

4.13 CULTURAL RESOURCES

4.13.1 Introduction

Research and consultation identified 128 cultural resources in the Project APE. These resources include 91 shipwrecks, 12 Lewis and Clark campsites, 10 archaeological sites, and 15 bridges. The Historic Trail also passes through the Project area. The majority of cultural resources (112, or 88 percent) have not been relocated or evaluated for inclusion in the NRHP. In terms of location, 113 sites were identified in the main channel of the LOMR, 13 were identified along the banks of tributaries, and two were identified at a proposed sand plant location. Project effects to the 128 NRHP-evaluated and unevaluated sites are discussed below.

4.13.2 Assessment Methods

As outlined in Section 3.16, NEPA and Section 106 of the NHPA processes are being coordinated for this Project. Consistent with Section 106 of the NHPA and for the purposes of this section, the term “effects” is used when considering Project effects on historic properties. The Section 106 process requires that project effects on NRHP-listed or-eligible sites be analyzed and, if necessary, mitigated. For this Project, effects on evaluated and unevaluated sites were preliminarily considered as no field work has been conducted to evaluate the significance of these sites. Potential effects to the 128 sites identified in the APE, which includes the main channel of the LOMR and a perennial tributary buffer of 20 feet wide and 0.25-mile long, were analyzed using the Criteria of Adverse Effect. Refer to Section 3.15.2 for a description of the APE.

4.13.2.1 Criteria of Adverse Effect

The Criteria of Adverse Effect, found in 36 CFR 800.5, were applied in determining effects to historic properties located in the Project APE. An adverse effect takes place when the undertaking alters, directly or indirectly, any of the characteristics of a historic property that qualify that property for inclusion in the NRHP. Adverse effects include, but are not limited to:

- Physical destruction of or damage to all or part of the property;
- Removal of a property from its historic location;
- Change of the character of the property’s use or of physical features within the property’s setting that contribute to its historic significance; and

- Introduction of visual, atmospheric, or audible elements that diminish the integrity of the property's significant historic features.

4.13.2.2 Direct and Indirect Effects Related to Project Activities

Adverse effects to historic properties identified in the APE include those effects that are caused at the same time and location as dredging (direct effect) and reasonably foreseeable effects that may occur later in time or may be later removed in distance (indirect effect). The principal direct adverse effect that could occur because of the Project is the destruction or damage to all or part of a property as a result of dredging. The analysis of direct effects has taken into account a number of restrictions historically placed on dredging operations through special conditions of USACE dredge permits. These conditions include:

- A 500-foot dredging exclusion zone for bridge piers and abutments and other infrastructure (including levees, pipelines, and submerged utility crossings);
- A 200-foot dredging exclusion zone for any other structures built or authorized by the U.S. Government;
- A 100-foot dredging exclusion zone for any normal bank line or island, without special authorization; and,
- A dredging exclusion zone for the shipwreck *Saluda*, which extends from RM 316.4 through RM 317.3, near Lexington, Missouri.
- The permittee must confine dredging to the reaches specified in the permit document. Requests for expansion or relocation of the specified reaches must identify the proposed new limits, in river miles, and the location of the unloading facility to be used. Copies of the relocation requests must be furnished to state and federal agencies, including the MDNR-SHPO and Kansas State Historical Society-SHPO (as applicable) for concurrence prior to approval of the request.

Because of the extensive history of dredging in the main channel of the LOMR, adverse effects to shipwrecks, Lewis and Clark sites, and bridges are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. Expansion of dredging activities to new areas would require further cultural resources consultation as described by the last bullet above. Discovery of unidentified sites located in the main channel could be addressed through USACE permit conditions. Those sites that may be adversely affected by headcutting and erosion that might result from more than slight degradation would need to be evaluated and assessed

under a Programmatic Agreement (PA if dredging operations exceed levels described in the Environmentally Preferred Alternative.

The principal indirect effects of dredging include tributary headcutting and erosion and scouring of the river bed near bridge abutments. These processes may (1) destroy or damage all or part of the property; or (2) expose archaeological resources, thereby, making an entire site or part of a site vulnerable to human disturbance such as looting or vandalism. Because tributary degradation has not been well quantified on the LOMR and each tributary is different with regard to size, degree of modification, length between the main channel and control points, degradation, and other factors, impacts on the geomorphology of each tributary were not analyzed individually. Instead, the geomorphic impact assessment characterizes the likelihood that tributary degradation would increase under an alternative based on the change in low-flow water surface elevations on the mainstem LOMR occurring near the tributary. The geomorphic analysis focused on tributaries in areas with concentrated dredging and river bed degradation under existing conditions, such as the areas around St. Joseph, Kansas City, Jefferson City, and St. Charles (Table 4.2-1). In general, low-flow water surface elevations on the LOMR would need to decrease a moderate (from 2 to 4 feet) or substantial (greater than 4 feet) amount before tributaries would likely be affected (see Section 4.2.3.4). The geomorphic analysis indicates that indirect effects to cultural resources would be most likely to occur in locations where dredging is the most concentrated (see Section 4.2). With the adoption of the Environmentally Preferred Alternative, only slight changes in channel degradation are expected. This would prevent or minimize the direct and indirect effects on cultural resources associated with tributary head cutting.

4.13.3 Proposed Action

Under the Proposed Action, there are no direct effects to cultural resources. Indirect effects to cultural resources would be associated with tributary headcutting, erosion, and scour. If dredging were to continue at previously dredged locations, indirect effects associated with headcutting and erosion would likely occur along tributaries where dredging has been the most concentrated. Refer to Table 4.2-1 for a list of these tributaries. A total of five tributary sites (three archaeological sites in the Jefferson City segment, one shipwreck, and one Lewis and Clark campsite in the St. Charles segment) may be adversely affected under the Proposed Action. Undocumented sites located along tributaries where dredging has been the most concentrated also may be adversely effected. In addition, indirect effects under the Proposed Action would be associated with the proposed development of two sand plants. Two archaeological sites that are located in the St. Joseph segment may be adversely affected by sand

plant construction and operation. Adverse effects may occur to undocumented or unidentified sites at potential sand plant locations.

4.13.3.1 St. Joseph Segment

Table 4.13-1 outlines the potential effects under the Proposed Action to the 21 known cultural resources in the St. Joseph segment and identifies mitigation measures that are in place or could be developed. No direct effects to sites have been identified. Indirect effects may occur at two sites that are located at potential sand plants locations and at undocumented sites located along two perennial tributaries.

Direct Effects

NRHP-eligible properties in the St. Joseph segment include three bridges. The Rulo Bridge, Leavenworth Bridge, and the Atchison Bridge are protected by dredging exclusion zones that have been established for all bridges along the LOMR. Therefore, there is no potential for direct effects to the NRHP-eligible bridges under the Proposed Action.

No direct effects would occur to the 16 unevaluated shipwrecks or the Lewis and Clark campsites identified in the main channel of the LOMR. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks and the Lewis and Clark sites are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the St. Joseph segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that bed degradation of the LOMR would continue in the St. Joseph segment because of dredging under the Proposed Action. Therefore, scour attributable to dredging has the potential to adversely affect the Rulo Bridge, Leavenworth Bridge, and Atchison Bridge. The NDOR, MoDOT, and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the two bridges such that scour would not adversely affect the Rulo Bridge or Atchison Bridge under the Proposed Action.

Table 4.13-1 Effects to Cultural Resources in the St. Joseph Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Bridge	Rulo	MC	Listed	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (NDOR Bridge Inspection Program – effect minimization)
Shipwreck	<i>Bertha</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Emilie No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Denver City</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dorothy</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mt. Sterling</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Pathfinder</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri Mail</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Della</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Atchison	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Arabian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hesperian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Platte Valley</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tom Morgan</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Minnie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Express</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Leavenworth	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Archaeological site	PL110	SP	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	PL341	SP	Unevaluated	N/A	No further work if avoided. No adverse effect

Notes:

NDOR = Nebraska Department of Roads.

N/A = Not applicable.

NRHP = National Register of Historic Places.

^a Location: MC = Main channel; SP = Proposed sand plant location.

Geomorphic analysis also indicates that tributary degradation would likely increase in areas of concentrated dredging in the St. Joseph segment under the Proposed Action. While no cultural resources were identified within the perennial tributary buffer, unidentified sites may exist and may be adversely affected by headcutting and erosion as a result of the Proposed Action. If dredging continues at previously dredged locations, undocumented cultural resources located along two perennial tributaries (Mace Creek and an unnamed tributary at RM 450.1) may be adversely affected. Destruction or disturbance of these historic properties would constitute an adverse effect.

Under the Proposed Action, one sand plant and associated infrastructure, which may encompass up to 60 acres, would be constructed at one of two locations along the river in the St. Joseph segment. Sand plant and pipeline construction has the potential to affect two unevaluated archaeological sites (PL341 and PL110). Previously unidentified prehistoric or historic archaeological sites also may exist at the proposed sand plant sites. The potential destruction or disturbance of such resources would constitute an adverse effect. .

