fish, invertebrates, and non-vascular aquatic plants. Acute risks to fish and aquatic invertebrates were not calculated because LC_{50} values were greater than the highest concentration tested. Chronic LOC's were also not exceeded for these organisms. In addition, no LOC's were exceeded for aquatic non-vascular plants. Therefore, there is minimal risk to fish, aquatic invertebrates, and aquatic non-vascular plants. However, there is an uncertainty for estuarine/marine fish and invertebrates, since no toxicity data were available to observe the prolonged effects of imazapyr to estuarine/marine fish and invertebrates. These organisms were assumed to have similar sensitivity as freshwater fish and invertebrates.

The Agency has determined that there are ecological risks of concern associated with the use of imazapyr for non-target terrestrial plants and aquatic vascular plants, and potential risks to endangered species (aquatic vascular plants, terrestrial and semi-aquatic monocots and dicots). Because the ecological risks of concern for imazapyr are only to non-target plants, the remainder of this Ecological Risk Assessment section of the RED document will address risks to non-target plants.

a. Plant Toxicity

Terrestrial plant toxicity studies with monocots and dicots indicate that seedling emergence and vegetative vigor are severely impacted by exposure to imazapyr acid and to the isopropylamine salt of imazapyr. Seedling emergence, based on "fresh weight", was adversely impacted in monocots (wheat) at an EC_{25} (Effect Concentration) of 0.0046 lb a.e./acre and in dicots (sugar beet) with an EC_{25} of 0.0024 lb a.e./acre (Table 6). Vegetative vigor in monocots, based on "fresh weight", was adversely impacted by both imazapyr acid and the isopropylamine salt of imazapyr at an EC_{25} of 0.012 lb a.e./acre in wheat. In vegetative vigor studies with dicots (cucumber), imazapyr acid was more toxic than the isopropylamine salt of imazapyr with an EC_{25} of 0.0009 lbs a.e./acre. Non-lethal effects included stunting, chlorosis, and necrosis.

Table 6.Summary of Selected Endpoints for Imazapyr Terrestrial Toxicity Studies

Plant Species	Effect	Endpoint (lbs a.e./acre)		
		EC 25	EC 05/NOAEC	MRID
Terrestrial Monocots				
Wheat	Emergence	0.0046	0.00099	40811801
	Vegetative Vigor	0.012	0.0039	43889101
Terrestrial Dicots				
Sugar Beet	Emergence	0.0024	0.00017	40811801
Cucumber	Vegetative Vigor	0.0009	0.000064	40811801

For aquatic plants, available toxicity studies indicate that imazapyr acid and the isopropylamine salt are highly toxic and expected to exert detrimental effects to aquatic vascular plants. The EC_{50} for the aquatic vascular plant (duckweed) is 0.018 mg a.e./L (NOAEC 0.011 mg a.e./L), based on inhibition of plant growth and reduction of frond count (Table 7).

Table 7. Summary of Selected Endpoints for Imazapyr Aquatic Toxicity Studies

Plant Species	Effect	Endpoint (mg a.e./L)		
		EC 50	NOAEC	MRID
Aquatic Vascular	Inhibition of plant growth	0.018	0.011	43889102
Aquatic Nonvascular	Inhibition of plant growth	11.5	7.6	43889102

b. Terrestrial Plant Risk

Table 8 presents the RQs for terrestrial plants for three imazapyr uses and both ground and aerial spray applications. For the terrestrial non-crop use of imazapyr and the application rates of 0.9 and 1.5 lbs a.e./acre, RQ LOCs exceeded for all non-endangered and endangered monocots and dicots located adjacent to treated areas, in semi-aquatic areas, and as a result of runoff and spray drift with the exception of non-endangered monocots receiving spray drift alone from ground applications at 0.9 lb a.e./acre. RQs were higher for aerial applications when compared to ground applications, as expected given the assumption that 5% of aerial sprays and 1% of ground sprays drift to non-target areas.

For Clearfield™ corn and the label application rate of 0.014 lbs a.e./acre, LOCs were exceeded for non-endangered monocots and dicots located in semi-aquatic areas (based on "channelized runoff" ratio) when exposed to imazapyr via ground or aerial spray application. LOCs were not exceeded for non-endangered monocots and dicots inhabiting dry areas (based on "sheet runoff" ratio) via ground or aerial application, or from spray drift alone. With the exception of monocots receiving drift alone, the endangered species LOCs were exceeded for terrestrial plants located adjacent to treated areas, in semi-aquatic areas and as a result of spray drift alone from aerial application on cornfields. For ground application, the endangered species LOCs were exceeded for both monocots and dicots located in semi-aquatic areas. However, the endangered species LOCs were not exceeded for monocots inhabiting dry areas or exposed to spray drift alone. Exposure to dicots from spray drift alone exceeds the endangered species LOC but is not expected to exceed the non-endangered species LOC.

Table 8.Terrestrial Plant Risk Quotient Summary for Terrestrial Spray Uses

Scenario	Non-endangered RQs			Endangered RQs		
	Adjacent to treated sites	Semi-aquatic areas	Drift	Adjacent to treated sites	Semi-aquatic areas	Drift
Terrestrial non-crop high application rate (1.5 lbs a.e./acre						
Ground spray application						
Monocot	20**	166**	1.3**	91*	773*	3.9*
Dicot	38**	319**	17**	529*	4500*	234*
Aerial spray application						
Monocot	26**	114**	6.3**	121*	530*	19*
Dicot	50**	219**	83**	706*	3090*	1170*
Terrestrial non-crop low application rate (0.9 lbs a.e./acre)						
Ground spray application						
Monocot	12**	100**	0.75	55*	464*	2.3*
Dicot	23**	191**	10**	318*	2700*	141*
Aerial spray application						
Monocot	16**	68**	3.8**	73*	318*	124*
Dicot	30**	131**	50**	424*	1850*	703*
Clearfield™ Corn (0.014 lbs a.e./acre)						
Ground spray application						
Monocot	0.18	1.6**	0.01	0.85	7.2*	0.04
Dicot	0.35	3.0**	0.16	4.9*	42*	2.2*
Aerial spray application						
Monocot	0.24	1.1**	0.06	1.1*	5.0*	0.18
Dicot	0.47	2.0**	0.78	6.6*	29*	11*

* indicates an exceedance of the Endangered Species LOC (LOC=1).
** indicates an exceedance of the Acute Risk LOC (LOC=1).

For the aquatic non-crop use of imazapyr at the maximum application rate of 1.5 lbs a.e./acre, LOCs were exceeded for non-endangered and endangered monocots and dicots located adjacent to or on the edge of lakes and ponds as a result of flooding semi-aquatic areas and spray drift from a direct application to surface water (Table 9). RQs were higher for plants adjacent to or on the edge of lakes and ponds versus those exposed via drift.

Table 9. Terrestrial Plant Risk Quotient Summary for Aquatic Spray Uses

Scenario	Non-endangered RQs		Endangered RQs	
	Water overflows to flood a terrestrial site	**Incoming tide pushes water to flood a terrestrial site**	**Water overflows to flood a terrestrial site**	**Incoming tide pushes water to flood a terrestrial site**
Aquatic non-crop high application rate (1.5 lbs a.e./acre)				
Ground spray application				
Monocot	163**	24*	758**	111*
Dicot	313**	46*	4412**	647*

* indicates an exceedance of the Endangered Species LOC (LOC=1).
** indicates an exceedance of the plant LOC (LOC=1).

For the granular uses of imazapyr at the maximum application rates of 1.5 lbs a.e./acre and 0.5 lbs a.e./acre, LOCs were exceeded for both non-endangered and endangered monocots and dicots located adjacent to treated areas, in semi-aquatic areas and as a result of runoff from application on non-crop areas (Table 10). Currently, EFED does not perform chronic risk assessments for terrestrial plants.

Table 10. Terrestrial Plant Risk Quotient Summary for Granular Uses

Scenario	Non-endangered RQs		Endangered RQs	
	Adjacent to treated sites	Semi-aquatic areas	Adjacent to treated sites	Semi-aquatic areas
Terrestrial non-crop high application rate (1.5 lbs a.e./acre)				
Monocot	16**	163**	76*	758*
Dicot	31**	313**	441*	4410*
Terrestrial non-crop low application rate (0.5 lbs a.e./acre)				
Monocot	5.4**	54**	25*	253*
Dicot	10**	104**	147*	1471*

* indicates an exceedance of the Endangered Species LOC (LOC=1).
** indicates an exceedance of the Acute Risk LOC (LOC=1).

For a complete discussion, see the *Screening Level Ecological Risk Assessment for the Reregistration Eligibility Decision Document for Imazapyr*, dated December 9, 2005.

c. Aquatic Plant Risk

For imazapyr, there are exceedances of the endangered and non-endangered LOCs for vascular plants for runoff/drift from ground and aerial spray and granular applications at high and low rates for terrestrial use sites (Table 11). However, there were no exceedances of non-vascular aquatic plant LOCs for these scenarios. There were no exceedances of aquatic plants LOCs for the Clearfield™ corn application scenario.

Table 11. Aquatic Plant Risk Quotient Summary for Terrestrial Uses

Scenario	Non-endangered RQs		Endangered RQs
	Non-Vascular	Vascular	Vascular
Non-Crop (high application rate, 1.5 lbs a.e./acre)			
Ground Application	<0.01	4.5**	7.4*
Aerial Application	<0.01	4.7**	7.6*
Non-Crop (low application rate, 0.9 lbs a.e./acre)			
Ground Application	<0.01	2.5**	4.1*
Aerial Application	<0.01	2.8**	4.6*
Forestry Granular (high application rate, 1.5 lbs a.e./acre			
Broadcast	<0.01	4.3**	7.0*
Forestry Granular (low application rate, 0.5 lbs a.e./acre			
Broadcast	<0.01	1.4**	2.3*
Clearfield™ Corn (0.014 lbs a.e./acre)			
Ground Application	<0.01	0.04	0.07
Aerial Application	<0.01	0.04	0.07

* indicates an exceedance of Endangered Species LOC (LOC=1).
** indicates an exceedance of plant LOC (LOC=1).

The imazapyr direct application to water scenario for aquatic uses indicated exceedance of the non-endangered LOCs for vascular plants inhabiting various water depths (Table 12). Likewise, endangered vascular plant LOCs were exceeded for the direct application to waters at all three depths considered. There were no LOC exceedances for non-vascular aquatic plants.

Table 12. Aquatic Plant Risk Quotient Summary for Aquatic Use

Scenario	Water Depth	Non-endangered		Endangered
		Non-Vascular	Vascular	Vascular
Direct Application to Water (1.5 lbs a.e./acre)	1 foot	0.048	31**	50*
	3 feet	0.016	10**	17*
	2 meters	<0.01	4.7**	7.6*

* indicates an exceedance of Endangered Species LOC (LOC=1).
** indicates an exceedance of Acute Risk LOC (LOC=1).

For a complete discussion, see the *Screening Level Ecological Risk Assessment for the Reregistration Eligibility Decision Document for Imazapyr*, dated December 9, 2005.

3. Incident Reports

The Environmental Incident Information System (EIIS) database has records of 12 incidents related to the use of imazapyr (April 2005). Incidents reported include impacts to terrestrial and aquatic plants and possibly birds and fish. There are several reports of spray drift affecting plants on adjacent property and one report of agricultural runoff to a pond resulting in a possible fish kill from imazapyr. In this report, it could not be definitively determined that the fish kill was due to exposure to imazapyr. Another report concerning mortality in birds and fish was based on an incident using a mixture of herbicides, one of which was imazapyr. Because a mixture was used, it could not be definitively determined that the mortalities were due to exposure to imazapyr. One incident was a mixed herbicidal spray, including imazapyr, that resulted in a bird, terrestrial and aquatic plant, and fish kill. Another incident involved a goldfish kill from suspected runoff following aerial application of imazapyr. However, the cause of the kill could not be determined. Nine other incidents involving plants have also been reported.

4. Endangered Species Risk.

As discussed previously, imazapyr acid and the imazapyr isopropylamine salt are used in both aquatic and terrestrial environments. The screening level risk assessment for endangered species indicates that imazapyr RQs exceed the endangered species LOCs for the specified use scenario in the following taxonomic groups:

- non-target aquatic vascular plants for non-crop uses (both high and low application rates) and for direct application to water (RQs are listed in Tables 11 and 12).

- non-target terrestrial plants - monocots and dicots adjacent to treated areas, semi-aquatic areas, and subject to drift for non-crop uses at both high and low application rates by ground and aerial spray and granular applications; monocots and dicots adjacent to semi-aquatic areas for Clearfield™ corn use by ground spray application; dicots adjacent to treated sites for Clearfield™ corn use by ground spray application; and monocots and dicots adjacent to treated areas and semi-aquatic areas for Clearfield™ corn use by aerial spray application; and for dicots, drift from Clearfield™ corn use by ground and aerial spray application (RQs are listed in Tables 8, 9, and 10).

Registered uses of imazapyr acid and the imazapyr isopropylamine salt will have no direct effect on endangered or threatened fish, aquatic invertebrates, non-vascular aquatic plants (algae), birds or mammals. However, there is a potential concern for indirect effects to listed species with either broad or narrow dependencies on impacted plant species/populations/communities for habitat, feeding or cover requirements.

