

4.8 FEDERALLY LISTED SPECIES

4.8.1 Introduction

This section describes the potential impacts of the Proposed Action and the alternatives on species federally listed as threatened or endangered, and their habitats in the Action Area. For the purposes of the Section 4.8 analysis, the term “Action Area” includes those portions of the LOMR that would be affected by dredging under the Proposed Action or alternatives. Therefore, the Action Area extends from Rulo, Nebraska to the mouth of the LOMR in St. Louis, Missouri. Federally listed species potentially present in the Action Area include pallid sturgeon, piping plover, interior least tern, Indiana bat, and decurrent false aster.

4.8.2 Assessment Methods

Documented species occurrence in the Action Area, their life history, and habitat needs were considered in relation to the amounts and locations of commercial sand and gravel dredging described for the Proposed Action and alternatives. Project-related impacts are evaluated in terms of the Action Area (opposed to the Project area, as discussed in the other EIS sections) because this section summarizes the biological assessment and assesses the potential Project-related impacts in the context of ESA consultation.

The potential direct and indirect impacts of dredging affecting the reproduction, growth, maturation, movements, and migrations of each species are considered in this section. Impacts that may affect federally listed species include those affecting riverine habitats, water quality, and physical disturbance from dredging. This section also considers impacts described in other resource sections, including water quality, aquatic ecology, and geology and geomorphology, as they relate to federally listed threatened and endangered species. This section does not evaluate the potential impacts of dredging within individual river segments because federally listed threatened and endangered species could occur throughout multiple segments of the Action Area, and the effects of dredging in one segment could affect individuals or populations in other locations within the Action Area.

4.8.3 Potential Impacts

Direct impacts would be limited to the time period during or shortly after dredging activity or sand plant construction. Individual organisms could be affected through injury, mortality, or behavioral modifications arising mostly from physical disturbance. Indirect impacts would include those that affect

habitat quality or quantity and could occur at the local or river-wide spatial scale as a result of geomorphic changes in the LOMR. Indirect impacts could occur in the short term and in the long term.

Impacts associated with some of the alternatives (the No Action Alternative and Alternatives A and B) may result from greater reliance on alternate sources of sand and gravel and could be short term (sand plant construction) or long term (dredging in other rivers). Because the locations of these alternate sources have not been definitively identified, the extent of these potential impacts cannot be quantified. Alternatives that would require greater use of alternate sources would have a greater potential to affect federally listed threatened and endangered species. The number of federally listed threatened or endangered species that would be potentially affected by alternate sources cannot be exhaustively listed because the exact location of alternate sources cannot be definitively determined. Some alternate sources would potentially affect species that also could be affected by dredging in the Action Area, while for other sources there would be little overlap of potential species affected. For example, in the *Final Regulatory Report and Environmental Impact Statement – Commercial Dredging Activities on the Kansas River, Kansas* (USACE 1990), the following species were identified within the dredging area at the time of EIS preparation: peregrine falcon (*Falco peregrinus*), least tern, piping plover, Eskimo curlew (*Numenius borealis*), Mead's milkweed (*Asclepias meadii*), and western prairie fringed orchid. Alternate sources would have the potential to affect these, and other, species with different listings depending on the alternate source type, location, habitats affected, and species abundance. Open-pit floodplain and upland mining would be more likely to affect terrestrial species, while alternate river dredging and instream mining would be more likely to affect waterbird, floodplain, and aquatic threatened or endangered species.

The potential for impacts to federally listed threatened or endangered species from alternate sources would be greatest under the No Action Alternative, followed by Alternative A and then Alternative B. No impacts to threatened or endangered species from the use of alternate sources would occur under the Proposed Action or Alternative C.

Special conditions and dredge exclusion zones would be in effect in permits, as described in Chapter 2, such as excluding dredging in some areas. Other restrictions and controls in dredging permits would prevent or minimize the potential for some negative impacts, for example to potential spawning habitat to protect pallid sturgeon.