4.13.3.2 Kansas City Segment

Table 4.13-2 outlines the potential effects under the Proposed Action to 12 known cultural resources in the Kansas City segment and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table; however, indirect effects to undocumented sites located along 11 perennial tributaries are possible in the Kansas City segment.

Direct Effects

Six NRHP-eligible bridges are located in the Kansas City segment. Because dredging exclusion zones have been established for all bridges along the LOMR, there is no potential for direct effects to these properties under the Proposed Action.

No adverse direct effects would occur to the five unevaluated shipwrecks identified in the main channel of the LOMR. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Kansas City segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Table 4.13-2 Effects to Cultural Resources in the Kansas City Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	PL288	T	Not eligible	N/A	No adverse effect
Bridge	Fairfax	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Fairfax (1955)	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Broadway	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Fire Canoe</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bennett</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mike Bauer</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Armour-Swift- Burlington (ASB) Railroad Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Maintenance Division – effect minimization)
Shipwreck	<i>Glenmore</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Paseo	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Liberty Bend	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Corvette</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

- BNSF = Burlington Northern Santa Fe Railway Company.
- MoDOT = Missouri Department of Transportation.
- N/A = Not applicable.
- NRHP = National Register of Historic Places.
- USACE = U.S. Army Corps of Engineers.

^a Location: main channel (MC), tributary (T).

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Kansas City segment would likely continue under the Proposed Action. Therefore, scour has the potential to adversely affect the six historic bridges. The MoDOT and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the historic properties such that scour would not adversely affect the bridges under the Proposed Action.

Archaeological site PL288 was found ineligible for listing in the NRHP based on survey and evaluation. Since this site is not eligible for listing in the NRHP, no adverse effects to this site would result from the Proposed Action.

Geomorphic analysis also indicates that tributary degradation is likely to increase in the Kansas City segment under the Proposed Action. While no cultural resources were identified within the perennial tributary buffer, unidentified sites may exist and may be adversely affected by headcutting and erosion under the Proposed Action. If dredging continues at previously dredged locations, any unanticipated site located along 11 perennial tributaries (refer to Table 4.2-1) may be adversely affected. Destruction or disturbance of these cultural resources would constitute an adverse effect.

4.13.3.3 Waverly Segment

Table 4.13-3 outlines the potential effects under the Proposed Action to 15 known cultural resources in the Waverly segment and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table, and no indirect effects are anticipated for undocumented sites along tributaries in this segment.

Direct Effects

There are no NRHP-eligible sites in the Waverly segment. One shipwreck, the *Saluda*, is protected by a no-dredge zone that was established in previous USACE permits; therefore, no direct effects would result to this resource under the Proposed Action. No adverse direct effects would occur to the other unevaluated shipwrecks identified in this segment. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Waverly segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

No cultural resources were identified along perennial tributaries in the Waverly segment. Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the Waverly segment under the Proposed Action. Therefore, indirect effects to undocumented sites along tributaries in this segment are not anticipated.

Table 4.13-3 Effects to Cultural Resources in the Waverly Segment under the Proposed Action

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Wakendah</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Saluda</i>	MC	Unevaluated	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Shipwreck	<i>Nymph</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Zephyr</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Princess</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Leavenworth</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ariel</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Roy Lynds</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Eagle</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tropic</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Golong</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Govener Allen</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>T.T. Hilman</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel.

4.13.3.4 Jefferson City Segment

Table 4.13-4 outlines the potential effects under the Proposed Action to 29 known cultural resources in the Jefferson City segment. The table includes information about mitigation measures that are in place or could be developed. There are no direct effects to the sites identified in the table. Under the

Proposed Action, indirect effects may occur to three archaeological sites and unidentified sites along six perennial tributaries in the Jefferson City segment.

Direct Effects

NRHP-eligible sites in the Jefferson City segment include two bridges and one shipwreck. Dredging exclusion zones have been established for all bridges along the LOMR. Therefore, the two NRHP-eligible bridges would not be directly affected under the Proposed Action. The *Radnor* (23CP320), which is located along the banks of the LOMR in a water fluctuation zone, was determined to be eligible for listing in the NRHP. A 100-foot dredging exclusion zone has been established in the USACE dredge permits for any normal bank line. Therefore, the Proposed Action would not directly affect this site.

No direct effects would occur to the 18 unevaluated shipwrecks identified in the Jefferson City segment. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historical dredging locations which appear likely to impact eligible sites, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2..

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Jefferson City segment would continue under the Proposed Action in areas of concentrated dredging. Although scour has the potential to adversely affect the Rocheport Bridge and Jefferson City Bridge, the MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize indirect effects from the Proposed Action to this historic property such that no adverse effects would result.

Tributary degradation is likely to increase around the Jefferson City portion of the segment under the Proposed Action. If historic dredging areas are maintained, only six perennial tributaries in this segment are at increased risk of degradation (see Table 4.2-1). Because three archaeological sites (MU134/MU135, B01000, and BO1100), the shipwreck *Little Dick*, and one Lewis and Clark campsite are not located along tributaries that are predicted to degrade, these resources would not be adversely affected by the Proposed Action. The three archaeological sites (CO28, CO52, and CO108) that are located along tributaries near Jefferson City may be affected by headcutting and erosion attributable to dredging. In addition, unidentified archaeological sites located along the six perennial tributaries

located near Jefferson City could be adversely affected by these conditions under the Proposed Action. Destruction or disturbance of these historic properties would constitute an adverse effect.

Table 4.13-4 Effects to Cultural Resources in the Jefferson City Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Joseph Kinney</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dart</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Timour</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Naomi</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Sonora</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>West Wind</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Glasgow Railroad Bridge	MC	Not Eligible	No adverse effect	No adverse effect
Bridge	Rocheport	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Jefferson City	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Annie Lee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Plow Boy No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Radnor</i>	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Archaeological Site	MU134/MU135	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1000	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Little Dick</i>	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1100	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Marie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bright Light</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Martha Stevens</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Floyd</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-4 Effects to Cultural Resources in the Jefferson City Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CY28	T	Unevaluated	N/A	No further work if avoided No adverse effect
Archaeological site	CO52	T	Unevaluated	N/A	No further work if avoided No adverse effect
Shipwreck	<i>Statie Fisher</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CO108	T	Unevaluated	N/A	No further work if avoided No adverse effect
Campsite	Lewis and Clark 1804	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Emma</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dew Drop</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

KCS = Kansas City Southern Railway Company.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

4.13.3.5 St. Charles Segment

Table 4.13-5 outlines potential effects under the Proposed Action to 51 known cultural resource sites in the St. Charles segment. The table includes information about mitigation measures that are in place or could be developed. There are no direct effects to the resources identified below; however, indirect effects could occur to two known sites along tributaries and to undocumented sites along 19 perennial tributaries in the St. Charles segment.

Direct Effects

Three NRHP-eligible bridges are located in the St. Charles segment. Dredging exclusion zones have been established for all bridges along the LOMR. Therefore, no direct effects to these two NRHP-eligible bridges would occur under the Proposed Action.

No direct effects would occur to the 44 unevaluated shipwrecks or the Lewis and Clark campsites identified in main channel of this segment. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks and the Lewis and Clark campsites are not

anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that bed degradation of the LOMR would continue in the St. Charles segment because of dredging under the Proposed Action. Although scour has the potential to adversely affect the Daniel Boone Bridge, Blanchette Bridge, and the Washington Bridge, the MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects to historic properties under the Proposed Action such that no adverse effects would result.

Table 4.13-5 Effects to Cultural Resources in the St. Charles Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>E.H. Durfee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Camden</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Gus Fowler</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New St. Paul</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Nodaway</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Robert Emmett</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 108.2)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster (1932)</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mandan</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological Site	GA184	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 104.3)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Cappa</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Alert</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Washington</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lynchburgh</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Petral</i>	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 72.5)	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 72.1)	Unevaluated	No adverse effect	N/A

Table 4.13-5 Effects to Cultural Resources in the St. Charles Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Bridge	Washington Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Bridge	Blanchette	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Seventy-Six</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Bell</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Duncan S. Carter</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Montana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lily</i>	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Bridge	Daniel Boone Bridge	MC	Eligible	No adverse effect (USACE – Avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Shipwreck	<i>James Lyons</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>General McNeil</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ella Kimbrough</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 29.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tyler</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 28.4)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Anthony</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Luke</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Benton No. 1</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Far West</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Halcyon</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Haidee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Car of Commerce</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Hancock</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-5 Effects to Cultural Resources in the St. Charles Segment under the Proposed Action

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>New Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Julia</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 7.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Campground	Lewis and Clark	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Shipwreck	<i>Bald Eagle</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary; I = Island; SC = Side channel; RM = River mile.