Risks to endangered species identified in the Environmental Fate and Ecological Risk Assessment for Imazapyr are based solely on the Agency's screening level assessment and do not constitute "may effect" findings under the Endangered Species Act. Rather, this assessment serves as a screen to determine the need for any species-

specific assessments that will evaluate whether exposure may be at levels that could cause harm to specific listed species and their critical habitat. That assessment refines the screening-level assessment to take into account the geographic area of pesticide use in relation to the listed species, the habits and habitat requirements of the listed species, etc. If the Agency's specific assessments result in the need to modify use of the pesticide in specific geographic areas, those changes to the pesticide's registration will take effect through the process described in the Agency's Federal Register Notice (54 FR 27984) regarding implementation of the Endangered Species Protection Program.

For a complete discussion, see the *Screening Level Ecological Risk Assessment for the Reregistration Eligibility Decision Document for Imazapyr*, dated December 9, 2005.

IV. Risk Management, Reregistration, and Tolerance Reassessment Decision

A. Determination of Reregistration Eligibility

Section 4(g)(2)(A) of the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) calls for the Agency to determine, after submission of relevant data concerning an active ingredient, whether pesticides containing the active ingredient are eligible for reregistration. The Agency has previously identified and required the submission of the generic (i.e., active ingredient specific) data required to support reregistration of products containing imazapyr.

The Agency has completed its assessment of the dietary, residential, occupational, and ecological risks associated with the use of pesticides containing the active ingredient imazapyr. Based on a review of these data and public comments on the Agency's assessments for the active ingredient imazapyr, the Agency has sufficient information on the human health and ecological effects of imazapyr to make decisions as part of the reregistration process under FIFRA, as amended by the Food Quality Protection Act (FQPA). Note that the Agency reassessed the imazapyr tolerances in 2003. The Agency has determined that currently registered uses of imazapyr will not pose unreasonable risks or adverse effects to humans or the environment if the risk mitigation measures and label changes outlined in the RED are implemented; therefore, products containing imazapyr are eligible for reregistration. These products containing imazapyr are eligible for reregistration provided that: (i) required product-specific data are submitted; (ii) the risk mitigation measures outlined in the document are adopted; and, (iii) label amendments are made to reflect these measures. Products that contain active ingredients in addition to imazapyr will be reregistered when all of their other active ingredients also are reregistered. Label changes are described in Section V of this document. Appendix B identifies the generic data that the Agency reviewed as part of its determination of reregistration eligibility of imazapyr and lists the submitted studies that the Agency found acceptable.

The Agency has determined that specific drift language amendments proposed in this RED will substantially reduce, though may not eliminate, the risks to non-target plants.

Based on its evaluation of imazapyr, the Agency has determined that imazapyr products, unless labeled and used as specified in this document, would present risks inconsistent with FIFRA. Accordingly, should a registrant fail to implement any of the risk mitigation measures identified in this document, the Agency may take regulatory action to address the risk concerns from the use of imazapyr. If all changes outlined in this document are incorporated into the product labels, then all current risks for imazapyr will be adequately mitigated for the purposes of this determination under FIFRA. Once a comprehensive endangered species assessment is completed, further changes to these registrations may be necessary.

B. Public Comments and Responses

Through the Agency's public participation process, the Agency worked with stakeholders and the public to reach the regulatory decisions for imazapyr. During the public comment period on the risk assessments, which closed on February 21, 2006, the Agency received comments from the BASF Corporation, the Nebraska Department of Agriculture, and the California Indian Basketweavers Association (CIBA). For responses to public comments from the BASF Corporation and the Nebraska Department of Agriculture please refer to the *EFED Responses to Imazapyr Phase 3 Comments*, dated March 29, 2006 and is located in the public docket, http://www.regulations.gov, OPP-2005-0495. Response to comments from CIBA is as follows:

As stated above, the CIBA submitted a public comment dated 2/21/06 to Docket ID Number EPA-OPP-2005-0495 in response to the *Imazapyr: HED Chapter of the Reregistration Eligibility Decision Document*, dated December 8, 2005. This group is concerned about long-term use of pesticides such as imazapyr in forests and on rangeland and their possible effects on wildlife, native plants, life cycles and contamination of basket-making materials, water, and traditional foods. CIBA stated, "Currently, no pesticide residue tolerance has been established for traditional foods eaten and gathered by Native Americans, and the health and risk assessment is not protective for Native American uses of plants growing on public lands where high volumes of imazapyr and other herbicide uses occur. CIBA cited a study conducted by C. Ando, et al. at the California Department of Pesticide Regulation (CDPR) claiming that, following forest treatments, the researchers found that residues of "herbicides" in certain forest plants used by Indians greatly exceed tolerances currently established for the same chemicals in certain fruits, berries, herbs, and grains."

Many of CIBA's statements seem to be addressing general concerns associated with various pesticide uses on rangeland and in forests. The published study supporting the group's claims only addressed the use of glyphosate, hexazinone, and triclopyr in California forests and residues of these three pesticides in four native species used by local Indians. Maximum residues of these three herbicides in the four sampled native plants were found at 19-241 ppm on the day of treatment; half-lives varied from 1 week to 19 weeks. However, none of the tested pesticides are chemically similar to imazapyr. There are several details about imazapyr that, taken together, should minimize CIBA's concerns for imazapyr risks, specifically: Imazapyr tolerances at 40 CFR 180.500 have been established at 100 ppm in grass forage and 30 ppm in grass hay. These tolerances

reflect spot treatment of weed species in pasture and rangeland at 0.75 lb a.i./A, but ≤10% of any given acre may be treated. Therefore, the likelihood of imazapyr use on plants traditionally used by Native Americans, unless targeted as a weed, is unlikely. If spot-treated as a weed, the plant is likely to be exhibiting symptoms of phytotoxicity. Applications in forests are also typically directed, spot treatments although broadcast treatments may be applied at <1.5 lb a.i./A. The preharvest interval is 7 days. The Agency has usage information indicating that <2.5% of all U.S. pasture and rangeland is treated with imazapyr.

As described in the 12/8/05 HED Chapter of the RED, there are no acute risks associated with imazapyr because a single dose of the chemical does not induce adverse effects. Aggregate chronic/long-term risk is <0.1% of the chronic Population Adjusted Dose (cPAD), i.e., a negligible risk. Short-term aggregate risks (MOEs of 410 in children and 720 in adults) are well below the Agency's level of concern (i.e., the MOEs estimated for pesticide exposures are greater than 100).

In other words, additional human exposures to imazapyr in excess of those expected from consumption of default, high volume foods could still occur in subpopulations before the Agency's levels of concern (100% of the cPAD and an MOE of 100 for short-term) would be approached. Note that greater emphasis is being placed by the Agency on determining consumption and exposure patterns of U.S. subpopulations, such as Native Americans, that have thus far not been sufficiently represented in USDA's Continuing Survey of Food Intakes by Individuals (CSFII), 1994-1996 and 1998 to permit more refined dietary exposure assessments to be conducted for these groups.

C. Regulatory Position

1. Food Quality Protection Act Findings

a. "Risk Cup" Determination

Imazapyr tolerances were reassessed in 2003 when new food uses were established. However, part of reregistration under FIFRA, the Agency assessed the risks associated with imazapyr. The Agency has concluded that aggregate exposure to imazapyr through food, drinking water, and residential sources is within its own "risk cup" and that human health risks from these combined exposures are within acceptable levels. The Agency has determined that the human health risks from these combined exposures are within acceptable levels. In other words, the Agency has concluded that the tolerances for imazapyr meet FQPA safety standards. In reaching this determination, the Agency has considered the available information on the special sensitivity of infants and children, as well as aggregate exposure from food, drinking water, and residential uses. The FQPA safety factor has not been retained for imazapyr because acceptable developmental and reproduction studies have been submitted and reviewed and there is low concern and no residual uncertainties for pre- and post-natal toxicity. In addition, the dietary and residential assessments are not expected to underestimate exposure.

b. Endocrine Disruptor Effects

The Agency is required under the FFDCA, as amended by FQPA, to develop a screening program to determine whether certain substances (including all pesticide active and other ingredients) "may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or other endocrine effects as the Administrator may designate." Following recommendations of its Endocrine Disruptor Screening and Testing Advisory Committee (EDSTAC), the Agency determined that there was a scientific basis for including, as part of the program, the androgen and thyroid hormone systems, in addition to the estrogen hormone system. The Agency also adopted EDSTAC's recommendation to include evaluations of potential effects in wildlife. For pesticides, the Agency will use FIFRA and, to the extent that effects in wildlife may help determine whether a substance may have an effect in humans, FFDCA authority to require the wildlife evaluations. As the science develops and resources allow, screening for additional hormone systems may be added to the Endocrine Disruptor Screening Program (EDSP).

In the available toxicity studies on imazapyr, there was no evidence of endocrine disruption. When the appropriate screening and/or testing protocols being considered under the EDSP have been developed, imazapyr may be subject to additional screening and/or testing to better characterize effects related to endocrine disruption.

c. Cumulative Risks

Risks summarized in this document are those that result only from the use of imazapyr. Unlike other pesticides for which the Agency has followed a cumulative risk approach based on a common mechanism of toxicity, the Agency has not made a common mechanism of toxicity finding for imazapyr and any other substances. Therefore, for the purposes of reregistration, the Agency has not assumed that imazapyr shares a common mechanism of toxicity with other compounds.

2. Tolerance Summary

Imazapyr tolerances were reassessed in 2003 when new food uses were established. This document does not result in any additional tolerances being reassessed. The following information is provided for informational purposes only. A tolerance summary is presented below in Table 13. The Agency has determined that the residue of concern for tolerance expression in plants, livestock, fish, and water is imazapyr *per se*.

Existing tolerances are established in 40 CFR §180.500 for residues of the herbicide imazapyr, [2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid], applied as the acid or ammonium salt, in/on corn, grass, milk, meat, poultry, eggs, fish, and shellfish. Adequate data are available to reassess the existing tolerance levels for imazapyr.

The submitted magnitude of the residue data for corn, grass, milk, meat, poultry, and eggs are fulfilled and are adequate for the purposes of reregistration; however, acceptable supporting storage stability data on corn forage and fodder and clarification of

the identity and quantity of spray additives utilized in the grass field trials remain outstanding. The submitted processing data on corn are acceptable, and the results of these studies show that imazapyr does not appreciably concentrate in the processed commodities of field corn. The submitted confined rotational crop data are adequate for the purposes of reregistration, and limited field rotational crop data and rotational crop tolerances are not required at this time.

Imazapyr is registered for use on aquatic areas and the treated water from these sites may be diverted to irrigate food or feed crops. No data depicting imazapyr residue levels in irrigated crops have been submitted and at present, no label restriction prohibits use of imazapyr treated waters for irrigated crops. Data on irrigated crops or label restrictions that prohibit the irrigation of crops with imazapyr treated water for 120 days following application and/or demonstrates non-detectable residue levels of imazapyr in irrigation water by laboratory analysis prior to use are required for reregistration.

Two methods are currently listed in the Pesticide Analytical Manual (PAM) Vol. II for enforcing tolerances of imazapyr in/on corn commodities. Method M 2468 is a gas chromatograph/ mass spectrometry (GC/MS) method with a limit of quantitation (LOQ) of 0.01 ppm for imazapyr in/on corn grain, forage and fodder, and Method M 2657 is a capillary electrophoresis (CE) method with UV detection that has a LOQ of 0.05 ppm for imazapyr in/on corn grain, forage and fodder.

A series of CE/UV Methods are currently listed as enforcement methods for determining imazapyr in/on grass forage and hay (Method M 3023), in livestock tissues (Method M 3184), in milk and milk fat (Methods M 3075 and M 3223), and in fish and shellfish tissues (Method M 3066). These methods are similar to the enforcement method M 2657, and each of these methods also includes directions for a confirmatory analysis using LC/MS.

Each of the above methods has undergone a successful independent laboratory validation (ILV) trial. Adequate radiovalidation data were also submitted for CE/UV methods M 3066, M 3075, and M 3184, demonstrating the efficiency of these methods in extracting residues from aged samples.

The Food and Drug Administration (FDA) multiresidue methods do not exhibit sufficient sensitivity to other imidazolinone herbicides, and thus there is no reasonable expectation that these methods would prove to be useful for determining residues of imazapyr.

Currently there are no Codex, Canadian or Mexican tolerances for residues of imazapyr in/on corn, grass, fish, shellfish, or livestock commodities. Thus, international harmonization of tolerances is not an issue at this time.

a. Tolerances Currently Listed and Tolerance Reassessment

Table 13. Tolerance Table

Commodity	Current Tolerance (ppm)	Reassessed Tolerance (ppm)	Comments (Correct commodity definition)
Corn, field, forage	0.05	0.05	The available residue data support the reassessed tolerances.
Corn, field, grain	0.05	0.05	
Corn, field, stover	0.05	0.05	
Grass, forage	100	100.0	The available residue data support the reassessed tolerances.
Grass, hay	30	30.0	
Fish	1.0	1.0	The available residue data support the reassessed tolerances.
Shellfish	0.1	0.10	The available residue data support the reassessed tolerances.
Fat of cattle	0.05	0.05	The available residue data support the reassessed tolerances.
Kidney of cattle	0.20	0.20	
Meat byproducts, excluding kidney, of cattle	0.05	0.05	
Meat of cattle	0.05	0.05	
Fat of sheep	0.05	0.05	
Kidney of sheep	0.20	0.20	
Meat byproducts, excluding kidney of sheep	0.05	0.05	
Meat of sheep	0.05	0.05	
Fat of goats	0.05	0.05	
Kidney of goats	0.20	0.20	
Meat byproducts, excluding kidney, of goats	0.05	0.05	
Meat of goats	0.05	0.05	
Fat of horses	0.05	0.05	
Kidney of horses	0.20	0.20	
Meat byproducts, excluding kidney, of horses	0.05	0.05	
Meat, of horses	0.05	0.05	
Milk	0.01	0.01	

D. Regulatory Rationale

The Agency has determined that imazapyr is eligible for reregistration provided the risk mitigation measures outlined in this document are adopted, and label amendments are made to reflect these measures. This decision considers the risk assessments conducted by the Agency and the significance of the use of imazapyr.

