

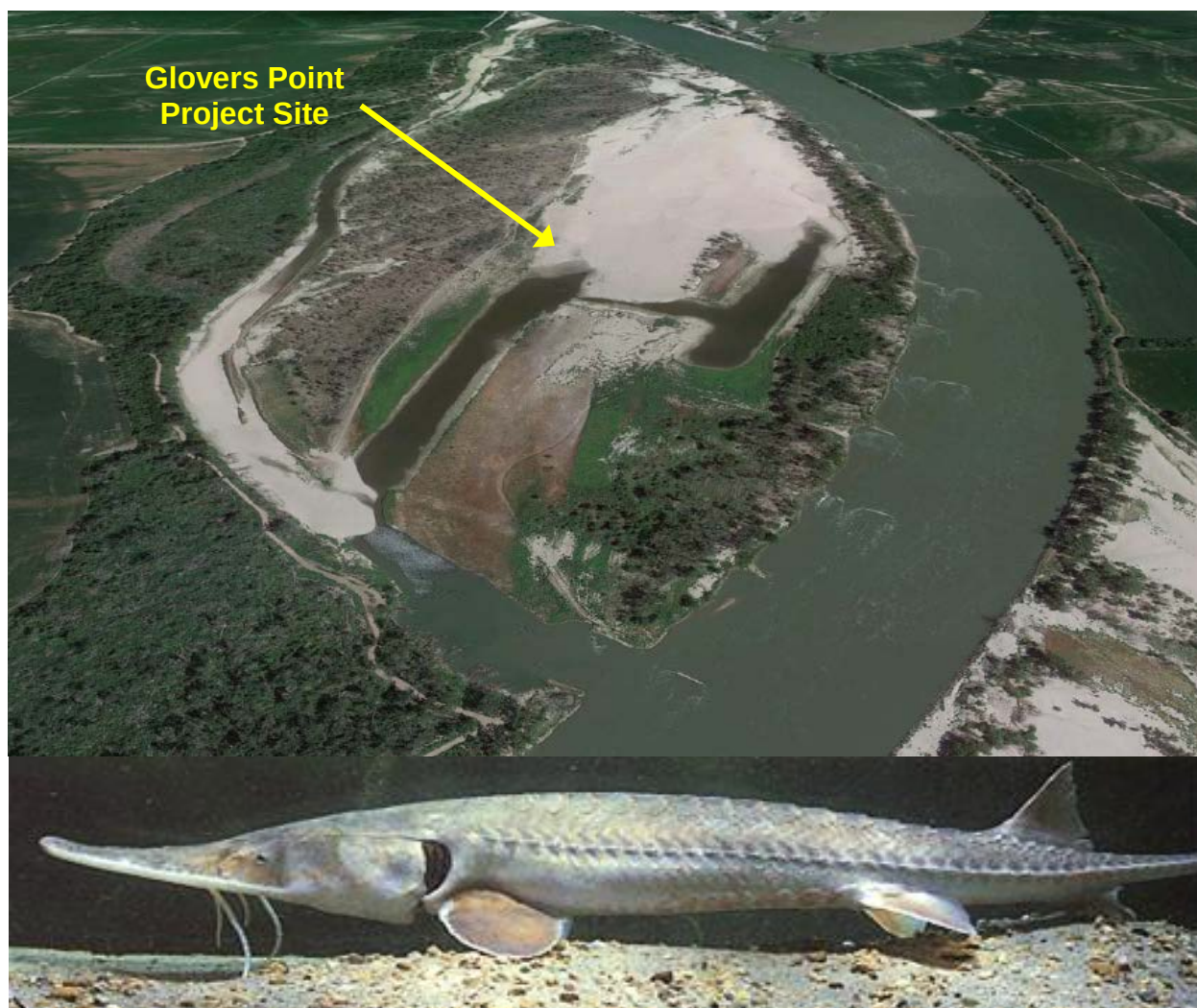


U.S. Army Corps of Engineers  
Omaha District

# Water Quality Sampling Report and Factual Determinations

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## Results of Sediment Sampling and Elutriate Testing at the Proposed Glovers Point Shallow Water Habitat Project Site



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April 2013

| Report Documentation Page                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                    |                                     |                                                           | Form Approved<br>OMB No. 0704-0188                  |                                 |
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# **Water Quality Sampling Report and Factual Determinations**

## **Results of Sediment Sampling and Elutriate Testing at the Proposed Glovers Point Shallow Water Habitat Project Site**

**Prepared by:**

**Water Quality Unit  
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**April 2013**

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**Attachment 1.** Sampling and Analysis Plan for 2012 Elutriate Sampling – Missouri River Glovers Point Bend Enhancement Project Area.

**Attachment 2.** Particle Size Distribution Reports for Collected Sediment and Soil Samples.

**Attachment 3.** Laboratory Reports of Results for Analysis of Collected Sediment, Soil, Receiving Water, and Prepared Elutriate Samples.

## 1 BACKGROUND INFORMATION

### 1.1 Project Description

A project is being proposed to expand and enhance previously constructed shallow-water habitat (SWH) along the Missouri River at Glovers Point Bend in Thurston County, Nebraska. The U.S. Army Corps of Engineers (USACE) is constructing SWH along the lower Missouri River downstream of Gavins Point Dam to mitigate aquatic habitat lost from past bank stabilization and channelization. Increasing SWH will enhance habitat for the endangered pallid sturgeon (*Scaphirhynchus albus*) population along the lower Missouri River. The District is referring to the proposed project as the Glovers Point project. Deposited sediment will be excavated from the area to enhance and expand previously constructed SWH at the project site. Sediment excavation will involve hydraulic dredging with the dredge spoil being discharged to the adjacent Missouri River. It is believed the dredge material will be primarily sand with some silts and clays. An estimated 910,000 cubic yards of material would be excavated and discharged to the Missouri River.

### 1.2 Project Location

The project area is located in Thurston County, Nebraska along Glovers Point Bend of the Missouri River between RM 711 and RM713 (Figure 1). The proposed project area is on tribal lands of the Winnebago Indian Reservation. Figure 2 shows the proposed area for excavation to expand and enhance SWH at the Glovers Point project area.

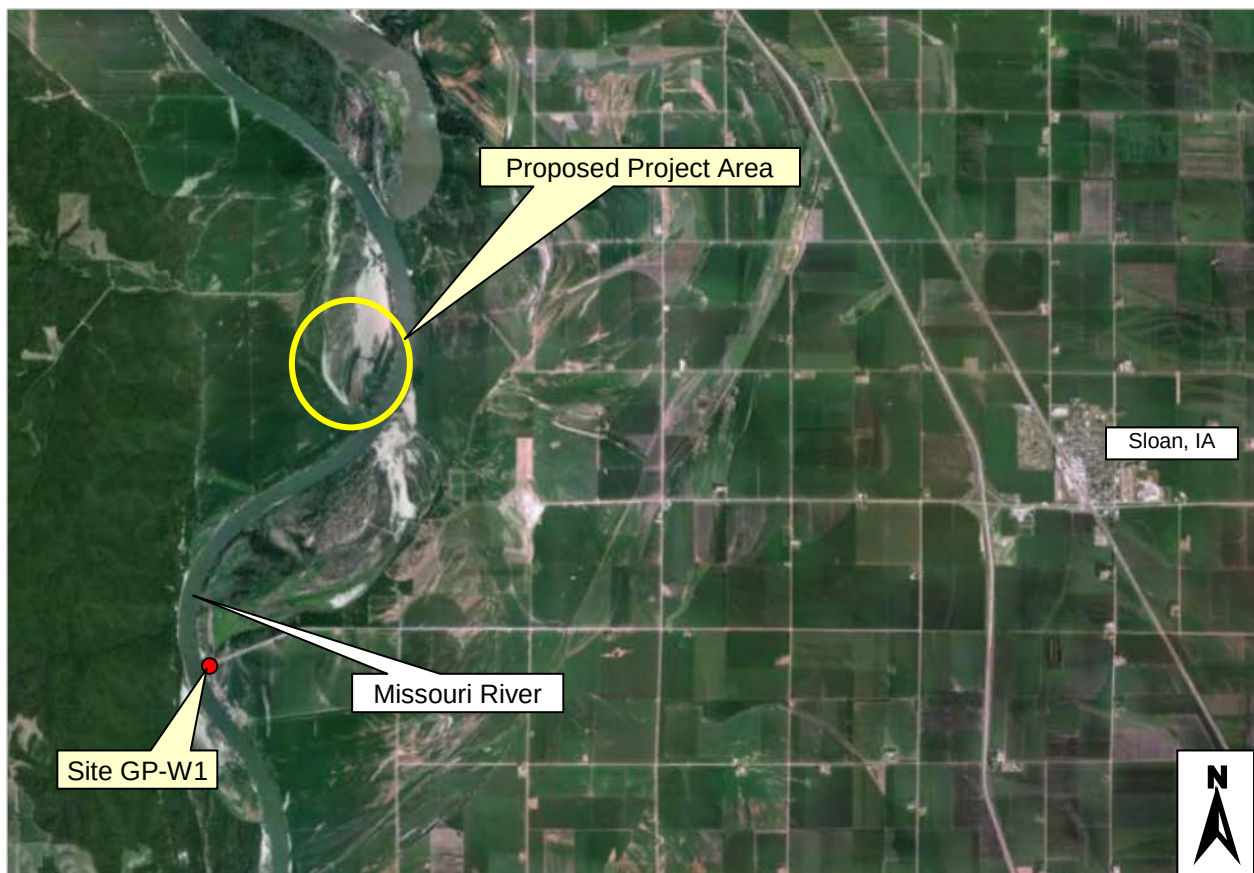


**Figure 1.** Location of proposed Glovers Point project site along the Missouri River west of Sloan, Iowa. (Imagery Date: 18-July-2012, Google Earth)

**Figure 2.** Proposed excavation to expand and enhance the shallow-water habitat at the Glovers Point project area.

### **1.3     Section 404 Permitting Requirements – 404(b)(1) Guidelines**

Section 404 of the Federal Clean Water Act (CWA) requires that a §404 permit be appropriately obtained prior to the discharge of any dredge or fill material into waters of the United States. The issuance of §404 permits is pursuant to the Section 404(b)(1) Guidelines for Specification of Disposal Sites for Dredged or Fill Material [40 CFR Ch. I (7-1-10 Edition)]. Fundamental to the 404(b)(1) Guidelines is the precept that dredged or fill material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts of other activities affecting the ecosystems of concern. No discharge of dredged or fill material is permitted: 1) if it will cause or contribute, after consideration of disposal site dilution and dispersion, to violations of any applicable State water quality standard; 2) if it will cause or contribute to significant degradation of the waters of the United States; or 3) unless appropriate and practicable steps have been taken which will minimize potential adverse impacts of the discharge on the aquatic system.

Compliance with the 404(b)(1) Guidelines is based, in part, on “Factual Determinations” of the potential impact of the proposed dredge and fill on the aquatic environment. The §404 permitting authority is required to determine in writing the potential short-term or long-term effects of a proposed discharge of dredged or fill material on the physical, chemical, and biological components of the aquatic environment. These Factual Determinations are used in making findings of compliance or non-compliance with the restrictions on discharge. The 404(b)(1) Guidelines at §230.11 identify the following eight Factual Determinations that are to be made on the effects of each proposed discharge of dredge and fill material:

- 1) Physical substrate determinations.
- 2) Water circulation, fluctuation, and salinity determinations.
- 3) Suspended particulate/turbidity determinations.
- 4) Contaminant determinations.
- 5) Aquatic ecosystem and organism determinations.
- 6) Proposed disposal site determinations.
- 7) Determination of cumulative effects on the aquatic ecosystem.
- 8) Determination of secondary effects on the aquatic ecosystem.

The intent of this report is to provide Factual Determinations of the potential water quality impacts of hydraulic dredging discharge at the proposed Glovers Point project on the Missouri River. As defined in the Federal CWA and USACE Regulation No. 1110-2-8154, water quality is defined as the physical, chemical, and biological characteristics of water. This report specifically provides information for water quality Factual Determinations regarding:

- Physical substrate determinations,
- Suspended particulate/ turbidity determinations,
- Contaminant determinations,
- Proposed disposal site determinations.

The following describe the Factual Determinations that are to be made pursuant to the 404(b)(1) Guidelines regarding water quality impacts.

#### **1.3.1    Physical Substrate Determinations**

Determine the nature and degree of effect that the proposed discharge will have on the characteristics of the substrate at the proposed disposal site. Consideration shall be given to the similarity

in particle size, shape, and degree of compaction of the material proposed for discharge and the material constituting the substrate at the disposal site, and any potential changes in substrate elevation and bottom contours, including changes outside of the disposal site which may occur as a result of erosion, slumpage, or other movement of the discharged material.

### **1.3.2 Suspended Particulate/Turbidity Determinations**

Determine the nature and degree of effect that the proposed discharge will have in terms of potential changes in the kinds and concentrations of suspended particulate/turbidity in the vicinity of the disposal site. Consideration is to be given to the grain size of the material proposed for discharge, the shape and size of the plume of suspended particulates, the duration of the discharge and resulting plume and whether or not the potential changes will cause violations of applicable water quality standards.

### **1.3.3 Contaminant Determinations**

Determine the degree to which the material proposed for discharge will introduce, relocate, or increase contaminants. This determination shall consider the material to be discharged, the aquatic environment at the proposed disposal site, and the availability of contaminants.

### **1.3.4 Proposed Disposal Site Determinations**

The disposal site is specified through the application of the 404(b)(1) Guidelines. The mixing zone associated with the discharge is to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. In a few special cases under unique environmental conditions, where there is adequate justification to show that widespread dispersion by natural means will result in no significantly adverse environmental effects, the discharged material may be intended to be spread naturally in a very thin layer over a large area of the substrate rather than be contained within the disposal site.

## **1.4 Section 401 Water Quality Certification**

Under §401 of the Federal CWA an applicant for a federal license or permit (i.e. §404 permit) must obtain a certification that the discharge and activity is consistent with State or Tribal effluent limitations (CWA §301), water quality related effluent limitations (CWA §302), water quality standards and implementation plans (CWA §303), national standards of performance (§306), toxic and pretreatment effluent standards (CWA §307) and “any other appropriate requirement of State or Tribal law set forth in such certification.” Regarding the Glovers Point project, a §401 water quality certification will be requested from EPA Region VII. The Winnebago Tribe in Nebraska does not have approved water quality standards or Section 401 authority for the purpose of regulating water resources within Indian Country pursuant to Section 518(e) of the Clean Water Act (CWA). The CWA states, in part, that in any case where a state, interstate agency, or Tribe has no authority to issue a water quality certification, such certification shall be issued by EPA. The previous completed project that utilized hydraulic dredging to construct SWH at the site was reviewed by EPA pursuant to Section 401 in 2009 and certification was granted. This report and water quality Factual Determinations will be provided to the EPA Region VII to appropriately facilitate their water quality certification review pursuant to §401.

## **1.5 Water Quality Standards Classifications of the Missouri River**

The Winnebago Tribe does not have EPA-approved water quality standards. The two states directly adjacent to the proposed project area, Nebraska and Iowa, do have EPA-approved water quality standards promulgated that designate beneficial uses to the Missouri River for water quality protection.

### **1.5.1 Iowa**

The State of Iowa designates the following uses to the Missouri River from the Iowa-Missouri state line to the confluence with the Big Sioux River: Primary Contact Recreation, Warmwater Type 1 Aquatic Life, and Human Health. The Missouri River at the Council Bluffs water works intake is also designated a use of raw water source of potable water supply. Pursuant to Iowa's antidegradation policy, the Missouri River in the vicinity of the proposed Little Sioux project is not identified as an outstanding State water (Tier 2 ½) or an outstanding National Resource Water (Tier 3). As appropriate, Iowa's antidegradation policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected and associated numeric and narrative water quality criteria to protect these beneficial uses are not to be violated.

### **1.5.2 Nebraska**

The State of Nebraska has designated the following uses to the entire length of the Missouri River in Nebraska: Primary Contact Recreation, Warmwater Aquatic Life Class A, Agricultural Water Supply, and Aesthetics. It has designated the use of public drinking water supply to the river downstream of the confluence of the Niobrara River, and industrial water supply to the river downstream of the confluence of the Big Sioux River. Nebraska has not identified the Missouri River in the vicinity of the Glovers Point project as a National or State Resource Water. As appropriate, Nebraska's antidegradation policy provides Tier 2 protection (existing water quality) to the Missouri River. Tier 1 protection (existing uses) applies and the State designated beneficial uses must be protected and associated numeric and narrative water quality criteria to protect these beneficial uses are not to be violated.

### **1.6 Use of Sediment/Soil Analysis, Elutriate Testing, and Ambient Missouri River Water Quality Data for Factual Determinations**

Factual Determinations regarding potential water quality impacts from the proposed hydraulic dredging to construct SWH at the Glovers Point project was based on the analyses of representative sediment/soil samples collected from the identified excavation area at the proposed project site. The collected sediment/soil samples were also subjected to elutriate testing pursuant to the Inland Testing Manual, "Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA and USACE, 1998). Historic ambient water quality data collected along the Missouri River by the Omaha District were assessed.

## **2 SITE-SPECIFIC WATER QUALITY CONCERNS**

### **2.1 Fish Consumption Advisory**

The State of Nebraska had issued a fish consumption advisory for Dieldrin and PCBs on the Missouri River downstream of Gavins Point Dam. This advisory was based on the analysis of past fish tissue sampling that found levels of these substances at concentrations above the State's defined risk factor for protecting public health via fish consumption. However, the fish consumption advisory has recently been removed based on recent fish tissue sampling (NDEQ, 2012).

### **2.2 Section 303(d) Impaired Waters Listings**

Section 303(d) of the Federal CWA requires States to evaluate water quality conditions in designated waterbodies, and list as impaired (i.e. 303(d) list) any waterbodies not meeting water quality

standards. As appropriate, States must develop and implement Total Maximum Daily Loads –TMDLs (i.e. pollutant management plans) for waterbodies identified as impaired.

### **2.2.1 Iowa**

Iowa has not listed the Missouri River in the area of the proposed Glovers Point project site on the State's most recent (i.e. 2010) 303(d) impaired waters list.

### **2.2.2 Nebraska**

Nebraska's water quality standards identify the Missouri River from the Big Sioux River to the Platte River as designated Segment MT1-10000. Segment MT1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to a fish consumption advisory. The identified parameters of concern are Cancer Risk & Hazard Index Compounds, specifically, Dieldrin and PCBs. After the Nebraska Department of Environmental Quality (NDEQ) published their 2012 Integrated Water Quality Report and Section 303(d) list on 1-April-2012 that listed Segment MT1-10000 as impaired due to the fish consumption advisory in effect, the NDEQ published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska" in June, 2012 (NDEQ, 2012). That report indicated that Dieldrin and PCBs were no longer a fish tissue concern on Segment MT1-10000. This resulted in the fish consumption advisory for the Missouri River regarding Dieldrin and PCBs being removed. Based on the removal of the fish consumption advisory for the Missouri River, the NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next published 303(d) listing (personal communication NDEQ). As such, the Missouri River in the area of the proposed Glovers Point project site will not be identified as impaired from Cancer Risk & Hazardous Index Compounds (i.e. Dieldrin and PCBs) by Nebraska's next 303(d) list of impaired waters. Personnel communication with NDEQ has indicated that elutriate testing for Dieldrin and PCBs to a detection limit of 0.4 parts-per-trillion is no longer required.

As indicated, analysis and elutriate testing was previously done on sediment samples collected from the proposed Glovers Point project site in 2009 to provide water quality information to facilitate §401 Certification for the SWH that was constructed earlier. Two sediment samples were collected and elutriate testing was done for Dieldrin and PCBs to a detection of 0.4 parts-per-trillion. No traces of Dieldrin or PCBs were detected in elutriate testing of the two collected sediment samples.

## **2.3 Nutrients**

### **2.3.1 Gulf of Mexico Hypoxia**

A large area of the northern Gulf of Mexico is experiencing low dissolved oxygen or hypoxia during periods in the summer off the coasts of Louisiana and Texas. The hypoxia is primarily caused by excess nutrients – originating from cities, farms, and industries in the Mississippi River Basin – which cause extensive growths of algae that deplete the oxygen in the water when they die, sink to the bottom, and decompose. The condition is exacerbated by the stratification of the water column – result of warmer, low salinity surface waters that isolate the organic-rich bottom waters from the surface and prevent oxygen exchange with the atmosphere. Nutrient loading reduction targets of 45% of the current total nitrogen and total phosphorus riverine loads have been identified to achieve the goal for hypoxic zone size and to facilitate water quality improvements in the basin (MRGMWNTF, 2008).

The watershed of the Mississippi River drains 41 percent of the contiguous United States and includes waters from several major river systems, including the Missouri/Platte River Basin, the Ohio/Tennessee River Basin, and the Arkansas/Red/White River Basin. The Mississippi River Basin

includes two functionally distinct zones, each with its own potential to contribute to Gulf hypoxia. These zones include the huge Mississippi watershed with its tributary network, and at the lower end of the river system, the deltaic zone that formerly dispersed river water naturally throughout Southeast Louisiana via a distributary (deltaic) network. While the tributaries of the Mississippi River are the sources of nutrient loading to the river trunk, the distributaries within the Mississippi Delta are critical to the final dispersal of nutrients and sediments into the Gulf of Mexico and the salinity of the estuaries and coastal waters. During the past two centuries the hydrology of the distributary zone was totally modified by the construction of flood levees, closing of key distributaries for flood control, and navigation enhancement programs. These structures isolated the river from its delta, causing an ongoing catastrophic collapse in the deltaic landscape, primarily wetlands. The hydrologic changes that have caused such damage to South Louisiana also exacerbate Gulf hypoxia by jetting most nutrient-rich river water and sediments directly into the Gulf of Mexico, bypassing the deltaic wetlands that captured the nutrients and sediments.

### **2.3.2 Iowa Nutrient Reduction Strategy**

The 2008 Gulf Hypoxia Action Plan calls for the 12 states along the Mississippi River to develop strategies to reduce nutrient loading to the Gulf of Mexico (MRGMWNTF, 2008). In this regard, the State of Iowa has recently released a draft of the *“Iowa Nutrient Reduction Strategy – A science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico”* (IDALS et. al., 2012). The Iowa strategy follows the recommended framework provided by EPA in 2011, and is only the second state to complete a statewide nutrient reduction strategy. The Iowa Nutrient Reduction Strategy is a science and technology-based framework to assess and reduce nutrients to Iowa waters and the Gulf of Mexico. It is designed to direct efforts to reduce nutrients in surface water from both point and nonpoint sources in a scientific, reasonable and cost-effective manner. The Iowa strategy proposes a pragmatic, strategic and coordinated approach for reducing nutrient loads discharged from the state’s largest wastewater treatment plants, in combination with targeted practices designed to reduce loads from nonpoint sources now while evaluating the future need for nutrient water quality standards.