One Lewis and Clark campsite, one archaeological site (GA184), and two shipwrecks (*Lily* and *Petral*) are located along tributaries in the St. Charles segment. Geomorphic analysis indicates that, if dredging occurs at historic locations, 19 perennial tributaries in this segment are likely to experience increased river bed degradation (refer to Table 4.2-1). Archaeological site GA184 and the shipwreck *Petral* are not located along tributaries that are predicted to degrade and, therefore, are unlikely to be adversely affected by the Proposed Action. However, the shipwreck *Lily* and one Lewis and Clark campsite could be affected by headcutting and erosion attributable to dredging under the Proposed Action. In addition, unidentified archaeological sites located along the 19 perennial tributaries could be adversely affected by these conditions under the Proposed Action. Destruction or disturbance of these sites would constitute an adverse effect.

Under the Proposed Action, one sand plant and associated infrastructure, which would encompass approximately 25 acres, would be constructed approximately 0.5 mile from the river in the St. Charles segment. Construction of the sand plant and conveyor system has the potential to impact currently unidentified sites. Although a records search did not reveal cultural resources in this area, previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant location.

4.13.3.6 Alternate Sources

Under the Proposed Action, demand for sand and gravel would be met by dredging in the LOMR. Expansion of existing alternate sources of sand and gravel and development of new sources would not be necessary. No adverse effects on cultural resources would be associated with alternate sources under the Proposed Action.

4.13.4 No Action Alternative

4.13.4.1 All Segments

Under the No Action Alternative, dredging along the LOMR would cease. There would be no direct effects to cultural resources along the LOMR. Indirect effects on cultural resources associated with river bed degradation and tributary headcutting would remain at current levels.

4.13.4.2 Alternate Sources

Under the No Action Alternative, production of sand and gravel would shift to alternate sources, including expansion of existing locations in the short term and development of new locations in the long term.

Expansion of Existing Sources

In the long term, gravel mining operations would be expanded at existing river locations; floodplain open-pit mines, including open-pit mines for manufactured sand; and instream mines. Dredging operations could be expanded along the Mississippi and Kansas Rivers. Expanded operations in these rivers would have the potential to directly affect cultural resources if new sand plants were constructed or dredging shifted to locations that had not previously been dredged. In addition, continued dredging in these rivers may indirectly affect cultural resources (such as bridges) because of river bed degradation. River bed degradation has been documented along the Kansas River in the area of Kansas City (USACE 1990).

Existing floodplain open-pit mines are located in Missouri, Kansas, and Illinois. In cases that involve open-pit mines in US waters, a USACE permit under Section 404 of the Clean Water Act. Section 404 permits are subject to environmental review pursuant to NEPA (42 United States Code [USC] 4321 et seq.) and Section 106 of the NHPA as codified in 36 CFR Part 800 or alternatively Appendix C to 33 CFR Part 325. Compliance with these regulations requires the USACE to take into account the potential for impacts to historic properties and to consult with the applicable SHPOs, tribes, and, if

necessary, the ACHP. In cases that do not involve US waters, only the IDNR, Division of Water Resource Management, requires cultural resource consultation with the SHPO prior to authorization of a floodplain construction permit. Missouri and Kansas do not require cultural resource consultation or evaluation as a part of the permit process. Therefore, it is likely that adverse effects to cultural resources outside of US waters could occur from expansion of mining operations in these states.

Development of New Sources

Under the No Action Alternative, new sand and gravel sources would be developed in proximity to processing facilities and urban centers in Missouri and Kansas. These states do not require cultural resource identification, evaluation, or consultation as part of their permitting processes. Kansas considers effects to NRHP-listed properties as a result of projects that are supported by a government entity (KAR 118-3-1-16). This statute, however, would not apply to development of new sources of sand and gravel. It is probable that prehistoric or historic archaeological sites exist in potential alternate dredging and processing locations. Destruction or damage of cultural resources as a result of dredging or construction of sand plants would constitute an adverse effect.

4.13.5 Alternative A

Under Alternative A, dredging would continue at considerably reduced levels for most segments of the LOMR, and production would shift to alternate sources to provide additional gravel. As with the Proposed Action, there would be no direct effects on cultural resources under Alternative A. Geomorphic analysis indicates that the risk of dredging-related tributary degradation would be unlikely to increase in any segment under this alternative. Therefore, indirect effects associated with headcutting and erosion are not anticipated. However, the potential remains to adversely affect cultural resources at the two proposed sand plant locations. Because dredging would shift to alternate sources of sand and gravel (existing and new), the potential effects to cultural resources associated with alternate sources under Alternative A would be the same as those outlined for the No Action Alternative.

4.13.5.1 St. Joseph Segment

Table 4.13-6 outlines the potential effects under Alternative A to the 21 cultural resources in the St. Joseph segment and identifies mitigation measures that are in place or could be developed. There are no direct or indirect effects to the sites in this segment under Alternative A, and indirect effects to undocumented sites are unlikely.

Table 4.13-6 Effects to Cultural Resources in the St. Joseph Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Bridge	Rulo	MC	Listed	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (NDOR Bridge Inspection Program – effect minimization)
Shipwreck	<i>Bertha</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Emilie No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Denver City</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dorothy</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mt. Sterling</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Pathfinder</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri Mail</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Della</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Atchison	MC	Eligible	No adverse effect (USACE – avoidance within dredging exclusion zone)	No adverse effect (BNSF Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Arabian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hesperian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Platte Valley</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tom Morgan</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Minnie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Express</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Leavenworth	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Archaeological site	PL110	SP	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	PL341	SP	Unevaluated	N/A	No further work if avoided. No adverse effect

Table 4.13-6 Effects to Cultural Resources in the St. Joseph Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
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Notes:

- BNSF = Burlington Northern Santa Fe Railway Company.
- NDOR = Nebraska Department of Roads.
- NRHP = National Register of Historic Places.
- USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; SP = Proposed sand plant location.

Direct Effects

NRHP-eligible properties in the St. Joseph segment include three bridges. Rulo Bridge, Leavenworth Bridge, and the Atchison Bridge are protected by dredging exclusion zones that have been established for all bridges along the LOMR. Therefore, there is no potential for adverse direct effects to the NRHP-eligible bridges under Alternative A.

No adverse direct effects would occur to the 16 unevaluated shipwrecks or the Lewis and Clark campsites identified in the main channel of the LOMR. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks and the Lewis and Clark sites are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the St. Joseph segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that localized areas of the St. Joseph segment would likely experience river bed degradation under Alternative A. Although scour attributable to dredging has the potential to adversely affect the Rulo Bridge, Leavenworth Bridge, and Atchison Bridge, the NDOR, MoDOT, and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the two bridges such that scour would not adversely affect the Rulo Bridge, Leavenworth Bridge, or Atchison Bridge under Alternative A.

Geomorphic analysis also indicates that tributary degradation would be unlikely to increase under Alternative A. Therefore, adverse effects to unidentified sites are unlikely under this alternative.

Under Alternative A, one sand plant and associated infrastructure, which may encompass up to 60 acres, would be constructed at one of two locations along the river in the St. Joseph segment. Sand plant and pipeline construction has the potential to affect two unevaluated archaeological sites (PL341 and PL110). Previously unidentified prehistoric or historic archaeological sites also may exist at the proposed sand plant sites. The potential destruction or disturbance of such resources would constitute an adverse effect.

4.13.5.2 Kansas City Segment

Table 4.13-7 outlines the potential effects under Alternative A to the 12 identified cultural resources in the Kansas City segment and identifies mitigation measures that are in place. There are no direct or indirect effects to sites in this segment under Alternative A, and indirect effects to undocumented sites are unlikely.

Direct Effects

NRHP-eligible sites located in the Kansas City segment include six bridges. Because dredging exclusion zones have been established for all bridges along the LOMR, there is no potential for direct effects to these properties under Alternative A.

No adverse direct effects would occur to the five unevaluated shipwrecks identified in the main channel of the LOMR. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Kansas City segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation is likely to occur in localized areas of the Kansas City segment of the LOMR. Although scour has the potential to adversely affect the six historic bridges, the MoDOT and BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the historic bridges such that scour would not adversely affect the bridges under Alternative A.

Archaeological site PL288 was found ineligible for listing in the NRHP based on survey and evaluation. Therefore, no adverse indirect effects to this site would result from Alternative A.

Geomorphic analysis also indicates that tributary degradation would be unlikely to increase under Alternative A. Therefore, adverse indirect effects to undocumented sites along perennial tributaries are not probable under this alternative.

Table 4.13-7 Effects to Cultural Resources in the Kansas City Segment under Alternative A

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	PL288	T	Not eligible	N/A	No adverse effect
Bridge	Fairfax	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Fairfax (1955)	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Broadway	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Fire Canoe</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bennett</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mike Bauer</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Armour-Swift-Burlington (ASB) Railroad Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Maintenance Division – effect minimization)
Shipwreck	<i>Glenmore</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Paseo	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Liberty Bend	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Corvette</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

BNSF = Burlington Northern Santa Fe Railway Company.