The following is a summary of the rationale for managing risks associated with the use of imazapyr. Where labeling revisions are warranted, specific language is set forth in the summary tables in Section V of this document.

1. Human Health Risk Management

In the human health risk assessment, dietary risks (food and drinking water), residential handler dermal and inhalation risks, residential oral and dermal post-application risks, and aggregate risks do not exceed the Agency's level of concern. Therefore, no risk mitigation measures are required to address these exposure scenarios.

a. Occupational Risk Mitigation

As discussed in Section III.A.7.a, short- and intermediate-term dermal and inhalation risks to occupational handlers who may be exposed to imazapyr during mixer/loader/applicator activities are below the Agency's level of concern at either the baseline level of personal protective equipment or with the addition of gloves. To protect workers mixing and loading liquid formulations for aerial applications to aquatic sites, terrestrial non-crop sites, forestry sites, and areas grazed or cut for hay, these handlers are required to wear chemical resistant gloves. To protect workers mixing, loading, and applying liquid and granular formulations via handwands, backpack spreaders and sprayers, and handgun sprayers for non-crop and aquatic uses, those handlers are required to wear chemical-resistant gloves. As a condition of reregistration, imazapyr formulation into wettable powder end use products is not allowed unless they are packaged in water soluble bags. Label language will include the following measures:

- Liquids: Chemical-resistant gloves are required for all mixers and loaders of liquid formulations and for applicators using hand-held equipment.

- Granulars: Chemical-resistant gloves are required for all mixers and loaders of granular formulations and applicators using hand-held equipment.

- Dry Flowables and Wettable Powders (water soluble bags): Chemical-resistant gloves are required for all mixers and loaders of dry flowable and water soluble bag formulations and applicators using hand-held equipment.

For all agricultural postapplication exposure scenarios, postapplication occupational risks are below HED's level of concern (i.e., the MOEs are greater than 100) on day 0 – approximately 12 hours following application. However, the Agency has determined that imazapyr is a Toxicity Category I primary eye irritant and under the Worker Protection Standard (WPS; 40 CFR Part 170), a 48-hour REI is required. Also under the WPS, early entry requires that coveralls, shoes and socks, chemical resistant gloves, and protective eyewear be used.

2. Environmental Risk Management

To address risks to non-target aquatic and terrestrial plants, additional directions for use and use restrictions will be added to product labels to reduce potential risks. Specific language and restrictions are discussed below.

a. Non-target Terrestrial Plant Risk Mitigation

As mentioned earlier, screening-level risk quotients (RQs) for non-target terrestrial plants resulting from the terrestrial and aquatic spray uses range from 0.01 to 319 for non-target terrestrial plants and from 0.04 to 4,500 for endangered terrestrial plants. Likewise, RQs for non-endangered terrestrial plants from the granular use range from 5.4 to 313 for non-target terrestrial plants and from 25 to 4,410 for endangered non-target terrestrial plants. For aquatic uses of imazapyr, the RQs for non-endangered terrestrial plants ranged from 24 to 313 and 111 to 4,412 for endangered terrestrial plants. Direct exposure scenarios were not calculated, but RQs for plants and endangered plants would be significantly higher than those estimated from exposure via spray drift and/or runoff.

Because imazapyr is an herbicide and may therefore harm non-target plants exposed via drift, to be eligible for reregistration labels must require that imazapyr be applied in a manner that minimizes spray drift. Strict use restrictions to minimize spray drift will be placed on the labels for all imazapyr products. This language will include:

- For aerial applications, applicators are required to use a Coarse or coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater for release heights below 10 feet; Applicators are required to use a Very Coarse or coarser droplet size or, if specifically using a spinning atomizer nozzle, applicators are required to use a VMD of 475 microns or greater for release heights above 10 feet; applicators must consider the effects of nozzle orientation and flight speed when determining droplet size;

- For aerial applications, applicators are required to use upwind swath displacement;

- For aerial applications, the boom length must not exceed 60% of the wingspan or 90% of the rotor blade diameter, to reduce spray drift;

- For aerial applications, applications with wind speeds less than 3 mph and with wind speeds greater than 10 mph are prohibited;

- For groundboom applications, applicators are required to use a nozzle height below 4 feet above the ground or plant canopy and Coarse or coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater;

- For groundboom applications, applications with wind speeds greater than 10 mph are prohibited;

- Applications into temperature inversions are prohibited.

The Agency has determined that specific drift language amendments proposed in this RED will substantially reduce, though may not completely eliminate, the risks to non-target plants.

b. Non-target Aquatic Plant Risk Mitigation

Screening-level risk quotients (RQs) for both the aquatic and terrestrial uses of imazapyr were calculated. The RQs for non-endangered aquatic plants from the aquatic use range from <0.01 for non-vascular aquatic plants to 31 for vascular aquatic plants and from 7.6 to 50 for endangered vascular aquatic plants. The non-target endangered and non-endangered aquatic plant RQs resulting from the terrestrial uses range from <0.01 for non-vascular plants to 4.7 for vascular aquatic plants and from 0.07 to 7.6 for endangered vascular aquatic plants. The Agency has determined that the specific drift requirements listed above will substantially reduce the risks to non-target aquatic plants from terrestrial uses of imazapyr.

For non-target plant risks resulting from the aquatic use of imazapyr, there is currently the statement, "Do not apply to bodies of water or portions of bodies of water where emergent and/or floating weeds do not exist" on labels that allow application to water bodies. The Agency believes that this statement also substantially reduces the risks to non-target aquatic plants (including endangered plants) from this use. However, the Agency feels that this language should be placed in a more prominent location on the label. Therefore, the Agency is requiring the statement be placed in the General Use Precautions and Restrictions section of the label. Putting this use requirement in this section will make it clearer that this is a use restriction when applying to bodies of water. Currently, this statement is in the General Information section of the label.

3. Significance of Imazapyr Use

The application of imazapyr for aquatic and semi-aquatic weed control is predominantly conducted to control nuisance and nonnative weed species; most often species such as Purple Loosestrife (*Lythrum salicaria* L.). When these species begin to invade shoreline areas of lakes, streams, or canals, their establishment is rapid and often results in their out-competing indigenous species, which then leads to a monoculture. Since imazapyr has no effect on submerged aquatic vegetation (SAV), it can be used in these margin, or shoreline, areas to control weeds without the risk of damaging desirable SAV.

4. Other Labeling Requirements

In order to be eligible for reregistration, imazapyr use and safety information will be included in the labeling of all end-use products containing imazapyr. Imazapyr is classified as a Toxicity Category I primary eye irritant; therefore, the WPS requires a REI of 48 hours. Also under the WPS, early entry requires that coveralls, shoes and socks, chemical resistant gloves, and protective eyewear be used.

For the specific labeling statements and a list of outstanding data, refer to Section V of this RED document.

5. Threatened and Endangered Species Considerations

a. The Endangered Species Program

The Agency has developed the Endangered Species Protection Program to identify pesticides whose use may cause adverse impacts on threatened and endangered species, and to implement mitigation measures that address these impacts. The Endangered Species Act requires federal agencies to ensure that their actions are not likely to jeopardize listed species or adversely modify designated critical habitat. To analyze the potential of registered pesticide uses that may affect any particular species, the Agency uses basic toxicity and exposure data developed for the REDs and then considers ecological parameters, pesticide use information, geographic relationship between specific pesticide uses and species locations, and biological requirements and behavioral aspects of the particular species. When conducted, this species-specific analysis will also consider the risk mitigation measures that are being implemented as a result of this RED.

Following this future species-specific analysis, a determination that there is a likelihood of potential effects to a listed species may result in limitations on use of the pesticide, other measures to mitigate any potential effects, or consultations with the Fish and Wildlife Service and/or the National Marine Fisheries as appropriate. If the Agency determines use of imazapyr "may effect" listed species or their designated critical habitat, the Agency will employ the provisions in the Services regulations (50 CFR Part 402). Until the species-specific analysis is completed, the risk mitigation measures being implemented through this RED will reduce the likelihood that endangered and threatened species may be exposed to imazapyr at levels of concern. The Agency is not requiring

specific imazapyr label language at the present time relative to threatened and endangered species. If, in the future, specific measures are necessary for the protection of listed species, the Agency will implement them through the Endangered Species Program.

b. General Risk Mitigation

Imazapyr end-use products (EUPs) may also contain other registered pesticides. Although the Agency is not proposing any mitigation measures for products containing imazapyr specific to federally listed threatened and endangered species, the Agency needs to address potential risks from other end-use products. Therefore, the Agency requires that users adopt all threatened and endangered species risk mitigation measures for all active ingredients in the product. If a product contains multiple active ingredients with conflicting threatened and endangered species risk mitigation measures, the more stringent measure(s) must be adopted.

V. What Registrants Need to Do

The Agency has determined that imazapyr is eligible for reregistration provided that the risk mitigation measures identified in this document are adopted and label amendments are made to reflect these measures; however, additional data are required to confirm this decision. In the near future, the Agency intends to issue Data Call-In Notices (DCIs) requiring product specific data and generic (technical grade) data. Generally, registrants will have 90 days from receipt of a DCI to complete and submit response forms or request time extension and/or waiver requests with a full written justification. For product specific data, the registrant will have 8 months to submit data and amend labels. For generic data, due dates can vary depending on the specific studies being required. Below are tables of additional generic data that the Agency intends to require for imazapyr to be eligible for reregistration.

A. Manufacturing Use Products

1. Additional Generic Data Requirements

The generic database supporting the reregistration of imazapyr has been reviewed and determined to be substantially complete. However, the following additional data requirements have been identified by the Agency as confirmatory and are included in the generic DCI for this RED.

Table 14. Confirmatory Data Requirements for Reregistration

New Guideline Number	Old Guideline Number	Study/Requirements
123-1(a)	850.4225	Seedling Emergence- Tier II using Imazapyr isopropylamine salt PLUS the adjuvant/surfactant/wetting agent as required on the label
123-1(b)	850.4250	Vegetative Vigor- Tier II using Imazapyr isopropylamine salt PLUS the adjuvant/surfactant/wetting agent as required on the label
171-4e	860.1380	Storage stability data for corn or grass
171-4f, g, h, 165-5	860.1400	Magnitude of residues in fish
171-4k	860.1500	Identity and quantity of spray additives used in all of the grass field trials

Imazapyr is registered for use on aquatic areas and the treated water from these sites may be diverted to irrigate food or feed crops. No data depicting imazapyr residue levels in irrigated crops have been submitted and presently no label restriction prohibits use of imazapyr treated waters for irrigated crops. Data on irrigated crops or label restrictions that prohibit the irrigation of crops with imazapyr treated water for 120 days following application and/or demonstrates non-detectable residue levels of imazapyr in irrigation water by laboratory analysis prior to use are required to confirm this for reregistration decision.

2. Labeling for Technical and Manufacturing Use Products

To ensure compliance with FIFRA, technical and manufacturing use products (MP) labeling should be revised to comply with all current EPA regulations, PR Notices and applicable policies. In order to be eligible for reregistration, amend all product labels to incorporate the risk mitigation measures outlined in Section IV. The technical and MP labeling should also bear the labeling statements contained in Table 15, Label Changes Summary Table.

B. End-Use Products

1. Additional Product-Specific Data Requirements

Section 4(g) (2) (B) of FIFRA calls for the Agency to obtain any needed product-specific data regarding the pesticides after a determination of eligibility has been made. The registrant must review previous data submissions to ensure they meet current EPA acceptance criteria and if not, commit to conduct new studies. If a registrant believes that previously submitted data meet current testing standards, then the study MRID numbers should be cited according to the instructions in the Requirement Status and Registrations Response Form provided for each product.

A product-specific data call-in, outlining specific data requirements will be issued in the near future.

2. Labeling for End-Use Products

Labeling changes are necessary to implement measures outlined in Section IV above. Specific language to incorporate these changes is specified in the Label Changes Summary Table below.

a. Label Changes Summary Table

In order to be eligible for reregistration, registrants must amend all product labels to incorporate the risk mitigation measures outlined in Section IV. The following table describes how language on the labels should be amended.