For Iowa streams, EPA’s recommended water quality standards’ criteria range is from 0.712 to 3.26 mg/L for total N and from 0.070 to 0.118 mg/L total P (IDALS et.al., 2012). If these nutrient criteria recommendations were adopted as Iowa water quality standards, cities would be required to pay for expensive wastewater treatment plant upgrades that would address only a fraction of the overall amount of nutrients discharged to Iowa’s streams while leaving wastewater treatment facilities unable to comply with permit limits (IDALS et.al., 2012). If compliance with stringent numeric effluent limits on point source discharges did not eliminate an existing impairment, the receiving stream would continue to exceed the water quality standard and would require development of a total maximum daily load (TMDL). At that point, any further reduction required by a TMDL would need to be accomplished through voluntary controls placed only on nonpoint sources. Because of the lack of confidence in EPA’s recommended criteria and substantial financial costs associated with implementing nutrient removal technologies, legitimate concerns about the value of numeric nutrient criteria have been raised (IDALS, et.al., 2012). Other criteria derivation approaches such as nutrient stressor-response analysis and reference condition modeling are better alternatives that Iowa will continue assessing as a basis for appropriate nutrient standards for implementation within an adaptive watershed management framework (IDALS et.al, 2012).

### **2.4 National Research Council of the National Academies Assessment of Missouri River Water Quality and Sediment Management**

USACE’s SWH and emergent sandbar habitat (ESH) projects are directly depositing sediment into the mainstem Missouri River. Concerns have been expressed regarding the potential water quality impacts of those projects downstream and into the northern Gulf of Mexico. The following questions

were tasked to the National Research Council regarding water quality and sediment management in the Missouri River:

- *What is the significance of the Missouri River sediments to the Gulf of Mexico Hypoxia problem?*
- *What are the key environmental and economic considerations regarding nutrient loads and/or contaminants in Missouri River Sediment? To what extent can such issues be addressed with management strategies?*

The following discussion and conclusions are taken from the document, “Missouri River Planning – Recognizing and Incorporating Sediment Management” prepared by the National Research Council (NRC, 2011).

Excess nitrogen loads are responsible for the long-term increase in the hypoxic area in the northern Gulf of Mexico; however, recent studies suggest that phosphorus may also be contributing to hypoxia, especially near the mouths of the Mississippi and Atchafalaya Rivers during the spring. The USACE’s construction of SWH projects will result in releases of both nitrogen and phosphorus to the Missouri River because much of the topsoil portion of the sediment disposed of in the river has been heavily fertilized.

The Nation Research Council further assessed the situation based on total nitrogen (TN) and total phosphorus (TP) levels representative of excavated sediment/soil at SWH project sites and current TN and TP loads in the Missouri River and delivered to the Gulf of Mexico. It was concluded that the TN loads from constructed SWH projects will be insignificant compared to the current TN loads transported in the Missouri River and to the Gulf. Phosphorus loadings to the Missouri River from these projects, however, are likely to constitute a much greater fraction of the current load than additional nitrogen loadings. An upper-bound estimate of the increase in TP loadings to the Gulf of Mexico as a result of all potential SWH projects is a 6 to 12 percent increase. This estimate represents an upper bound assuming all sediment is delivered to the Gulf. In reality, sediment deposition processes in the Missouri and lower Mississippi river channels would reduce loads delivered downstream and eventually to the Gulf of Mexico. A comparison of potential phosphorus loads from USACE’s SWH projects, with load increments required to produce measurable changes in the areal extent of Gulf hypoxia, showed these projects will not significantly change the extent of the hypoxic area in the Gulf of Mexico.

### **3 SAMPLING AND ANALYSIS METHODS**

Sediment/soil samples, representative of the areas to be excavated for SWH construction at the proposed Glovers Point project site, were collected, analyzed, and subjected to elutriate testing. The results were used to assess the potential water quality impacts that the discharge from hydraulic dredging at the proposed project site would have on the Missouri River.

#### **3.1 Sampling and Analysis Plan**

A Sampling and Analysis Plan (SAP) was developed to collect sediment/soil samples at the proposed Glovers Point project site and conduct elutriate testing of the collected samples. The SAP was developed in consultation with the Iowa Department of Natural Resources and the Nebraska Department of Environmental Quality. The SAP was implemented as written with no modifications and is included as Attachment 1. The parameters that were measured in the field and analyzed in the laboratory for the different collected samples and elutriate testing are listed in Table 1. Analytical methods are provided in the attached SAP (Attachment 1).

**Table 1.** Parameters measured in the field and analyzed in the laboratory for the different media assessed.

| Parameter                                                                                   | Sample Analysis |                 |                     |                 |
|---------------------------------------------------------------------------------------------|-----------------|-----------------|---------------------|-----------------|
|                                                                                             | Soil            | Receiving Water | Pre-Elutriate Water | Elutriate Water |
| <b>Field Measurements:</b>                                                                  |                 |                 |                     |                 |
| Water Temperature (°C)                                                                      |                 | ✓               |                     |                 |
| pH (S.U)                                                                                    |                 | ✓               |                     |                 |
| Dissolved Oxygen (mg/l, % saturation)                                                       |                 | ✓               |                     |                 |
| Conductivity (uS/cm)                                                                        |                 | ✓               |                     |                 |
| Turbidity (NTU)                                                                             |                 | ✓               |                     |                 |
| <b>Laboratory Analysis:</b>                                                                 |                 |                 |                     |                 |
| Atrazine (mg/kg, µg/l)                                                                      | ✓               | ✓               |                     | ✓*              |
| Carbonaceous Biochemical Oxygen Demand - CBOD (mg/L)                                        |                 | ✓               |                     | ✓*              |
| Chemical Oxygen Demand - COD (mg/L)                                                         |                 | ✓               |                     | ✓               |
| Nitrogen, Ammonia as N, Total (mg/kg, mg/L)                                                 | ✓               | ✓               |                     | ✓*              |
| Nitrogen, Total Kjeldahl as N (mg/kg, mg/L)                                                 | ✓               | ✓               | ✓                   | ✓*              |
| Nitrogen, Nitrate-Nitrite as N (mg/kg, mg/L)                                                | ✓               | ✓               | ✓                   | ✓               |
| Organic Carbon, Total - TOC (mg/kg, mg/L)                                                   | ✓               | ✓               | ✓                   | ✓*              |
| Particle Size (% composition)                                                               | ✓               |                 |                     |                 |
| Percent Solids (%)                                                                          | ✓               |                 |                     |                 |
| pH (S.U.)                                                                                   | ✓               | ✓               |                     | ✓               |
| Phosphorus, Dissolved (mg/L)                                                                |                 | ✓               |                     | ✓               |
| Phosphorus, Total (mg/kg, mg/L)                                                             | ✓               | ✓               | ✓                   | ✓*              |
| Phosphorus, Orthophosphate (mg/L)                                                           |                 | ✓               |                     | ✓               |
| Metals Scan - Dissolved (µg/L)**                                                            |                 | ✓               |                     | ✓               |
| Metals - Total (mg/kg)<br>(Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc) | ✓               |                 |                     |                 |
| Organochlorine Pesticide and PCB Scan (µg/kg)                                               | ✓               |                 |                     |                 |
| Organochlorine Pesticide and PCB Scan (µg/L)                                                |                 | ✓               |                     | ✓*              |
| Total Suspended Solids (mg/L)                                                               |                 | ✓               | ✓                   | ✓*              |
| Turbidity (NTU)                                                                             |                 | ✓               | ✓                   | ✓*              |

\* Determined on supernatant prior to filtration.

\*\* Dissolved metals scan includes: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Calcium, Chromium III, Copper, Iron, Lead, Magnesium, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, and Zinc.

### 3.2 Collection of Sediment/Soil Samples

Four sediment/soil samples were collected at the proposed Glovers Point project site for analysis and elutriate testing on 14-November-2012. The locations where the sediment/soil samples were collected are shown in Figures 2 and 3 and described in Tables 2 and 3. The sediment samples at each of the four sites were collected with a gas-powered auger equipped with a 2-in diameter stainless steel coring bit. Core samples were collected to a depth of 4 feet and composited. One gallon of the composited sediment/soil material was collected and transported to the laboratory for analysis and elutriate testing.

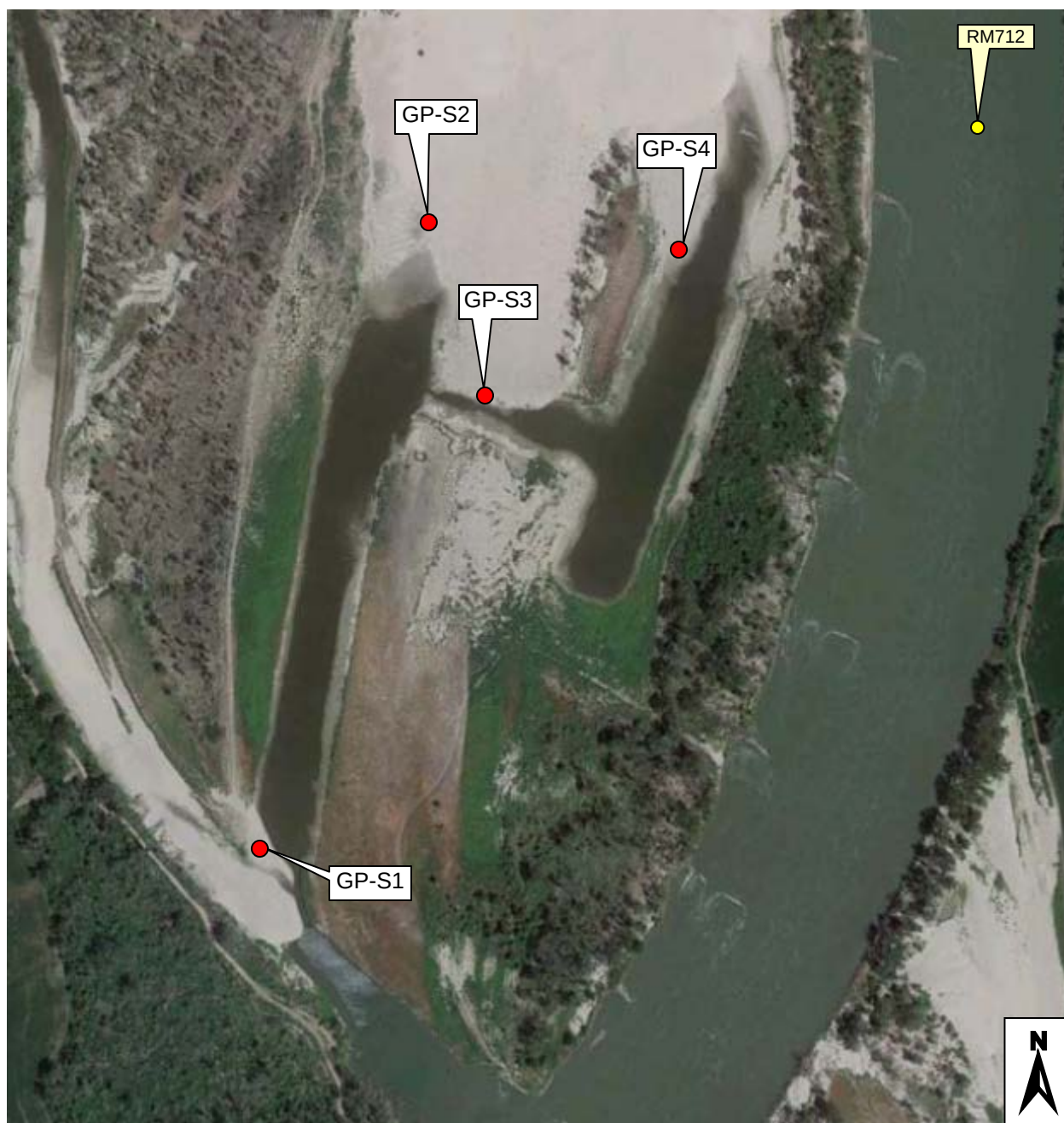


**Figure 3.** Locations where sediment/soil samples were collected at the proposed Glovers Point shallow-water habitat project site on 14-November-2012. *(Site locations shown on 18-July-2012 Google Earth aerial photo of the project area.)*

**Table 2.** Sediment/soil samples collected at the proposed Glovers Point shallow-water habitat project site for analysis and elutriate testing

| Sample Type   | Sample ID | Sampled Depth | Collection Time | Sampling Method |
|---------------|-----------|---------------|-----------------|-----------------|
| Sediment/Soil | GP-S1     | 0 - 4 feet    | 11:30           | Composite Core  |
| Sediment/Soil | GP-S2     | 0 - 4 feet    | 12:10           | Composite Core  |
| Sediment/Soil | GP-S3     | 0 - 4 feet    | 12:25           | Composite Core  |
| Sediment/Soil | GP-S4     | 0 - 4 feet    | 13:10           | Composite Core  |

**Table 3.** Geo-referenced locations where sediment/soil samples were collected for elutriate testing at the proposed Glovers Point shallow-water habitat project site.

| Site  | Latitude      | Longitude     |
|-------|---------------|---------------|
| GP-S1 | 42° 14' 26.1" | 96° 20' 14.8" |
| GP-S2 | 42° 14' 48.3" | 96° 20' 06.3" |
| GP-S3 | 42° 14' 42.3" | 96° 20' 03.7" |
| GP-S4 | 42° 14' 47.7" | 96° 19' 54.2" |

**Note:** GPS device used for determining locations was Garmin Map 76.

### 3.3 Collection of Receiving Water

In accordance with the “*Inland Testing Manual*”, receiving water was collected from the Missouri River for elutriate testing. Receiving water measurements and samples were collected from the Missouri River at the Sloan, Iowa boat ramp approximately 2.6 miles downstream of the proposed Glovers Point project site. The receiving water sampling site, GP-W1, is shown on Figure 1. The mean daily flow of the Missouri River on 14-November-2012 when the receiving water sample was collected was 37,100 cfs.

### 3.4 Elutriate Testing

The process that was used to prepare samples for elutriate testing from the sediment/soil samples collected at the proposed Glovers Point project site is depicted in Figure 4.

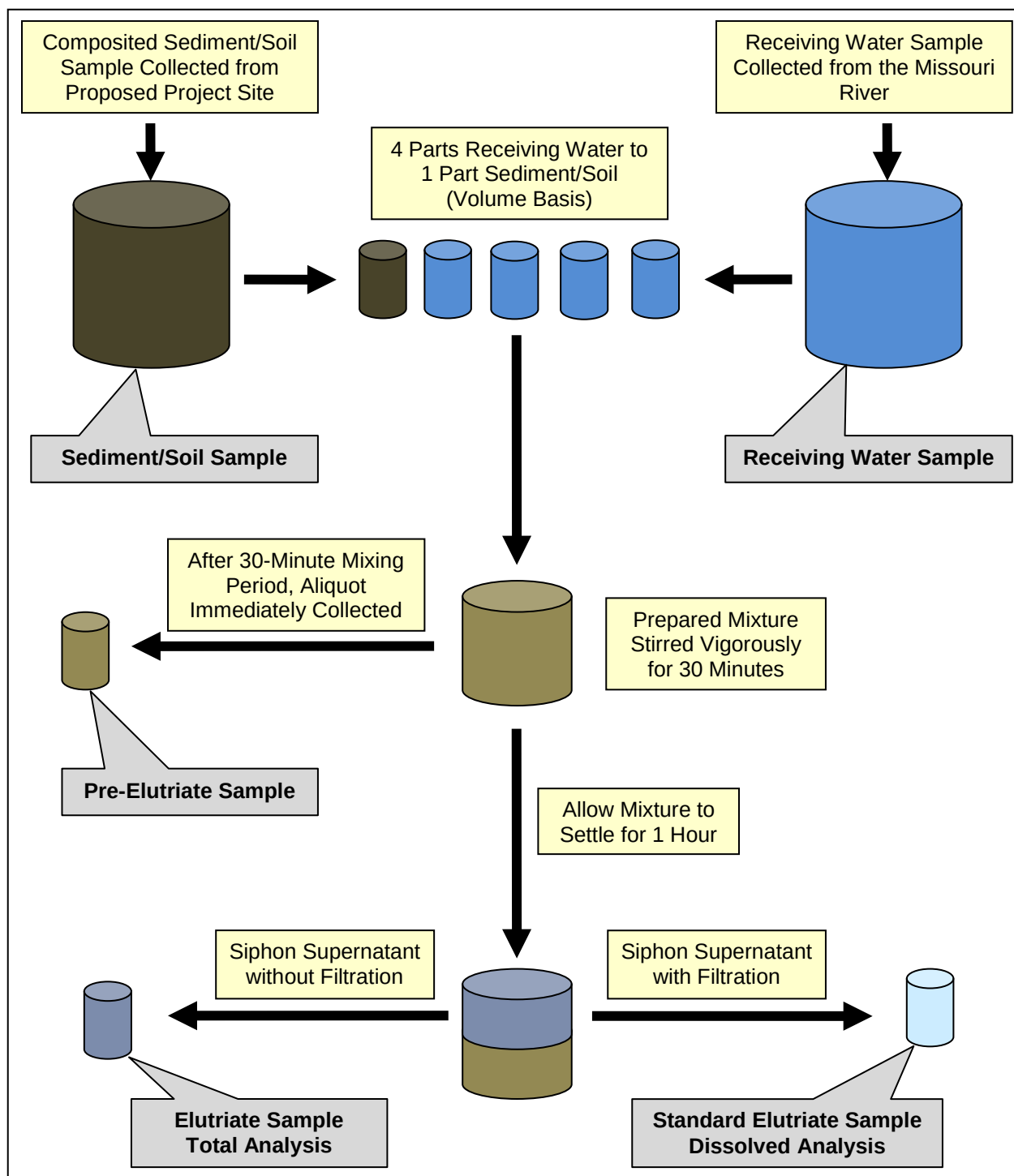


**Figure 4.** Process used to prepare samples for elutriate testing from collected sediment/soil samples.

### **3.4.1 Elutriate Samples**

Elutriate samples were prepared in accordance with the “*Inland Testing Manual*”, and were prepared by using receiving water collected from the Missouri River at site GP-W1. The samples were prepared in the laboratory by sub-sampling approximately 1-liter of the collected sediment/soil sample from the well-mixed original sample. The sediment material and unfiltered receiving water were then combined in a sediment-to-water ratio of 1:4 on a volume basis at room temperature ( $22 \pm 2^\circ\text{C}$ ). The 1:4 sediment-to-water ratio is believed to represent “end-of-pipe” discharge conditions for hydraulic dredging. After the correct ratio was achieved, the mixture was stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for one hour. The supernatant was then siphoned off without disturbing the settled material. Analysis for total constituents was done on the supernatant without filtration, and the supernatant was filtered through a 0.45-micron filter for analysis of dissolved constituents. The filtered water is the standard elutriate sample identified by the “*Inland Testing Manual*” and represents the dissolved constituents that could be released from dredged material during the hydraulic dredging process.

### **3.4.2 Pre-Elutriate Samples**

Pre-elutriate samples were prepared for analysis of selected constituents. The pre-elutriate samples were prepared the same as standard elutriate samples through the point of the 30-minute mixing period. At that time an aliquot of water was immediately drawn off the mixed solution and identified as the pre-elutriate sample. The pre-elutriate sample was analyzed for the following constituents: Total Kjeldahl Nitrogen, Total Nitrate-Nitrite Nitrogen, Total Phosphorus, Total Organic Carbon, Total Suspended Solids, Turbidity, and pH. The pre-elutriate sample is believed to represent conditions of the “end-of-pipe” hydraulic dredging discharge slurry prior to any mixing with the receiving water (i.e. Missouri River).

### **3.4.3 Metal Analysis**

The metals Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, and Zinc were identified as parameters of concern by either the State of Iowa or Nebraska.

#### **3.4.3.1 Sediment/Soil Samples**

Collected sediment/soil samples were directly analyzed for total levels of the eight identified metals.

#### **3.4.3.2 Receiving Water and Elutriate Samples**

Water samples (i.e. receiving water and elutriate) were analyzed for dissolved metals only. Iowa and Nebraska’s water quality standards for selected metals are hardness-based. Iowa’s metals criteria are based on “total recoverable” concentrations which is not directly measured by the standard elutriate testing (i.e. the final step of the standard elutriate test is filtration which results in dissolved metals being measured). The Iowa total recoverable metals criteria were compared to the results of the analysis of the Standard Elutriate samples which are a dissolved metals concentrations. Nebraska’s metals criteria, other than the chronic criterion for mercury, are based on dissolved concentrations. The District has monitored ambient water quality conditions of the Missouri River at Decatur, NE (RM691) over the 10-year period 2003 through 2012. Based on 34 quarterly measurements, hardness (mg/L) in the Missouri River ranged from 232 to 381, averaged 272, and had a median of 266. The hardness of the receiving water sample collected on 14-November -2012 was 237 mg/L.

## 4 RESULTS

### 4.1 Receiving Water Field Measurements

The receiving water used for the elutriate testing was collected from the Missouri River at site GP-W1. Water quality conditions of the receiving water measured in the field at the time of collection were: Water Temperature, 7.1°C; Dissolved Oxygen, 11.7 mg/l and 99.6% saturation; pH, 8.4 S.U.; Specific Conductance, 797  $\mu\text{S}/\text{cm}$ ; and Turbidity, 30 NTU.

### 4.2 Particle Size Analysis

The collected sediment/soil samples were analyzed for particle size using Method ASTM D422. The Particle Size Distribution Reports for the analyzed sediment/soil samples collected at the proposed Glovers Point project site are provided in Attachment 2. Table 4 and Figure 5 summarize the particle size percent composition of the collected sediment/soil samples. The collected sediment/soil samples ranged from 2.9% to 72.3% fines and 27.7% to 97.1% sand. None of the four collected sediment/soil samples contained material of a grain size greater than sand (Table 4).