As discussed in Section 3.10, in correspondence dated February 10, 2010, the USFWS identified piping plover, interior least tern, pallid sturgeon, and Indiana bat as potentially occurring within or near

the LOMR (Ledwin pers. comm. [a]). Follow-up telephone correspondence with the USFWS indicated that the decurrent false aster could potentially occur in the LOMR floodplain in St. Charles County, Missouri (Ledwin pers. comm. [b]). Below is a discussion of the individual species that have been identified by the USFWS as potentially occurring within the Action Area and the potential impacts associated with the Proposed Action and the alternatives.

4.8.3.1 Pallid Sturgeon

The pallid sturgeon is found in the LOMR throughout the Action Area and uses various river segments for different life stages. Several entities (e.g., MDC and USFWS) stock hatchery-reared pallid sturgeon in the Action Area. These hatchery fish have been captured in several locations during population assessment sampling efforts. These fish have been documented spawning in the LOMR, indicating the survival and growth to reproductive maturity of hatchery fish (Delonay et al. 2009). Sampling of two segments of the LOMR was conducted in 2008 between the Platte River, Nebraska and Big Sioux River, Iowa; and Osage River, Missouri, upstream to the Grand River, Missouri (Delonay et al 2009). Of the 218 pallid sturgeon captured, 190 were hatchery-origin fish, and 28 were wild fish. Pallid sturgeon Population Assessment Project data from 2005 through 2009 are illustrated in Figure 4.8-1.

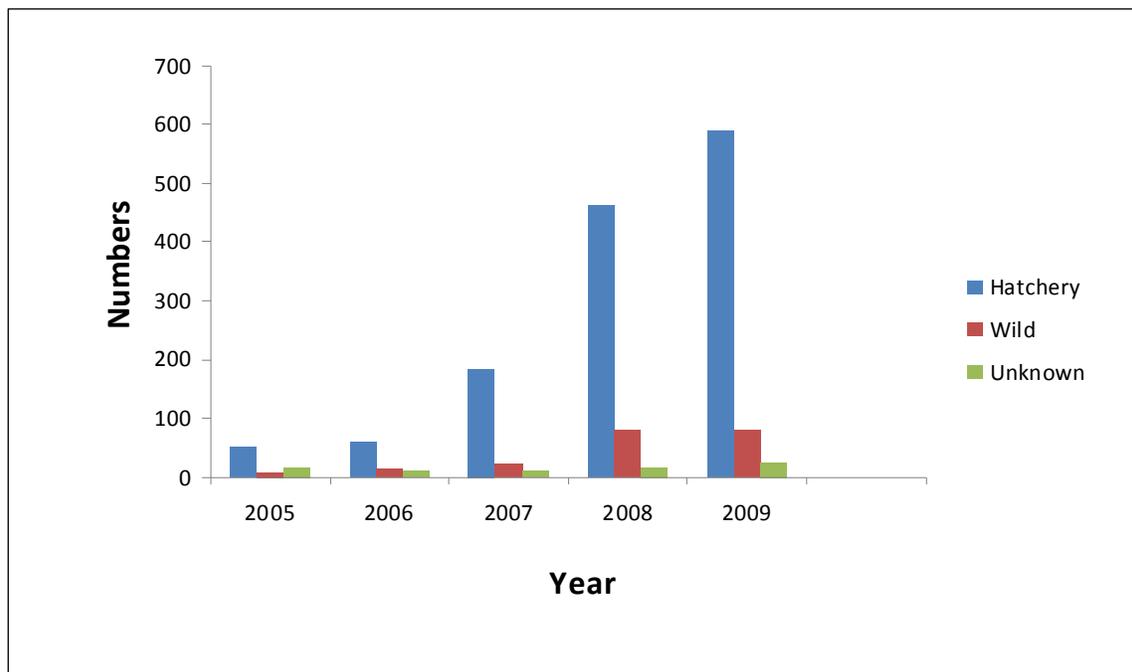


Figure 4.8-1 Pallid Sturgeon sampled by the Population Assessment Project (2005–2009)

Source: Covington pers. comm.