Table 15: Summary of Labeling Changes for Imazapyr

Description	Amended Labeling Language	Placement on Label
For all Manufacturing Use Products	"Only for formulation into an ***herbicide*** for the following uses: liquid, wettable powder (in water soluble bags only), and granular." "Not for formulation into wettable powder end use products unless they are packaged in water soluble bags."	Directions for Use
One of these statements may be added to a label to allow reformulation of the product for a specific use or all additional uses supported by a formulator or user group	"This product may be used to formulate products for specific use(s) not listed on the MP label if the formulator, user group, or grower has complied with U.S. EPA submission requirements regarding support of such use(s)." "This product may be used to formulate products for any additional use(s) not listed on the MP label if the formulator, user group, or grower has complied with U.S. EPA submission requirements regarding support of such use(s)."	Directions for Use
Environmental Hazards	"This product is toxic to plants. Drift and run-off may be hazardous to plants in water adjacent to treated areas. Do not apply to water except as specified on the label. Treatment of aquatic weeds may result in oxygen depletion or loss due to decomposition of dead plants. Do not treat more than one half the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas. Do not contaminate water when disposing of equipment, washwater, or rinsate. See Directions for Use for additional precautions and requirements."	Precautionary Statements

End Use Products for Occupational Use (WPS and non-WPS)		
PPE Requirements Established by the RED[1] For All Formulations	"Personal Protective Equipment (PPE) Some materials that are chemical-resistant to this product are" (*registrant inserts correct chemical-resistant material*). "If you want more options, follow the instructions for category" *[registrant inserts A,B,C,D,E,F,G, or H]* "on an EPA chemical-resistance category selection chart. "Mixers, loaders, applicators, and other handlers must wear: > Long-sleeve shirt and long pants, > Shoes plus socks, > Chemical resistant gloves for all mixers and loaders, plus applicators using handheld equipment."	Precautionary Restrictions
User Safety Requirements	"Follow manufacturer's instructions for cleaning/maintaining PPE. If no such instructions for washables exist, use detergent and hot water. Keep and wash PPE separately from other laundry. Discard clothing and other absorbent materials that have been drenched or heavily contaminated with this product's concentrate. Do not reuse them."	Immediately following the PPE requirements
Engineering controls for Products Applied Aerially as Sprays	"Pilots must use an enclosed cockpit that meet the requirements listed in the Worker Protection Standard (WPS) for agricultural pesticides [40 CFR 170.240(d)(6)]."	Immediately following the User Safety Requirements

User Safety Recommendations	"User Safety Recommendations Users should wash hands with plenty of soap and water before eating, drinking, chewing gum, using tobacco, or using the toilet. Users should remove clothing/PPE immediately if pesticide gets inside. Then wash thoroughly and put on clean clothing. Users should remove PPE immediately after handling this product. Wash the outside of gloves before removing. As soon as possible, wash thoroughly and change into clean clothing."	Immediately following Engineering Controls (Must be placed in a box.)
Environmental Hazards	"This product is toxic to plants. Drift and run-off may be hazardous to plants in water adjacent to treated areas. Do not apply to water except as specified on the label. Treatment of aquatic weeds may result in oxygen depletion or loss due to decomposition of dead plants. Do not treat more than one half the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas. Do not contaminate water when disposing of equipment, washwater, or rinsate. See Directions for Use for additional precautions and requirements."	Precautionary Statements immediately following the User Safety Recommendations
Restricted-Entry Interval for products with directions for use within scope of the Worker Protection Standard for Agricultural Pesticides (WPS)	"Do not enter or allow worker entry into treated areas during the restricted entry interval (REI) of 48 hours."	Directions for Use, In Agricultural Use Requirements Box

Entry Restrictions for Products with Directions for Use not Within the Scope of WPS	For products applied as Sprays: "Do not enter or allow others to enter treated areas until sprays have dried" For products applied as Dry: "Do not enter or allow others to enter treated areas until dusts have settled."	
Early Entry Personal Protective Equipment for products with directions for use within the scope of the WPS	"PPE required for early entry to treated areas that is permitted under the Worker Protection Standard and that involves contact with anything that has been treated, such as plants, soil, or water, is: * coveralls * shoes plus socks * chemical-resistant gloves made of any waterproof material * protective eyewear"	Direction for Use, In Agricultural Use Requirements box, immediately following the REI
General Application Restrictions	"Do not apply this product in a way that will contact workers or other persons, either directly or through drift. Only protected handlers may be in the area during application."	Place in the Direction for Use directly above the Agricultural Use Box.
Spray Drift	<u>Spray drift requirements</u> <u>Aerial Applications:</u> (1) Applicators are required to use a Coarse or coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater for release heights below 10 feet; Applicators are required to use a Very Coarse or coarser droplet size or, if specifically using a spinning atomizer nozzle, applicators are required to use a VMD of 475 microns or greater for release heights above 10 feet; Applicators must consider the effects of nozzle orientation and flight speed when determining droplet size.	Directions for Use

	(2) Applicators are required to use upwind swath displacement. (3) The boom length must not exceed 60% of the wingspan or 90% of the rotor blade diameter to reduce spray drift. (4) Applications with wind speeds less than 3 mph and with wind speeds greater than 10 mph are prohibited. (5) Applications into temperature inversions are prohibited. <u>Ground Boom Applications:</u> (1) Applicators are required to use a nozzle height below 4 feet above the ground or plant canopy and Coarse or coarser droplet size (ASABE S572) or, if specifically using a spinning atomizer nozzle, applicators are required to use a volume mean diameter (VMD) of 385 microns or greater. (2) Applications with wind speeds greater than 10 mph are prohibited. (3) Applications into temperature inversions are prohibited.	
	The use of treated waters on irrigated crops within 120 days of treatment is prohibited.	

End Use Products Primarily Intended for Residential Use		
Environmental Hazard Statements	"This product is toxic to plants. Drift and run-off may be hazardous to plants in water adjacent to treated areas. Do not apply to water except as specified on the label. Treatment of aquatic weeds may result in oxygen depletion or loss due to decomposition of dead plants. Do not treat more than one half the surface area of the water in a single operation and wait at least 10 to 14 days between treatments. Begin treatment along the shore and proceed outward in bands to allow aquatic organisms to move into untreated areas. Do not contaminate water when disposing of equipment, washwater, or rinsate. See Directions for Use for additional precautions and requirements."	Precautionary Statements immediately following the User Safety Recommendations
Entry Restrictions for products applied as a spray	For products applied as Sprays: "Do not enter or allow others to enter treated areas until sprays have dried" For products applied as Dry: "Do not enter or allow others to enter treated areas until dusts have settled."	Directions for use under General Precautions and Restrictions
General Application Restrictions	"Do not apply this product in a way that will contact any person, pet, either directly or through drift. Keep people and pets out of the area during application."	Directions for Use under General Precautions and Restrictions

[1] PPE that is established on the basis of Toxicity of the end-use product must be compared to the active ingredient PPE in this document. The more protective PPE must be placed in the product labeling. For guidance on which PPE is considered more protective, see PR Notice 93-7.

[2] If the product contains oil or bears instructions that will allow application with an oil-containing material, the "N" designation must be dropped.

BASF Corporation

BASF

MATERIAL SAFETY DATA SHEET

Agricultural Products Group
P.O.Box 13528,
Research Triangle Park, NC 27709
(919) 547-2000

EMERGENCY TELEPHONE NUMBERS:

BASF Corporation: 1 (800) 832-HELP

CHEMTREC: 1 (800) 424-9300

Product No.: 58A119 **Habitat ® Herbicide**

Date Prepared: 9/22/2003 **Date Revised: 1/21/2004**

SECTION I

Trade Name: Habitat ® Herbicide

Chemical Name: 2-[4,5-dihydro-4-methyl-4-(1-methylethyl)-5-oxo-1H-imidazol-2-yl]-3-pyridinecarboxylic acid, salt with 2-propanamine (1:1)

Synonyms: Isopropylamine of imazapyr; AC252, 925; **Formula:** C(13)H(15)N(3)O(3).C(3)H(9)N

Chemical Family: Imidazolinone **Mol Wt:** 320.4

SECTION II - INGREDIENTS

COMPONENT	CAS NO.	%	PEL/TLV - SOURCE
Isopropylamine salt of Imazapyr	81510-83-0	28.7	0.5 mg/m3 TWA BASF recommended
Inerts	N/A	71.3	None established

SARA Title III Section 313: Not listed

SECTION III - PHYSICAL DATA

BOILING/MELTING POINT@760mm Hg: N/D **pH:** 6.6 - 7.2

VAPOR PRESSURE mmHg @ 20°C: N/D

SPECIFIC GRAVITY OR BULK DENSITY: 1.04 - 1.07 g/mL

SOLUBILITY IN WATER: Soluble

APPEARANCE: Clear blue liquid **ODOR:** Ammonia **INTENSITY:** Slight

SECTION IV - FIRE AND EXPLOSION DATA

FLASH POINT (TEST METHOD): >210°F SFCC **AUTOIGNITION TEMP:** > 200° F

FLAMMABILITY LIMITS IN AIR (% BY VOL): **LOWER:** N/D **UPPER:** N/D

NFPA 704 HAZARD CODES

HEALTH: 1 **FLAMMABLE:** 1 **INSTABILITY:** 0 **OTHER:** N/R

NFPA 30 STORAGE CLASSIFICATION: Class IIIB

EXTINGUISHING MEDIUM	Use water fog, foam, CO(2), or dry chemical extinguishing media.
SPECIAL FIREFIGHTING PROCEDURES	Firefighters should be equipped with self-contained breathing apparatus and turnout gear.
UNUSUAL FIRE EXPLOSION HAZARDS	None known.

SELECT ACRONYM KEY

N/A - Not available; N/D - Not determined; N/R - Not rated; N/E - Not established

SECTION V - HEALTH DATA

TOXICOLOGICAL TEST DATA:

Data for formulated product:

Rat, Oral LD50 (combined sexes) > 5000 mg/kg

Rabbit, Dermal LD50 (combined sexes) > 2000 mg/kg

Rat, Inhalation LC50 (4 hr) > 4.62 mg/L

Rat, Inhalation LC50 (1 hr calculated) > 18.48 mg/L

Rabbit, Eye Irritation - Not Irritating

Rabbit, Skin Irritation - Mildly irritating

Guinea pig, Dermal Sensitizer - Not Sensitizer

OSHA, NTP, or IARC Carcinogen: Not listed.

EFFECTS OF OVEREXPOSURE:

See Product Label and Directions For Use for additional precautionary statements.

CAUTION

Avoid contact with skin, eyes, and clothing. Avoid breathing spray mist.

Existing medical conditions aggravated by this product:

None known.

FIRST AID PROCEDURES

If on skin:	Wash with plenty of soap and water. Get medical attention if irritation persists.
If in eyes:	Flush eyes with plenty of water. Call a physician if irritation persists.
If inhaled:	Remove victim to fresh air. If not breathing, give artificial respiration, preferably mouth-to-mouth. Get medical attention.
If swallowed:	Call a physician or Poison Control Center. Drink 1 or 2 glasses of water and induce vomiting by touching back of throat with finger. If person is unconscious, do not give anything by mouth and do not induce vomiting.
Note to physician:	Treat symptomatically. No specific antidote.
Note:	Have the product container or label with you when calling a poison control center or doctor or going for treatment.

SECTION VI - REACTIVITY DATA

STABILITY: Stable. Do not store below 32° F or above 100° F.

CONDITIONS TO AVOID: Store in original container in cool,dry, well ventilated place away from ignition sources, heat or flame.

CHEMICAL INCOMPATIBILITY: Oxidizing agents and reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Including but not limited to oxides of carbon and nitrogen.

HAZARDOUS POLYMERIZATION: Does not occur.

CONDITIONS TO AVOID: Does not polymerize.

CORROSIVE TO METAL: Mild steel, brass **OXIDIZER:** No

SECTION VII - PERSONAL PROTECTION

Users of a pesticidal end use product should refer to the product label for personal protective equipment requirements.

RECOMMENDATIONS FOR MANUFACTURING, COMMERCIAL BLENDING, AND PACKAGING WORKERS:

Respiratory Protection:
Supplied air respirators should be worn if large quantities of mist/dust are generated or prolonged exposure possible.

Eye Protection:
Chemical goggles when respirator does not provide eye protection.

Protective Clothing:
Gloves and protective clothing as necessary to prevent skin contact.

Ventilation:
Whenever possible, engineering controls should be used to minimize the need for personal protective equipment.

SECTION VIII - ENVIRONMENTAL DATA

ENVIRONMENTAL TOXICITY DATA

See the product label for information regarding environmental toxicity.

SARA 311/312 REPORTING

FIRE:N PRESSURE:N REACTIVITY:N ACUTE:Y CHRONIC:N TPQ(lbs): N/R

SPILL AND LEAK PROCEDURES:

In case of large scale spillage of this product, avoid contact, isolate area and keep out animals and unprotected persons. Call CHEMTREC (800 424-9300) or BASF Corporation (800 832-HELP). For a small spill, wear personal protective equipment as specified on the label.
FOR A LIQUID SPILL: Dike and contain the spill with inert material (sand, earth, etc.) and transfer the liquid and solid diking materials to separate containers for disposal.
FOR A SOLID SPILL: Sweep solid into a drum for re-use or disposal. Remove personal protective equipment and decontaminate it prior to re-use.

HAZARDOUS SUBSTANCE SUPERFUND: No RQ(lbs): None

WASTE DISPOSAL METHOD:

Pesticide wastes are acutely hazardous. Wastes resulting from this product may be disposed of on site or at an approved waste disposal facility. Improper disposal of excess pesticide, spray mix or rinsate is a violation of federa law. If these wastes cannot be disposed of according to label instructions, contact the state agency responsible for pesticide regulation or the Hazardous Waste representative at the nearest EPA Regional Office for guidance.