**Table 4.** Summary of particle size analysis of the sediment/soil samples collected at the proposed Glovers Point project site.

| Sample ID | % Cobbles | % Gravel |      | % Sand |        |      | % Fines |      |
|-----------|-----------|----------|------|--------|--------|------|---------|------|
|           |           | Coarse   | Fine | Coarse | Medium | Fine | Silt    | Clay |
| GP-S1     | 0.0       | 0.0      | 0.0  | 0.0    | 0.5    | 27.2 | 61.0    | 11.3 |
| GP-S2     | 0.0       | 0.0      | 0.0  | 0.0    | 7.7    | 89.4 | 1.8     | 1.1  |
| GP-S3     | 0.0       | 0.0      | 0.0  | 0.0    | 0.2    | 94.6 | 4.1     | 1.1  |
| GP-S4     | 0.0       | 0.0      | 0.0  | 0.0    | 10.4   | 76.2 | 11.9    | 1.5  |
| MEAN      | 0.0       | 0.0      | 0.0  | 0.0    | 4.7    | 71.9 | 19.7    | 3.8  |

See Attachment 2 for definition of particle sizes.

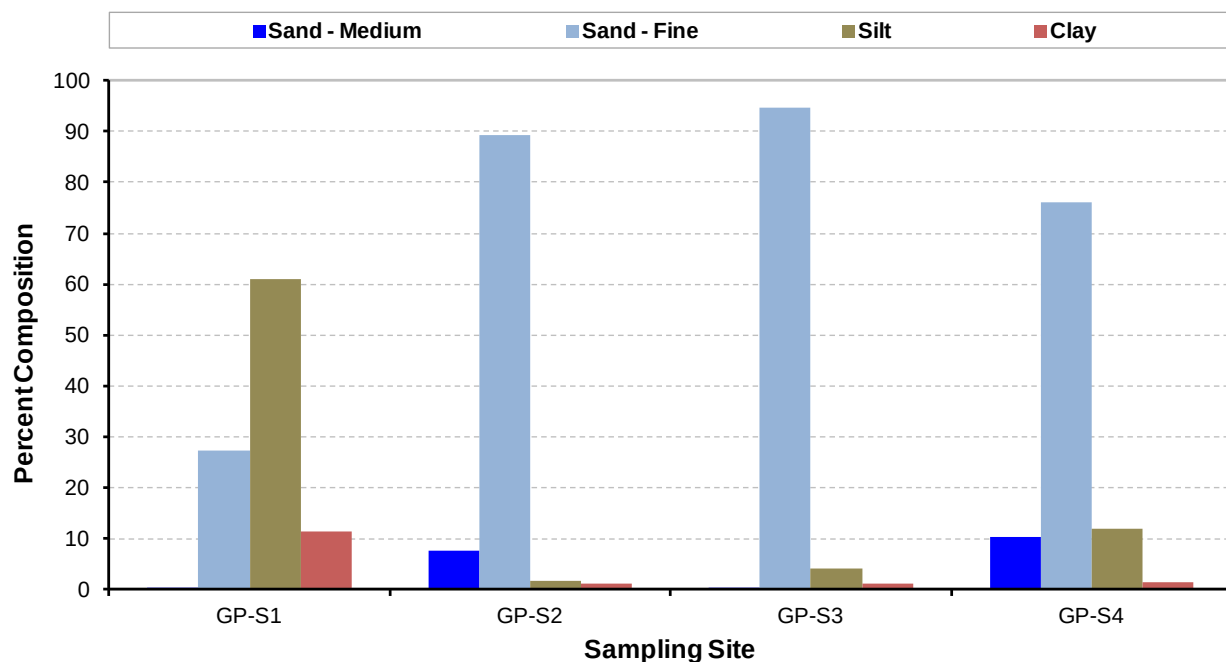


**Figure 5.** Particle size percent composition of sediment/soil samples collected at sites GP-S1, GP-S2, GP-S3, and GP-S4.

#### **4.3     Physiochemical Analysis of Sediment/Soil and Receiving Water Samples and Elutriate Testing Results**

The laboratory report of the analyses of the sediment/soil, receiving water, and elutriate samples is provided as Attachment 3. The following summarizes these results and their application to Iowa and Nebraska water quality standards.

##### **4.3.1     Analyzed Constituents with Promulgated State Water Quality Standards**

The following constituents were analyzed and have water quality standards criteria promulgated by the State of Iowa or Nebraska:

- Ammonia Nitrogen
- Atrazine
- Metals
  - Aluminum
  - Antimony
  - Arsenic
  - Beryllium
  - Cadmium
  - Chromium III
  - Copper
  - Iron
  - Lead
  - Manganese
  - Mercury
  - Nickel
  - Selenium
  - Silver
  - Thallium
  - Zinc
- Nitrate-Nitrite Nitrogen
- Organochlorine Pesticides (Scan)
- Polychlorinated Biphenyls – PCBs (Scan)
- pH

#### 4.3.1.1 Ammonia Nitrogen

| Constituent: Ammonia Nitrogen |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location               | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                               |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                         | 79.6                  | 0.08J                            | 0.07J            |                     | 0.82                               | 0.72                               |
| GP-S2                         | n.d.                  | 0.08J                            | 0.07J            |                     | 0.14                               | 0.08J                              |
| GP-S3                         | n.d.                  | 0.08J                            | 0.07J            |                     | 0.12                               | 0.07J                              |
| GP-S4                         | n.d.                  | 0.08J                            | 0.07J            |                     | 0.19                               | 0.08J                              |
| MEAN                          |                       | -----                            | -----            |                     | 0.32                               | 0.24                               |

Detection and Reporting Limits – Ammonia as N:

Sediment/Soil = 0.2 mg/kg and 1 mg/kg; Water = 0.02 mg/L and 0.1 mg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

For application of water quality standards criteria for ammonia, field measured pH and temperature of the Missouri River when sediment/soil samples collected were 8.4 S.U and 7.1°C, respectively.

#### Iowa Water Quality Standards – Ammonia as N; Use Class B(WW-1)

| Constituent                                                                                         | Acute Standard | Chronic Standard |
|-----------------------------------------------------------------------------------------------------|----------------|------------------|
| Ammonia (Total as N)<br><i>Early Life Stages Present</i><br><i>pH = 8.4, Temperature (°C) = 7.1</i> | 3.88 mg/L      | 1.29 mg/L        |

#### Nebraska Water Quality Standards – Ammonia as N; Warmwater Aquatic Life Class A

| Constituent                                                                                         | Acute Standard | Chronic Standard |
|-----------------------------------------------------------------------------------------------------|----------------|------------------|
| Ammonia (Total as N)<br><i>Early Life Stages Present</i><br><i>pH = 8.4, Temperature (°C) = 7.1</i> | 3.88 mg/L      | 1.29 mg/L        |

#### Comparison of Ammonia Elutriate Tests to Water Quality Standards

Both the Iowa and Nebraska acute and chronic ammonia criteria (i.e. 3.88 and 1.29 mg/L) for the Missouri River are the same based on the ambient water quality conditions of the Missouri River measured at the time the sediment/soil samples were collected. All non-filtered and filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute and chronic criteria for ammonia. The highest elutriate test for total ammonia was 0.82 mg/L.

#### 4.3.1.2 Atrazine

| Constituent: Atrazine |                       |                                  |                  |                     |                                    |                                    |
|-----------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location       | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                       |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                 | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S2                 | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S3                 | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S4                 | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |

Detection and Reporting Limits – Dieldrin:

Sediment/Soil = 0.01 and 0.02 mg/kg; Water = 0.2 µg/L and 5 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Atrazine; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Drinking Water Supply |
|-------------|----------------|------------------|-----------------------|
| Atrazine    | -----          | -----            | 3 µg/L                |

#### NEBRASKA WATER QUALITY STANDARDS – Atrazine; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Atrazine    | 330 µg/L       | 12 µg/L          | 3 µg/L                         |

#### Comparison of Atrazine Elutriate Tests to Water Quality Standards

All sediment/soil, receiving water, and non-filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were non-detectable for Atrazine, and were less than the Iowa and Nebraska acute, chronic, and public drinking water criteria for Atrazine. The highest elutriate test for total Atrazine was non-detect.

#### 4.3.1.3 Metals – Aluminum

| Constituent: Metals - Aluminum |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Aluminum: Water = 40 µg/L and 50 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Aluminum; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Aluminum    | 750 µg/L       | 87 µg/L          | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Aluminum; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Aluminum    | 750 µg/L       | 87 µg/L          | 200 µg/L                       |

#### Comparison of Aluminum Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Aluminum. The highest elutriate test for dissolved Aluminum was non-detect.

#### 4.3.1.4 Metals – Antimony

| Constituent: Metals - Antimony |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                          |                       |                                  | n.d.             |                     |                                    | 9J                                 |
| GP-S3                          |                       |                                  | n.d.             |                     |                                    | 8J                                 |
| GP-S4                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Antimony: Water = 6 µg/L and 50 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Antimony; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Antimony    | N/A            | N/A              | 5.6 µg/L              |

#### NEBRASKA WATER QUALITY STANDARDS – Antimony; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Antimony    | 88 µg/L        | 30 µg/L          | 5.6 µg/L                       |

#### Comparison of Antimony Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, and chronic criteria for Antimony. Two filtered elutriate samples had estimated values slightly higher than the Iowa human health and Nebraska public drinking water standards. The highest elutriate test for dissolved Antimony was an estimated value of 9 µg/L.

#### 4.3.1.5 Metals – Arsenic

| Constituent: Metals - Arsenic |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location               | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                               |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Arsenic: Sediment/Soil = 0.1 mg/kg and 0.5 mg/kg; Water = 1 µg/L and 3 µg/L.  
n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Arsenic; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Arsenic     | 340 µg/L       | 150 µg/L         | 50 µg/L               |

#### NEBRASKA WATER QUALITY STANDARDS – Arsenic; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Arsenic     | 340 µg/L       | 16.7 µg/L        | 10 µg/L                        |

#### Comparison of Arsenic Elutriate Tests to Water Quality Standards

All sediment/soil, receiving water, and non-filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were non-detectable for Arsenic and were less than the Iowa and Nebraska acute, chronic, and public drinking water criteria for Arsenic. The highest elutriate test for total Arsenic was non-detect.

#### 4.3.1.6 Metals – Beryllium

| Constituent: Metals - Beryllium |                       |                                  |                  |                     |                                    |                                    |
|---------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                 | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                 |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                           |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                           |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                           |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                           |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Beryllium: Water = 0.2 µg/L and 5 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Beryllium; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Beryllium   | N/A            | N/A              | 4 µg/L                         |

#### NEBRASKA WATER QUALITY STANDARDS – Beryllium; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Beryllium   | 130 µg/L       | 5.3 µg/L         | 4 µg/L                         |

#### Comparison of Beryllium Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Beryllium. The highest elutriate test for dissolved Beryllium was non-detect.

#### 4.3.1.7 Metals – Cadmium

| Constituent: Metals - Cadmium |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location               | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                               |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                         | 0.7J                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                         | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Cadmium: Sediment/Soil = 0.5 mg/kg and 2 mg/kg; Water = 0.2 µg/L and 1 µg/L.  
n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Cadmium; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                           | Acute Standard | Chronic Standard | Human Health Standard |
|---------------------------------------|----------------|------------------|-----------------------|
| Cadmium<br><i>Hardness = 272 mg/L</i> | 5.9 µg/L       | 0.57 µg/L        | 168 µg/L              |

#### NEBRASKA WATER QUALITY STANDARDS – Cadmium; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                           | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|---------------------------------------|----------------|------------------|--------------------------------|
| Cadmium<br><i>Hardness = 272 mg/L</i> | 16 µg/L        | 0.49 µg/L        | 5 µg/L                         |

#### Comparison of Cadmium Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Cadmium. The highest elutriate test for dissolved Cadmium was non-detect.

#### 4.3.1.8 Metals – Chromium III

| Constituent: Metals – Chromium III |                       |                                  |                  |                     |                                    |                                    |
|------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                    | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                    |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                              | 17.9                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                              | 4.6                   |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                              | 7.5                   |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                              | 7.2                   |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Chromium III:

Sediment/Soil = 0.5 mg/kg and 2 mg/kg; Water = 4 µg/L and 10 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Chromium III; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent  | Acute Standard | Chronic Standard | Human Health Standard |
|--------------|----------------|------------------|-----------------------|
| Chromium III | N/A            | N/A              | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Chromium III; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                         | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------------------------------|----------------|------------------|--------------------------------|
| Chromium III<br>Hardness = 272 mg/L | 1,344 µg/L     | 175 µg/L         | 100 µg/L                       |

#### Comparison of Chromium III Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Nebraska acute, chronic, and public drinking water criteria for Chromium III. The highest elutriate test for dissolved Chromium III was non-detect.

#### 4.3.1.9 Metals – Copper

| Constituent: Metals – Copper |                       |                                  |                  |                     |                                    |                                    |
|------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location              | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                              |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                        | 22.1                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                        | 2.2                   |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                        | 3.5                   |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                        | 3.1                   |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Copper: Sediment/Soil = 0.2 mg/kg and 1 mg/kg; Water = 2 µg/L and 10 µg/L.  
n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Copper; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                          | Acute Standard | Chronic Standard | Human Health Standard |
|--------------------------------------|----------------|------------------|-----------------------|
| Copper<br><i>Hardness = 272 mg/L</i> | 35 µg/L        | 21 µg/L          | 1,000 µg/L            |

#### NEBRASKA WATER QUALITY STANDARDS – Copper; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                          | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|--------------------------------------|----------------|------------------|--------------------------------|
| Copper<br><i>Hardness = 272 mg/L</i> | 39 µg/L        | 24 µg/L          | 1,000 µg/L                     |

#### Comparison of Copper Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Copper. The highest elutriate test for dissolved Copper was non-detect.

#### 4.3.1.10 Metals – Iron

| Constituent: Metals - Iron |                       |                                  |                  |                     |                                    |                                    |
|----------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location            | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                            |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                      |                       |                                  | n.d.             |                     |                                    | 15J                                |
| GP-S2                      |                       |                                  | n.d.             |                     |                                    | 13J                                |
| GP-S3                      |                       |                                  | n.d.             |                     |                                    | 23J                                |
| GP-S4                      |                       |                                  | n.d.             |                     |                                    | 15J                                |
| MEAN                       |                       |                                  | -----            |                     |                                    | 16.5                               |

Detection and Reporting Limits – Iron: Water = 10 µg/L and 50 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Iron; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Iron        | N/A            | N/A              | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Iron; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Iron        | N/A            | 1,000 µg/L       | 300 µg/L                       |

#### Comparison of Iron Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Nebraska chronic and public drinking water criteria for Iron. The highest elutriate test for dissolved Iron was an estimated value 23.

#### 4.3.1.11 Metals – Lead

| Constituent: Metals – Lead |                       |                                  |                  |                     |                                    |                                    |
|----------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location            | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                            |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                      | 12                    |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                      | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                      | n.d.                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                      | 3.16                  |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Lead: Sediment/Soil = 2 mg/kg and 5 mg/kg; Water = 0.5 µg/L and 2 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Lead; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                        | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|------------------------------------|----------------|------------------|--------------------------------|
| Lead<br><i>Hardness = 272 mg/L</i> | 292 µg/L       | 11.4 µg/L        | 50 µg/L                        |

#### NEBRASKA WATER QUALITY STANDARDS – Lead; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                        | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|------------------------------------|----------------|------------------|--------------------------------|
| Lead<br><i>Hardness = 272 mg/L</i> | 188 µg/L       | 7.3 µg/L         | N/A                            |

#### Comparison of Lead Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute and chronic criteria for Lead. The highest elutriate test for dissolved lead was non-detect.

#### 4.3.1.12 Metals – Manganese

| Constituent: Metals - Manganese |                       |                                  |                  |                     |                                    |                                    |
|---------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                 | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                 |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                           |                       |                                  | 7                |                     |                                    | ---                                |
| GP-S2                           |                       |                                  | 7                |                     |                                    | 0.1J                               |
| GP-S3                           |                       |                                  | 7                |                     |                                    | 0.2J                               |
| GP-S4                           |                       |                                  | 7                |                     |                                    | 1J                                 |
| MEAN                            |                       |                                  | -----            |                     |                                    | 0.4                                |

Detection and Reporting Limits – Manganese: Water = 0.1 µg/L and 2 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Manganese; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Manganese   | N/A            | N/A              | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Manganese; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Manganese   | N/A            | 1,000 µg/L       | 50 µg/L                        |

#### Comparison of Manganese Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Nebraska chronic and public drinking water criteria for Manganese. The highest elutriate test for dissolved Manganese was an estimated value of 1 mg/L.

#### 4.3.1.13 Metals – Mercury

| Constituent: Metals – Mercury |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location               | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                               |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                         | n.d.                  |                                  | n.d.             |                     | n.d.                               | n.d.                               |
| GP-S2                         | n.d.                  |                                  | n.d.             |                     | n.d.                               | n.d.                               |
| GP-S3                         | n.d.                  |                                  | n.d.             |                     | n.d.                               | n.d.                               |
| GP-S4                         | n.d.                  |                                  | n.d.             |                     | n.d.                               | n.d.                               |

Detection and Reporting Limits – Mercury:

Sediment/Soil = 0.02 mg/kg and 0.05 mg/kg; Water = 0.02 µg/L and 0.05 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Mercury; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Mercury     | 1.64 µg/L      | 0.90 µg/L        | 0.15 µg/L             |

#### NEBRASKA WATER QUALITY STANDARDS – Mercury; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking water Standard |
|-------------|----------------|------------------|--------------------------------|
| Mercury     | 1.40 µg/L      | 0.77 µg/L        | 2 µg/L                         |

#### Comparison of Mercury Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Mercury. The highest elutriate test for total or dissolved Mercury was non-detect.

#### 4.3.1.14 Metals – Nickel

| Constituent: Metals – Nickel |                       |                                  |                  |                     |                                    |                                    |
|------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location              | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                              |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                        | 21.0                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                        | 9.8                   |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                        | 13.1                  |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                        | 10.3                  |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Nickel: Sediment/Soil = 0.5 mg/kg and 2 mg/kg; Water = 2 µg/L and 10 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Nickel; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                   | Acute Standard | Chronic Standard | Human Health Standard |
|-------------------------------|----------------|------------------|-----------------------|
| Nickel<br>Hardness = 272 mg/L | 1,094 µg/L     | 122 µg/L         | 4,600 µg/L            |

#### NEBRASKA WATER QUALITY STANDARDS – Nickel; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                   | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------------------------|----------------|------------------|--------------------------------|
| Nickel<br>Hardness = 272 mg/L | 1,092 µg/L     | 121 µg/L         | 610 µg/L                       |

#### Comparison of Nickel Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water for Nickel. The highest elutriate test for dissolved Nickel was non-detect.

#### 4.3.1.15 Metals – Selenium

| Constituent: Metals - Selenium |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Selenium: Water = 10 µg/L and 100 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Selenium; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Selenium    | 19.3 µg/L      | N/A              | 170 µg/L              |

#### NEBRASKA WATER QUALITY STANDARDS – Selenium; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|-------------|----------------|------------------|--------------------------------|
| Selenium    | 20 µg/L        | 5.0 µg/L         | 50 µg/L                        |

#### Comparison of Selenium Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Selenium. The highest elutriate test for dissolved Selenium was non-detect.

#### 4.3.1.16 Metals – Silver

| Constituent: Metals - Silver |                       |                                  |                  |                     |                                    |                                    |
|------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location              | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                              |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                        |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                        |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                        |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                        |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Silver: Water = 6 µg/L and 10 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Silver; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                          | Acute Standard | Chronic Standard | Human Health Standard |
|--------------------------------------|----------------|------------------|-----------------------|
| Silver<br><i>Hardness = 272 mg/L</i> | 30 µg/L        | NA               | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Silver; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                          | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|--------------------------------------|----------------|------------------|--------------------------------|
| Silver<br><i>Hardness = 272 mg/L</i> | 18 µg/L        | N/A              | 100 µg/L                       |

#### Comparison of Silver Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Silver. The highest elutriate test for dissolved Silver was non-detect.

#### 4.3.1.17 Metals – Thallium

| Constituent: Metals - Thallium |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S2                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S3                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |
| GP-S4                          |                       |                                  | n.d.             |                     |                                    | n.d.                               |

Detection and Reporting Limits – Thallium: Water = 10 µg/L and 50 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Thallium; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent | Acute Standard | Chronic Standard | Human Health Standard |
|-------------|----------------|------------------|-----------------------|
| Thallium    | N/A            | N/A              | 7.4 µg/L              |

#### NEBRASKA WATER QUALITY STANDARDS – Thallium; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent | Acute Standard | Chronic & Human Health Standard | Public Drinking Water Standard |
|-------------|----------------|---------------------------------|--------------------------------|
| Thallium    | 1,400 µg/L     | 0.47 µg/L                       | 0.24µg/L                       |

#### Comparison of Thallium Elutriate Tests to Water Quality Standards

All filtered elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Nebraska acute criteria for Thallium. The highest elutriate test for dissolved Thallium was non-detect.

#### 4.3.1.18 Metals – Zinc

| Constituent: Metals – Zinc |                       |                                  |                  |                     |                                    |                                    |
|----------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location            | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                            |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                      | 59                    |                                  | 20               |                     |                                    | 70                                 |
| GP-S2                      | 20                    |                                  | 20               |                     |                                    | 10                                 |
| GP-S3                      | 28                    |                                  | 20               |                     |                                    | 10                                 |
| GP-S4                      | 23                    |                                  | 20               |                     |                                    | 10                                 |
| MEAN                       | 33                    |                                  | -----            |                     |                                    | 25                                 |

Detection and Reporting Limits – Zinc: Sediment/Soil = 1 mg/kg and 5 mg/kg; Water = 2 µg/L and 10 µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Zinc; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent                        | Acute Standard | Chronic Standard | Human Health Standard |
|------------------------------------|----------------|------------------|-----------------------|
| Zinc<br><i>Hardness = 272 mg/L</i> | 280 µg/L       | 280 µg/L         | 26,000 µg/L           |

#### NEBRASKA WATER QUALITY STANDARDS – Zinc; Warmwater Aquatic Life Class A and Public Drinking Water

| Constituent                        | Acute Standard | Chronic Standard | Public Drinking Water Standard |
|------------------------------------|----------------|------------------|--------------------------------|
| Zinc<br><i>Hardness = 272 mg/L</i> | 274 µg/L       | 274 µg/L         | 5,000 µg/L                     |

#### Comparison of Zinc Elutriate Tests to Water Quality Standards

All elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Iowa and Nebraska acute, chronic, human health, and public drinking water criteria for Zinc. The highest elutriate test for dissolved Zinc was 70 µg/L.