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

4.13.5.3 Waverly Segment

Table 4.13-8 outlines potential effects under Alternative A to the 15 known cultural resources in the Waverly segment and identifies mitigation measures that are in place. There are no direct or indirect effects to sites in this segment under Alternative A, and indirect effects to undocumented sites are unlikely.

Table 4.13-8 Effects to Cultural Resources in the Waverly Segment under Alternative A

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Wakendah</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Saluda</i>	MC	Unevaluated	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Shipwreck	<i>Nymph</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Zephyr</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Princess</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Leavenworth</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ariel</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Roy Lynds</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Eagle</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tropic</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Golong</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Govener Allen</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>T.T. Hilman</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel.

Direct Effects

There are no NRHP-eligible sites in the Waverly segment. One shipwreck, the *Saluda*, is protected by a no dredge zone that was established in previous USACE permits; therefore, no adverse direct effects

to this resource would result under Alternative A. The other unevaluated shipwrecks identified in this segment would not experience direct effects under Alternative A. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks are not anticipated, provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Waverly segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

No cultural resources were identified along perennial tributaries in the Waverly segment. Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the Waverly segment under Alternative A. Therefore, indirect effects to undocumented sites along tributaries in this segment are not anticipated.

4.13.5.4 Jefferson City Segment

Table 4.13-9 outlines potential effects under Alternative A to the 29 cultural resources in the Jefferson City segment. The table includes information about mitigation measures that are in place. No direct or indirect effects to sites in this segment would result under Alternative A, and indirect effects to unidentified sites are unlikely.

Direct Effects

NRHP-eligible sites in the Jefferson City segment include two bridges and one shipwreck. Dredging exclusion zones have been established for all bridges along the LOMR; therefore, no direct effects to the Rocheport Bridge and Jefferson City Bridge would occur under Alternative A. The *Radnor* (23CP320), which is located along the banks of the LOMR in a water fluctuation zone, was determined to be eligible for listing in the NRHP. A 100-foot dredging exclusion zone has been established in the USACE dredge permits for any normal bank line. Therefore, no direct adverse effects would result to this site under Alternative A.

No direct effects would occur to the 18 unevaluated shipwrecks identified in the Jefferson City segment. Because of the extensive history of dredging in the main channel of the LOMR, direct effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained as required by permit conditions described in section 4.13.2.2.

Table 4.13-9 Effects to Cultural Resources in the Jefferson City Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Joseph Kinney</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dart</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Timour</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Naomi</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Sonora</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>West Wind</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Glasgow Railroad Bridge	MC	Not Eligible	No adverse effect	No adverse effect
Bridge	Rocheport	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Jefferson City	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Annie Lee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Plow Boy No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Radnor</i>	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Archaeological Site	MU134/MU135	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1000	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Little Dick</i>	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1100	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Marie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bright Light</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Martha Stevens</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Floyd</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CY28	T	Unevaluated	N/A	No adverse effect

Table 4.13-9 Effects to Cultural Resources in the Jefferson City Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	CO52	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Statie Fisher</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CO108	T	Unevaluated	N/A	No adverse effect
Campsite	Lewis and Clark 1804	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Emma</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dew Drop</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

KCS = Kansas City Southern Railway Company.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Jefferson City segment would not worsen under Alternative A; however, bridge scour may occur in this region. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects from Alternative A to the two historic bridges such that no adverse indirect effects would result.

Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the Jefferson City segment under Alternative A. Therefore, adverse effects are not anticipated for the eight documented sites (six archaeological sites, shipwreck *Little Dick*, and one Lewis and Clark campsites) along the six perennial tributaries in the segment. Adverse indirect effects also are not anticipated for unidentified sites along these tributaries under Alternative A.

4.13.5.5 St. Charles Segment

Table 4.13-10 outlines the potential effects under Alternative A to the 51 known cultural resources in the St. Charles segment. The table includes information about mitigation measures that are in place. There are no direct or indirect effects to sites in this segment under Alternative A, and indirect effects to unidentified sites are unlikely.

Table 4.13-10 Effects to Cultural Resources in the St. Charles Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>E.H. Durfee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Camden</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Gus Fowler</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New St. Paul</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Nodaway</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Robert Emmett</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 108.2)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster (1932)</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mandan</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological Site	GA184	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 104.3)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Cappa</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Alert</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Washington</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lynchburgh</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Petral</i>	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 72.5)	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 72.1)	Unevaluated	No adverse effect	N/A
Bridge	Washington Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Bridge	Blanchette	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Seventy-Six</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Bell</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Duncan S. Carter</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-10 Effects to Cultural Resources in the St. Charles Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Montana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lily</i>	T	Unevaluated	N/A	No adverse effect
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Bridge	<i>Daniel Boone Bridge</i>	MC	Eligible	No adverse effect (USACE – Avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Shipwreck	<i>James Lyons</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>General McNeil</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ella Kimbrough</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 29.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tyler</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 28.4)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Anthony</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Luke</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Benton No. 1</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Far West</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Halcyon</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Haidee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Car of Commerce</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Hancock</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Julia</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 7.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Campground	Lewis and Clark	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Bald Eagle</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-10 Effects to Cultural Resources in the St. Charles Segment under Alternative A

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
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Notes:

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary; I = Island; SC = Side channel; RM = River mile.

No direct effects would occur to the 44 unevaluated shipwrecks or the Lewis and Clark campsites identified in the main channel of the St. Charles segment under Alternative A. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks and the Lewis and Clark campsites are not anticipated, provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation is unlikely to continue in the St. Charles segment under Alternative A; however, bridge scour may occur in this region. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects to the three historic bridges such that no adverse effects would result.

Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the St. Charles segment under Alternative A. Therefore, adverse indirect effects are not anticipated for the four sites (one Lewis and Clark campsite, archaeological site GA184, and two shipwrecks) identified along the tributaries. Adverse effects also are not predicted for unidentified sites along tributaries in this segment under Alternative A.

Under Alternative A, one sand plant and associated infrastructure, which would encompass approximately 25 acres, would be constructed approximately 0.5 mile from the river in the St. Charles segment. Construction of the sand plant and conveyor system has the potential to impact currently unidentified sites. Although a records search did not reveal cultural resources in this area, previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant location.

4.13.5.6 Alternate Sources

Under Alternative A, production of sand and gravel would shift to alternate sources, including expansion of existing sources in the short term and development of new sources in the long term.

Expansion of Existing Sources

In the short term, gravel mining would be expanded at existing river locations; floodplain open-pit mines, including open-pit mines for manufactured sand; and instream mines. Dredging operations could be expanded along the Mississippi and Kansas Rivers. Expanded operations in these rivers could adversely affect cultural resources if new sand plants were constructed or dredging shifted to locations that had not previously been dredged. In addition, continued dredging in these rivers may indirectly affect cultural resources (such as bridges) through river bed degradation. River bed degradation has been documented along the Kansas River in the area of Kansas City (USACE 1990).

Existing floodplain open-pit mines are located in Missouri, Kansas, and Illinois. Only the Illinois Department of Natural Resources (IDNR), Division of Water Resource Management, requires cultural resource consultation with the SHPO prior to authorization of a floodplain construction permit. Missouri and Kansas do not require cultural resource consultation or evaluation as a part of the permit process. Therefore, it is probable that adverse effects to cultural resources would occur as a result of mining operation expansion in these states.

Development of New Sources

In the long term under Alternative A, new sand and gravel sources would be developed in proximity to processing facilities and urban centers in Missouri and Kansas. These states do not require cultural resource identification, evaluation, or consultation as part of their permitting processes. Kansas considers effects to NRHP-listed properties as a result of projects that are supported by a government entity (KAR 118-3-1-16). This statute, however, would not apply to development of new sources of sand and gravel. It is probable that prehistoric or historic archaeological sites exist in potential alternate dredging and processing locations. Destruction or damage of cultural resources as a result of dredging or sand plant facility construction would constitute an adverse effect.

4.13.6 Alternative B

Under Alternative B, dredging would continue at reduced levels in the LOMR, and production would shift to alternate sources to provide additional gravel in order to meet regional demand. As with the Proposed Action, there would be no direct effects to cultural resources under Alternative B. Indirect

effects to cultural resources would be associated with tributary headcutting, erosion, and scour. Indirect effects associated with headcutting and erosion are likely to occur from continued dredging along tributaries where dredging has been the most concentrated. Refer to Table 4.2-1 for a list of these tributaries. Five tributary sites (three archaeological sites in the Jefferson City segment and one shipwreck and one campsite in the St. Charles segment) may be adversely affected under Alternative B. Undocumented sites located along tributaries where dredging has been the most concentrated also may be adversely affected. In addition, indirect effects are associated with the proposed development of two sand plants under Alternative B. Two archaeological sites located in the St. Joseph segment may be adversely affected by sand plant construction and operation. Indirect adverse effects to undocumented or unidentified sites may result at potential sand plant locations. Because dredging would shift to alternate gravel sources (existing and new), the effects to cultural resources at locations of alternate sources would be the same as those described for the No Action Alternative.