HAZARDOUS WASTE 40CFR261: No HAZARDOUS WASTE NUMBER:None

CONTAINER DISPOSAL:

FOR PLASTIC CONTAINERS: Triple rinse (or equivalent) and add rinsate to the spray tank. Then offer for recycling or reconditioning, or puncture and dispose of in a sanitary landfill, or by incineration, or if allowed by state and local authorities, by burning. If burned, stay out of smoke.
FOR BULK CONTAINERS: Reusable containers should be returned to the point of purchase for cleaning and re-filling.
FOR MINIBULK CONTAINERS: Clean all tanks on an approved loading pad so rinsate can be collected and mixed into the spray solution or into a dedicated tank. Using a high pressure sprayer, rinse several times with small volumes of water to minimize rinsate.

SECTION IX - SHIPPING DATA - PACKAGE AND BULK

D.O.T. PROPER SHIPPING NAME (49CFR172.101-102):	HAZARDOUS SUBSTANCE (49CFR CERCLA LIST):
None	None RQ(lbs): None

D.O.T. HAZARD CLASSIFICATION (CFR 172.101-102): PRIMARY	SECONDARY
None	None

D.O.T. LABELS REQUIRED (49CFR172.101-102):	D.O.T. PLACARDS REQUIRED (CFR172.504):	POISON CONSTITUENT (49CFR172.203(K)):
None	None	None

BILL OF LADING DESCRIPTION

Compounds, tree or weed killing, NOIBN
This product is not regulated by the Department of Transportation (DOT). It does not meet the definition of DOT corrosive (49 CFR 173.136).

CC NO.: Not applicable | **UN/NA CODE:**

SECTION X - ADDITIONAL INFORMATION

Habitat ® Herbicide

KEEP OUT OF REACH OF CHILDREN

CAUTION

BASF Corporation

Agricultural Products Group
P.O.Box 13528,
Research Triangle Park, NC 27709
(919) 547-2000

DISCLAIMER

IMPORTANT: WHILE THE DESCRIPTIONS, DESIGNS, DATA AND INFORMATION CONTAINED HEREIN ARE PRESENTED IN GOOD FAITH AND BELIEVED TO BE ACCURATE, IT IS PROVIDED FOR YOUR GUIDANCE ONLY. BECAUSE MANY FACTORS MAY AFFECT PROCESSING OR APPLICATION/USE, WE RECOMMEND THAT YOU MAKE TESTS TO DETERMINE THE SUITABILITY OF A PRODUCT FOR YOUR PARTICULAR PURPOSE PRIOR TO USE. NO WARRANTIES OF ANY KIND, EITHER EXPRESS OR IMPLIED, INCLUDING WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE MADE REGARDING PRODUCTS DESCRIBED OR DESIGNS, DATA OR INFORMATION SET FORTH, OR THAT THE PRODUCTS, DESIGNS, DATA OR INFORMATION MAY BE USED WITHOUT INFRINGING THE INTELLECTUAL PROPERTY RIGHTS OF OTHERS. IN NO CASE SHALL THE DESCRIPTIONS, INFORMATION, DATA OR DESIGNS PROVIDED BE CONSIDERED A PART OF OUR TERMS AND CONDITIONS OF SALE. FURTHER, YOU EXPRESSLY UNDERSTAND AND AGREE THAT THE DESCRIPTIONS, DESIGNS, DATA, AND INFORMATION FURNISHED BY BASF HEREUNDER ARE GIVEN GRATIS AND BASF ASSUMES NO OBLIGATION OR LIABILITY FOR THE DESCRIPTION, DESIGNS, DATA AND INFORMATION GIVEN OR RESULTS OBTAINED, ALL SUCH BEING GIVEN AND ACCEPTED AT YOUR RISK.

Material Safety Data Sheet

Section 1. Product and Company Identification

Product Name: Hi-Light® Blue Liquid
Product Code: BUI/HL

Hazardous Material Information System:

Health	1
Flammability	0
Physical Hazard	0
Personal Protection	X

Manufacturer Information:
Becker Underwood, Inc.
801 Dayton Avenue
Ames, Iowa 50010
Information Phone: (515) 232-5907
Emergency Phone: Chemtrec (800) 424-9300 or 703 527 3887 (international)

Section 2. Hazard Identification

Emergency Overview: May cause respiratory tract, eye, and skin irritation.
Potential Acute Health Effects:

Eyes: Short term harmful effects are not expected. However, irritation may develop causing itching and redness.

Skin: Short term harmful effects are not expected. However, mild skin irritation may develop causing itching and redness.

Inhalation: Short term harmful effects are not expected. However, exposure to vapors or mist may cause coughing or wheezing when inhaled.

Ingestion: Not an intended route of exposure. Short term harmful effects are not expected. However, may upset the gastrointestinal tract and cause diarrhea.

Section 3. Composition/Information on Ingredients

The composition of this material is a trade secret. Contains no other components or impurities which will influence the classification with regard to human and environmental risk assessment.

Section 4. First Aid Measures

Eye Contact: Immediately flush eyes with water for at least 15 minutes. Prolonged or repeated contact may result in mechanical irritation.
Skin Contact: Wash with soap and water.
Inhalation: Move to fresh air. Seek medical attention if irritation persists.
Ingestion: Seek medical attention.

Section 5. Fire Fighting Measures

Flammability of Product: Not a fire or explosion hazard when stored under normal conditions.
Fire Fighting Media: Foam, alcohol foam, CO2, dry chemical, water fog
Protective Clothing: This product is an aqueous mixture which will not burn. If evaporated to dryness, the solid residue may pose a moderate fire hazard. No special procedures required besides standard fire fighting procedures.

Section 6. Accidental Release Measures

Clean-Up Procedures: Collect spilled material with an inert absorbent such as sand or vermiculite. Place in properly labeled and closed container. Dispose of collected material according to federal, state, and local regulations.

Spills and Leaks: Contain the spill or leak to prevent a discharges to surface streams or storm sewers. This material is a concentrated dye/pigment. Small quantities in contaminated water solutions will color large volumes.

Section 7. Handling and Storage

Handling: Avoid breathing fumes. General mechanical ventilation can be expected to effectively remove and prevent build up of any vapor or mist generated from handling this product in a closed environment. Do not freeze. Protect eyes to prevent contact. Avoid prolong or repeated exposure to skin.

Storage: Keep container dry. Keep containers sealed until ready for use.

Section 8. Exposure Control/Personal Protection

Hazardous Components		**Occupational Exposure Limits**		
Component	**CAS Number**	**OSHA PEL**	**ACGIH TLV**	**Weight Percent**
No reportable quantities of hazardous ingredients are present				
No reportable quantities of toxic chemical(s) subject to the reporting requirements of Section 313 of SARA Title III and of 40 CFR 372 are present				

Engineering controls: General mechanical ventilation can be expected to effectively remove and prevent build up of any vapor or mist generated from handling this product in a closed environment

Personal Protection:

Eyes: Wear safety glasses with side shields. Wear additional eye protection such as chemical goggles or face shield if splashing or spraying hazard exists. Have an eye wash station available.

Body: To prevent skin contact use coveralls, apron, boots, or lab coat.

Hands: Avoid skin contact by using chemically resistant gloves.

Respiratory: No respiratory protection required under normal conditions of use. Use local exhaust to control excessive vapors/mists. If excessive vapors or mists are persist use appropriate NIOSH/MSHA approved organic vapor/mist respirator.

Other: Open wounds or skin surface disruptions should be covered with a chemical resistant patch to minimize absorption risks. Clean clothing should be worn daily to avoid possible long-term build up of the product leading to chronic overexposure.

Section 9. Physical and Chemical Properties

Odor	No odor	**Vapor Density**	Heavier than air
Color	Blue	**Evaporation Rate**	Slower than ether
Physical state	Liquid	**Specific Gravity ($H_20 = 1$)**	~ 1.1 g/mL
pH	NA	**Solubility**	Water soluble
Melting/Freezing Point	NA		

Section 10. Stability and Reactivity

Chemical Stability: This material is chemically stable under normal and storage and handling conditions.

Hazardous Decomposition: When involved in a fire, burning may evolve noxious fumes which may include carbon monoxide, carbon dioxide, nitrous oxides, acetic acid, or other toxic compounds depending on the chemical composition and combustion conditions. However, all of the water must be driven off first for this to occur.

Hazardous Polymerization: Is not known to occur.

Incompatibility (Materials to Avoid): Long term storage in direct contact with reactive metals such as aluminum, zinc, copper, nickel, magnesium, etc. Other materials to avoid include strong oxidizing agents.

Section 11. Toxicological Information

Chronic Toxicity: None known
Carcinogenic Effects: None known
Mutagenic Effects: None known
Teratogenic Effects: None known
Developmental Toxicity: None known

Acute Effects on Humans: May cause skin, eye, and respiratory irritation.

Sensitization: Repeated or prolonged exposure to the substance at concentration above the exposure limits may cause respiratory tract and lung sensitization.

Carcinogenic Effects: This material is not known to cause cancer in animals or humans.

Existing Medical Conditions Aggravated By Exposure: May provoke asthmatic response in persons with asthma who are sensitive to airway irritants

Section 12. Ecological Information

Ecotoxicity: No data available, however the material is not expected to have any deleterious toxic effect.

Environmental Fate: No data available regarding the environmental fate or biodegradation.

Section 13. Disposal Considerations

EPA Waste Number: Non-hazardous waste

Treatment: Dispose of according to all federal, state, local, and provincial environmental regulations.

Section 14. Transport Information

D.O.T. Classification: Not regulated
IMO/IMDG Classification: Not regulated
IATA Classification: Not regulated

Section 15. Regulatory Information

US Federal Regulations:

TSCA Toxic Substances Control Act		All ingredients are listed or exempt from the requirement.
SARA Superfund Amendment and Reauthorization Act		
EPCRA Emergency Planning & Community Right-to-Know Act		
Section 302 Extremely Hazardous Substances		None of the chemicals in this product are listed.
Section 311 and 312 Hazards	*Acute:*	No
	Chronic:	No
	Fire:	No
	Pressure:	No
	Reactive:	No
Section 313 Toxic Chemical Release Inventory		No reportable quantities of toxic chemical(s) subject to the reporting requirements of Section 313 of SARA Title III and of 40 CFR 372 are present.
CERCLA Hazardous substances		None of the chemicals in this product have an RQ.
Clean Air Act		This material does not contain any hazardous air pollutants, nor any Class 1, 2 ozone depletors.
Clean Water Act		None of the chemicals in this product are listed as Hazardous Substances, Priority or Toxic Pollutants under the CWA.
California Proposition 65 Carcinogens & Reproductive Toxicity (CRT) List:		No reportable quantities of carcinogens or reproductive toxins subject to the reporting requirements of California Prop 65

Regulatory Listings:
Canada (CEPA): Listed

Section 16. Other Information

Revision	2
Date	February 24, 2012
Supersedes	March 24, 2009
Revised by	AG

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Hi-Light® is a Registered Trademark of Becker Underwood.

HI-LIGHT®

Industrial Strength Spray Pattern Indicator

Hi-Light® is a temporary colorant used for effectively marking spray applications. Hi-Light improves applicator safety. It provides the applicator with an economical marker for broadcast, backpack, or general spot treatment. It can be used with spotgun, hand equipment, small broadcast equipment, boom-jet, and other spray application equipment. Hi-Light washes off equipment, clothing and skin with soap and water.

By adding Hi-Light to spraying systems, spray application personnel are able to uniformly apply pesticides and liquid fertilizers. Hi-Light is compatible with most chemical compounds and is used in applications ranging from broadcasting of soil sterilants to spot treating with brush control products. Hi-Light is available in liquid form and in convenient WSP (water soluble packets).

Hi-Light WSP is a dry flowable formulation of Hi-Light colorant packed in easy-to-use WSPs. It dissolves quickly and completely in the spray tank, leaving no residue to clog screens or nozzles.

Hi-Light WSP eliminates applicator contact or container disposal problems.

PACKAGING

Hi-Light is available in several formulations: blue liquid, blue dry and red liquid. The packaging sizes are listed below:

Blue
- Liquid: 12 x 1 quarts, 4 x 1 gallons, 2 x 2.5 gallons, 30 gallon drums.
- Dry: 40 x 1 WSP

Hi-Light Red
- Liquid: 12 x 1 quarts

RECOMMENDED RATES

LIQUID APPLICATION RATES	
TREATMENT AREA	**RATE** / 100 gal. solution
Gravel, bare ground	6 - 12 oz. (177 - 355 mL)
Roadside right-of-way, industrial vegetation	10 - 16 oz. (296 - 473 mL)
Utility right-of-way, forestry, railroads, brush	12 - 32 oz. (355 - 946 mL)
ATV sprayers (30 gal.)	6 - 10 oz. (177 - 296 mL)

WSP APPLICATION RATES	
TREATMENT AREA	**WSP** / 100 gal. solution
Bare ground, substations, lots	1 packet
Limited foliage, roadside and highway right-of-way, fence lines, forestry	1-3 packets
Dense foliage, utility right-of-way and corridors, heavy brush, forestry	2-4 packets

40 Hi-Light WSP = 4 gallons Hi-Light liquid

DIRECTIONS FOR USE

Fill the spray tank half full of water/solution. For paddle agitation systems, paddles should at least be partially covered with water. Activate agitation system. Add required number of WSPs to obtain desired color concentration. (See chart for recommended rates.) Continue filling tank while the packets dissolve and Hi-Light WSP disperses. Prior to spraying, make sure Hi-Light WSP has properly dispersed in spray tank.