#### 4.3.1.19 Nitrate-Nitrite Nitrogen

| Constituent: Nitrate-Nitrite Nitrogen |                       |                                  |                  |                     |                                    |                                    |
|---------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                       | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                       |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                                 | n.d.                  |                                  | 0.12J            | 0.13J               |                                    | 0.12J                              |
| GP-S2                                 | n.d.                  |                                  | 0.12J            | 0.15J               |                                    | 0.13J                              |
| GP-S3                                 | 1.5                   |                                  | 0.12J            | 0.82                |                                    | 0.76                               |
| GP-S4                                 | 1.8                   |                                  | 0.12J            | 0.87                |                                    | 0.89                               |
| MEAN                                  | 0.9                   |                                  | -----            | 0.49                |                                    | 0.48                               |

Detection and Reporting Limits – Nitrate-Nitrite Nitrogen:

Sediment/Soil = 0.2 mg/kg and 1 mg/kg; Water = 0.05 mg/L and 0.20 mg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – Nitrate-Nitrite Nitrogen; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent              | Acute Standard | Chronic Standard | Human Health Standard |
|--------------------------|----------------|------------------|-----------------------|
| Nitrate-Nitrite Nitrogen | N/A            | N/A              | N/A                   |

#### NEBRASKA WATER QUALITY STANDARDS – Nitrate-Nitrite Nitrogen; Agricultural Water Supply and Public Drinking Water

| Constituent              | Acute Standard | Chronic Standard | Agricultural Water Supply | Public Drinking Water Standard |
|--------------------------|----------------|------------------|---------------------------|--------------------------------|
| Nitrate-Nitrite Nitrogen | N/A            | N/A              | 100 mg/L                  | 10 mg/L                        |

#### Comparison of Nitrate-Nitrite Nitrogen Elutriate Tests to Water Quality Standards

All elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were less than the Nebraska agricultural water supply and public drinking water criteria for Nitrate-Nitrite Nitrogen. The highest elutriate test for dissolved Nitrate-Nitrite Nitrogen was 0.89 mg/L.

#### 4.3.1.20 Organochlorine Pesticide Scan

| Constituent: Organochlorine Pesticide Scan |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                            | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                            |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                                      | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S2                                      | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S3                                      | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S4                                      | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |

Detection and Reporting Limits – Organochlorine Pesticide Scan:

20 different pesticides were analyzed with varying detection and reporting levels – see Appendix 2.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

**Iowa Water Quality Standards – Organochlorine Pesticides; Use Class B(WW-1), Human Health – Fish Consumption**

**Nebraska Water Quality Standards – Organochlorine Pesticides; Warmwater Aquatic Life Class A and Human Health (Fish Consumption)**

| Organochlorine Pesticide | Acute Standard (µg/L) | Chronic Standard (µg/L) | Human Health Criterion (µg/L) |
|--------------------------|-----------------------|-------------------------|-------------------------------|
| Aldrin                   | 3                     | 0.0005                  | 0.0005                        |
| BHC                      | 100                   | 0.414                   | 0.414                         |
| BHC (Alpha)              | -----                 | 0.049                   | 0.049                         |
| BHC (Beta)               | -----                 | 0.17                    | 0.17                          |
| Chlordane                | 2.4                   | 0.0043                  | -----                         |
| DDT                      | 1.1                   | 0.001                   | -----                         |
| DDD                      | 0.6                   | 0.0031                  | 0.0031                        |
| DDE                      | 1,050                 | 0.0022                  | 0.0022                        |
| Dieldrin                 | 0.24                  | 0.00054                 | 0.00054                       |
| Endosulfan (Alpha)       | 0.22                  | 0.056                   | -----                         |
| Endosulfan (Beta)        | 0.22                  | 0.056                   | -----                         |
| Endosulfan sulfate       | -----                 | 89                      | 89                            |
| Endrin                   | 0.086                 | 0.036                   | -----                         |
| Endrin aldehyde          | -----                 | 0.30                    | 0.30                          |
| Heptachlor               | 0.52                  | 0.00079                 | 0.00079                       |
| Heptachlor epoxide       | 0.52                  | 0.00039                 | 0.00039                       |
| Lindane                  | 0.95                  | 0.16                    | -----                         |

#### Comparison of Organochlorine Pesticide Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were non-detectable for the Organochlorine Pesticides included in the Scan. Some of the Iowa and Nebraska's water quality standards for the scanned pesticides were below the detection limits of the scan.

#### 4.3.1.21 Polychlorinated Biphenyls (PCBs) Scan

| Constituent: Polychlorinated Biphenyls |                       |                                  |                  |                     |                                    |                                    |
|----------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                        | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                        |                       | Total (µg/L)                     | Dissolved (µg/L) | Total (µg/L)        | Non-Filtered Total Analysis (µg/L) | Filtered Dissolved Analysis (µg/L) |
| GP-S1                                  | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S2                                  | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S3                                  | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S4                                  | n.d.                  | n.d.                             |                  |                     | n.d.                               |                                    |

Detection and Reporting Limits – PCBs: Sediment/Soil = Varies by PCB congener and 50 µg/kg; Water = 0.01µg/L and 1µg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

#### Iowa Water Quality Standards – PCBs; Use Class B(WW-1), Human Health – Fish Consumption

| Constituent               | Acute Standard | Chronic Standard | Human Health Standard |
|---------------------------|----------------|------------------|-----------------------|
| Polychlorinated Biphenyls | 2.0 µg/L       | 0.014 µg/L       | 0.00064 µg/L          |

#### Nebraska Water Quality Standards – PCBs; Warmwater Aquatic Life Class A and Human Health – Fish Consumption

| Constituent               | Acute Standard | Chronic Standard | Human Health Criterion |
|---------------------------|----------------|------------------|------------------------|
| Polychlorinated Biphenyls | 2.0 µg/L       | 0.00064 µg/L     | 0.00064 µg/L           |

#### Comparison of PCBs Scan Elutriate Tests to Water Quality Standards

All elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were non-detectable (< 0.01 µg/L) for PCBs.

#### 4.3.1.22 pH

| Constituent: pH |                      |                                  |            |                     |                                    |                                    |
|-----------------|----------------------|----------------------------------|------------|---------------------|------------------------------------|------------------------------------|
| Sample Location | Sediment/Soil (S.U.) | Receiving Water (Missouri River) |            | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                 |                      | Field (S.U.)                     | Lab (S.U.) | Lab (S.U.)          | Non-Filtered Total Analysis (S.U.) | Filtered Dissolved Analysis (S.U.) |
| GP-S1           | 7.7                  | 8.4                              | 8.3        | 7.7                 | 7.9                                |                                    |
| GP-S2           | 8.5                  | 8.4                              | 8.3        | 8.2                 | 8.2                                |                                    |
| GP-S3           | 8.5                  | 8.4                              | 8.3        | 8.1                 | 8.1                                |                                    |
| GP-S4           | 8.4                  | 8.4                              | 8.3        | 8.1                 | 8.0                                |                                    |

Detection and Reporting Limits – pH: Sediment/Soil and Water = 0.1 S.U. and 0.2 S.U.

#### Iowa Water Quality Standards – pH; Use Class B(WW-1)

| Constituent | Minimum Standard | Maximum Standard |
|-------------|------------------|------------------|
| pH          | 6.5 S.U.         | 9.0 S.U.         |

#### Nebraska Water Quality Standards – pH; Warmwater Aquatic Life Class A

| Constituent | Minimum Standard | Maximum Standard |
|-------------|------------------|------------------|
| pH          | 6.5 S.U.         | 9.0 S.U.         |

#### Comparison of pH Elutriate Tests to Water Quality Standards

Both the Iowa and Nebraska minimum and maximum pH criteria (i.e. 6.5 and 9.0 S.U.) for the Missouri River are the same. The pH of all elutriate tests of the 4 collected sediment/soil samples at the proposed Glovers Point project site were within the minimum and maximum pH criteria.

#### 4.3.2 Analyzed Constituents with No Promulgated State Water Quality Standards

The following constituents were analyzed and have no water quality standards numeric criteria promulgated by the State of Iowa or Nebraska:

- Carbonaceous Biochemical Oxygen Demand, 5-Day (CBOD<sub>5</sub>)
- Chemical Oxygen Demand (COD)
- Kjeldahl Nitrogen, Total (TKN)
- Percent Solids
- Total Organic Carbon (TOC)
- Total Phosphorus
- Total Suspended Solids
- Turbidity

##### 4.3.2.1 Carbonaceous Biochemical Oxygen Demand (5-day)

| Constituent: Carbonaceous Biochemical Oxygen Demand (5-Day) |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                                             | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                                             |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                                                       |                       | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S2                                                       |                       | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S3                                                       |                       | n.d.                             |                  |                     | n.d.                               |                                    |
| GP-S4                                                       |                       | n.d.                             |                  |                     | n.d.                               |                                    |

Detection and Reporting Limits – CBOD<sub>5</sub>: Water = 2 mg/L and 5 mg/L.

n.d. = Non-detect.

J = Estimated Value (Reported Value > Detection Limit and < Reporting Limit).

##### 4.3.2.2 Chemical Oxygen Demand

| Constituent: Chemical Oxygen Demand |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                     | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                     |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                               |                       | 13                               |                  |                     | 15                                 |                                    |
| GP-S2                               |                       | 13                               |                  |                     | 10                                 |                                    |
| GP-S3                               |                       | 13                               |                  |                     | 14                                 |                                    |
| GP-S4                               |                       | 13                               |                  |                     | 10                                 |                                    |
| MEAN                                |                       | -----                            |                  |                     | 12.3                               |                                    |

Detection and Reporting Limits – COD: Water = 3 mg/L and 10 mg/L.

#### 4.3.2.3 Total Kjeldahl Nitrogen

| Constituent: Total Kjeldahl Nitrogen |                       |                                  |                  |                     |                                    |                                    |
|--------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                      | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                      |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                                | 1,207                 | 0.4J                             | 0.3J             | 63.0                | 1.6                                | 1.2                                |
| GP-S2                                | 61                    | 0.4J                             | 0.3J             | 6.3                 | 0.9                                | 0.3J                               |
| GP-S3                                | 113                   | 0.4J                             | 0.3J             | 9.6                 | 0.6                                | 0.5J                               |
| GP-S4                                | 121                   | 0.4J                             | 0.3J             | 18.6                | 0.8                                | 0.3J                               |
| MEAN                                 | 376                   | -----                            | -----            | 24.4                | 1.0                                | 0.6                                |

Detection and Reporting Limits – TKN: Sediment/Soil = 2 mg/L and 10 mg/L; Water = 0.2 mg/L and 0.5 mg/L.

#### 4.3.2.4 Percent Solids

| Constituent: Percent Solids |                   |  |  |  |  |  |
|-----------------------------|-------------------|--|--|--|--|--|
| Sample Location             | Sediment/Soil (%) |  |  |  |  |  |
|                             |                   |  |  |  |  |  |
| GP-S1                       | 77.2              |  |  |  |  |  |
| GP-S2                       | 81.5              |  |  |  |  |  |
| GP-S3                       | 86.6              |  |  |  |  |  |
| GP-S4                       | 91.1              |  |  |  |  |  |
| MEAN                        | 84.1              |  |  |  |  |  |

Detection and Reporting Limits – Percent Solids: Sediment/Soil = 0.01% and 1%.

#### 4.3.2.5 Total Organic Carbon

| Constituent: Total Organic Carbon |                       |                                  |                  |                     |                                    |                                    |
|-----------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                   | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                   |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                             | 18,200                | 3.5                              | 3.5              | 670                 | 9.5                                | 4.7                                |
| GP-S2                             | 2,200                 | 3.5                              | 3.5              | 113                 | 7.8                                | 4.1                                |
| GP-S3                             | 3,400                 | 3.5                              | 3.5              | 190                 | 6.0                                | 3.7                                |
| GP-S4                             | 3,600                 | 3.5                              | 3.5              | 278                 | 6.9                                | 4.1                                |
| MEAN                              | 6,850                 | -----                            | -----            | 312.8               | 7.6                                | 4.2                                |

Detection and Reporting Limits – TOC: Sediment/Soil = 2 mg/L and 10 mg/L; Water = 0.2 mg/L and 1 mg/L.

#### 4.3.2.6 Total Phosphorus

| Constituent: Total Phosphorus |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location               | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                               |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                         | 665                   | 0.05                             | n.d.             | 20.9                | 0.26                               | 0.05                               |
| GP-S2                         | 307                   | 0.05                             | n.d.             | 4.8                 | 0.30                               | 0.05                               |
| GP-S3                         | 388                   | 0.05                             | n.d.             | 9.5                 | 0.23                               | 0.05                               |
| GP-S4                         | 403                   | 0.05                             | n.d.             | 13.7                | 0.24                               | 0.06                               |
| MEAN                          | 441                   | -----                            | -----            | 12.2                | 0.26                               | 0.05                               |

Detection and Reporting Limits – TP: Sediment/Soil = 0.2 mg/L and 1 mg/L; Water = 0.02 mg/L and 0.05 mg/L.

#### 4.3.2.7 Total Suspended Solids

| Constituent: Total Suspended Solids |                       |                                  |                  |                     |                                    |                                    |
|-------------------------------------|-----------------------|----------------------------------|------------------|---------------------|------------------------------------|------------------------------------|
| Sample Location                     | Sediment/Soil (mg/kg) | Receiving Water (Missouri River) |                  | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                                     |                       | Total (mg/L)                     | Dissolved (mg/L) | Total (mg/L)        | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                               |                       | 34                               |                  | 51,100              | 228                                |                                    |
| GP-S2                               |                       | 34                               |                  | 6,027               | 272                                |                                    |
| GP-S3                               |                       | 34                               |                  | 10,825              | 184                                |                                    |
| GP-S4                               |                       | 34                               |                  | 20,267              | 148                                |                                    |
| MEAN                                |                       | -----                            |                  | 22,055              | 208                                |                                    |

Detection and Reporting Limits – TSS: Water = 4 mg/L and 10 mg/L.

#### 4.3.2.8 Turbidity

| Constituent: Turbidity |               |                                  |                 |                     |                                    |                                    |
|------------------------|---------------|----------------------------------|-----------------|---------------------|------------------------------------|------------------------------------|
| Sample Location        | Sediment/Soil | Receiving Water (Missouri River) |                 | Pre-Elutriate Water | Elutriate Water                    |                                    |
|                        |               | Total (NTU)                      | Dissolved (NTU) | Total (NTU)         | Non-Filtered Total Analysis (mg/L) | Filtered Dissolved Analysis (mg/L) |
| GP-S1                  |               | 15                               | n.d.            | >1,000              | 340                                | n.d.                               |
| GP-S2                  |               | 15                               | n.d.            | >1,000              | 336                                | n.d.                               |
| GP-S3                  |               | 15                               | n.d.            | >1,000              | 281                                | n.d.                               |
| GP-S4                  |               | 15                               | n.d.            | >1,000              | 269                                | n.d.                               |
| MEAN                   |               | -----                            | -----           | >1,000              | 307                                | -----                              |

Detection and Reporting Limits – Turbidity: Water = 1 NTU and 3 NTU.

## 5 WATER QUALITY FACTUAL DETERMINATIONS

### 5.1 Physical Substrate Determinations

Table 4 and Figure 5 described the particle size composition of the material identified for excavation for the construction of SWH at the proposed Glovers Point project site. A mean particle size composition for the material identified for excavation at the proposed Glovers Point site was calculated from the four collected sediment samples. The sediment/soil to be excavated is believed to be alluvial material.

As part of Bank Stabilization and Navigation Project (BSNP), the Omaha District irregularly samples substrate composition in the navigation channel of the Missouri River. In 2008, particle size composition of the river bottom was measured every 5 miles from Ponca, NE to Rulo, NE. At each location two to three substrate samples were collected from the navigation channel. Table 5 shows the particle size composition of the substrate samples collected from the navigation channel upstream and downstream of the proposed Glovers Point project (RM712) site at RM715 and RM710. The substrate particle size composition in the navigation channel of the Missouri River indicates that the finer material has been washed out and transported downstream. This is in line with the management goals of the BSNP to maintain the navigation channel. Depth-discrete water quality sampling in the navigation channel of the lower Missouri River by the Omaha District indicates that the water column is completely mixed except for a restricted area near the river bottom where bed-load is transported.

**Table 5.** Summary of particle size analysis of the sediment samples collected from the Missouri River navigation channel at RM715 and RM710 during 2008.

| Sample Location   | % Cobbles  | % Gravel   |            | % Sand     |             |             | % Fines    |      |
|-------------------|------------|------------|------------|------------|-------------|-------------|------------|------|
|                   |            | Coarse     | Fine       | Coarse     | Medium      | Fine        | Silt       | Clay |
| RM715 - 70137     | 0.0        | 0.0        | 1.1        | 0.5        | 26.3        | 71.6        | 0.5        |      |
| RM715 - 70138     | 0.0        | 0.0        | 0.4        | 0.0        | 33.3        | 65.7        | 0.6        |      |
| <b>MEAN RM715</b> | <b>0.0</b> | <b>0.0</b> | <b>0.8</b> | <b>0.3</b> | <b>29.8</b> | <b>68.7</b> | <b>0.6</b> |      |
| RM710 - 70139     | 0.0        | 0.0        | 0.9        | 4.9        | 66.2        | 28.0        | 0.0        |      |
| RM710 - 70140     | 0.0        | 0.0        | 0.6        | 0.6        | 33.3        | 65.4        | 0.1        |      |
| RM710 - 70141     | 0.0        | 0.0        | 4.9        | 9.5        | 61.0        | 24.6        | 0.0        |      |
| <b>MEAN RM710</b> | <b>0.0</b> | <b>0.0</b> | <b>2.1</b> | <b>5.0</b> | <b>53.5</b> | <b>39.3</b> | <b>0.1</b> |      |

Figure 6 plots the mean particle size composition of the sediment samples collected at the proposed Glovers Point project site and from the navigation channel of the Missouri River at RM715 and RM710. As seen in Figure 6, there are more fines in the sediment identified for excavation at the proposed Glovers Point project site as compared to the bottom substrate of the Missouri River navigation channel. This is not unexpected given that the existing sediment at the Glovers Point project site is finer alluvial material that settled out along the river benches during higher flows. As occurs with sediment delivered from inflowing tributaries, the finer material in the proposed dredging discharge will be transported downstream as part of the suspended solids load, and the heavier material will be incorporated into the Missouri River bed-load.

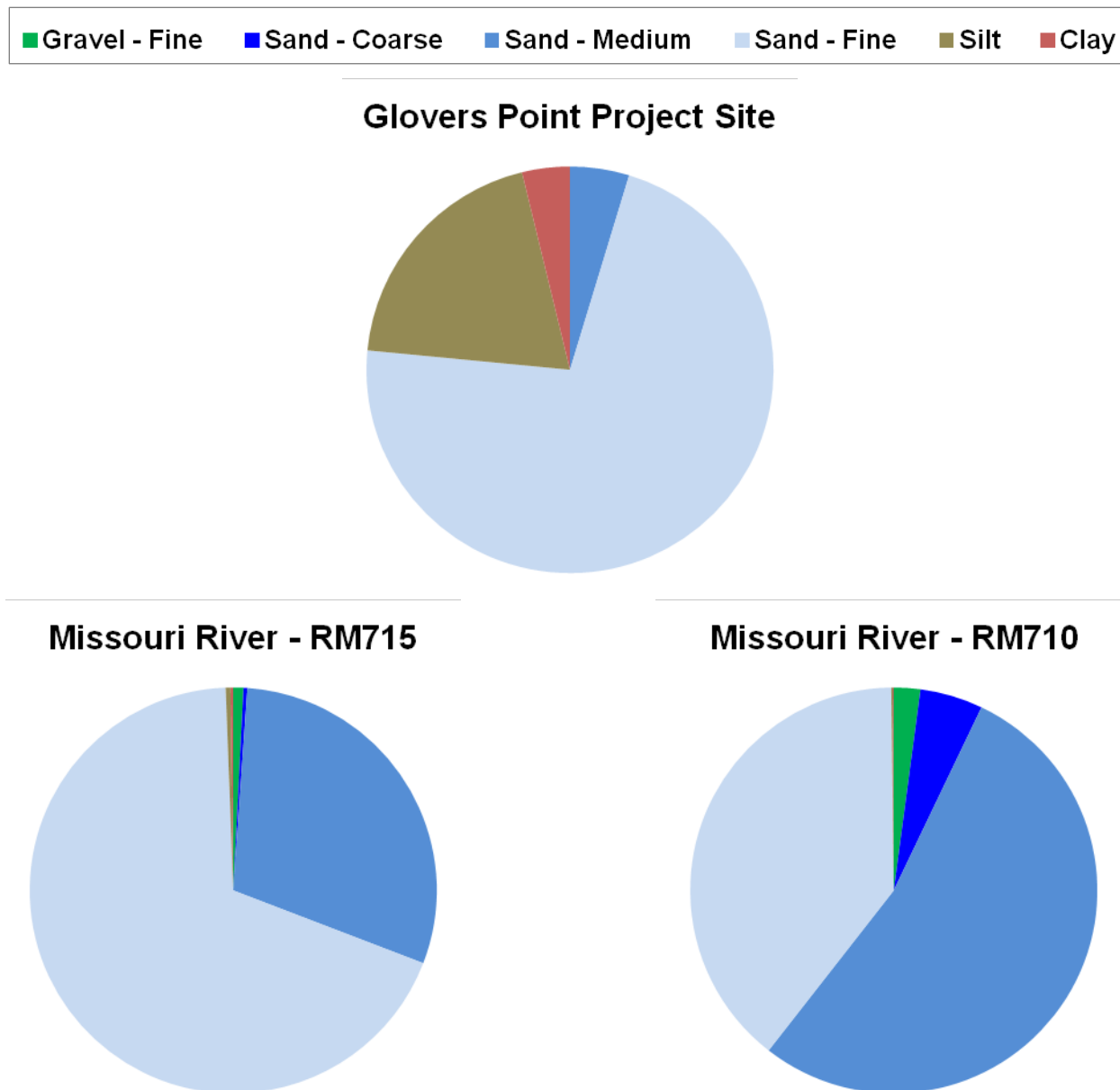


**Figure 6.** Particle size composition of likely dredge material at the proposed Glovers Point project site and the substrate of the Missouri River bottom in the navigation channel in the area of the proposed Glovers Point project.