Direct and indirect effects on pallid sturgeon and their habitats would be similar to those described for aquatic resources (Section 4.6). Potential Project-related impacts to pallid sturgeon would include a negligible quantity of coarse substrate spawning habitat that may be subject to dredging, mortality through entrainment (incidental trapping of fish and other aquatic organisms in the dredge suction field or by the dredging vessel propeller), and alterations of shallow-water habitat.

Dredging may result in changes to benthic substrate at and downstream of dredging sites and potentially throughout the Action Area. Laustrup et al. (2007) surveyed the LOMR during low water conditions to identify and map coarse substrate deposits and bedrock exposures. These particular areas would likely serve as sturgeon and other coarse aggregate spawner habitat. A GIS coverage of the locations of aggregate areas was overlaid with the dredge areas (assuming that future dredging under all alternatives [except the No Action Alternative] would occur in similar locations) to estimate the quantity of dredging that would occur in areas containing potential spawning habitat. Approximately 219 acres of aggregate were identified within the Action Area. Of this quantity, a small amount (approximately 0.4 percent [0.8 acre]) of potential spawning habitat was found to be potentially subject to dredging. This would represent a small quantity of the mapped aggregate habitat in the Action Area.

Alterations of benthic substrate may diversify local benthic habitats. As discussed in Section 4.2, as dredging removes sand and gravel, coarser-grained material is returned to the LOMR river bed. Depending on the type of dredge, coarse material is deposited on the river bed below the dredge or to the side of the dredge. As a result, rows of coarse material can form on the river bottom as the dredge moves up and down the river. Bed sediment also can become coarser below dredging operations as finer material is picked up by the river to replenish what was deposited in the dredging depression (Kondolf 1997). These effects are relatively local, tend to accumulate in areas with the most dredging (Simons, Li, and Associates 1985), and may result in a localized alteration of benthic habitat used by pallid sturgeon. While changes to benthic sediment and the associated pallid sturgeon habitat may result from dredging in the Action Area, data have not been collected in the Action Area to definitively characterize the dispersal patterns of coarse-grained sediment after dredging or how it may be used by pallid sturgeon.

For the portion of the LOMR between the Platte River, Nebraska and its confluence with the Mississippi River, the USFWS stated that larval and juvenile pallid sturgeon abundance is limited by the quantity of shallow-water habitat that provides rearing and refugia habitat for this life stage (USFWS 2003). Under the Proposed Action and some of the alternatives, portions of the Action Area would undergo river bed degradation in some to all river segments, which could lead to the alteration of shallow-water habitat

abundance and connectivity in both the short term and the long term. The effect of river bed degradation on shallow-water habitat abundance would vary depending on multiple site-specific conditions, such as the existing depth distribution and river flows. Under certain flow conditions, river bed degradation could increase the amount of shallow-water habitat by lowering the depth of water and velocity in dike fields. A more detailed assessment of the potential Project-related effects to shallow-water habitat is found in Section 4.6.

The importance of tributaries of the LOMR to pallid sturgeon is largely unknown. Tagged wild pallid sturgeon have been found to move short distances up some tributaries, which suggests that pallid sturgeon use tributaries opportunistically for feeding when conditions allow (DeLonay et al. 2009). As described in Section 4.2, river bed degradation under the Proposed Action and Alternatives B and C may contribute to increased tributary headcutting and altered surface water elevations. These geomorphic changes may result in decreased tributary habitat connectivity through tributary headcutting (as described in Section 4.2), which could slightly reduce tributary availability for pallid sturgeon feeding.