NOTE: the time required to dissolve and disperse Hi-Light WSP varies depending upon water temperature and tank agitation. Allow at least five minutes for the packets to dissolve after being added to the spray solution.

BECKER UNDERWOOD
Inventing the Future

www.beckerunderwood.com
800-232-5907

801 Dayton Avenue,
Ames, IA 50010

APPENDIX C

CONSULTATION AND COORDINATION CORRESPONDENCE

Project Review

DATE: May 29, 2012
TO: Ruth Bentzinger, U.S. Army Corps of Engineers
FROM: John Callen, NDNR
SUBJECT: Maintenance/Restoration of Emergent Sandbar Habitat along the Missouri River from Fort Randall Dam to Ponca, NE (Boyd, Knox, Cedar, and Dixon Counties, NE); ESH Program for Fiscal Years 2012-2017.

As requested, the Nebraska Department of Natural Resources (NDNR) has reviewed the potential project area for potential impacts to surface water rights, registered groundwater wells, and floodplain management, and has listed the comments below:

Surface Water Rights

NDNR records indicate that multiple surface water appropriations may be appurtenant to the potential project location, please see enclosed figures. Therefore, NDNR requests that the appropriate modifications to the appropriations be made, if applicable for any particular project activity. If necessary, in order to modify or relinquish a portion of the appropriation, please complete and submit the Notice of Change of Ownership form and the Relinquishment of Appropriation by Landowner form. If you have any questions about surface water appropriations, please contact Beth Eckles at 402.471.0591 or reference the surface water links below.

Surface water rights data: http://dnrdata.dnr.ne.gov/SWRCombined/SelectSearchOptions.aspx
Surface water rights forms: http://dnr.ne.gov/docs/surfaceforms.html
Notice of change of ownership: http://dnr.ne.gov/wellforms/CHG-OWN2008.pdf
Relinquishment by landowner: http://dnr.ne.gov/SWForms/IndividualRelinquishmentForm.pdf

Groundwater Wells

According to NDNR records, there are public supply wells within the 1,000 foot spacing for the potential project area and numerous other registered wells within the potential project area. Please see enclosed figures depicting the registered location of the wells. Special care should be taken to locate and avoid impacting these wells in any significant way. If the status, use, or ownership of any well changes due to the project, NDNR will need to be properly notified. If you have any additional questions on groundwater wells, please contact Pam Bonebright at 402.471.0572 or reference the groundwater links below.

Groundwater well data: http://dnrdata.dnr.ne.gov/wellscs/Menu.aspx
Groundwater forms: http://dnr.ne.gov/docs/wellforms.html

Floodplain Management

The potential project may be located within the regulated (1% annual chance) floodplain and/or floodway, please see the attached figures. All development or land disturbance within a regulated floodplain and/or floodway needs to comply with local floodplain regulations, which includes obtaining a floodplain development permit. If you have any questions concerning floodplain management and permitting, please contact the Boyd County floodplain administrator Dolly Kienke at (402) 497-2868 or dollybkp@threeriver.net or the Knox County floodplain administrator Liz Doerr at (402) 288-5618 or kczoning@gpcom.net. Currently, Cedar and Dixon Counties do not participate in the National Flood Insurance Program (NFIP) and therefore do not have any local floodplain permitting requirements or administrators. However, NDNR is currently assisting Cedar and Dixon counties with the development of digital floodplain work maps and due to this these counties may participate in the NFIP in the future; in this event permitting requirements would apply. Additionally, if a project completed under this initiative has the potential for altering the Missouri River channel flow characteristics, care should be taken to evaluate the potential impacts. More information regarding individual community floodplain administrators, if needed, is available at the following location:

Community Status List: http://dnrdata.dnr.ne.gov/floodplain/CommunityStatusList.aspx

If you have any questions about this review, please feel free to contact me at 402.471.3957 or john.callen@nebraska.gov.

Enclosure (5)

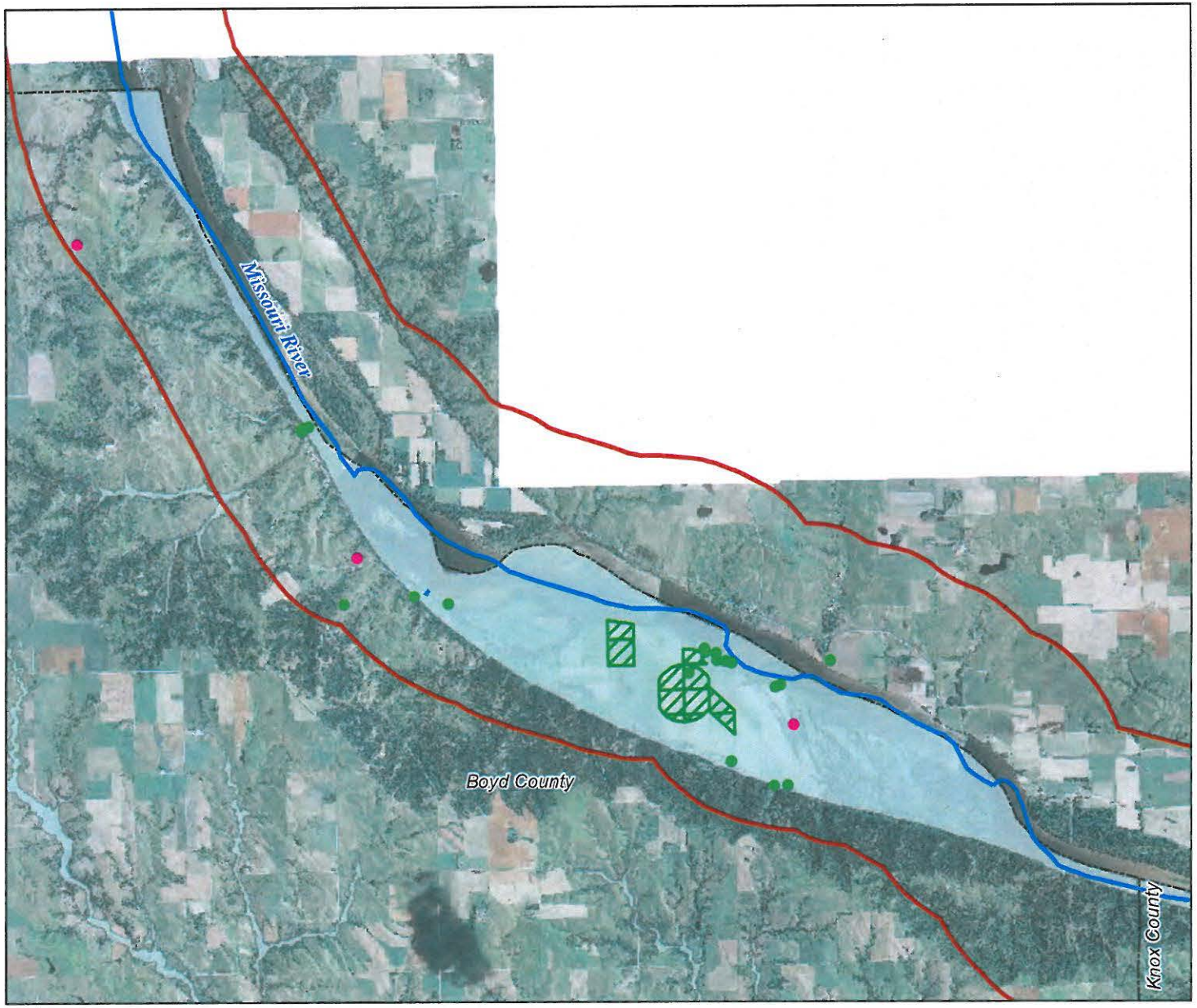
Cc: Beth Eckles, NDNR
Pam Bonebright, NDNR
Dolly Kienke, Boyd County
Liz Doerr, Knox County

Emergent Sandbar Habitat (ESH)
Corps' ESH Program for Fiscal Years 2012-2017

Missouri River, Boyd County, Nebraska

May 14, 2012

Nebraska
Department of Natural Resources



LEGEND

Registered Wells
- Commercial
- Domestic
- Irrigation
- Public Water Supply (PWS)
- Stock Watering
- Unprotected PWS
- Other Wells

Surface Water
- Irrigation
- Supplemental Irrigation
- Domestic
- Other

Effective Flood Zones
- 1% Annual Flood Chance
- Floodway
- 0.2% Annual Flood Chance
- X Protected by Levee

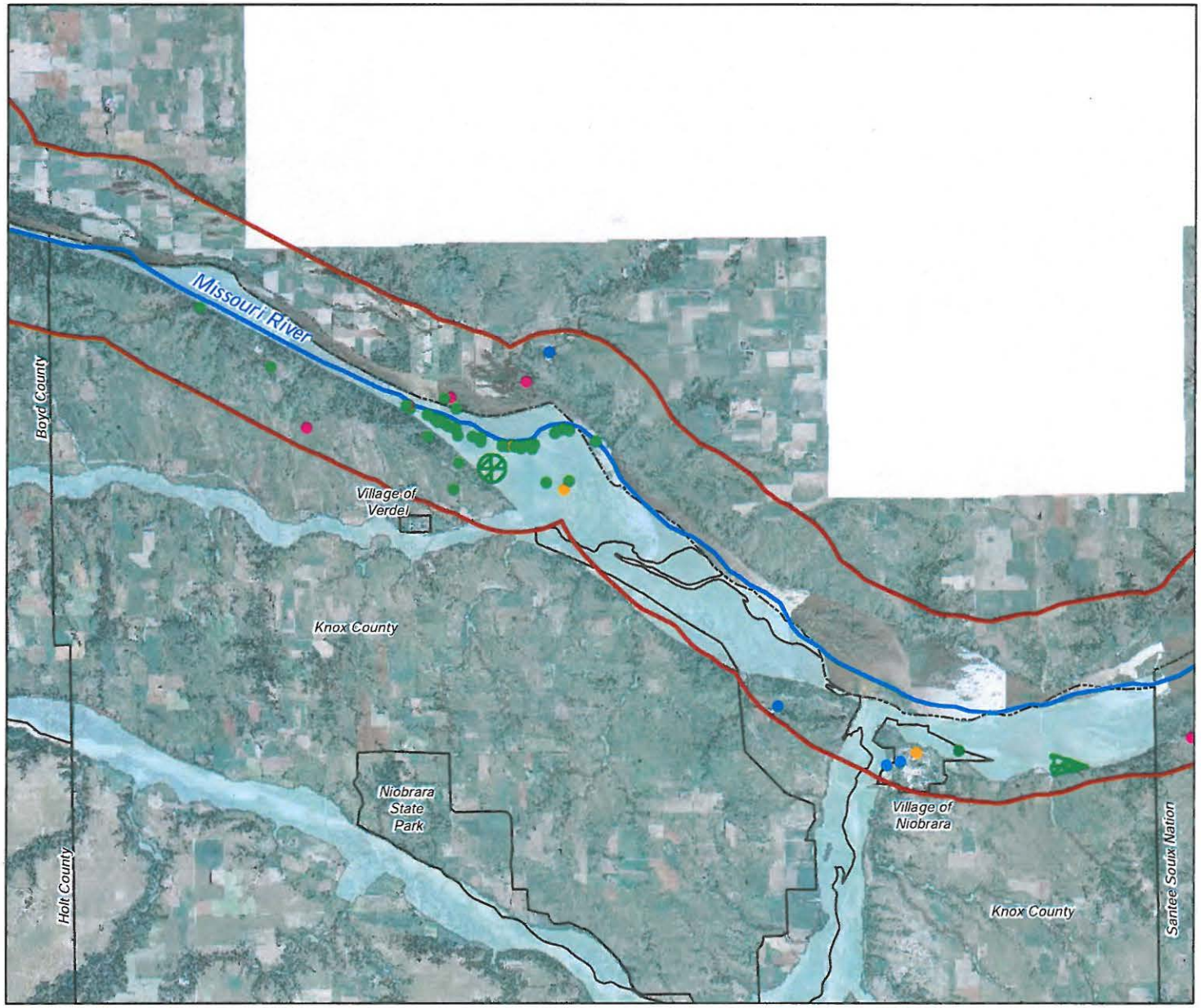
Other
- Approximate Project Area
- City Boundary
- Roads
- River

N

0 0.75 1.5 3 Miles

Emergent Sandbar Habitat (ESH)
Corps' ESH Program for Fiscal Years 2012-2017
Missouri River, Knox County (West of Santee Souix Nation), Nebraska
May 14, 2012

Nebraska
Department of Natural Resources



LEGEND

Registered Wells
- Commercial
- Domestic
- Irrigation
- Public Water Supply (PWS)
- Stock Watering
- Unprotected PWS
- Other Wells

Surface Water
- Irrigation
- Supplemental Irrigation
- Domestic
- Other

Effective Flood Zones
- 1% Annual Flood Chance
- Floodway
- 0.2% Annual Flood Chance
- X Protected by Levee