4.13.6.1 St. Joseph Segment

Table 4.13-11 outlines potential effects under Alternative B to the 21 known cultural resources in the St. Joseph segment and identifies mitigation measures that are in place or could be developed. There are no direct effects to the sites identified in the table. Indirect effects may occur to two sites that are located at potential sand plants locations, and at undocumented sites located along two perennial tributaries.

Table 4.13-11 Effects to Cultural Resources in the St. Joseph Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Bridge	Rulo	MC	Listed	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (NDOR Bridge Inspection Program – effect minimization)
Shipwreck	<i>Bertha</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Emilie No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Denver City</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dorothy</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mt. Sterling</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Pathfinder</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-11 Effects to Cultural Resources in the St. Joseph Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri Mail</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Della</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Atchison	MC	Eligible	No adverse effect (USACE – avoidance within dredging exclusion zone)	No adverse effect (BNSF Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Arabian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hesperian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Platte Valley</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tom Morgan</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Minnie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Express</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Leavenworth	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Archaeological site	PL110	SP	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	PL341	SP	Unevaluated	N/A	No further work if avoided. No adverse effect

Notes:

- BNSF = Burlington Northern Santa Fe Railway Company.
- NDOR = Nebraska Department of Roads.
- NRHP = National Register of Historic Places.
- USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; SP = Proposed sand plant location.

Direct Effects

NRHP-eligible properties in the St. Joseph segment include three bridges. Rulo Bridge, Leavenworth Bridge, and the Atchison Bridge are protected by dredging exclusion zones that have been established for all bridges along the LOMR. Therefore, the NRHP-eligible bridges would not be directly affected under Alternative B.

No direct adverse effects would occur to the 16 unevaluated shipwrecks or the Lewis and Clark campsites identified in the main channel of the LOMR. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks or the Lewis and Clark sites are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the St. Joseph segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation would continue in the St. Joseph segment because of dredging under Alternative B. Therefore, scour attributable to dredging has the potential to adversely affect the Rulo Bridge, Leavenworth Bridge, and Atchison Bridge. The NDOR, MoDOT and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the two bridges such that scour would not adversely affect the Rulo Bridge, Leavenworth Bridge, or Atchison Bridge under Alternative B.

Geomorphic analysis also indicates that tributary degradation would likely increase in areas of concentrated dredging in the St. Joseph segment under Alternative B. Although no cultural resources were identified within the perennial tributary buffer, unidentified sites may exist and may be adversely affected by headcutting and erosion under Alternative B. If dredging continues at previously dredged locations, unidentified sites located along two perennial tributaries (Mace Creek and an unnamed tributary at RM 450.1) may be adversely affected. Destruction or disturbance of these sites would constitute an adverse effect.

Under Alternative B, one sand plant and associated infrastructure, which may encompass up to 60 acres, would be constructed at one of two locations along the river in the St. Joseph segment. Sand plant and pipeline construction has the potential to affect two unevaluated archaeological sites (PL341 and PL110). Previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant sites.

4.13.6.2 Kansas City Segment

Table 4.13-12 outlines potential effects under Alternative B to the 12 known cultural resources in the Kansas City segment and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table; however, be indirect effects may result to undocumented sites located along 11 perennial tributaries in the segment.

Direct Effects

Six NRHP-eligible bridges are located in the Kansas City segment. Because dredging exclusion zones have been established for all bridges along the LOMR, the NRHP-eligible bridges would not be directly affected under Alternative B.

Table 4.13-12 Effects to Cultural Resources in the Kansas City Segment under Alternative B

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	PL288	T	Not eligible	N/A	No adverse effect
Bridge	Fairfax	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Fairfax (1955)	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Broadway	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Fire Canoe</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bennett</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mike Bauer</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Armour-Swift-Burlington (ASB) Railroad Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Maintenance Division – effect minimization)
Shipwreck	<i>Glenmore</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Paseo	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Liberty Bend	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Corvette</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-12 Effects to Cultural Resources in the Kansas City Segment under Alternative B

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
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Notes:

- BNSF = Burlington Northern Santa Fe Railway Company.
- MoDOT = Missouri Department of Transportation.
- NRHP = National Register of Historic Places.
- USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

No direct adverse effects would occur to the five unevaluated shipwrecks identified in the main channel of the LOMR in the Kansas City segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Kansas City segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Kansas City segment would continue under Alternative B. Therefore, scour has the potential to adversely affect the six historic bridges. The MoDOT and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the six historic bridges such that scour would not adversely affect the bridges under the Alternative B.

Archaeological site PL288 was found ineligible for listing in the NRHP based on survey and evaluation. Therefore, there would be no adverse effects to this site under Alternative B.

Geomorphic analysis also indicates that tributary degradation would likely continue in the Kansas City segment under Alternative B. Although no cultural resources were identified within the perennial tributary buffer, unidentified sites may exist and may be adversely affected by headcutting and erosion. If dredging continues at previously dredged locations, unidentified cultural resources along 11 perennial tributaries (refer to Table 4.2-1) may be adversely affected.

4.13.6.3 Waverly Segment

Table 4.13-13 outlines potential effects under Alternative B to the 15 known cultural resources in the Waverly segment and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table, and indirect effects are not anticipated for undocumented sites located along tributaries in this segment.

Table 4.13-13 Effects to Cultural Resources in the Waverly Segment under Alternative B

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Wakendah</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Saluda</i>	MC	Unevaluated	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Shipwreck	<i>Nymph</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Zephyr</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Princess</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Leavenworth</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ariel</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Roy Lynds</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Eagle</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tropic</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Golong</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Govener Allen</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>T.T. Hilman</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel.

Direct Effects

There are no NRHP-eligible sites in the Waverly segment. One shipwreck, the *Saluda*, is protected by a no dredge zone that was established in previous USACE permits; therefore, no adverse effects to this resource would result under Alternative B. There would be no adverse direct effects to the other

unevaluated shipwrecks identified in this segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Waverly segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

No cultural resources were identified along perennial tributaries in the Waverly segment. Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the Waverly segment under Alternative B. Therefore, indirect effects to undocumented sites along tributaries in this segment are not expected.

4.13.6.4 Jefferson City Segment

Table 4.13-14 outlines potential effects under Alternative B to the 29 known cultural resources in the Jefferson City segment. The table includes information about mitigation measures that are in place or could be developed. There are no direct effects to the sites identified in the table; however, indirect effects may occur to three archaeological sites and unidentified sites along six perennial tributaries in this segment under Alternative B.

Direct Effects

NRHP-eligible sites in the Jefferson City segment include two bridges and one shipwreck. Dredging exclusion zones have been established for all bridges along the LOMR. Therefore, the two NRHP-eligible bridges would not be directly affected under Alternative B. The *Radnor* (23CP320), which is located along the banks of the LOMR in a water fluctuation zone, was determined to be eligible for listing in the NRHP. A 100-foot exclusion zone has been established in the USACE dredge permits for any normal bank line. Therefore, there would be no adverse effects to this site under Alternative B.

No direct adverse effects would occur to the 18 unevaluated shipwrecks identified in this segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historical dredging locations, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Table 4.13-14 Effects to Cultural Resources in the Jefferson City Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Joseph Kinney</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dart</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Timour</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Naomi</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Sonora</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>West Wind</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Glasgow Railroad Bridge	MC	Not Eligible	No adverse effect	No adverse effect
Bridge	Rocheport	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Jefferson City	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Annie Lee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Plow Boy No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Radnor</i>	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Archaeological Site	MU134/MU135	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1000	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Little Dick</i>	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1100	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Marie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bright Light</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Martha Stevens</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Floyd</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-14 Effects to Cultural Resources in the Jefferson City Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	CY28	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	CO52	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Shipwreck	<i>Statie Fisher</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CO108	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Campsite	Lewis and Clark 1804	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Emma</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dew Drop</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

KCS = Kansas City Southern Railway Company.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Jefferson City segment would continue under Alternative B in the areas of concentrated dredging; therefore, scour has the potential to adversely affect the Rocheport Bridge and Jefferson City Bridge. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects to the bridges such that no adverse effects would result.

Tributary degradation is likely to increase around the Jefferson City portion of the segment under Alternative B. If dredging continues in historically dredged areas, only six perennial tributaries in this segment are at an increased risk of river bed degradation (see Table 4.2-1). Because three archaeological sites (MU134/MU135, B01000, and BO1100), the shipwreck *Little Dick*, and one Lewis and Clark campsite are not located along tributaries that are predicted to degrade, these resources would not be adversely affected under Alternative B. Three archaeological sites (CO28, CO52, and CO108) that are located along tributaries near Jefferson City may be affected by headcutting and erosion attributable to dredging. In addition, unidentified archaeological sites located along the six

perennial tributaries located near Jefferson City could be adversely affected by these conditions under Alternative B. Destruction or disturbance of these sites would constitute an adverse effect.