Increased injury or mortality to pallid sturgeon eggs, larvae, or juveniles through entrainment could occur at and near the dredge suction field and from dredging-related tugboat propellers. Section 4.6 contains a detailed analysis of potential dredging-related entrainment. Limited information is available regarding the rate of pallid sturgeon entrainment in the Action Area and throughout the species' range. The USACE has conducted dredging entrainment susceptibility studies of sturgeon and paddlefish species (Hoover et al. 2005). Intake water velocity, and the organism's susceptibility to entrainment in the intake water flow, is the primary determinant for entrainment, but there are other secondary variables affecting swimming behavior and performance that could influence and determine entrainment rates (Boyson and Hoover 2009). Researchers found that the rate of sturgeon entrainment at dredge heads would be determined, in part, by the organism's location relative to the dredge in the water column, their swim speed ability, and if the species readily swims against the current (rheotaxis) (Hoover et al. 2005). While these factors are important to determining entrainment levels, other factors such as the species' response to noise and turbidity, and its localized abundance and distribution, also would affect entrainment rates (Hoover et al. 2005).

Ship propellers cause abrupt changes in hydraulic patterns due to increased turbulence and water velocities, pressure changes, and shear forces (Maynard 1990; Hyun and Patel 1991). Ship propellers may also injure or kill pallid sturgeon eggs or larvae if they come in contact with the blades (Gutreuter et al 2003). Cada (1990) reported that fish eggs and larvae that pass through water currents induced

by a propeller may come in contact with the blade and can experience stresses from pressure changes and shear forces. The extent of pallid sturgeon mortality would be a function of the amount of tow traffic in a given area and the distribution pallid sturgeon eggs and larvae within the Action Area.

There is uncertainty about the population-level effects of entrainment because of the uncertainty of egg, benthic juvenile, and drift larvae mortality that may occur naturally or due to entrainment. Under the alternatives that would include dredging (the Proposed Action and Alternatives A, B, and C), entrainment could occur if pallid sturgeon are present within the dredge suction field or eggs or larvae are present in the propeller inflow zone. The Action Area, depending on river stage, contains approximately 75,517 acres of total river area (as determined through GIS analysis). Approximately 17,506 acres of the Action Area currently undergoes dredging. Using the assumption that future dredging under all alternatives (except the No Action Alternative) would occur in similar locations, approximately 23 percent of the total Action Area could be subject to dredging.

A localized increased suspended sediment plume downstream of the dredge would be expected under the Proposed Action and the dredging alternatives, but the rate at which these local plumes occur would vary by alternative. As discussed in Section 3.7, the USGS estimates that suspended sediment levels in the LOMR have decreased approximately 70–80 percent compared to pre-impoundment conditions (Blevins 2006). Pallid sturgeon are tolerant of highly turbid environments and use turbidity as a cover habitat element. Decreased turbidity may have increased predation risk to small sturgeons that have historically used elevated turbidity as cover from sight-feeding piscivorous fishes (DeLonay et al. 2009). Because elevated suspended sediment plumes would extend only a short distance downstream of dredging activities, dredging could result in a slight temporary beneficial increase in cover habitat to pallid sturgeon that are located downstream of dredging activities. Localized areas with a slight increase in potential cover habitat would occur under all of the alternatives that contain dredging.

Sand plant construction under the Proposed Action and Alternatives A, B, and C would require land-clearing activities during construction, which could result in overland runoff or erosion from uncontained storm water. A bedrock patch located on an outside meander bend is located approximately one mile downstream of The Master's Dredging Company proposed sand plant at Waldron. Pallid sturgeon using potential spawning habitat there may be exposed to elevated suspended sediment from storm water runoff during construction. These facilities would likely require NPDES storm water permitting that would minimize the potential introduction of suspended sediment and contaminants to the LOMR. Further, due to the distance downstream of this habitat from the proposed sand plant facility,

suspended sediment levels are anticipated to return to background levels and not result in a significant impact to spawning habitat. Sensitive pallid sturgeon habitat was not identified downstream of the Edward N. Rau Contractor Company sand plant.

Alternate Sources

Upland and floodplain open-pit mining sources are not expected to substantially affect pallid sturgeon or their habitat. Uncontrolled storm water runoff could result in the introduction of contaminants to adjacent water bodies that may contain pallid sturgeon habitat, affecting pallid sturgeon or their habitat, although these impacts are expected to be minor.