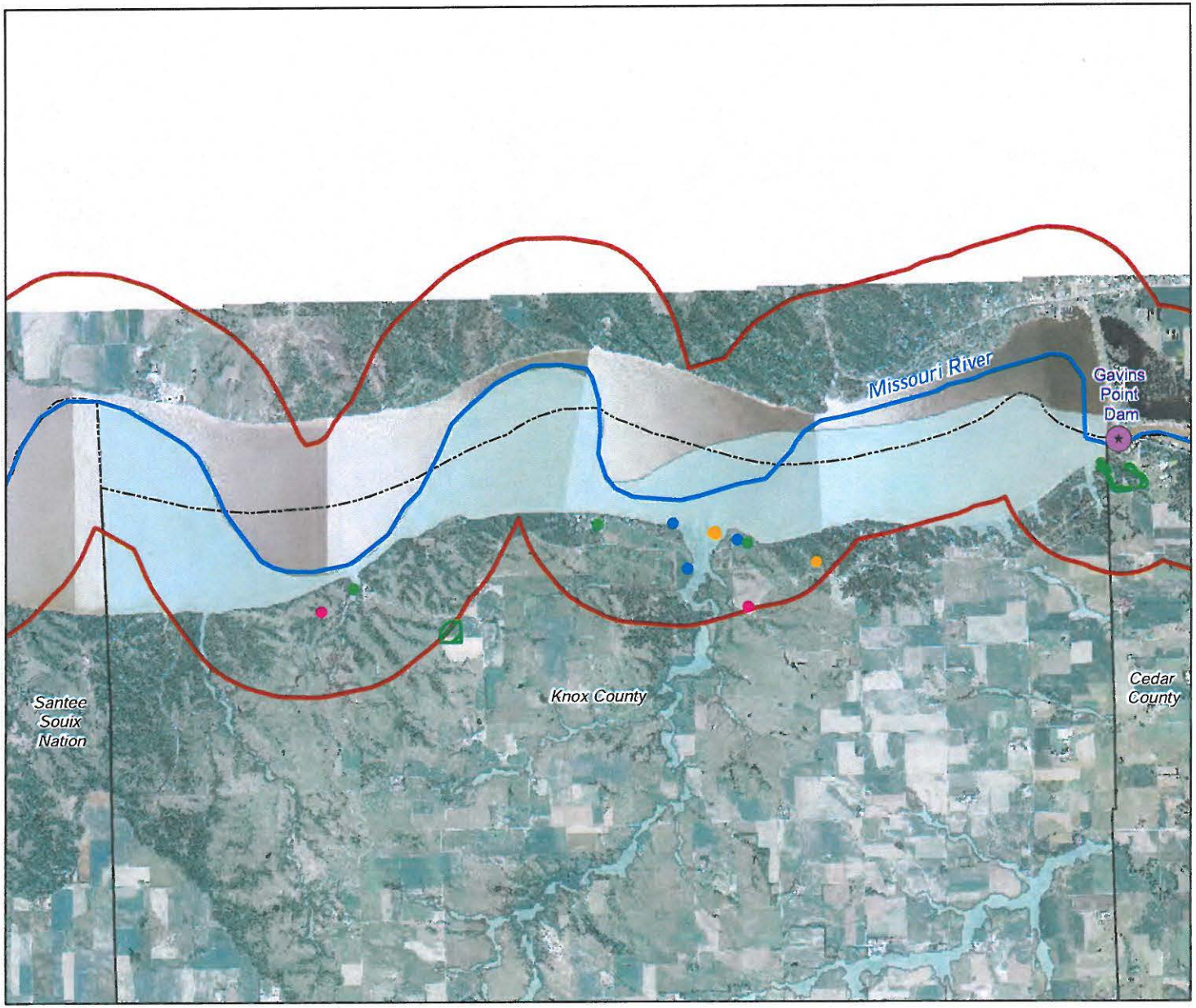
Other
- Approximate Project Area
- City Boundary
- Roads
- River

N

0 1.25 2.5 5 Miles

Emergent Sandbar Habitat (ESH)
Corps' ESH Program for Fiscal Years 2012-2017
Missouri River, Knox County (East of Santee Souix Nation), Nebraska
May 14, 2012

Nebraska
Department of Natural Resources



LEGEND

Registered Wells
- Commercial
- Domestic
- Irrigation
- Public Water Supply (PWS)
- Stock Watering
- Unprotected PWS
- Other Wells

Surface Water
- Irrigation
- Supplemental Irrigation
- Domestic
- Other

Effective Flood Zones
- 1% Annual Flood Chance
- Floodway
- 0.2% Annual Flood Chance
- X Protected by Levee

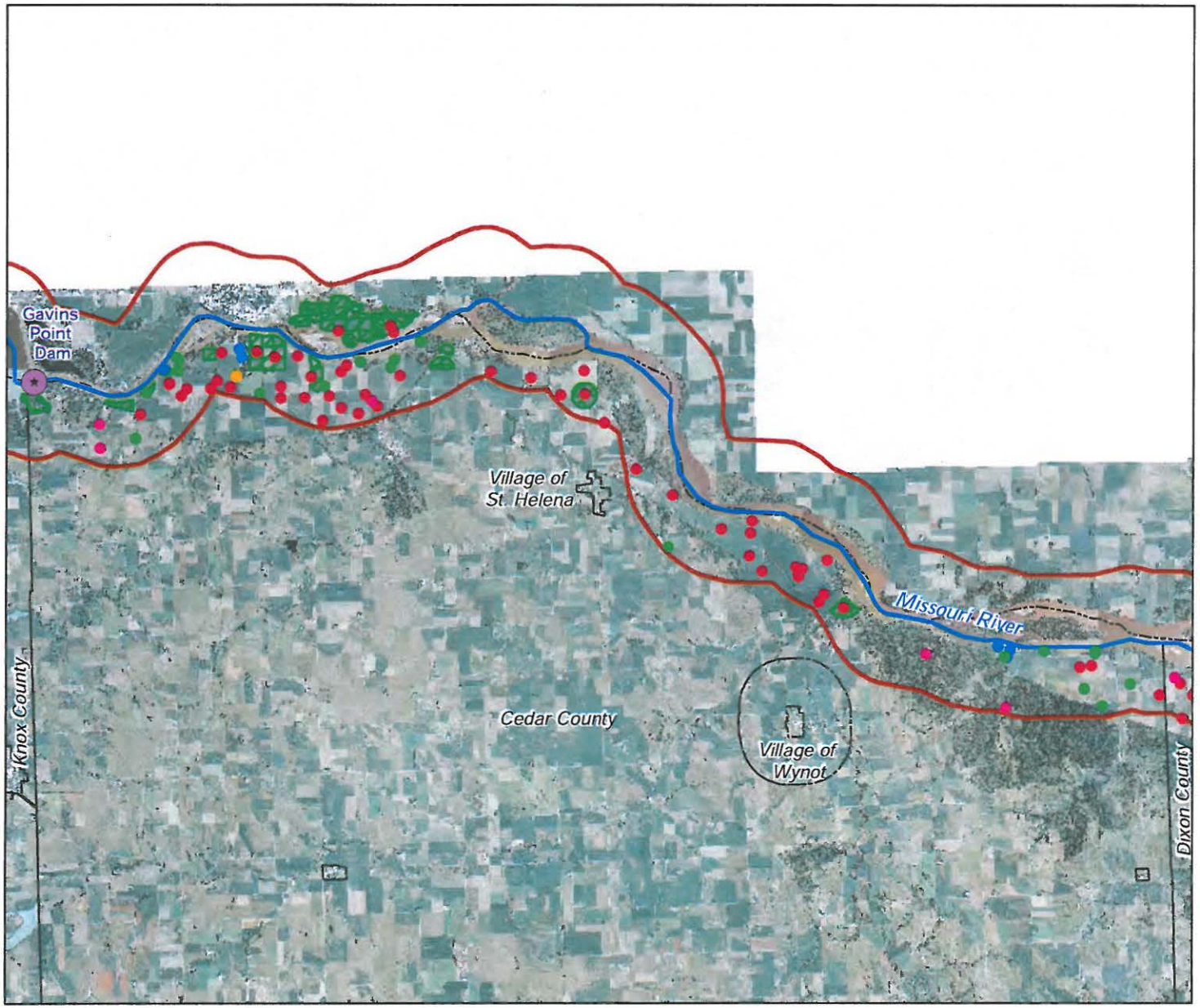
Other
- Approximate Project Area
- City Boundary
- Roads
- River
- Dam

N

0 0.9 1.8 3.6 Miles

Emergent Sandbar Habitat (ESH)
Corps' ESH Program for Fiscal Years 2012-2017
Missouri River, Cedar County, Nebraska
May 14, 2012

Nebraska
Department of Natural Resources



LEGEND

Registered Wells
- Commercial
- Domestic
- Irrigation
- Public Water Supply (PWS)
- Stock Watering
- Unprotected PWS
- Other Wells

Surface Water
- Irrigation
- Supplemental Irrigation
- Domestic
- Other

Effective Flood Zones
- 1% Annual Flood Chance
- Floodway
- 0.2% Annual Flood Chance
- X Protected by Levee

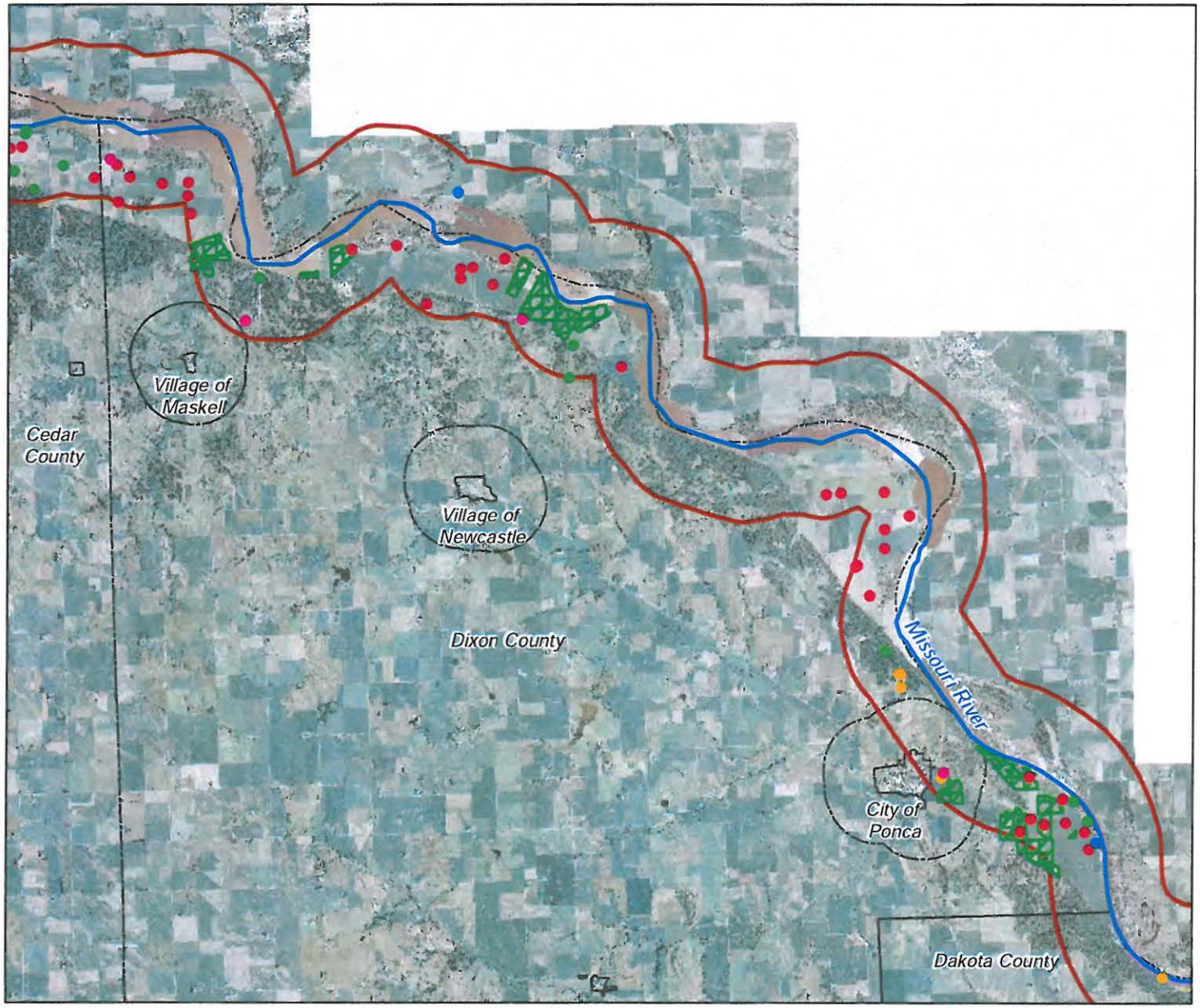
Other
- Approximate Project Area
- City Boundary
- Roads
- River
- Dam

N

0 1.6 3.2 6.4 Miles

Emergent Sandbar Habitat (ESH)
Corps' ESH Program for Fiscal Years 2012-2017
Missouri River, Dixon County, Nebraska
May 14, 2012

Nebraska
Department of Natural Resources



LEGEND

Registered Wells
- Commercial
- Domestic
- Irrigation
- Public Water Supply (PWS)
- Stock Watering
- Unprotected PWS
- Other Wells

Surface Water
- Irrigation
- Supplemental Irrigation
- Domestic
- Other

Effective Flood Zones
- 1% Annual Flood Chance
- Floodway
- 0.2% Annual Flood Chance
- X Protected by Levee

Other
- Approximate Project Area
- City Boundary
- Roads
- River

N

0 1.5 3 6 Miles

From: Barnum, Sandra V NWO
To: Wallace, A Luke NWO
Cc: Bentzinger, Ruth E NWO
Subject: RE: cultural clearance for NE-SH ESH vege removal projects (UNCLASSIFIED)
Date: Monday, September 17, 2012 2:46:32 PM

Classification: UNCLASSIFIED
Caveats: NONE

Hi
I have reviewed the information provided for the proposed vegetation removal at for sandbars at River Miles 880.0-845, 845.0-828.0, and 811.1-753.0. A September 17, 2012 cultural resources files search revealed no recorded sites within the APE. As the project will involve little or no ground disturbance in in an area of accreted sediment, I believe that the project as described will have No Potential to Affect Historic Properties. Recommend project approval.