## 5.2 Suspended Particulate/Turbidity Determinations

The dredge slurry discharge at the “end-of-pipe” will have a high total suspended solids (TSS) concentration and be quite turbid. Table 6 provides the TSS and turbidity levels measured in the pre-elutriate samples prepared from the four sediment/soil samples collected at the proposed Glovers Point project site. Turbidity levels measured for all four prepared pre-elutriate samples were greater than 1,000 NTU. Analysis of pre-elutriate samples prepared during elutriate testing at other SWH project sites along the Missouri River indicate turbidity levels up to 8,000 NTUs could be expected at the “end-of-pipe” slurry discharge. Some local impacts to existing Missouri River water quality from TSS and turbidity can be expected in the immediate vicinity of the dredging discharge.

**Table 6.** Total suspended solids and turbidity levels measured in pre-elutriate samples prepared from sediment/soil samples collected at the proposed Glovers Point project site.

| <b>Sediment/Soil Sample</b> | <b>Total Suspended Solids<br/>(mg/L)</b> | <b>Turbidity<br/>(NTU)</b> |
|-----------------------------|------------------------------------------|----------------------------|
| GP-S1                       | 51,100                                   | >1,000                     |
| GP-S2                       | 6,027                                    | >1,000                     |
| GP-S3                       | 10,825                                   | >1,000                     |
| GP-S4                       | 20,267                                   | >1,000                     |
| <b>MEAN</b>                 | <b>22,055</b>                            | <b>&gt;1,000</b>           |

Past dredging discharges to construct SWH have attempted to minimize any such impacts by targeted placement of the dredging discharge in the Missouri River (e.g. mid-channel, mid-depth, etc.). The Omaha District assessed in-river TSS and turbidity levels upstream and downstream of the dredging discharge during construction of SWH at the California Bend project site. Four sites were monitored: 1) upstream of the “end-of-pipe”, 2) zone of initial dilution at the dredging discharge, 3) 200 feet downstream of the “end-of-pipe” in the discharge plume, and 4) 2,000 feet downstream of the “end-of-pipe” in the discharge plume. Table 7 gives TSS and turbidity levels measured at the four locations during dredging discharge in September 2003. Figure 7 plots the same information. As seen in Table 9 and Figure 7, TSS and turbidity levels are elevated in the zone of initial dilution; however, these levels quickly dissipate downstream in the discharge plume.

**Table 7.** Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project site in 2003.

| <b>Date</b> | <b>Upstream of Discharge</b> |                             | <b>Zone of Initial Dilution</b> |                             | <b>200 Feet Downstream</b> |                             | <b>2,000 Feet Downstream</b> |                             |
|-------------|------------------------------|-----------------------------|---------------------------------|-----------------------------|----------------------------|-----------------------------|------------------------------|-----------------------------|
|             | <b>TSS<br/>(mg/L)</b>        | <b>Turbidity<br/>(NTUs)</b> | <b>TSS<br/>(mg/L)</b>           | <b>Turbidity<br/>(NTUs)</b> | <b>TSS<br/>(mg/L)</b>      | <b>Turbidity<br/>(NTUs)</b> | <b>TSS<br/>(mg/L)</b>        | <b>Turbidity<br/>(NTUs)</b> |
| 5-Sep-03    | 46                           | 30                          | 331                             | 218                         | 81                         | 90                          | 29                           | 38                          |
| 12-Sep-03   | 84                           | 43                          | 629                             | 414                         | 144                        | 94                          | 74                           | 56                          |

### 5.3 Contaminant Determinations

#### 5.3.1 **Constituents with Promulgated State Water Quality Standards’ Criteria**

Elutriate testing of representative sediment/soil samples collected at the proposed Glovers Point project included analysis for the following constituents that the States of Iowa or Nebraska have promulgated water quality standards criteria: Ammonia; Atrazine; Metals: Aluminum, Antimony, Arsenic, Beryllium, Cadmium, Chromium III, Copper, Iron, Lead, Manganese, Mercury, Nickel, Selenium, Silver, Thallium, Zinc; Nitrate-Nitrite Nitrogen; Organochlorine Pesticides; PCBs; and pH. Except for Antimony, none of the prepared elutriate samples exceeded promulgated State water quality standards criteria. Two estimated, filtered elutriate tests for Antimony were slightly higher than the Iowa human health and Nebraska public drinking water standards.

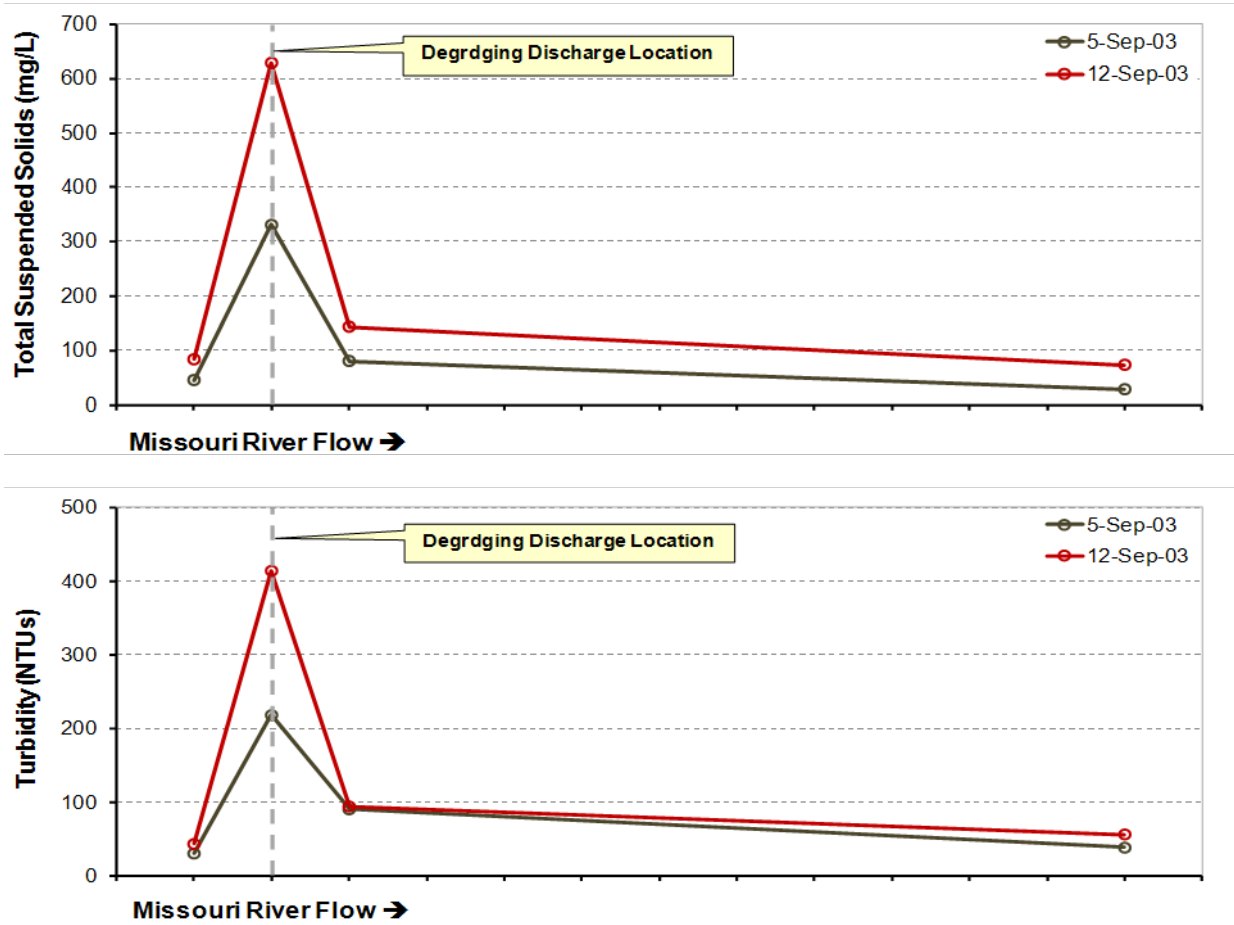


**Figure 7.** Total suspended solids and turbidity levels monitored in the Missouri River upstream and downstream of the dredging discharge to construct shallow-water habitat at the California Bend project in 2003.

### 5.3.2 Nutrients

Table 8 summarizes the nutrient analyses of sediment/soil samples collected at the proposed Glovers Point site, and elutriate samples prepared from the collected sediment/soil samples. Pre-elutriate samples characterize total nutrients (i.e. settleable, suspended, and dissolved nutrients) in the prepared elutriate mixture. Non-filtered elutriate samples characterize suspended and dissolved nutrients remaining in the elutriate mixture supernatant after 1-hour of settling. Filtered elutriate samples characterize dissolved nutrients in the elutriate mixture supernatant. Pre-elutriate samples represent potential “end-of-pipe” nutrient concentrations of the slurry discharge prior to any mixing with the receiving water (i.e. Missouri River). Pre-elutriate samples were analyzed for Total Kjeldahl Nitrogen and Total Phosphorus. Non-filtered elutriate samples were analyzed for Total Kjeldahl Nitrogen, Total Ammonia Nitrogen, and Total Phosphorus. Standard, filtered elutriate samples were analyzed for dissolved Nitrate-Nitrite Nitrogen and dissolved Phosphorus.

**Table 8.** Summary of nutrient analyses of sediment/soil samples collected at the proposed Glovers Point shallow-water habitat site on 14-November-2012 and elutriate testing of the collected sediment/soil samples.

|                               | <b>Total Kjeldahl N<br/>(mg/L)</b> | <b>Ammonia N<br/>(mg/L)</b> | <b>Nitrate-Nitrite N<br/>(mg/L)</b> | <b>Total P<br/>(mg/L)</b> | <b>Dissolved P<br/>(mg/L)</b> |
|-------------------------------|------------------------------------|-----------------------------|-------------------------------------|---------------------------|-------------------------------|
| <b>Site GP-S1:</b>            |                                    |                             |                                     |                           |                               |
| Sediment/Soil                 | 1,207*                             | 79.6*                       | < 0.2*                              | 665*                      | -----                         |
| Pre-Elutriate                 | 63                                 | -----                       | -----                               | 20.9                      | -----                         |
| Non-Filtered Elutriate        | 1.6                                | 0.82                        | -----                               | 0.26                      | -----                         |
| Standard Elutriate            | -----                              | -----                       | 0.12                                | -----                     | 0.05                          |
| <b>Site GP-S2:</b>            |                                    |                             |                                     |                           |                               |
| Sediment/Soil                 | 61*                                | < 2*                        | < 0.2*                              | 307*                      | -----                         |
| Pre-Elutriate                 | 6.3                                | -----                       | -----                               | 4.8                       | -----                         |
| Non-Filtered Elutriate        | 0.9                                | 0.14                        | -----                               | 0.30                      | -----                         |
| Standard Elutriate            | -----                              | -----                       | 0.13                                | -----                     | 0.05                          |
| <b>Site GP-S3:</b>            |                                    |                             |                                     |                           |                               |
| Sediment/Soil                 | 113*                               | < 2*                        | 1.5*                                | 388*                      | -----                         |
| Pre-Elutriate                 | 9.6                                | -----                       | -----                               | 9.5                       | -----                         |
| Non-Filtered Elutriate        | 0.6                                | 0.12                        | -----                               | 0.23                      | -----                         |
| Standard Elutriate            | -----                              | -----                       | 0.76                                | -----                     | 0.05                          |
| <b>Site GP-S4:</b>            |                                    |                             |                                     |                           |                               |
| Sediment/Soil                 | 121*                               | < 2*                        | 1.8*                                | 403*                      | -----                         |
| Pre-Elutriate                 | 18.6                               | -----                       | -----                               | 13.7                      | -----                         |
| Non-Filtered Elutriate        | 0.8                                | 0.19                        | -----                               | 0.24                      | -----                         |
| Standard Elutriate            | -----                              | -----                       | 0.89                                | -----                     | 0.06                          |
| <b>Mean Concentration</b>     |                                    |                             |                                     |                           |                               |
| <b>Sediment/Soil</b>          | <b>376*</b>                        | <b>20.7*</b>                | <b>0.88*</b>                        | <b>441*</b>               | <b>-----</b>                  |
| <b>Pre-Elutriate</b>          | <b>24.4</b>                        | <b>-----</b>                | <b>-----</b>                        | <b>12.2</b>               | <b>-----</b>                  |
| <b>Non-Filtered Elutriate</b> | <b>1.0</b>                         | <b>0.32</b>                 | <b>-----</b>                        | <b>0.26</b>               | <b>-----</b>                  |
| <b>Standard Elutriate</b>     | <b>-----</b>                       | <b>-----</b>                | <b>0.48</b>                         | <b>-----</b>              | <b>0.05</b>                   |

\* mg/kg

#### 5.3.2.1 Estimated Total Tonnage of Nutrients to be Discharged to the Missouri River

It is estimated that that a total of 910,000 cubic yards of material would be excavated and discharged to the Missouri River to construct SWH at the proposed Glovers Point project. Table 4 and Figure 6 describe the particle size composition of the material proposed for excavation. Based on the sandy alluvial material to be excavated, a conversion factor of 85 lbs/ft<sup>3</sup> was used to convert the estimated material volume (910,000 yd<sup>3</sup>) to estimated material weight (1,044,225 tons). The metric tonnage of nutrients that would be discharged to the Missouri River during the period of SWH construction was estimated from the mean nutrient levels determined for the collected sediment/soil samples and the total material to be excavated (Table 9). Currently, the total phosphorus load to the Gulf of Mexico is estimated to be 154,300 metric tons per year, with the contribution of the Missouri River to this total load estimated to be between 16.8% and 20% (NRC, 2011). If the proposed SWH construction at Glovers Point was completed within one year and the estimated total discharge of 417.76 metric tons of total phosphorus made it to the Gulf of Mexico in one year, it would represent 1.35% of the annual Missouri River total phosphorus load delivered to the Mississippi River, and 0.27% of the annual total phosphorus load delivered to the Gulf of Mexico. These percentages are upper bound estimates, as sediment deposition processes in the Missouri and Mississippi River channels would reduce loads delivered to the Gulf, and actual downstream deliveries would be significantly less than these values.

**Table 9.** Estimated metric tonnage of nutrients that would be discharged to the Missouri River during the entire period shallow-water habitat was constructed at the proposed Glovers Point project.

| Total Kjeldahl Nitrogen<br>(metric tons) | Ammonia<br>(metric tons) | Nitrate-Nitrite Nitrogen<br>(metric tons) | Total Phosphorus<br>(metric tons) |
|------------------------------------------|--------------------------|-------------------------------------------|-----------------------------------|
| 356.19                                   | 19.61                    | 0.83                                      | 417.76                            |

Note: 1 metric ton = 1,000 kg

### 5.3.2.2 *Potential Impacts to Missouri River Water Quality*

#### 5.3.2.2.1 *Dredging Discharge Flows*

The following information was taken from EM 1110-2-5025 (25-Mar-1983), “*Dredging and Dredged material Disposal*” (USACE, 1983):

“The hydraulic pipeline cutterhead suction dredge ... is equipped with a rotating cutter apparatus surrounding the intake end of the suction pipe, it can effectively dig and pump all types of alluvial materials and compacted deposits, such as clay and hardpan. Slurries of 10 to 20 percent solids (by dry weight) are typical, depending upon the material being dredged, dredging depth, horsepower of dredge pumps, and pumping distance to disposal area. If no other data are available, a pipeline discharge concentration of 13 percent by dry weight (145 ppt) should be used for design purposes. Pipeline discharge velocity, under routine working conditions, ranges from 15-20 ft/sec. Table 10 presents theoretical pipeline discharge rates as functions of pipeline discharge velocity for dredges ranging from 8 to 30 in.”

**Table 10.** Suction dredge pipeline discharge rates (cfs)<sup>(a)</sup> [taken from EM 1110-2-5025].

| Discharge Velocity<br>(ft/sec) | Discharge Pipe Diameter |         |         |         |
|--------------------------------|-------------------------|---------|---------|---------|
|                                | 8-inch                  | 18-inch | 24-inch | 30-inch |
| 10                             | 3.5                     | 17.7    | 31.4    | 49.1    |
| 15                             | 5.2                     | 26.5    | 47.1    | 73.6    |
| 20                             | 7.0                     | 35.3    | 62.8    | 98.1    |
| 25                             | 8.7                     | 44.2    | 78.5    | 122.7   |

<sup>(a)</sup> Discharge rate = pipeline area x discharge velocity.

Discharge rate for 20-inch diameter pipe:

Pipe radius = 10 in. = 0.833 ft.

Pipe area =  $\pi r^2 = (3.1416)(0.833)^2 = 2.18 \text{ ft}^2$

Discharge rate =  $2.18 \text{ ft}^2 \times 20 \text{ ft/sec} = 43.6 \text{ cfs}$

Note: Given a velocity of 20 ft/sec was used, this is a maximum estimate for discharge rate.

#### 5.3.2.2.2 *Elutriate Testing of Sediment/Soil Samples Collected at the Glovers Point Site*

Elutriate testing of the sediment/soil samples collected at the proposed Glovers Point project site was done pursuant to the “*Inland Testing Manual*”. A test slurry was prepared based on a dilution of 1 part sediment to 4 parts receiving water on a volume basis. The 1:4 dilution for elutriate testing represents a 20% slurry. However, elutriate testing is done using “wet” sediment to avoid volatilization of any potential contaminants in the sediment during a drying process. The “wet” sediment was analyzed for percent solids and the amount of water present in the sediment sample can be mathematically converted to “dry weight” based on the percent solids quantification. Table 11 estimates the dry-weight percent slurries for each of the elutriate mixtures prepared from the four sediment/soil samples collected

from the proposed Glovers Point project site. The percent slurry estimate is based on the measured percent solids of the collected sediment/soil samples and the 1:4 dilution used to prepare elutriate samples. All of the prepared elutriate mixtures from the collected sediment/soil samples fall within the 10 to 20 percent solids (by dry weight) typically for a hydraulic pipeline cutterhead suction dredge.

**Table 11.** Dry-weight percent slurries represented by the elutriate mixtures prepared from the four sediment/soil samples collected at the proposed Glovers Point shallow-water habitat site.

| Sediment/Soil Sample | Percent Solids | Percent Slurry<br>(Based on Estimated Dry Weight) |
|----------------------|----------------|---------------------------------------------------|
| GP-S1                | 77.2%          | 15.4%                                             |
| GP-S2                | 81.5%          | 16.3%                                             |
| GP-S3                | 86.6%          | 17.3%                                             |
| GP-S4                | 91.1%          | 18.2%                                             |

**Note:** Based on a 1:4 (dry-weight sediment to water ratio):

- 100% percent solids = 20% slurry
- 50% percent solids = 10% slurry

#### 5.3.2.2.3 *Missouri River Nutrient Conditions at Glovers Point Area on 14-November-2012*

Tables 12, 13, and 14, respectively, summarize the nutrient concentrations, fluxes, and loadings present in the Missouri River on 14-November-2012 when sediment/soil samples were collected at the proposed Glovers Point project site.

**Table 12.** Nutrient concentrations measured in the Missouri River at RM709 on 14-November-2012.

| Total Kjeldahl N<br>(mg/L) | Ammonia N<br>(mg/L) | Nitrate-Nitrite N<br>(mg/L) | Total P<br>(mg/L) | Dissolved P<br>(mg/L) |
|----------------------------|---------------------|-----------------------------|-------------------|-----------------------|
| 0.4                        | 0.08                | 0.12                        | 0.05              | < 0.02                |

**Table 13.** Estimated nutrient fluxes in the Missouri River at RM709 on 14-November-2012 based on measured nutrient concentrations and recorded mean daily flow of 37,100 cfs.

| Flow<br>(cfs) | Total Kjeldahl N<br>(kg/sec) | Ammonia N<br>(kg/sec) | Nitrate-Nitrite N<br>(kg/sec) | Total P<br>(kg/sec) | Dissolved P<br>(kg/sec) |
|---------------|------------------------------|-----------------------|-------------------------------|---------------------|-------------------------|
| 37,100        | 0.4202                       | 0.0840                | 0.1261                        | 0.0525              | < 0.0210                |

**Table 14.** Estimated nutrient loadings in the Missouri River at RM709 on 14-November-2012 based on estimated nutrient fluxes.

| Flow<br>(cfs) | Total Kjeldahl N<br>(tons/day) | Ammonia N<br>(tons/day) | Nitrate-Nitrite N<br>(tons/day) | Total P<br>(tons/day) | Dissolved P<br>(tons/day) |
|---------------|--------------------------------|-------------------------|---------------------------------|-----------------------|---------------------------|
| 37,100        | 40.02                          | 8.00                    | 12.01                           | 5.00                  | < 2.00                    |

#### 5.3.2.2.4 *Missouri River Mean Nutrient Conditions at Decatur (RM691) and Rulo (RM498) Nebraska*

Mean nutrient conditions were determined for the Missouri River at Decatur (RM691) and Rulo (RM498) Nebraska from monthly water quality sampling of the river by the Omaha District at the two sites over the 5-year period 2007 through 2011 (Table 15). The Decatur site represents conditions of the Missouri River in the Little Sioux area, and the Rulo site the conditions of the Missouri River as it leaves the Omaha District.

**Table 15.** Mean nutrient concentrations measured in the Missouri River at Decatur, NE (RM691) and Rulo, NE (RM498) by the Omaha District over the 5-year period 2007 through 2011.

| Location            | Total Kjeldahl N (mg/L) | Ammonia N (mg/L) | Nitrate-Nitrite N (mg/L) | Total P (mg/L) | Dissolved P (mg/L) |
|---------------------|-------------------------|------------------|--------------------------|----------------|--------------------|
| Decatur, NE (RM691) | 1.0                     | 0.09             | 1.14                     | 0.21           | 0.07               |
| Rulo, NE (RM498)    | 1.3                     | 0.11             | 2.01                     | 0.43           | 0.10               |

The average mean daily flow of the Missouri River at Decatur (USGS gauge 06601200) and Rulo (USGS gauge 06813500) Nebraska was determined from USGS flow records. The average mean daily flow of the Missouri River at Decatur (period of record 1988 -2012) was determined to be 31,719 cfs (range = 7,070 - 189,000 cfs; median = 28,500 cfs). The average mean daily flow of the Missouri River at Rulo (period of record 1967 -2012) was determined to be 46,151 cfs (range = 7,450 – 302,000 cfs; median = 28,500 cfs). The mean daily flows were used to determine nutrient fluxes and loadings based on the Missouri River water quality conditions monitored by the Omaha District over the 5-year period 2007 through 2011. Tables 16 and 17, respectively, summarize the mean nutrient fluxes and loadings for the Missouri River at Decatur and Rulo, Nebraska.