Instream dredging in the Kansas and Mississippi Rivers has the potential to affect pallid sturgeon. Between 1952 and 2007, no captures of pallid sturgeon were recorded in the Kansas River (Niswonger et al. 2009). Since 2007, five hatchery-stocked pallid sturgeon have been captured near the mouth of the Kansas River between RM 5.8 and 14.3; therefore, dredging in the Kansas River could affect pallid sturgeon. The current Kansas River dredging permits limit the amount of sand that can be extracted from each reach of the river and limits river bed degradation in any 10-mile reach to no more than 2 feet from the baseline established when the EIS was completed (1990). Some reaches of the Kansas River already have been closed to dredging because degradation has surpassed 2 feet. Some of the tonnage authorized to be extracted from the remaining reaches of the river has not been extracted and could be extracted to make up for any decreased dredging in the Missouri River. However, increased dredging of sand and gravel from the Kansas River could result in river bed degradation beyond the 2-foot limit and would result in termination of dredging in those degraded reaches. Increasing the dredging or degradation limits in the Kansas River dredging permits would require a new EIS and consultation with the USFWS regarding potential impacts to federally listed threatened and endangered species, including the pallid sturgeon.

Potential impacts to pallid sturgeon from dredging in the Mississippi River could include entrainment and alteration of habitat. Dredging beyond the limits currently permitted by the USACE also would require separate consultation with the USFWS to minimize any impacts to pallid sturgeon. Based on consultation with the USFWS, the USACE permit conditions could include avoidance, minimization, and mitigation measures—such as restricted dredging locations or timing restrictions.

Instream mining in smaller rivers in Kansas or Missouri is not expected to affect the pallid sturgeon because this species occurs in large, turbid, free-flowing riverine habitats.

4.8.3.2 Piping Plover

Due to impoundment and channelization, virtually no piping plover nesting habitat is located in the Action Area (USFWS 2003). No portion of the LOMR in the Action Area has been designated as critical piping plover habitat (USFWS 2002). Piping plovers are a transient species that rarely occur in Missouri during migration between wintering grounds and breeding areas (The Audubon Society of Missouri 2009). Migration habitat use is poorly understood, but plovers likely use inland and coastal stopover sites when completing this migration (USFWS 2008). The importance of the Missouri River as migration habitat is unknown (USFWS 2003). Typically, piping plover migration between wintering and nesting habitats peak in spring and fall (USFWS 2008).

Due to the lack of suitable nesting habitat, the rare occurrence of this species during migration, and the lack of critical habitat in the Action Area, dredging under the Proposed Action or any of the alternatives is not likely to affect piping plover populations or their nesting habitat.

Alternate Sources

The Kansas River floodplain provides nesting habitat for breeding pairs of piping plover, and the area has been state listed as critical habitat (KDWP 2004b). As discussed in Section 4.2, river bed degradation can reduce sand bar habitat. The EIS for commercial dredging activities in the Kansas River indicated the occurrence of river bed degradation in the Kansas River (USACE 1990). The current Kansas River dredging permits limit the amount of sand that can be extracted from each reach of the river and limits the degradation in any 10 mile reach to no more than 2 feet from the baseline established when the EIS was completed. Some reaches of the Kansas River have already been closed to dredging because degradation surpassed 2 feet. Some of the tonnage authorized to be extracted from the remaining reaches of the river is not currently extracted and could be extracted to make up for any decreased dredging in the Missouri River. However, increased sand and gravel dredging from the Kansas River could result in river bed degradation beyond the 2 feet limit and would result in the termination of dredging in those degraded reaches and could cause the erosion and elimination of sand bars and the associated piping plover habitat. Increasing the dredging or degradation limits in the Kansas River dredging permits would require a new EIS and consultation with the USFWS regarding potential impacts to federally listed threatened and endangered species, including the piping plover.