4.13.6.5 St. Charles Segment

Table 4.13-15 outlines potential effects under Alternative B to the 51 known cultural resources in the St. Charles segment. The table includes information about mitigation measures that are in place or could be developed. No direct effects have been identified to the resources in the table; however, indirect effects could occur to two tributary sites (one shipwreck and one Lewis and Clark campsite) and undocumented sites along 19 tributaries in the segment.

Direct Effects

Three NRHP-eligible bridges are located in the St. Charles segment. Dredging exclusion zones have been established for all bridges along the LOMR. Therefore, no adverse effects to these three NRHP-eligible bridges would occur under Alternative B.

Under Alternative B, no direct adverse effects would occur to the 44 unevaluated shipwrecks or the Lewis and Clark campsites identified in main channel of the St. Charles segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks and the Lewis and Clark campsites are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation would occur as a result of dredging proposed under Alternative B; therefore, scour has the potential to adversely affect the Daniel Boone Bridge, Blanchette Bridge, and the Washington Bridge. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects to the three bridges such that no adverse effects would result.

Table 4.13-15 Effects to Cultural Resources in the St. Charles Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>E.H. Durfee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Camden</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Gus Fowler</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New St. Paul</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Nodaway</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Robert Emmett</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 108.2)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster (1932)</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mandan</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological Site	GA184	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 104.3)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Cappa</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Alert</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Washington</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lynchburgh</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Petral</i>	T	Unevaluated	N/A	No adverse effect
Campsite	1804 Lewis and Clark	MC (RM 72.5)	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 72.1)	Unevaluated	No adverse effect	N/A
Bridge	Washington Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Bridge	Blanchette	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Seventy-Six</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Bell</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Duncan S. Carter</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Montana</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-15 Effects to Cultural Resources in the St. Charles Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Lily</i>	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Bridge	<i>Daniel Boone Bridge</i>	MC	Eligible	No adverse effect (USACE – Avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Shipwreck	<i>James Lyons</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>General McNeil</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ella Kimbrough</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 29.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tyler</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 28.4)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Anthony</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Luke</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Benton No. 1</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Far West</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Halcyon</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Haidee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Car of Commerce</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Hancock</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Julia</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 7.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Campground	Lewis and Clark	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Shipwreck	<i>Bald Eagle</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-15 Effects to Cultural Resources in the St. Charles Segment under Alternative B

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
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Notes:

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary; I = Island; SC = Side channel.; RM = River mile.

One Lewis and Clark campsite, one archaeological site (GA184), and two shipwrecks (*Lily* and *Petral*) are located along tributaries in this segment. Geomorphic analysis indicates that, if dredging continues at historically dredged locations, 19 perennial tributaries in this segment are likely to experience increased degradation (refer to Table 4.2-1). Archaeological site GA184 and the shipwreck *Petral* are not located along tributaries that are predicted to degrade and, therefore, are unlikely to be adversely affected under Alternative B. However, the shipwreck *Lily* and one Lewis and Clark campsite could be affected by headcutting and erosion attributable to dredging under Alternative B. In addition, unidentified archaeological sites located along 19 perennial tributaries could be adversely affected by these conditions. Destruction or disturbance of these sites would constitute an adverse effect.

Under Alternative B, one sand plant and associated infrastructure, which would encompass approximately 25 acres, would be constructed approximately 0.5 mile from the river in the St. Charles segment. Construction of the sand plant and conveyor system has the potential to impact currently unidentified sites. Although a records search did not reveal cultural resources in this area, previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant location.

4.13.6.6 Alternate Sources

Under Alternative B, production of sand and gravel would shift to alternate sources, including expansion of existing sources in the short term and development of new sources in the long term.

Expansion of Existing Sources

In the short term, gravel mining would be expanded at existing river locations; floodplain open-pit mines, including open-pit mines for manufactured sand; and instream mines. Dredging operations could be expanded along the Mississippi and Kansas Rivers. Expanded operations in these rivers would have the potential to adversely affect cultural resources if new sand plants were constructed or

dredging shifted to locations that had not previously been dredged. In addition, continued dredging in these rivers may indirectly affect cultural resources (such as bridges) through river bed degradation. River bed degradation has been documented along the Kansas River in the area of Kansas City (USACE 1990).

Existing floodplain open-pit mines are located in Missouri, Kansas, and Illinois. Only the IDNR, Division of Water Resource Management, requires cultural resource consultation with the SHPO prior to authorization of a floodplain construction permit. Missouri and Kansas do not require cultural resource consultation or evaluation as a part of the permit process. Therefore, it is probable that adverse effects to cultural resources would occur as a result of mining operation expansion in these states.

Development of New Sources

In the long term under Alternative B, new sand and gravel sources would be developed in proximity to processing facilities and urban centers in Missouri and Kansas. These states do not require cultural resource identification, evaluation, or consultation as part of their permitting processes. Kansas considers effects to NRHP-listed properties as a result of projects that are supported by a government entity (KAR 118-3-1-16). This statute, however, would not apply to development of new sources of sand and gravel. It is probable that prehistoric or historic archaeological sites exist in potential alternate dredging and processing locations. Destruction or damage of cultural resources as a result of dredging or sand plant facility construction would constitute an adverse effect.

4.13.7 Alternative C

Under Alternative C, dredging would continue at the current level in the LOMR, and additional sources of sand and gravel would not be pursued. There would be no direct effects to cultural resources under Alternative C. Indirect effects to cultural resources would be associated with tributary headcutting, erosion, and scour. If dredging continues at previously dredged locations, indirect effects associated with headcutting and erosion are likely to occur along tributaries where dredging has been the most concentrated. Refer to Table 4.2-1 for a list of these tributaries. A total of five tributary sites (three archaeological sites in the Jefferson City segment and one shipwreck and one campsite in the St. Charles segment) may be adversely affected under Alternative C. Undocumented sites located along tributaries where dredging has been the most concentrated in the Kansas City, Jefferson City, and St. Charles segments also may be adversely effected. In addition, indirect effects are associated with the proposed development of two sand plants under Alternative C. Two archaeological sites located in the

St. Joseph segment may be adversely affected by sand plant construction and operation. There also may be adverse effects to undocumented or unidentified sites at potential sand plant locations.

4.13.7.1 St. Joseph Segment

Table 4.13-16 outlines potential effects under Alternative C to the 21 known cultural resources in the St. Joseph segment and identifies mitigation measures that are in place or could be developed. There are no direct effects to sites identified in the table. Indirect effects may occur to two sites, which are located at potential sand plant locations, and any unidentified sites located at the sand plant locations. No adverse effects are expected for unidentified sites located along tributaries in the St. Joseph segment.

Table 4.13-16 Effects to Cultural Resources in the St. Joseph Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Bridge	Rulo	MC	Listed	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (NDOR Bridge Inspection Program – effect minimization)
Shipwreck	<i>Bertha</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Emilie No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Denver City</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dorothy</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mt. Sterling</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Pathfinder</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri Mail</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Della</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Atchison	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Arabian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hesperian</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Platte Valley</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tom Morgan</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Minnie</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-16 Effects to Cultural Resources in the St. Joseph Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Express</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Leavenworth	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Archaeological site	PL110	SP	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	PL341	SP	Unevaluated	N/A	No further work if avoided. No adverse effect

Notes:

- BNSF = Burlington Northern Santa Fe Railway Company.
- NDOR = Nebraska Department of Roads.
- NRHP = National Register of Historic Places.
- USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; SP = Proposed sand plant location.

Direct Effects

Three NRHP-eligible bridges are located in the St. Joseph segment. The Rulo Bridge, Leavenworth Bridge, and the Atchison Bridge are protected by dredging exclusion zones that have been established for all bridges along the LOMR. Therefore, the NRHP-eligible bridges in this segment would not be directly affected under Alternative C.

No direct adverse effects would occur to the 16 unevaluated shipwrecks or the Lewis and Clark campsites identified in the main channel of the LOMR in the St. Joseph segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks and the Lewis and Clark sites are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the St. Joseph segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation would continue in the St. Joseph segment because of dredging under Alternative C; therefore, scour attributable to dredging has the potential to adversely affect the Rulo Bridge, Leavenworth Bridge, and Atchison Bridge. The NDOR, MoDOT, and

the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the two bridges such that scour would not adversely affect the Rulo Bridge, Leavenworth Bridge, or Atchison Bridge in the St. Joseph Segment under Alternative C.

Geomorphic analysis indicates that tributary degradation in the St. Joseph segment would be unlikely to worsen under Alternative C. Therefore, no adverse effects are expected for unidentified sites located along tributaries in the segment.

Under Alternative C, one sand plant and associated infrastructure, which may encompass up to 60 acres, would be constructed at one of two locations along the river in the St. Joseph segment. Sand plant and pipeline construction has the potential to affect two unevaluated archaeological sites (PL341 and PL110). Previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant sites. The potential destruction or disturbance of such resources would constitute an adverse effect.