**Table 16.** Estimated mean nutrient fluxes in the Missouri River at Decatur, NE (RM691) and Rulo, NE (RM498) based on period of record flows and water quality conditions monitored during the 5-year period 2007 through 2011.

| Location            | Flow (cfs) | Total Kjeldahl N (kg/sec) | Ammonia N (kg/sec) | Nitrate-Nitrite N (kg/sec) | Total P (kg/sec) | Dissolved P (kg/sec) |
|---------------------|------------|---------------------------|--------------------|----------------------------|------------------|----------------------|
| Decatur, NE (RM691) | 31,719     | 0.8982                    | 0.0808             | 1.0239                     | 0.1886           | 0.0629               |
| Rulo, NE (RM498)    | 46,151     | 1.6989                    | 0.1437             | 2.6267                     | 0.5619           | 0.1307               |

**Table 17.** Estimated mean nutrient loadings in the Missouri River at Decatur, NE (RM691) and Rulo, NE (RM498) based on estimated mean nutrient fluxes.

| Location            | Flow (cfs) | Total Kjeldahl N (tons/day) | Ammonia N (tons/day) | Nitrate-Nitrite N (tons/day) | Total P (tons/day) | Dissolved P (tons/day) |
|---------------------|------------|-----------------------------|----------------------|------------------------------|--------------------|------------------------|
| Decatur, NE (RM691) | 31,719     | 85.54                       | 7.70                 | 97.52                        | 17.96              | 5.99                   |
| Rulo, NE (RM498)    | 46,151     | 161.80                      | 13.69                | 250.17                       | 53.52              | 12.45                  |

### 5.3.2.2.5 *Estimation of Nutrient Loadings from Potential Hydraulic Dredging Discharge for the Construction of SWH at the Proposed Glovers Point Project Site*

#### 5.3.2.2.5.1 Calculated Nutrient Fluxes and Loadings from Potential 20-Inch Hydraulic Dredge Discharge of Excavated Sediment/Soil

Potential nutrient fluxes from hydraulic dredging to excavate SWH at the proposed Glovers Point project site were calculated. The calculated nutrient fluxes were based on use of a typical 20-inch hydraulic dredge (i.e. 43.6 cfs discharge), and mean nutrient levels determined from the four sediment/soil samples collected from the proposed project site. As appropriate, nutrient fluxes for total (pre-elutriate), suspended (non-filtered elutriate), and dissolved (filtered elutriate) nutrients were estimated from elutriate testing results. Table 18 shows the calculated nutrient fluxes for Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Table 19 shows the estimated loadings (tons/day) based on the calculated nutrient fluxes. Table 20 compares the nutrient loadings calculated for the 20-inch hydraulic dredge discharge to the loadings estimated for the Missouri River on 14-November-2012 and average conditions.

**Table 18.** Nutrient flux rates calculated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) based on mean sediment/soil nutrient levels sampled at the proposed Glovers Point project site.

| Total Kjeldahl Nitrogen<br>(kg/sec) |                           | Ammonia<br>(kg/sec)       | Nitrate-Nitrite<br>Nitrogen<br>(kg/sec) | Total Phosphorus<br>(kg/sec) |                           | Dissolved<br>Phosphorus<br>(kg/sec) |
|-------------------------------------|---------------------------|---------------------------|-----------------------------------------|------------------------------|---------------------------|-------------------------------------|
| Pre-Elutriate                       | Non-Filtered<br>Elutriate | Non-Filtered<br>Elutriate | Filtered<br>Elutriate                   | Pre-Elutriate                | Non-Filtered<br>Elutriate | Filtered<br>Elutriate               |
| 0.0301                              | 0.0012                    | 0.0004                    | 0.0006                                  | 0.0151                       | 0.0003                    | 0.0001                              |

**Table 19.** Nutrient loadings estimated for a typical 20-inch hydraulic dredge discharge (43.6 cfs) operating 12 hours a day based on nutrient fluxes calculated for mean sediment/soil nutrient levels sampled at the proposed Glovers Point project site.

| Total Kjeldahl Nitrogen<br>(tons/day) |                           | Ammonia<br>(tons/day)     | Nitrate-Nitrite<br>Nitrogen<br>(tons/day) | Total Phosphorus<br>(tons/day) |                           | Dissolved<br>Phosphorus<br>(tons/day) |
|---------------------------------------|---------------------------|---------------------------|-------------------------------------------|--------------------------------|---------------------------|---------------------------------------|
| Pre-Elutriate                         | Non-Filtered<br>Elutriate | Non-Filtered<br>Elutriate | Filtered<br>Elutriate                     | Pre-Elutriate                  | Non-Filtered<br>Elutriate | Filtered<br>Elutriate                 |
| 1.43                                  | 0.06                      | 0.02                      | 0.03                                      | 0.72                           | 0.02                      | 0.003                                 |

**Table 20.** Comparison of daily nutrient loadings for the estimated dredging discharge from the proposed Grovers Point shallow-water habitat construction project and the Missouri River when monitored on 14-November-2012 near Grovers Point and average conditions at Decatur (RM691) and Rulo (RM498) Nebraska.

| Total Kjeldahl Nitrogen<br>(tons/day)                                                                 |                           | Ammonia<br>(tons/day)     | Nitrate-Nitrite<br>Nitrogen<br>(tons/day) | Total Phosphorus<br>(tons/day) |                           | Dissolved<br>Phosphorus<br>(tons/day) |
|-------------------------------------------------------------------------------------------------------|---------------------------|---------------------------|-------------------------------------------|--------------------------------|---------------------------|---------------------------------------|
| Pre-Elutriate                                                                                         | Non-Filtered<br>Elutriate | Non-Filtered<br>Elutriate | Filtered<br>Elutriate                     | Pre-Elutriate                  | Non-Filtered<br>Elutriate | Filtered<br>Elutriate                 |
| 20-inch Hydraulic Dredge Discharge (43.6 cfs)                                                         |                           |                           |                                           |                                |                           |                                       |
| 1.43                                                                                                  | 0.06                      | 0.02                      | 0.03                                      | 0.72                           | 0.02                      | 0.003                                 |
| Missouri River on 14-November-2012 (37,100 cfs)                                                       |                           |                           |                                           |                                |                           |                                       |
| 40.02                                                                                                 |                           | 8.00                      | 12.01                                     | 5.00                           |                           | 2.00                                  |
| Missouri River mean conditions (31,719 cfs)                                                           |                           |                           |                                           |                                |                           |                                       |
| 85.54                                                                                                 |                           | 7.70                      | 97.52                                     | 17.96                          |                           | 5.99                                  |
| Percent of Estimated 20-in Hydraulic Dredge Discharge Load of Missouri River Load on 14-November-2012 |                           |                           |                                           |                                |                           |                                       |
| 3.6%                                                                                                  | 0.1%                      | 0.3%                      | 0.2%                                      | 14.4%                          | 0.4%                      | 0.2%                                  |
| Percent of Estimated 20-in Hydraulic Dredge Discharge Load of the Mean Missouri River Load at RM691   |                           |                           |                                           |                                |                           |                                       |
| 1.7%                                                                                                  | 0.1%                      | 0.3%                      | <0.1%                                     | 4.1%                           | 0.1%                      | 0.1%                                  |
| Percent of Estimated 20-in Hydraulic Dredge Discharge Load of the Mean Missouri River Load at RM498   |                           |                           |                                           |                                |                           |                                       |
| 0.9%                                                                                                  | <0.1%                     | 0.2%                      | <0.1%                                     | 1.4%                           | <0.1%                     | <0.1%                                 |

**Note:** Dredge flow (43.6 cfs) to mean Missouri River flow (31,719 cfs) is 0.14% (i.e. a dredging discharge of 43.6 cfs would represent 0.14% of the mean Missouri River flow of 31,719 cfs).

#### 5.3.2.2.6 Comparison of Estimated Nutrient Loadings from Hydraulic Dredging at the Proposed Grovers Point Project to Ambient Nutrient Loadings in the Missouri River

The Omaha District monitors water quality conditions in the Missouri River from near Landusky, MT (RM1922) to Rulo, NE (RM498). This includes seven locations monitored monthly since 2003 from the Gavins Point Dam tailwaters (RM810) to Rulo, NE. Nutrient constituents monitored monthly include Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. Figure 8 displays the mean daily loads for calculated for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus for the seven monitored locations on the Missouri River downstream of Gavins Point Dam over the 5-year period 2007 through 2011. Figure 8 also shows the location of the proposed Grovers Point project site. Figure 9 compares the estimated daily dredging discharge loading for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus and the calculated mean daily loads for the Missouri River immediately upstream (i.e. RM753) and downstream (i.e. RM691) of the proposed Grovers Point project site. Total nitrogen was determined by adding Total Kjeldahl Nitrogen and Nitrate-Nitrite Nitrogen. As indicated in Table 19 and Figure 9, the estimated daily nutrient loading from the proposed Grovers Point project site is minor compared to the nutrient daily loading currently present in the Missouri River. The greatest nutrient loading from the proposed dredging would be for Total Phosphorus where the dredging discharge daily loading could result in a 4.1% increase in the mean daily suspended Total Phosphorus loading currently present in the Missouri River. It is noted that much of the discharged particulate material, and associated phosphorus, would settle to the bottom of the Missouri River when discharged and be incorporated in the river's bed-load. The difference between a pre-elutriate sample and a non-filtered sample for Total Phosphorus is 1-hour of settling time. The elutriate testing of the collected Grovers Point sediment samples resulted in mean pre-elutriate and non-filtered elutriate

Total Phosphorus concentrations of 12.2 mg/L and 0.26 mg/L, respectively (i.e. 97.9% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour). Accounting for 1-hour settling, the 4.1% increase in mean daily suspended Total Phosphorus loading falls to 0.1% of the suspended Missouri River loading.

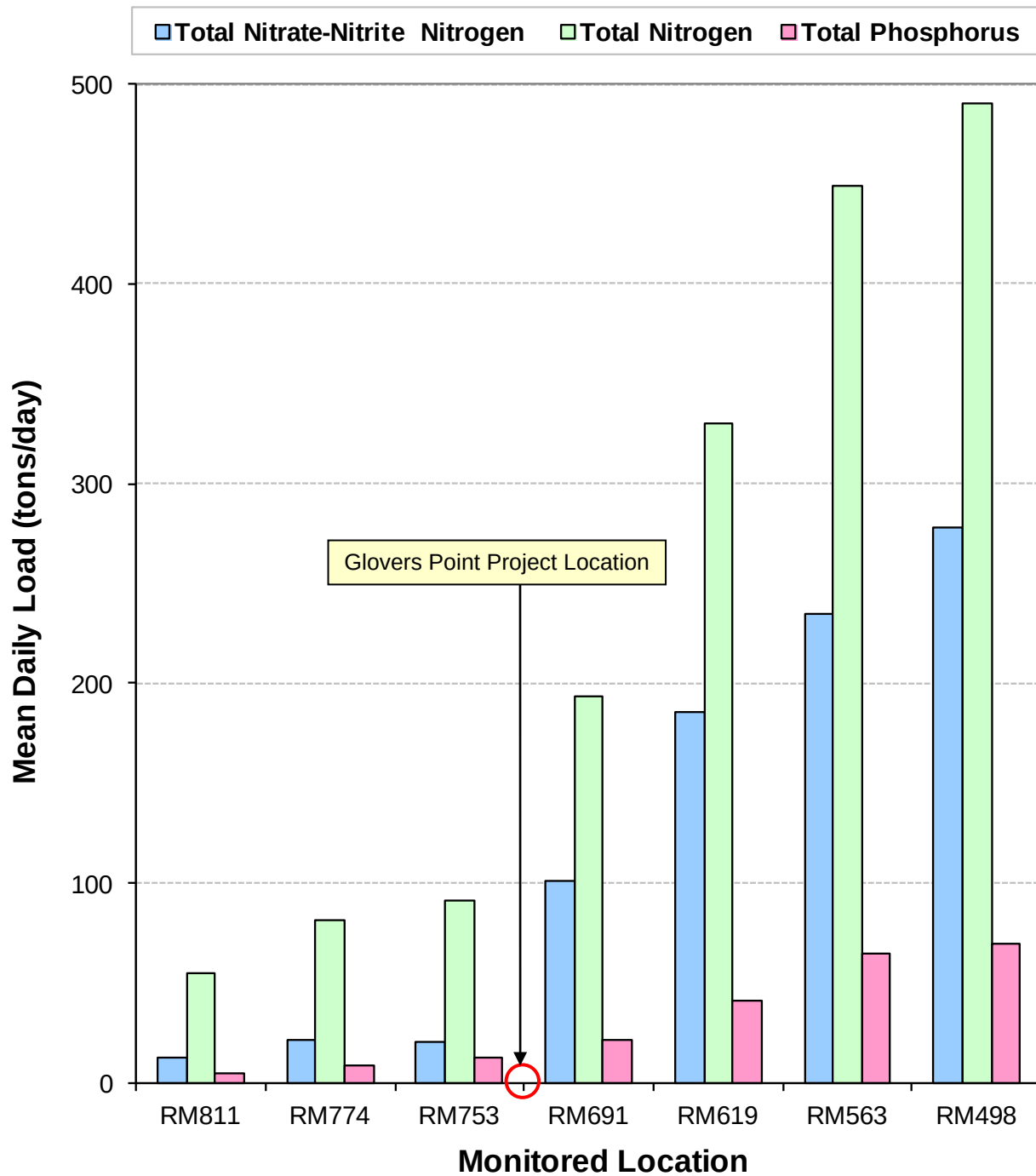


**Figure 8.** Mean daily loads for Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus based on monthly monitoring along the Missouri River from Gavins Point Dam to Rulo, Nebraska over the 5-year period 2007 through 2011.

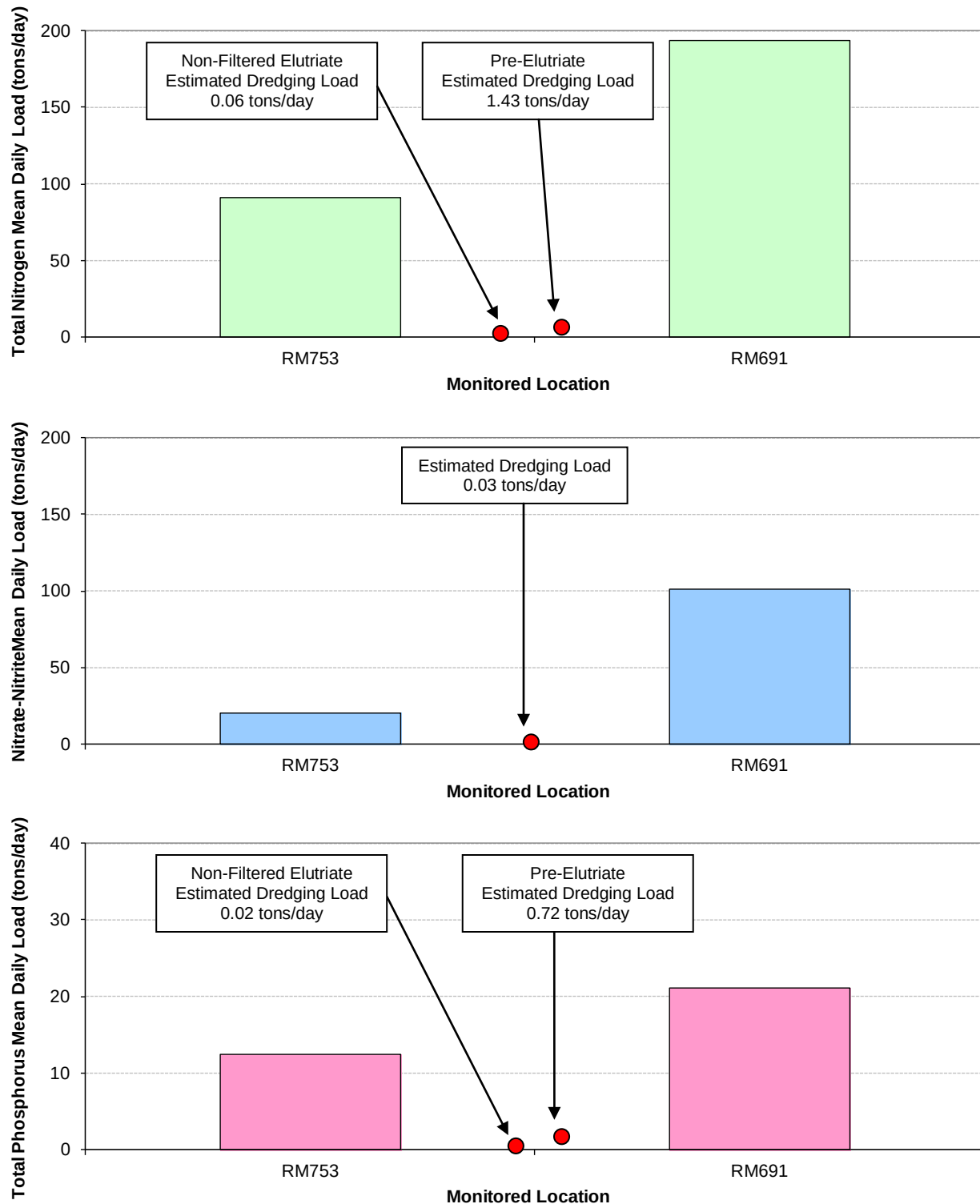


**Figure 9.** Comparison of estimated Total Nitrogen, Nitrate-Nitrite Nitrogen, and Total Phosphorus daily loadings from hydraulic dredging discharge to construct proposed shallow-water habitat at the Glovers Point project site to mean daily loadings calculated for the Missouri River at RM 753 and RM691 over the 5-year period 2007 through 2011.

#### **5.4 Proposed Disposal Site Determinations**

Mixing zone provisions for water quality standards application typically apply to “toxic contaminants” released from a point source discharge. State water quality standards, in most cases, define acute and chronic numeric criteria for toxic contaminants. Mixing zones are meant to provide water quality protection to a waterbody receiving a point source discharge, while at the same time allowing the discharge to initially mix and disperse within the receiving waterbody. Generally, mixing zones are to allow for a zone of passage for aquatic life and ensure that acute water quality standards criteria are not exceeded unless an allowance is made for a small zone of initial dilution. Chronic water quality standards criteria are typically allowed to be exceeded within the defined boundary of the mixing zone.

The Section 404(b)(1) Guidelines, at §230.11(f), allow for mixing zones. Mixing zones for dredge and fill discharges are to be confined to the smallest practicable zone that is consistent with the type of dispersion determined to be appropriate. The following factors are identified in §230.11(f) for consideration in determining the acceptability of a proposed mixing zone:

- Depth of water at the disposal site;
- Current velocity, direction, and variability at the disposal site;
- Degree of turbulence;
- Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site;
- Rate of discharge;
- Ambient concentration of constituents of interest;
- Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay, etc.) and settling velocities;
- Number of discharge actions per unit of time; and
- Other factors of the disposal site that affect the rates and patterns of mixing.

Elutriate testing of the collected sediment/soil samples at the proposed Glovers Point project site indicated that all assessed constituents, except Antimony, met applicable acute and chronic numeric water quality standards. Two estimated, non-filtered elutriate tests for Antimony were slightly higher than the Iowa human health and Nebraska public drinking water standards. As such, numeric water quality standards will be met in the dredge slurry at the “end-of-pipe” discharge. Since a “regulated” mixing is not needed to ensure compliance with numeric water quality standards, it’s assumed complete mixing of the dredging discharge with the flow in the Missouri River is appropriate in evaluating potential impacts to existing water quality pursuant to State and Federal antidegradation provisions.

##### **5.4.1 Completely Mixed Conditions**

Impacts of the proposed dredging discharge on existing water quality in the Missouri River was evaluated after consideration was given for complete mixing of the dredging discharge with the flow in the Missouri River. This was accomplished by calculating a flow-weighted average concentration for a water quality constituent based on flow and constituent concentration in the Missouri River and dredging discharge. The average mean daily flow of the Missouri River was determined at Decatur, NE (RM691) based on the period of record (1988 - 2012) mean daily flows recorded at the USGS’s Decatur gauge (06601200). The average mean daily flow of the Missouri River at Decatur, NE was determined to be 31,719 cfs (range = 7,070 - 189,000 cfs; median = 28,500 cfs).

##### **5.4.2 Existing Missouri River Water Quality**

Since 2003, the Omaha District has monitored water quality conditions monthly at seven locations along the Missouri River from the Gavins Point Dam tailwaters to Rulo, Nebraska. Constituents

monitored monthly include Chemical Oxygen Demand, Total Organic Carbon, Total Kjeldahl Nitrogen, Ammonia, Nitrate-Nitrite, Total Nitrogen, Total Phosphorus, and Dissolved Phosphorus. The elutriate testing results of the sediment/soil collected at the proposed Glovers Point project site were compared (plotted) to the ambient water quality conditions monitored in the Missouri River at Decatur, NE over the 5-year period 2007 through 2011 (Figures 10 - 17). Calculation of completely mixed conditions was applied to the estimated pre-elutriate results for Total Organic Carbon, Total Kjeldahl Nitrogen, and Total Phosphorus; and monitored Missouri River water quality conditions over the 5-year period (2007 - 2011). Table 21 summarizes the calculation of completely mixed conditions for Total Nitrogen, and Total Phosphorus.