Floodplain open-pit mining and instream mining could eliminate sand bar habitat if these facilities were located on sand bars. More often, these activities increase nesting habitat in the floodplains of major

rivers through removal of vegetation to create sand flats that are similar to natural sand bars. Piping plover have been found to use sand pits created during floodplain mining along the Platte River in Nebraska for nesting (Sidle and Kirsch 1993). Typically, these human-made sand flats are used in the portions of the species historical range where natural sand bars are limited or have been eliminated. In areas where natural sand bars are limited, the increase in sand pit mines may alter the piping plover distribution (Sidle and Kirsch 1993). The Nebraska Game and Parks Department (NGPD) (NGPD 2010) reports a low success rate of interior least terns using open-pit mines due to frequent human disturbance and predation. It is anticipated that piping plover using floodplain open-pit mines would experience similar pressures. Due to increased disturbance at these sites, reproductive success is reduced compared to natural sand bars. Overall, the use of alternate floodplain and instream open-pit mines would provide additional nesting habitat, although the new habitat associated with floodplain mining would be of relatively low quality.

4.8.3.3 Interior Least Tern

Small flocks of interior least terns migrate between wintering and nesting habitat through Missouri from late April to mid-May and from August through September (MDC 2010a). Although historical interior least tern breeding habitat was located along the Missouri River (USFWS 1992), a 2005 breeding bird survey (Lott 2006) did not identify any least tern nest sites in Missouri; and no nest sites were observed on the Missouri River south of its confluence with the Lower Platte River in Nebraska. Suitable sand bar nesting habitat has been eliminated in the Action Area because of river channelization (Smith and Renken 1991, USFWS 2003); past channelization projects along the LOMR have resulted in a 97-percent reduction in sand bar areas (Galat et al. 2005).

While interior least tern individuals may occur along the LOMR during migration, nesting has not been found to occur within the Action Area. Historically, the interior least tern nested along the LOMR to St. Louis, Missouri (USACE 2004); therefore, this species may use the LOMR for breeding if suitable nesting habitat was present. Due to the general lack of suitable sand bar nesting habitat currently in the Action Area and the lack of breeding birds in the Action Area, dredging under any of the alternatives is not likely to affect interior least tern populations or their nesting habitat.

Alternate Sources

Impacts to interior least terns from alternate sources would be similar to those described for the piping plover. Least terns have been observed in the Mississippi River floodplain in Missouri (Smith and Renken 1991) and along the Kansas River. In-channel dredging in these rivers could contribute to river

bed degradation, which could lead to the erosion or elimination of sand bar habitat within the floodplains of these rivers. Thus, dredging in other rivers could negatively affect sand bar nesting habitat. Commercial dredging in the Kansas and Mississippi Rivers is already authorized by Department of the Army permits with restrictions limiting the amount of sand that can be dredged, Increasing dredging in these rivers beyond current limits would require separate consultation with the USFWS regarding potential impacts to federally listed threatened and endangered species, including the interior least tern.

Like the piping plover, least terns have been observed nesting at open-pit sand mines in Nebraska along the Platte River (Sidle and Kirsch 1993) and along the Mississippi River in Missouri (Renken and Smith 1991). It is likely that this species would use open-pit sand mines in the floodplains of other major rivers, particularly those rivers where natural floodplain sand bar habitat is limited. As discussed above, reproductive success at floodplain sand pit mines is diminished (NGPD 2010) compared to natural sand bars. Overall, the use of floodplain and instream open-pit mines along major rivers would result in the creation of low-quality interior least tern nesting habitat.

4.8.3.4 Indiana Bat

Indiana bats are permanent residents throughout the Action Area (Natureserve 2009). Between early spring and autumn, Indiana bats migrate to and use summer roosting and foraging areas located in riparian, floodplain, and upland forests (MDC 2010b, USFWS 2007). Because Indiana bats are located in terrestrial areas, this species and their habitat are unlikely to be affected by the quantity of LOMR dredging under the Proposed Action or any of the alternatives.