Should the scope of this work change in any way, please contact this office for further review.

Thanks,
Sandy

-----Original Message-----
From: Wallace, A Luke NWO
Sent: Friday, September 14, 2012 12:46 PM
To: Barnum, Sandra V NWO
Cc: Bentzinger, Ruth E NWO
Subject: FW: cultural clearance for NE-SH ESH vege removal projects (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Sandy,

I added the following text to the affected environment and environmental consequences sections of the subject EA. Please let me know if these will work. They need to start spraying the sandbars next week. I do know that they found the hull of the steamboat North Alabama on the 59-mile segment of the MNRR in the middle of the channel during a low water period. However our proposed activities would occur on top of sandbars and there would be very little disturbance of the soil surface.

Affected Environment section:

In addition to review under NEPA, consideration of impacts to cultural resources is mandated under Section 106 of the National Historic Preservation Act (NHPA) as implemented by 36 CFR Part 800. Section 106 requires consideration of certain cultural resources (historic and archaeological) that meet specific criteria. Requirements include the need to identify significant historic properties that may be impacted by the proposed action or alternatives within the Area of Potential Affect (APE). The APE is the geographic area within which an undertaking may directly or indirectly cause changes in the character or use of historic properties. Historic properties are defined as archaeological sites, standing structures, or other historic resources listed in or determined eligible for listing in the National Register of Historic Places (NRHP) (36 CFR 60.4).

A Corps archeologist reviewed the sandbar locations within the proposed project area. A literature and cultural resources file search revealed no recorded historic properties or shipwrecks within the area of the proposed work sites.

Environmental Consequences section:

A review of the proposed project area and project activities conducted by a Corps Cultural Resource Specialist determined that no affects to cultural resources are expected as the work will be limited to spraying and vegetation removal with only shallow surface disturbance as a result of disking or raking. Staging areas will be limited to existing river or lake access points. In addition, the sediments in the channel have been primarily deposited in recent times. It is therefore highly unlikely that any cultural resources will be unearthed during the proposed activities, and the Corps believes that the proposed work will have No Potential to Affect Historic Properties.

Thanks,

Luke Wallace
Biologist
USACE, Omaha District
Environmental Resources and MRRP Plan Formulation
phone: [redacted]
Fax: [redacted]

-----Original Message-----
From: Bentzinger, Ruth E NWO
Sent: Friday, September 14, 2012 7:35 AM
To: Barnum, Sandra V NWO
Cc: Wallace, A Luke NWO
Subject: cultural clearance for NE-SH ESH vege removal projects (UNCLASSIFIED)

Classification: UNCLASSIFIED
Caveats: NONE

Good morning Sandy,
We are finishing up the draft EA for the NE-SD vegetation removal/control projects. The attached email includes the river segment and river miles that we are in need of cultural clearance on.

We would like to include some type of correspondence showing that cultural resources would not be adversely impacted by these projects.

There will be no contouring or dredging of sand. Project activities are mainly spraying the existing vegetation, although mowing/raking/disking may be done to remove vegetation off the sandbars.

Please let me know if you need additional information. Thank you. ~Ruth

Ruth Bentzinger
U.S. Army Corps of Engineers
Omaha District
[redacted]

Classification: UNCLASSIFIED
Caveats: NONE

Classification: UNCLASSIFIED

From: Carol_Aron@fws.gov
To: Bentzinger, Ruth E NWO
Cc: [redacted]
Subject: RE: ND ESH and NE-SD ESH proposed vegetation removal activities
Date: Friday, June 29, 2012 3:44:55 PM

Ruth,
We don't have any specific comments at this time, but we would like to remind you of the need to ensure compliance with other federal laws (in particular the Migratory Bird Treaty Act and the Bald & Golden Eagle Protection Act).

Thanks for the opportunity to comment.

Carol Aron
U.S. Fish and Wildlife Biologist
3425 Miriam Avenue
Bismarck, ND 58501
Telephone: [redacted]
Fax: [redacted]
E-mail: [redacted]

"Anyone can love a mountain, but it takes a soul to love the prairie."
- Variously attributed
Inactive hide details for "Bentzinger, Ruth E NWO" [redacted] "Bentzinger, Ruth E NWO" [redacted]

"Bentzinger, Ruth E NWO" [redacted]

06/27/2012 11:02 AM

To

[redacted]

cc

Subject

RE: ND ESH and NE-SD ESH proposed vegetation removal activities

Carol -
The draft EAs are not available yet. I have attached the scoping letters for both North Dakota and for Nebraska-South Dakota.

-----Original Message-----
From: [redacted]
Sent: Wednesday, June 27, 2012 10:28 AM
To: Bentzinger, Ruth E NWO

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS, OMAHA DISTRICT
1616 CAPITOL AVENUE
OMAHA NE 68102-4901

Planning, Programs, and Proj

Mr. Steven Pirner
South Dakota Department of Environment and Natural Resources
523 East Capitol Avenue
Pierre, South Dakota 57501

Dear Mr. Pirner:

The U.S. Army Corps of Engineers, Omaha District (Corps) is in the process of planning and evaluating projects to maintain and restore Emergent Sandbar Habitat (ESH) complexes within the Missouri River in South Dakota as a part of the Corps' ESH Program for Fiscal Years 2012 - 2017. ESH is nesting habitat for interior least terns (*Sternula antillarum athalassos*) and piping plovers (*Charadrius melodus)* and restoration of this habitat is recommended by Reasonable and Prudent Alternative Element IV. B. of the U.S. Fish and Wildlife Service's (USFWS) 2003 Amendment to the 2000 Biological Opinion on the Operation of the Missouri River Main Stem Reservoir System, Operation and Maintenance of the Missouri River Bank Stabilization and Navigation Project and Operation of the Kansas River Reservoir System (BiOp). The Missouri River experienced a significant high water event during 2011 resulting in record discharges on the Missouri River Main Stem System. It is estimated that the high releases resulted in the creation of more than 10,000 acres of ESH below the main stem dams. As a result, the focus of the ESH Program has shifted towards maintaining as much of the ESH created in 2011 as possible over the next several years. The Corps is currently seeking input on the scope of issues to be addressed in an Environmental Assessment (EA) regarding vegetation removal and maintenance projects at existing ESH complexes along the reaches described below (river miles (RM) are approximate).

Fort Randall (below Fort Randall Dam, RM 878.5 to Niobrara River, RM 845.0)
Lewis and Clark Lake, (Niobrara River Confluence, RM 845.0 to Gavins Point Dam, RM 811.0)
Gavins Point (below Gavins Point Dam, RM 810.0 to Ponca, NE, RM 752.5)

The Missouri River, from Fort Randall Dam to the headwaters of Lewis and Clark Lake and from Gavins Point Dam to Ponca, Nebraska are designated as part of the Missouri National Recreational River (MNRR). All projects planned for 2012-2017, which include projects that may require maintenance over the next several years, would consist of removing vegetation from existing sandbars between RM 878.5 to RM 752.5, encompassing the Fort Randall, Lewis and Clark Lake, and Gavins Point segments. The proposed project area is situated along the boundaries of Gregory / Charles Mix, Bon Homme, Yankton, Clay, and Union Counties in South Dakota. Sandbars will be selected based on several criteria including location within the river channel, width of the river channel, existence of residual vegetation, sandbar acreage, and landowner issues.

A Record of Decision (ROD) was issued in August 2011 for the Final Programmatic Environmental Impact Statement (PEIS) for the Mechanical Creation and Maintenance of Emergent Sandbar Habitat in the Riverine Segments of the Upper Missouri River. As authorized by the Council of Environmental Quality (CEQ) regulations contained in 40 CFR 1502.20 and 40 CFR 1502.28, and as outlined in Sections 1.4 and 1.5 of the PEIS, the EA will tier from the PEIS but will focus on site-specific issues and potential environmental effects of the proposed actions being considered.

The vegetation removal and vegetation control activities proposed for sandbars within the Fort Randall, Lewis & Clark, and Gavins Point segments are consistent with the PEIS as described in Section 6.3, Vegetation Removal Methods.

The PEIS analyzed the potential environmental consequences of implementing the ESH program on the Missouri River and evaluated a range of alternatives for creating the appropriate quantity of acres required in the BiOp. The Selected Plan (Alternative 3.5), as identified in the ROD, is an Adaptive Management Implementation Process (AMIP) with a construction ceiling of 4,370 acres, which allows for progressive implementation of larger acreage amounts of habitat until the desired biological response is attained and sustained. Alternative 3.5, as outlined in the PEIS, identified ESH acreage goals for each of the following river segments as identified in the BiOp:

Riverine Segment	River Miles	ESH per river mile (acres)	Total ESH (acres)
Fort Randall River	880.0-845.0	6.1	212
Lewis & Clark Lake (headwaters)	845.0-828.0	20.8	354
Gavins Point River	811.1-753.0	32.9	1,912

Vegetation removal and maintenance activities would entail the use of herbicides as a pre-emergent (before seed germination) and/or post-emergent (on leafed-out vegetation). Application methods could include the use of a helicopter, all terrain vehicle with boom, or a backpack sprayer. Spraying would follow Best Management Practices and standard environmental protection specifications for safe handling of chemicals. Only aquatically approved chemicals would be used and in quantities deemed safe by the EPA.

Vegetation treatment and removal on existing sandbars within the project area is proposed for late summer 2012. Time constraints (i.e., birds returning in April) will preclude spraying spring 2012; however, in future years it is possible spring spraying will be necessary. Late summer spray treatments will consist of spraying with approved pre- and post-emergent herbicides, disking, mowing, and/or removing vegetation from the sandbars. Expansion of the existing footprints of the bars will not occur. Effective implementation strategies and lessons learned from the 2009 Corps report: *Evaluation of Vegetation Removal and Control Methods to Create Emergent Sandbar Habitat on the Upper Missouri River* will be utilized to determine vegetation removal methodology. The 2009 Corps report is available upon request.

All sandbars proposed for vegetation removal and control will be described and evaluated in a forthcoming EA. Currently, the Corps is assessing the scope of the issues to be addressed within this document. We ask that you provide us with information on ongoing projects in the area, any applicable permitting requirements, information on other state or federally listed species in the area, other sensitive resources that may be impacted by these projects and any other comments you may have on these projects by 30 days from receipt of this letter. Comments, questions and information should be addressed to:

U.S. Army Corps of Engineers
Ruth Bentzinger
CENWO-PM-AC
1616 Capitol Avenue
Omaha, Nebraska 68102
Phone: [redacted]
Fax: [redacted]
Email: [redacted]

Thank you in advance for your considerations.

Sincerely,

Randal P. Sellers
Acting Chief, Environmental Resources and Missouri River Recovery Program Plan Formulation Section

US Army Corps of Engineers
BUILDING STRONG®

Corps seeks public comment on Draft Environmental Assessment, Restoration of Emergent Sandbar Habitat Complexes in the Missouri River, Nebraska and South Dakota

Posted 3/4/2013

Release no. 20130305-001

Contact
Maggie Oldham 402-995-2416
margaret.e.oldham@usace.army.mil

Related Content

Related Link Draft Environmental Documents

OMAHA, Neb. – A draft environmental assessment (EA) for the restoration of emergent sandbar habitat complexes in the Missouri River (Nebraska and South Dakota) is currently available for public review. The draft EA evaluates the environmental impacts of removing and preventing vegetation on emergent sandbar habitat located within the Fort Randall, Lewis and Clark Lake and Gavins Point reaches of the Missouri River between river mile 878.3 and 752.7.

This EA is consistent with the National Environmental Policy Act of 1969 (NEPA), as amended, 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 Engineering Regulation 200-2-2) and other applicable environmental laws and regulations.

BACKGROUND: In 2000, the U.S. Fish and Wildlife Service issued a Biological Opinion (BiOp) in which the agency found the Corps' operations on the Missouri River would not likely jeopardize endangered interior least tern and threatened piping plover populations if certain recommendations set forth in the BiOp were implemented. One of those recommendations is to restore emergent sandbar habitat as nesting habitat for these two species. In accordance with this recommendation, the Corps is proposing to begin vegetation control and removal activities on selected sandbars in 2013 and continue each spring and/or fall, as needed, until the fall of 2017 through the use of aerial and/or ground-based spraying of pre-emergent and/or post-emergent herbicide and mowing.

The public is encouraged to provide comments on the draft environmental assessment during the open comment period from March 5, 2013 to April 5, 2013. The draft environmental assessment is available for viewing at: http://www.nwo.usace.army.mil/Missions/CivilWorks/Planning/EnvironmentalPlanning/DraftDocuments.aspx. Comments can be mailed to: U.S. Army Corps of Engineers, Omaha District; CENWO-PM-AC; ATTN: Restoration of ESH Complexes in the Missouri River EA; 1616 Capitol Avenue; Omaha, NE 68102-4901. Comments can also be emailed to: cenwo-planning@usace.army.mil. Comments must be postmarked or received no later than April 5, 2013.