**Table 21.** Completely mixed, flow-weighted conditions for estimated pre-elutriate concentrations of Total Kjeldahl Nitrogen and Total Phosphorus.

| Water Quality Constituent            | Missouri River     |                       | Dredging Discharge |                                     | Completely Mixed Concentration |
|--------------------------------------|--------------------|-----------------------|--------------------|-------------------------------------|--------------------------------|
|                                      | Average Flow (cfs) | Average Concentration | Design Flow (cfs)  | Average Pre-Elutriate Concentration |                                |
| Nitrogen, Kjeldahl Total as N (mg/L) | 31,719             | 1.0                   | 43.6               | 24.4                                | 1.03                           |
| Phosphorus, Total (mg/L)             | 31,719             | 0.21                  | 43.6               | 12.2                                | 0.23                           |

## 5.5 Summary of Water Quality Factual Determinations

- Elutriate testing of representative sediment/soil samples collected at the proposed Glovers Point project site indicates that no numeric water quality standards criteria will likely be violated by the proposed dredging discharge. This is based on comparison of elutriate testing results to promulgated Iowa and Nebraska numeric water quality criteria. Elutriate testing results were for both dissolved and non-filtered elutriate sample analyses prepared in accordance with the “*Inland Testing Manual*”.
- The proposed dredging discharge should have minor impacts to the existing water quality of the Missouri River, especially after complete mixing is achieved in the river. Based on analyzed water quality constituents, only minor increases in constituent concentrations, within the natural variability of water quality in the Missouri River, are indicated. The minor impacts to water quality would only occur during the short-time dredging occurred to construct SWH at the proposed Glovers Point project site.
- The dredging discharge to construct SWH at the proposed Glovers Point project site could cause a slight increase to the nutrient loading currently present in the Missouri River. It is estimated that the mean daily suspended load for Total Kjeldahl Nitrogen could be increased by 0.2%, the mean daily suspended load for Nitrate-Nitrite Nitrogen could be increased by 0.2%, and the mean daily suspended load for Total Phosphorus could be increased by up to 14.4%. It is noted that the 14.4% increase in the suspended Total Phosphorus loadings is a worst-case estimate. Most of the suspended Total Phosphorus load is bound to particulate matter that will settle and become incorporated into the bed-load of the Missouri River. The bed-load Total Phosphorus loading is in addition to the suspended Total Phosphorus loading estimated in this report. As indicated by elutriate testing results, the estimated mean suspended Total Phosphorus concentration of 12.2 mg/L (estimated pre-elutriate) could decrease to 0.26 mg/L (non-filtered elutriate) after 1-hour of settling time (i.e. 97.9% of the total phosphorus present in the pre-elutriate samples settled out after 1-hour).

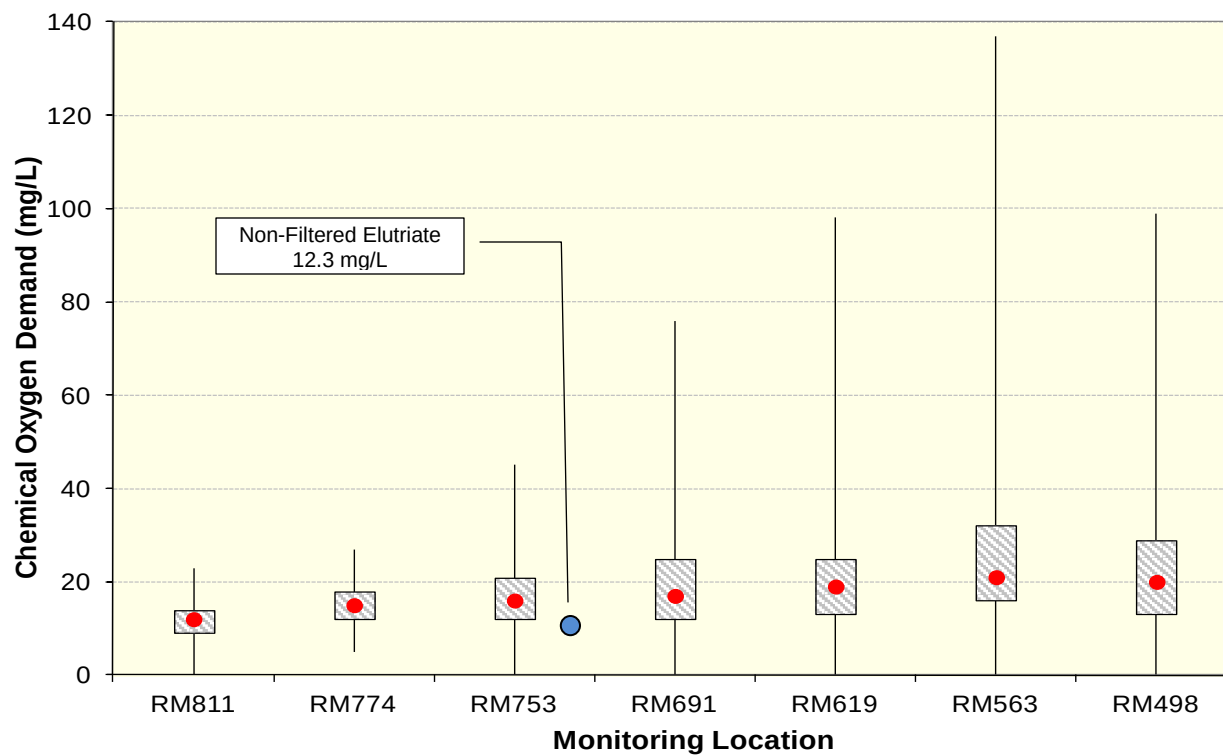


**Figure 10.** Mean elutriate testing results for Chemical Oxygen Demand as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011. Box plot displays minimum and maximum (whiskers) and inter-quartile range, red dot is the median value.

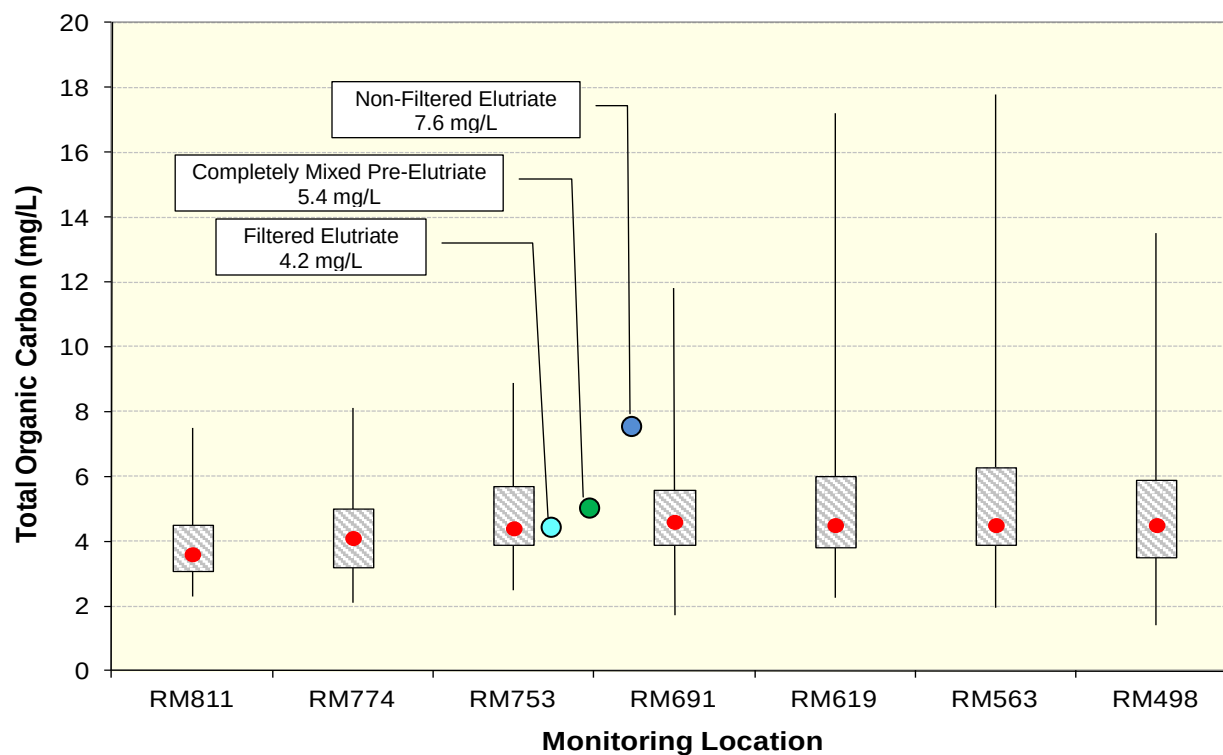


**Figure 11.** Mean elutriate testing results for Total Organic Carbon as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

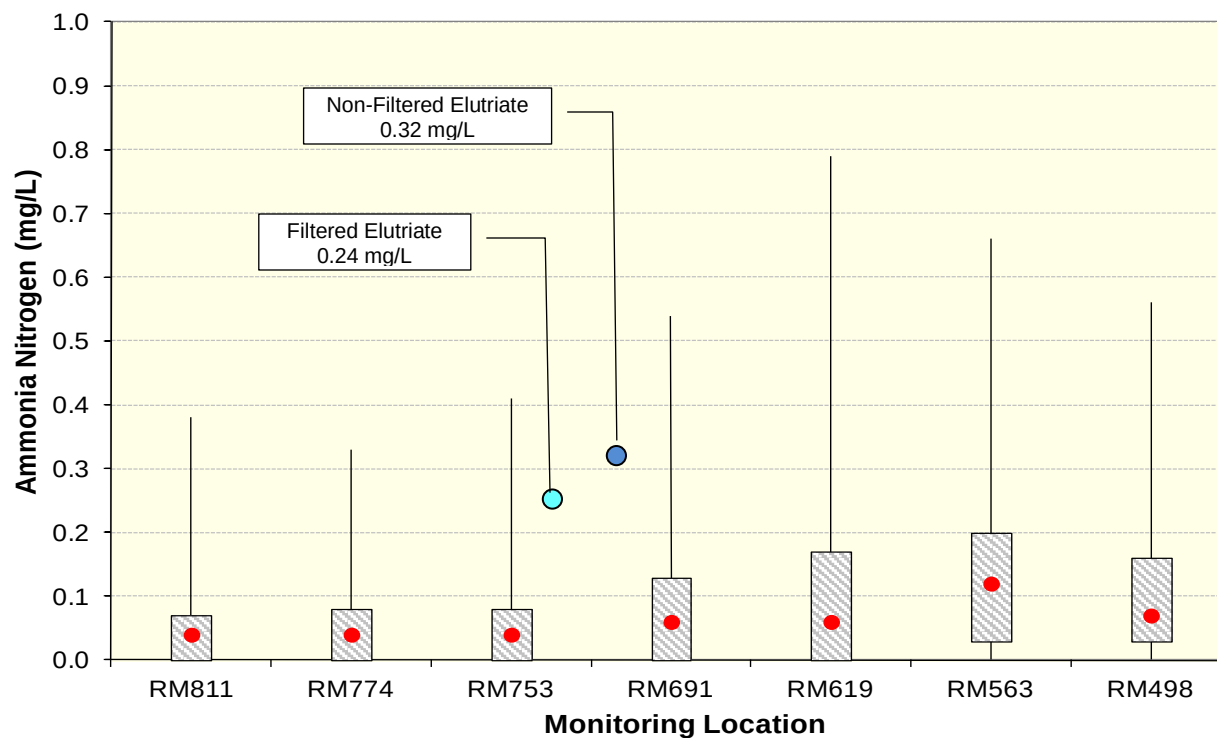


**Figure 12.** Mean elutriate testing results for Ammonia as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

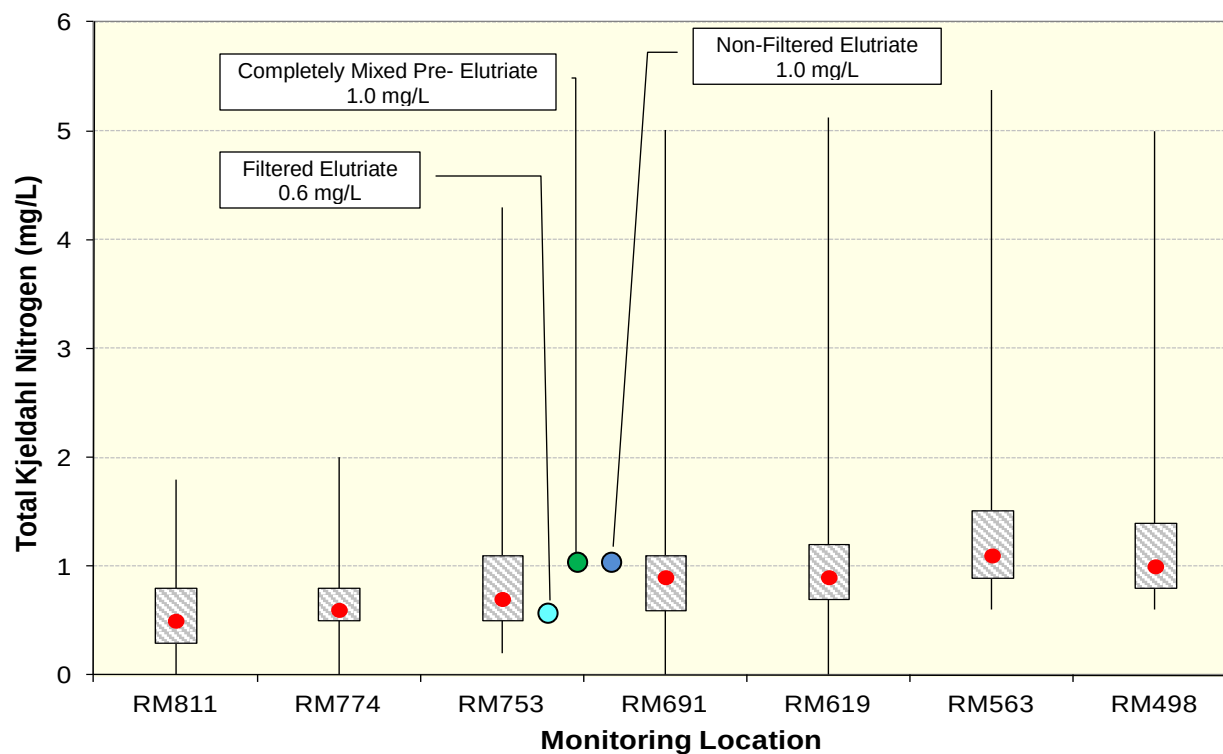


**Figure 13.** Mean elutriate testing results for Total Kjeldahl Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

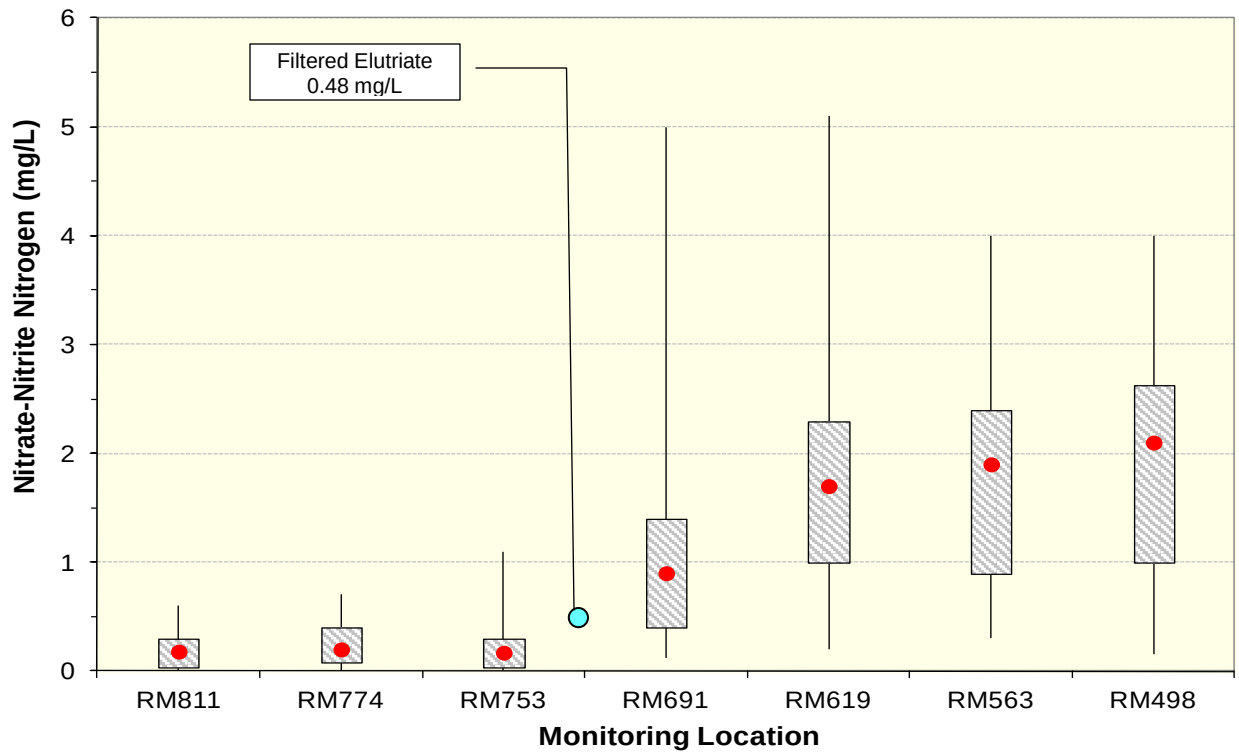


**Figure 14.** Mean elutriate testing results for Nitrate-Nitrite Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

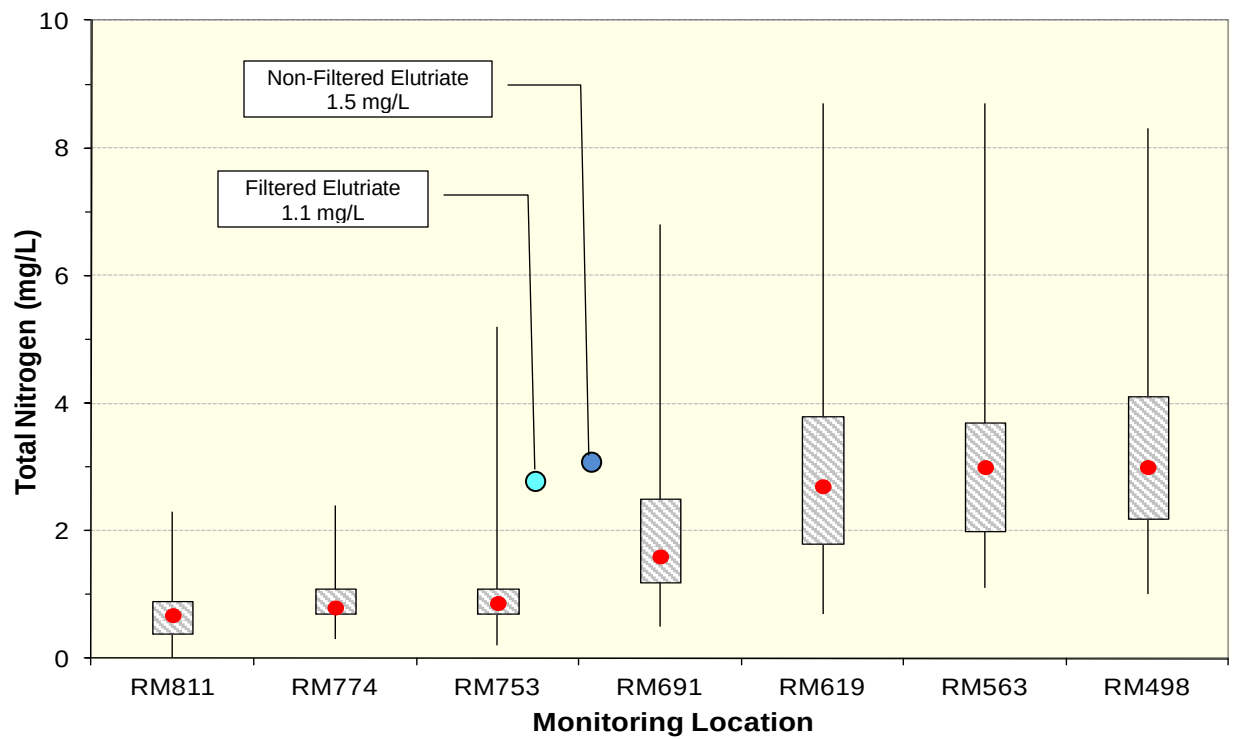


**Figure 15.** Mean elutriate testing results for Total Nitrogen as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

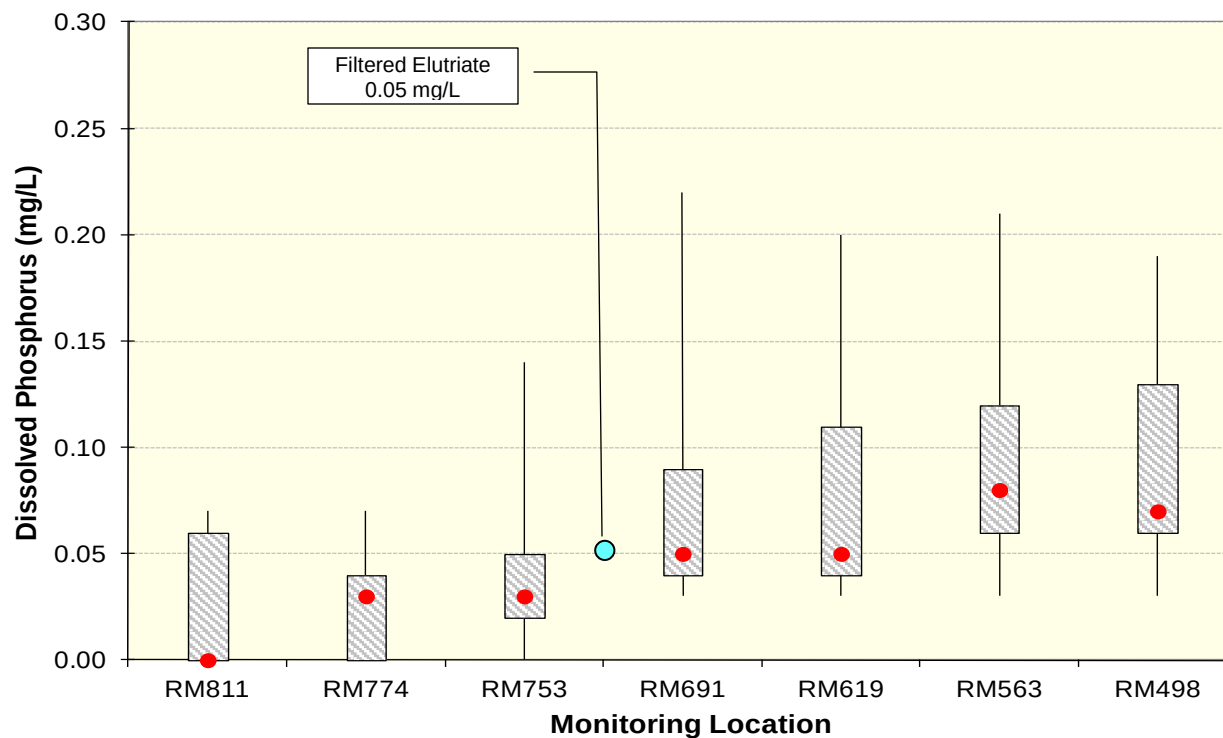


**Figure 16.** Mean elutriate testing results for Dissolved Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

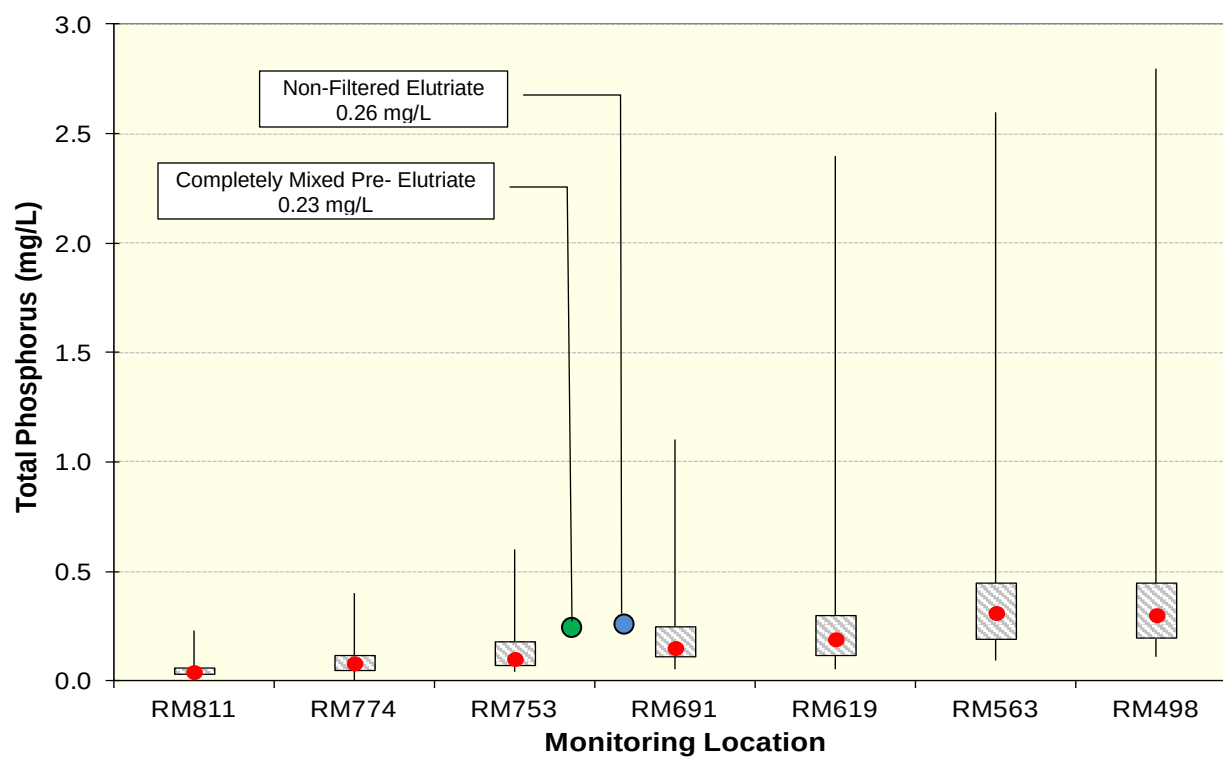


**Figure 17.** Mean elutriate testing results for Total Phosphorus as compared to ambient Missouri River conditions monitored over the 5-year period 2007 through 2011.