Between 2007 and 2009, the Missouri population of Indiana bat declined by 14 percent (USFWS 2010a). Current threats to the species include changes in summer habitats from alterations to land cover and the reduction in roosting and foraging forested habitat (MDC 2010b, USFWS 2010b). Construction of The Master's Dredging Company sand plant would affect only cropland, and examination of aerial photos indicate an absence of potential roosting trees at the proposed sand plant locations. Therefore, land-clearing activities for construction of The Master's Dredging Company sand plant is not expected to affect roosting trees. The Edward N. Rau Contractor Company sand plant would be constructed on lands with upland and wetland riparian forest vegetation, which may be appropriate roosting or foraging habitat for the Indiana bat. Because alteration and elimination of forested areas have been found to affect summer habitat for the Indiana bat, elimination of roosting trees could adversely affect Indiana bats. Critical habitat for the Indiana bat has been designated only

in caves that contain winter roosting habitat (USFWS 1976); therefore, neither the Proposed Action nor the alternatives would affect designated critical habitat for the Indiana bat.

Alternate Sources

Instream extraction from alternate sources would not directly affect Indiana bats or their habitat. Similar to the impacts described above, the disturbance of forested riparian, floodplain, or upland habitat through vegetation clearing in support of the expansion or creation of open-pit mines may result in elimination of summer roosting and foraging habitat. The use of alternate sources may result in impacts from vegetation clearing activities that could result in a decrease in summer roosting and foraging habitat.

4.8.3.5 Decurrent False Aster

The distribution of decurrent false aster in the Action Area is restricted to the portion of the Mississippi River floodplain south of the confluence of the Illinois River with the Mississippi River (MDC 2010c, Natureserve 2009). Decurrent false aster has the potential to occur along Missouri River floodplains in St. Charles County, Missouri (St. Charles Segment; MDC 2010c). The primary threat to the decurrent false aster is the loss of suitable wetland habitat (MDC 2010c).

No direct effects to the decurrent false aster from dredging would occur under the Proposed Action or any of the alternatives. Indirect effects to decurrent false aster located in St. Charles County, Missouri could include alteration of wetland habitat due to LOMR river bed degradation and the associated changes in surface water and alluvial aquifer elevations. This could occur only under the Proposed Action and Alternatives B and C. This potential impact would be limited to the small area where the LOMR and Mississippi River floodplains overlap near the confluence of the two rivers. Because the decurrent false aster colonizes margins around previously inundated open water wetlands (MDC 2010c), the effect of lowering of the water elevation in open water wetlands within this small area could allow this species to establish in newly exposed areas. A minor change in groundwater input into wetlands in this area may result in increased establishment opportunities; however, a greater reduction of groundwater input that results in total elimination of wetland habitat (as discussed in Section 4.7) may result in elimination of potential decurrent false aster habitat.

Under the Proposed Action and Alternatives A, B, and C, construction of a new sand plant at the Edward N. Rau Contractor Company property in the St. Charles segment would result in direct effects on up to 15.37 acres of forested wetlands, 4.24 acres of herbaceous-dominated wetlands, and 2.82 acres of open water. Installation of sand plant facilities in these floodplain wetland areas could result in

elimination of decurrent false aster habitat if the species is present near the proposed sand plant facilities.

Because this species has not been identified in the Jefferson City, Waverly, Kansas City, or St. Joseph segments, there would be no direct or indirect impact on the species associated with sand plant construction in these segments.

Alternate Sources

Currently, the decurrent false aster is limited to Illinois and St. Charles County, Missouri (Natureserve 2009, MDC 1997). Use of alternate sources of sand and gravel outside of these areas would not affect this species. Instream dredging in the Mississippi River would not directly affect the decurrent false aster. If increased dredging in the Mississippi River contributed to river bed degradation and decreases in alluvial aquifer levels, wetland habitat for the decurrent false aster could be altered or eliminated. Commercial dredging in the Mississippi River is already authorized by Department of the Army permits with restrictions limiting the amount of sand that can be dredged. Increasing dredging in the Mississippi River beyond current limits would require consultation with the USFWS regarding potential impacts to federally listed threatened and endangered species, including the decurrent false aster.

Floodplain open-pit mining along the Mississippi and Illinois Rivers could result in physical disturbance to this species or its habitat, if the species is present in wetlands at the open-pit mining sites.