4.13.7.2 Kansas City Segment

Table 4.13-17 outlines potential effects to the 12 known cultural resources in the Kansas City segment under Alternative C and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table; however, there may be indirect effects to undocumented sites located along 11 perennial tributaries.

Direct Effects

Six NRHP-eligible bridges are located in the Kansas City segment. Because dredging exclusion zones have been established for all bridges along the LOMR, the NRHP-eligible bridges would not be directly affected under Alternative C.

No direct adverse effects would occur to the five unevaluated shipwrecks identified in the main channel of the LOMR in the Kansas City segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Kansas City segment, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Table 4.13-17 Effects to Cultural Resources in the Kansas City Segment under Alternative C

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Archaeological site	PL288	T	Not eligible	N/A	No adverse effect
Bridge	Fairfax	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Fairfax (1955)	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Broadway	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Fire Canoe</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bennett</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mike Bauer</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Armour-Swift-Burlington (ASB) Railroad Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (BNSF Maintenance Division – effect minimization)
Shipwreck	<i>Glenmore</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Paseo	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Liberty Bend	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Corvette</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

BNSF = Burlington Northern Santa Fe Railway Company.

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Kansas City segment would likely continue under Alternative C; therefore, scour has the potential to adversely affect the six historic bridges. The MoDOT and the BNSF implement countermeasures to prevent bridge failure. These countermeasures would minimize effects to the six historic bridges such that scour would not adversely affect the bridges under Alternative C.

Archaeological site PL288 was found ineligible for listing in the NRHP based on survey and evaluation. Therefore, there would be no adverse effects to this site under Alternative C.

Geomorphic analysis also indicates that tributary degradation is likely to increase in the Kansas City segment under Alternative C. Unidentified sites may exist and may be adversely affected by headcutting and erosion. If dredging continues at previously dredged locations, cultural resources located along 11 perennial tributaries (refer to Table 4.2-1) may be adversely affected. Destruction or disturbance of these sites would constitute an adverse effect.

4.13.7.3 Waverly Segment

Table 4.13-18 outlines potential effects under Alternative C to the 15 known cultural resources in the Waverly segment and identifies mitigation measures that are in place. There are no direct or indirect effects to the sites identified in the table. Indirect effects to known and unidentified cultural resources along tributaries in this segment are not anticipated.

Direct Effects

No NRHP-eligible sites are found in the Waverly segment. One shipwreck, the *Saluda*, is protected by a no dredge zone that was established in previous USACE permits; therefore, no adverse effects to this resource would result under Alternative C. There would be no adverse effects to the other unevaluated shipwrecks identified in this segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historically dredged areas in the Waverly segment, further analysis could be undertaken.

Table 4.13-18 Effects to Cultural Resources in the Waverly Segment under Alternative C

Site Type	Site Name	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Wakendah</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Saluda</i>	MC	Unevaluated	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Shipwreck	<i>Nymph</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Zephyr</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Missouri</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Princess</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Leavenworth</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ariel</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Roy Lynds</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Eagle</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tropic</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Golong</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Govener Allen</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>T.T. Hilman</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel.

Indirect Effects

No cultural resources were identified along perennial tributaries in the Waverly segment. Geomorphic analysis indicates that dredging-related tributary degradation would be unlikely to increase in the Waverly segment under Alternative C. Therefore, indirect effects to unidentified sites along tributaries in this segment are not anticipated.

4.13.7.4 Jefferson City Segment

Table 4.13-19 outlines potential effects under Alternative C to the 29 known cultural resources in the Jefferson City segment. The table includes information about mitigation measures that are in place or could be developed. There are no direct effects to sites identified in the table; however, indirect effects

may occur to three archaeological sites and unidentified sites along six perennial tributaries in this segment under Alternative C.

Table 4.13-19 Effects to Cultural Resources in the Jefferson City Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Joseph Kinney</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dart</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Timour</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Naomi</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Sonora</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>West Wind</i>	MC	Unevaluated	No adverse effect	N/A
Bridge	Glasgow Railroad Bridge	MC	Not Eligible	No adverse effect	No adverse effect
Bridge	Rocheport	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Bridge	Jefferson City	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Annie Lee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Plow Boy No. 2</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Radnor</i>	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	N/A
Archaeological Site	MU134/MU135	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1000	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Little Dick</i>	T	Unevaluated	N/A	No adverse effect
Archaeological Site	BO1100	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Marie</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Bright Light</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Martha Stevens</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Floyd</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-19 Effects to Cultural Resources in the Jefferson City Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Diana</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CY28	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Archaeological site	CO52	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Shipwreck	<i>Statie Fisher</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological site	CO108	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Campsite	Lewis and Clark 1804	T	Unevaluated	N/A	No adverse effect
Shipwreck	<i>Emma</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Dew Drop</i>	MC	Unevaluated	No adverse effect	N/A

Notes:

KCS = Kansas City Southern Railway Company.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary.

Direct Effects

NRHP-eligible sites in the Jefferson City segment include two bridges and one shipwreck. Dredging exclusion zones have been established for all bridges along the LOMR. Therefore, the two NRHP-eligible bridges would not be directly affected under Alternative C. The *Radnor* (23CP320), which is located along the banks of the LOMR in a water fluctuation zone, was determined to be eligible for listing in the NRHP. A 100-foot dredging exclusion zone has been established in the USACE dredge permits for any normal bank line. Therefore, there would be no adverse effects to the site under Alternative C.

No direct adverse effects would occur to the 18 unevaluated shipwrecks identified in this segment. Because of the extensive history of dredging in the main channel of the LOMR, effects to shipwrecks are not anticipated provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. If dredging activities are planned outside historical dredging locations, further analysis could be undertaken as required by permit conditions described in section 4.13.2.2.

Indirect Effects

Geomorphic analysis indicates that river bed degradation in the Jefferson City segment would continue under Alternative C in areas of concentrated dredging; therefore, scour has the potential to adversely affect the Rocheport Bridge and Jefferson City Bridge. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects from Alternative C to the two historic bridges such that no adverse effects would result.

Tributary degradation is likely to increase around the Jefferson City portion of the segment under Alternative C. If historical dredging areas are maintained, only six perennial tributaries in this segment are at an increased risk of degradation (see Table 4.2-1). Three archaeological sites (MU134/MU135, B01000, and BO1100), the shipwreck *Little Dick*, and one Lewis and Clark campsite are not located along tributaries that are predicted to degrade and, therefore, would not be adversely affected by Alternative C. Three archaeological sites (CO28, CO52, and CO108), which are located along tributaries near Jefferson City, may be affected by headcutting and erosion attributable to dredging. In addition, unidentified archaeological sites located along the six perennial tributaries near Jefferson City could be adversely affected by these conditions. Destruction or disturbance of these sites would constitute an adverse effect.

4.13.7.5 St. Charles Segment

Table 4.13-20 outlines potential effects under Alternative C to the 51 known cultural resources in the St. Charles segment. The table includes information about mitigation measures that are in place or could be developed. There are no direct effects to the resources identified in the table; however, indirect effects could occur to two tributary sites and undocumented sites along 19 tributaries in the segment.

Indirect Effects

Geomorphic analysis indicates that the river bed would continue to degrade under Alternative C; therefore, scour has the potential to adversely affect the Daniel Boone Bridge, Blanchette Bridge, and the Washington Bridge. The MoDOT implements countermeasures to prevent bridge failure. These countermeasures would minimize effects to the bridges such that no adverse effects would result.

Table 4.13-20 Effects to Cultural Resources in the St. Charles Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>E.H. Durfee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Camden</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Gus Fowler</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New St. Paul</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Nodaway</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Robert Emmett</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	<i>1804 Lewis and Clark</i>	MC (RM 108.2)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lancaster (1932)</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Mandan</i>	MC	Unevaluated	No adverse effect	N/A
Archaeological Site	GA184	T	Unevaluated	N/A	No adverse effect
Campsite	<i>1804 Lewis and Clark</i>	MC (RM 104.3)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Chariton</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Cappa</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Alert</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Washington</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Lynchburgh</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Petral</i>	T	Unevaluated	N/A	No adverse effect
Campsite	<i>1804 Lewis and Clark</i>	MC (RM 72.5)	Unevaluated	No adverse effect	N/A
Campsite	<i>1806 Lewis and Clark</i>	MC (RM 72.1)	Unevaluated	No adverse effect	N/A
Bridge	Washington Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Bridge	Blanchette Bridge	MC	Eligible	No adverse effect (USACE – avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – effect minimization)
Shipwreck	<i>Seventy-Six</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Bell</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Duncan S. Carter</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Montana</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-20 Effects to Cultural Resources in the St. Charles Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
Shipwreck	<i>Lily</i>	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Campsite	1806 Lewis and Clark	MC	Unevaluated	No adverse effect	N/A
Bridge	<i>Daniel Boone Bridge</i>	MC	Eligible	No adverse effect (USACE – Avoidance through dredging exclusion zone)	No adverse effect (MoDOT Bridge Maintenance Program – avoidance)
Shipwreck	<i>James Lyons</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>General McNeil</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Ella Kimbrough</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1804 Lewis and Clark	MC (RM 29.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Tyler</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 28.4)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Anthony</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Hermann</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>St. Luke</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Benton No. 1</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Far West</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Halcyon</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Haidee</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Car of Commerce</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>John Hancock</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>New Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Julia</i>	MC	Unevaluated	No adverse effect	N/A
Campsite	1806 Lewis and Clark	MC (RM 7.0)	Unevaluated	No adverse effect	N/A
Shipwreck	<i>Georgetown</i>	MC	Unevaluated	No adverse effect	N/A
Campground	Lewis and Clark	T	Unevaluated	N/A	No further work if avoided. No adverse effect
Shipwreck	<i>Bald Eagle</i>	MC	Unevaluated	No adverse effect	N/A

Table 4.13-20 Effects to Cultural Resources in the St. Charles Segment under Alternative C

Site Type	Site Name/No.	Location ^a	NRHP Eligibility	Direct Effect (Further Work or Avoidance)	Indirect Effect (Further Work or Avoidance)
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Notes:

MoDOT = Missouri Department of Transportation.

NRHP = National Register of Historic Places.

USACE = U.S. Army Corps of Engineers.

^a Location: MC = Main channel; T = Tributary; I = Island; SC = Side channel; RM = River mile.

Geomorphic analysis also indicates that tributary degradation would occur in the St. Charles segment under Alternative C. One Lewis and Clark campsite, one archaeological site (GA184), and two shipwrecks (*Lily* and *Petral*) are located along tributaries in this segment. Analysis indicates that, if dredging occurs at previous locations, 19 perennial tributaries in this segment are likely to experience increased degradation (refer to Table 4.2-1). Archaeological site GA184 and the shipwreck *Petral* are not located along tributaries that are predicted to degrade and, therefore, are unlikely to be adversely affected under Alternative C. However, the shipwreck *Lily* and one Lewis and Clark campsite could be affected by headcutting and erosion attributable to dredging under Alternative C. In addition, unidentified archaeological sites located along 19 perennial tributaries could be adversely affected by these conditions. Destruction or disturbance of these sites would constitute an adverse effect.

Under Alternative C, one sand plant and associated infrastructure, which would encompass approximately 25 acres, would be constructed approximately 0.5 mile from the river in the St. Charles segment. Construction of the sand plant and conveyor system has the potential to impact currently unidentified sites. Although a records search did not reveal resources in this area, previously unidentified prehistoric or historic archaeological sites may exist at the proposed sand plant location.

4.13.7.6 Alternate Sources

Under Alternative C, demand for sand and gravel would be met by dredging in the LOMR. Expansion of existing alternate sources of sand and gravel and development of new sources would not be necessary. Therefore, no adverse effects to cultural resources associated with alternate sources are anticipated.

4.13.8 Summary of Effects

Table 4.13-21 provides a summary of potential effects on cultural resources for the Proposed Action and alternatives.

Table 4.13-21 Summary of Potential Effects on Cultural Resources

Category of Effect	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Direct effects (associated with destruction or damage to all or part of a property as a result of dredging)	<ul style="list-style-type: none"> • No direct effects to cultural resources (shipwrecks or Lewis and Clark sites) in main channel of the LOMR provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. • Potential direct effects to cultural resources if dredging occurs outside historically dredged areas. 	<ul style="list-style-type: none"> • Dredging in the Mississippi or Kansas Rivers – potential direct effects to cultural resources. • Floodplain open-pit mines or other upland sources – potential adverse effects to cultural resources from sand plant construction. • Floodplain open-pit mines or other upland sources – potential adverse effects to cultural resources from expanded dredging operations. 	<ul style="list-style-type: none"> • No direct effects to cultural resources (shipwrecks or Lewis and Clark sites) in main channel of the LOMR provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. • Potential direct effects to cultural resources if dredging occurs outside historically dredged areas. 	<ul style="list-style-type: none"> • No direct effects to cultural resources (shipwrecks or Lewis and Clark sites) in main channel of the LOMR provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. • Potential direct effects to cultural resources if dredging occurs outside historically dredged areas. 	<ul style="list-style-type: none"> • No direct effects to cultural resources (shipwrecks or Lewis and Clark sites) in main channel of the LOMR provided that dredging activities continue to occur in their historical locations and dredging exclusion zones are maintained. • Potential direct effects to cultural resources if dredging occurs outside historically dredged areas.
Indirect effects (associated with destruction or damage of a cultural resource as a result of river bed degradation, headcutting, erosion, and scouring of the river bed near bridge abutments)	<ul style="list-style-type: none"> • Indirect effects to bridges mitigated through counter-measures implemented by bridge owners. • Potential indirect effects to five documented cultural resources along tributaries as a result of headcutting and erosion. • Potential indirect effects to undocumented sites along perennial tributaries located in areas of concentrated dredging. 	<ul style="list-style-type: none"> • No indirect effects to resources located in the LOMR or along LOMR tributaries. 	<ul style="list-style-type: none"> • Indirect effects to bridges mitigated through counter-measures implemented by bridge owners. • No indirect effects to documented or undocumented cultural resources along tributaries. 	<ul style="list-style-type: none"> • Indirect effects to bridges mitigated through counter-measures implemented by bridge owners. • Potential indirect effects to five documented cultural resources along tributaries as a result of headcutting and erosion. • Potential indirect effects to undocumented sites along perennial tributaries located in areas of concentrated dredging. 	<ul style="list-style-type: none"> • Indirect effects to bridges mitigated through counter-measures implemented by bridge owners. • Potential indirect effects to five documented cultural resources along tributaries as a result of headcutting and erosion. • Potential indirect effects to undocumented sites along perennial tributaries located in areas of concentrated dredging.

Table 4.13-21 Summary of Potential Effects on Cultural Resources

Category of Effect	Proposed Action	No Action Alternative	Alternative A	Alternative B	Alternative C
Indirect effects (associated with destruction or damage of a cultural resource related to sand plant construction or operation, or expansion of dredging activities to new sites beyond the Missouri River)	<ul style="list-style-type: none"> • Potential indirect effects to two documented cultural resources at proposed sand plant locations. • Potential indirect effects to undocumented cultural resources at proposed sand plant locations. 	<ul style="list-style-type: none"> • Potential indirect effects to two documented cultural resources at proposed sand plant locations. • Potential indirect effects to undocumented cultural resources at proposed sand plant locations. • Dredging in the Mississippi or Kansas River – potential indirect effects to cultural resources. • Floodplain open-pit mines or other upland sources – potential adverse effects to cultural resources from expanded dredging operations. 	<ul style="list-style-type: none"> • Potential indirect effects to two documented cultural resources at proposed sand plant locations. • Potential indirect effects to undocumented cultural resources at proposed sand plant locations. • Dredging in the Mississippi or Kansas River – potential indirect effects to cultural resources. • Floodplain open-pit mines or other upland sources – potential adverse effects to cultural resources from expanded dredging operations. 	<ul style="list-style-type: none"> • Potential indirect effects to two documented cultural resources at proposed sand plant locations. • Potential indirect effects to undocumented cultural resources at proposed sand plant locations. • Dredging in the Mississippi or Kansas River – potential indirect effects to cultural resources. • Floodplain open-pit mines or other upland sources – potential adverse effects to cultural resources from expanded dredging operations. 	<ul style="list-style-type: none"> • Potential indirect effects to two documented cultural resources at proposed sand plant locations. • Potential indirect effects to undocumented cultural resources at proposed sand plant locations.

Note: LOMR = Lower Missouri River.

4.13.9 Environmentally Preferred Alternative

As noted in Section 2.7, the Environmentally Preferred Alternative would result in only slight bed degradation in the LOMR. This would prevent or minimize the direct and indirect effects on cultural resources associated with tributary head cutting. USACE permit conditions would include the requirement to notify the USACE and state agencies if unidentified cultural resources are discovered; a description of existing dredging exclusion zones to avoid and/or reduce the potential for adverse effects to historic properties; and the requirement to notify the USACE and state agencies if the Dredgers propose to expand dredging into areas not previously dredged. No adverse effects to historic properties, therefore, are expected from the selection of the Environmentally Preferred Alternative. No Programmatic Agreement between the USACE and the National Park Service, State Historic Preservation Offices of Kansas, Missouri, and Nebraska, tribes, and ACHP would be necessary.

4.13.10 References

USACE (U.S. Army Corps of Engineers). 1990. Final Regulatory Report and Environmental Impact Statement – Commercial Dredging Activities on the Kansas River, Kansas: Kansas City District, Kansas City, MO. 78 pp. (plus appendices).