4.8.4 Summary of Impacts

Table 4.8-1 provides a summary of the potential impacts to federally listed threatened and endangered species in and near the Action Area.

Table 4.8-1. Summary of Potential Impacts on Federally Listed Species in and near the Action Area

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Pallid sturgeon	<ul style="list-style-type: none"> Localized increase in cover habitat from suspended sediment. Potential entrainment, if pallid sturgeon are present in the dredge suction field. Potential alteration of shallow-water habitat and connectivity in those segments most affected by river bed degradation, removal of sediment load, and decreased low flow surface water elevation 	<ul style="list-style-type: none"> No additional cover habitat from suspended sediment. No potential for entrainment. Increase in or stabilization of shallow-water habitat in the mainstem. Potential entrainment and habitat alteration in the Kansas and Mississippi Rivers from alternate sources. 	<ul style="list-style-type: none"> Localized minor cover habitat from suspended sediment. Potential entrainment, if pallid sturgeon are present in the dredge suction field. Increase in or stabilization of shallow-water habitat in the mainstem in most areas. Potential entrainment and habitat alteration in the Kansas and Mississippi Rivers from alternate sources. 	<ul style="list-style-type: none"> Localized minor cover habitat from suspended sediment. Potential entrainment, if pallid sturgeon are present in the dredge suction field. Potential alteration of shallow-water habitat and connectivity in those segments most affected by river bed degradation, removal of sediment load, and decreased low flow surface water elevation. Potential entrainment and habitat alteration in the Kansas and Mississippi Rivers from alternate sources. 	<ul style="list-style-type: none"> Localized minor cover habitat from suspended sediment. Potential entrainment, if pallid sturgeon are present in the dredge suction field. Potential alteration of shallow-water habitat and connectivity in those segments most affected by river bed degradation, removal of sediment load, and decreased low flow surface water elevations.
Piping plover	<ul style="list-style-type: none"> No impact. 	<ul style="list-style-type: none"> Loss of sand bar habitat where associated with floodplains of alternate sources. Increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> Increased loss of sand bar habitat in floodplains of alternate sources. Minor increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> Increased loss of sandbar habitat in floodplains of alternate sources. Minor increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> No impact.

Table 4.8-1. Summary of Potential Impacts on Federally Listed Species in and near the Action Area

Category of Impact	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Interior least tern	<ul style="list-style-type: none"> No impact. 	<ul style="list-style-type: none"> Loss of sand bar habitat where associated with floodplains of alternate sources. Increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> Increased loss of sand bar habitat in floodplains of alternate sources. Increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> Increased loss of sand bar habitat in floodplains of alternate sources. Minor increase in human-made, low-quality nesting habitat at floodplain open-pit mines. 	<ul style="list-style-type: none"> No impact.
Indiana bat	<ul style="list-style-type: none"> Potential roosting habitat cleared for sand plant construction. 	<ul style="list-style-type: none"> Increased loss of riparian habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential roosting habitat cleared for sand plant construction. Increased loss of riparian habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential roosting habitat cleared for sand plant construction. Increased loss of riparian habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential roosting habitat cleared for sand plant construction.
Decurrent false aster	<ul style="list-style-type: none"> Potential clearing of habitat and individuals as a result of sand plant construction. 	<ul style="list-style-type: none"> Potential loss of riparian and wetland habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential clearing of habitat and individuals as a result of sand plant construction. Increased potential for loss of riparian and wetland habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential clearing of habitat and individuals as a result of sand plant construction. Increased potential for loss of riparian and wetland habitat in floodplains of alternate sources. 	<ul style="list-style-type: none"> Potential clearing of habitat and individuals as a result of sand plant construction.

4.8.5 References

- Blevins, D. 2006. The Response of Suspended Sediment, Turbidity, and Velocity to Historical Alterations of the Missouri River. (U.S. Geological Survey Circular 1301.)
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4.8.5.1 Personal Communications

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