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## **ATTACHMENT 1.**

**Sampling and Analysis Plan for 2012 Elutriate Sampling – Missouri River Glovers  
Point Bend Enhancement Project Area**

## SAMPLING AND ANALYSIS PLAN

for

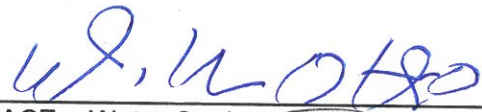
### 2012 Elutriate Sampling – Missouri River Glovers Point Bend Enhancement Project Area

Project Number: SPS-GVPTBD-002

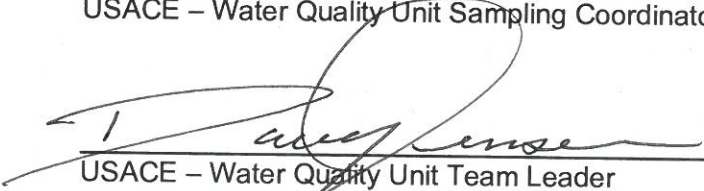
Prepared By:

Water Control and Water Quality Section  
Hydrologic Engineering Branch  
U.S. Army Corps of Engineers – Omaha District

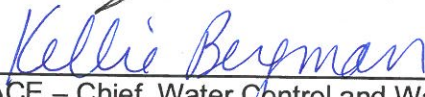
October 2012

  
USACE – Water Quality Unit Sampling Coordinator

13-Nov-12  
Date

  
USACE – Water Quality Unit Team Leader

13-Nov-2012  
Date

  
USACE – Chief, Water Control and Water Quality Section

13 Nov 2012  
Date

  
USACE – Chief, Sedimentation & Channel Stabilization Section

13 Nov 2012  
Date

  
USACE – (CENWO-PM-AE)

13 Nov 2012  
Date

**Distribution List:**

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Luke Wallace

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## **1. PROJECT DESCRIPTION**

### **1.1. BACKGROUND INFORMATION**

Shallow water habitat (SWH) was previously constructed along the Missouri River as part of the Glovers Point Bend project. The District plans to expand and enhance the previously constructed SWH. The removal of the deposited sediment will involve dredging with the dredge spoil being discharged to the Missouri River. It is believed the dredge material will be primarily sand with some silts and clays.

#### **1.1.1. Project Location**

The Glovers Point Bend is located along the Missouri River at RM 712 (Attachments 1 and 2). The proposed project is on tribal lands (Winnebago Indian Reservation).

#### **1.1.2. 404 Permitting Requirements**

The requirements for a USACE Individual Section 404 permit must be met for the proposed dredging activity. To meet the Section 404 Individual Permit requirements, a Section 401 Certification will be requested from the U.S. Environmental Protection Agency, Region VII that the proposed actions will not “violate” water quality standards. The Winnebago Tribe in Nebraska does not have approved water quality standards or Section 401 authority for the purpose of regulating water resources within Indian Country pursuant to Section 518(e) of the Clean Water Act (CWA). The CWA states in part that in any case where a state, interstate agency, or Tribe has no authority to issue a water quality certification, such certification shall be issued by EPA. To facilitate review of the proposed project for Section 401 Certification, “elutriate sampling” of material from the proposed dredging site will be conducted. This monitoring project plan was developed to collect the appropriate materials for elutriate analysis pursuant to the Inland Testing Manual, “Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual (USEPA and USACE, 1998).

## **2. PROJECT/TASK ORGANIZATION AND RESPONSIBILITIES**

The USACE’s Water Control and Water Quality Section will conduct the sampling required to facilitate elutriate analysis of prospective dredge material in the project area.

#### Staff Responsibilities and Contacts for Sampling:

Sample Collection: Dave Jensen (995-2310), Bill Otto (995-2313), John Hargrave (995-2347)

Sampling Coordination: Dave Jensen

Data Quality Review: Dave Jensen

Laboratory Analysis: Midwest Laboratories, Prem Arora (829-9878)

## **3. SITE-SPECIFIC WATER QUALITY CONCERNS**

### **3.1. SECTION 303(D) IMPAIRED WATERS LISTINGS**

Nebraska’s water quality standards identify the Missouri River from the Big Sioux River to the Platte River as designated Segment MT1-10000. Section 303(d) of the Federal Clean Water Act require States to evaluate water quality conditions in designated waterbodies, and list as impaired [i.e., 303(d ) list] any waterbodies not meeting water quality standards. As

appropriate, States must develop and implement Total Maximum Daily Loads –TMDLs (i.e., pollutant management plans) for waterbodies identified as impaired. Segment MT1-10000 is listed on Nebraska's 2012 Section 303(d) list as impaired due to a fish consumption advisory. The identified parameters of concern are Cancer Risk & Hazard Index Compounds, specifically, Dieldrin and PCBs. Previously, the State of Nebraska has indicated that due to the 303(d) listing of Segment MT1-10000 no dredged material can be discharged into the Missouri River unless concerns regarding Dieldrin and PCBs are addressed. Nebraska has promulgated surface water quality criteria for Dieldrin and PCBs of 0.00144 ug/l and 0.0017 ug/l (i.e., 1.4 and 1.7 parts-per-trillion), respectively. These values are defined as human health criteria at the  $10^{-5}$  risk level for carcinogens based on the consumption of fish and other aquatic organisms. Previously, Nebraska indicated that if levels of Dieldrin and PCBs determined from elutriate analysis of proposed dredge materials are found to be below the state water quality criteria this should meet potential concerns of the State regarding Dieldrin and PCBs in the discharge of dredged material. Thus, past elutriate testing included analyzing Dieldrin and PCBs to a detection limit of 1 per-per-trillion.

The Nebraska Department of Environmental Quality (NDEQ) recently published the report, "Findings of the 2010 Regional Ambient Fish Tissue Program in Nebraska (June 2012)." Findings in this report indicate that fish tissue samples collected from the Missouri River at Omaha and Rulo no longer contained harmful levels of Dieldrin and PCBs. As such, the State of Nebraska removed the fish consumption advisories for Dieldrin and PCBs from the Missouri River. This information became available after Nebraska's 2012 303(d) listing was published. The NDEQ has indicated that the 303(d) listing of the Missouri River for Dieldrin and PCBs will be removed in the next 303(d) listing published (personal communication NDEQ). Because the fish consumption advisory has been removed, the NDEQ indicated that analyzing Dieldrin and PCBs to a detection limit of 1 part-per-trillion will no longer be required (personal communication NDEQ). As part of the proposed elutriate testing an Organochlorine and PCB scan will be run that allows analysis of Dieldrin to a detection limit of 0.004 ug/L and a reporting limit of 0.1 ug/L, and analysis of PCBs to a detection limit of 0.2 ug/L and a reporting limit of 1.0 ug/L.

Previous sediment sampling and elutriate testing was conducted at the Glover's Point Bend project area in 2009 to facilitate the previous dredging conducted at the site. It is noted that elutriate testing of the 2009 collected sediments included analysis for Dieldrin and PCBs at a detection limit of 1 part-per-trillion and neither Dieldrin or PCBs were detected.

### **3.2. NUTRIENTS**

Concerns have been expressed regarding the nutrient enrichment and loading that the proposed dredging for SWH construction might pose to the Missouri River. Currently, no numeric water quality standards criteria have been promulgated for the Missouri River regarding nutrient enrichment. However, for background information, nutrient analysis will be included in the elutriate testing of proposed dredging sediments. This will include a pre-elutriate test for total nutrients (i.e. Total Phosphorus, Total Kjeldahl Nitrogen, and Nitrate-Nitrite Nitrogen). The pre-elutriate sample will be prepared as follows: after the 30-minute mixing period, the mixture will be allowed to settle for one-minute at which time a "sample" will be siphoned off and analyzed for specified total nutrients.

#### **4. DATA QUALITY OBJECTIVES**

The data collected through this monitoring project is meant to facilitate the review of the proposed dredging project by the States of Iowa and Nebraska for Section 401 Water Quality Certification.

#### **5. DATA COLLECTION APPROACH**

##### **5.1. DATA COLLECTION DESIGN**

##### **5.1.1. Sediment/Soil and Receiving Water Samples**

Sediment/soil samples will be collected at four sites (GP-S1, GP-S2, GP-S3, and GP-S4) and receiving water (Missouri River) at one site (GP-W1). The location of the five sites within the project area is shown in Attachments 1 and 2. Preliminary latitude and longitude coordinates for the four sediment/soil sampling sites are given below. The “actual” location of the sampled sites will be determined with a GPS unit in the field when the samples are collected.

| <b>Site</b> | <b>Latitude</b> | <b>Longitude</b> |
|-------------|-----------------|------------------|
| GP-S1       | 42° 14' 26.4"   | 96° 20' 14.4"    |
| GP-S2       | 42° 14' 48.4"   | 96° 20' 06.2"    |
| GP-S3       | 42° 14' 42.3"   | 96° 20' 03.2"    |
| GP-S4       | 42° 14' 47.7"   | 96° 19' 54.2"    |

##### **5.2. MEASUREMENT AND SAMPLING METHODS**

##### **5.2.1. Receiving Water Sample**

Water from the Missouri River near the dredge site (i.e., receiving water) will be used to prepare elutriate samples (see Section 2.2.3). The laboratory requires 4 parts receiving water for each 1 part of soil/sediment to be analyzed. In addition to the 4 parts of water for each 1 part soil/sediment, additional receiving water is required for analysis. The receiving water will be collected at Site GP-W1 adjacent to the proposed SWH project area.

At the time the receiving water is collected, the following field measurements will be taken: water temperature, dissolved oxygen, pH, specific conductance, and turbidity. These measurements will be obtained with a “HydroLab” equipped with a MS5 DataSonde and Surveyor data logger. Measurements will be taken by immersion of the DataSonde directly into the river. Measurements will be appropriately recorded on a field sheet (Attachment 3).

##### **5.2.2. Sediment/Soil Samples**

Sediment/soil samples will be collected at Sites GP-S1, GP-S2, GP-S3, and GP-S4. The equipment, supplies, and procedures to be used to collect the soil samples are as follows.

#### **5.2.2.1. Equipment and Supplies**

- 1) Gas powered auger head
- 2) Stainless steel coring device
- 3) Gasoline
- 4) 1 gallon wide mouth glass jars
- 5) 1 gallon narrow mouth glass jugs
- 6) Sample bottle labels
- 7) ARF
- 8) Field Sheets
- 9) GPS device
- 10) 5 gallon buckets
- 11) Several gallons of tap water
- 12) Pick/hammer
- 13) Tarp/cardboard
- 14) Screwdriver
- 15) Scrub brush
- 16) Cooler with Ice

#### **5.2.2.2. Soil Collection Procedure**

- 1) Select sample site and record general information (including Latitude/Longitude) on the field sheet.
- 2) Remove any vegetation near the proposed boring side (2-3 foot diameter circle).
- 3) Set out equipment on a tarp near the sample hole. Using a tarp keeps vegetation and other material out of the sample collection bucket.
- 4) If the ground is frozen, use a pick-type hammer to remove the top 3-6 inches of frozen soil.
- 5) Attach the corer to the auger head, bore down and collect sample in approximately one-foot increments.
- 6) After each coring, detach the device from the gas auger, suspend the corer over the sample collection bucket and deposit the sample into the collection bucket.
- 7) Heavy clays may require a screwdriver, hammer and/or wooden stake or other tool to remove the sample from the corer.
- 8) When all cores from one site have been collected in the bucket, homogenize the contents and transfer it to a wide mouth glass jar. Affix the sample label to the jar prior to filling it with the sample.
- 9) Clean the coring device, tools and sample collection bucket with tap water between sample locations.
- 10) Deliver the samples and an analytical request form to the laboratory analyzing the samples.

#### **5.2.3. Preparation of Elutriate Samples**

Elutriate testing will be done on sediment/soil samples collected at Sites GP-S1, GP-S2, GP-S3, and GP-S4.

##### **5.2.3.1. Standard Elutriate Samples**

Standard elutriate samples will be prepared in accordance with the “Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. – Testing Manual: Inland

Testing Manual” (USEPA and USACE, 1998). The elutriate sample will be prepared by using water from the dredging site. The sample will be prepared by subsampling approximately 1-liter of the collected soil sample from the well-mixed original sample. The soil material and unfiltered receiving water are then combined in a soil-to-water ratio of 1:4 on a volume basis at room temperature. After the correct ratio is achieved, the mixture is stirred vigorously for 30 minutes with a mechanical stirrer/shaker. After the 30-minute mixing period, the mixture is allowed to settle for at least one hour. The supernatant is then siphoned off without disturbing the settled material. Analysis for total constituents is done on the supernatant without filtration, and the supernatant is filtered through a 0.45-micron filter for analysis of dissolved inorganic constituents.

#### **5.2.3.2. Pre-Elutriate Samples**

Pre-elutriate samples will be prepared for analysis of selected constituents. The pre-elutriate sample will be prepared as follows: after the 30-minute mixing period, the mixture will be allowed to settle for one-minute at which time a “sample” will be siphoned off and analyzed as the “pre-elutriate sample”. The pre-elutriate sample will be analyzed for the following constituents: Total Kjeldahl Nitrogen, Total Nitrate-Nitrite Nitrogen, Total Phosphorus, Total Organic Carbon, Total Suspended Solids, and Turbidity.

### **5.3. SAMPLE HANDLING, CUSTODY, AND TRANSPORT**

The collected samples will be transported by sampling personnel to Midwest Laboratories, Inc. in Omaha, Nebraska for analysis. An Analytical Request Form (ARF) will be completed and submitted with the samples delivered to the laboratory (Attachment 4).

### **5.4. PARAMETERS TO BE MEASURED**

The parameters that will be measured or analyzed for the different types of samples are listed in Table 1.

### **5.5. LABORATORY ANALYTICAL METHODS AND COSTS**

Table 2 provides methods, detection limits, and costs for parameters to be analyzed on collected sediment/soil samples. Table 4 provides methods and detection limits for parameters to be analyzed on pre-elutriate samples. Table 5 provides methods and detection limits for parameters to be analyzed on filtered elutriate samples. Table 7 provides methods and detection limits for parameters to be analyzed on supernatant elutriate samples. Table 9 provides methods and detection limits for parameters to be analyzed on receiving water.

**Table 1.** Parameters to be measured and analyzed.

| Parameter                                                                                   | Sample Analysis |                 |                     |                 |
|---------------------------------------------------------------------------------------------|-----------------|-----------------|---------------------|-----------------|
|                                                                                             | Soil            | Receiving Water | Pre-Elutriate Water | Elutriate Water |
| <b>Field Measurements:</b>                                                                  |                 |                 |                     |                 |
| Water Temperature (°C)                                                                      |                 | X               |                     |                 |
| pH (S.U)                                                                                    |                 | X               |                     |                 |
| Dissolved Oxygen (mg/l)                                                                     |                 | X               |                     |                 |
| Conductivity (umhos/cm)                                                                     |                 | X               |                     |                 |
| Turbidity (NTU)                                                                             |                 | X               |                     |                 |
| <b>Laboratory Analysis:</b>                                                                 |                 |                 |                     |                 |
| Atrazine (ug/l)                                                                             | X               | X               |                     | X*              |
| Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)                                        |                 | X               |                     | X*              |
| Chemical Oxygen Demand - COD (mg/l)                                                         |                 | X               |                     | X               |
| Nitrogen, Ammonia as N, Total (mg/l)                                                        | X               | X               |                     | X*              |
| Nitrogen, Total Kjeldahl as N (mg/l)                                                        | X               | X               | X                   | X*              |
| Nitrogen, Nitrate/Nitrite as N (mg/l)                                                       | X               | X               | X                   | X               |
| Organic Carbon, Total - TOC (mg/l)                                                          | X               | X               | X                   | X*              |
| Particle Size                                                                               | X               |                 |                     |                 |
| pH (S.U.)                                                                                   | X               | X               |                     | X               |
| Phosphorus, Dissolved (mg/l)                                                                |                 | X               |                     | X               |
| Phosphorus, Total (mg/l)                                                                    | X               | X               | X                   | X*              |
| Phosphorus, Orthophosphate (mg/l)                                                           |                 | X               |                     | X               |
| Metals Scan - Dissolved (ug/l)                                                              |                 | X               |                     | X               |
| Metals - Total (mg/kg)<br>(Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc) | X               |                 |                     |                 |
| Organochlorine Pesticide and PCB Scan (ug/kg)                                               | X               |                 |                     |                 |
| Organochlorine Pesticide and PCB Scan (ug/l)                                                |                 | X               |                     | X*              |
| Total Suspended Solids (mg/l)                                                               |                 | X               | X                   | X*              |
| Turbidity (NTU)                                                                             |                 | X               | X                   | X*              |

\* Determined on supernatant prior to filtration.

**Table. 2.** Parameters to be Analyzed on Collected Sediment/Soil Samples and Unit Costs.

| Parameter                                                | Method                     | Detection Limit | Analytical Cost |
|----------------------------------------------------------|----------------------------|-----------------|-----------------|
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b>                 |                            |                 |                 |
| Particle Size                                            | Sieve (Minimum Sieve #200) | 0.001 mm        | \$65.05         |
| pH                                                       | EPA 150.1                  | 0.1 S.U.*       | 7.45            |
| <b>NUTRIENTS</b>                                         |                            |                 |                 |
| Nitrogen, Ammonia Total as N                             | EPA 350.1                  | 0.02 mg/kg      | 17.70           |
| Nitrogen, Kjeldahl Total as N                            | EPA 351.3                  | 0.2 mg/kg       | 20.55           |
| Nitrogen, Nitrate/Nitrite Total as N                     | EPA 353.2                  | 0.02 mg/kg      | 13.30           |
| Phosphorus, Total                                        | SM4500PF                   | 0.02 mg/kg      | 18.80           |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>                    |                            |                 |                 |
| Total Organic Carbon                                     | EPA 415.1                  | 0.4 mg/kg       | 26.55           |
| <b>TOTAL METALS</b>                                      |                            |                 |                 |
| Arsenic, Total                                           | EPA 6010B                  | 10 mg/kg        | 12.75           |
| Cadmium, Total                                           | EPA 6010B                  | 0.2 mg/kg       | 12.75           |
| Chromium, Total                                          | EPA 6010B                  | 1 mg/kg         | 12.75           |
| Copper, Total                                            | EPA 6010B                  | 1 mg/kg         | 12.75           |
| Lead, Total                                              | EPA 6010B                  | 13 mg/kg        | 12.75           |
| Mercury, Total                                           | EPA 6010B                  | 0.1 mg/kg       | 41.15           |
| Nickel, Total                                            | EPA 6010B                  | 1 mg/kg         | 12.75           |
| Zinc Total                                               | EPA 6010B                  | 2 mg/kg         | 12.75           |
| <b>PESTICIDES AND PCBs</b>                               |                            |                 |                 |
| Atrazine, Total                                          | EPA 507                    | 0.05 mg/kg      | 159.15          |
| Organochlorine Pesticide and PCB Scan                    | EPA 8081 and EPA 8082      | See Table 3     | 168.30          |
| <b>Total Laboratory Cost for Analyzing a Soil Sample</b> |                            |                 | <b>\$627.25</b> |

\* Resolution limit.

**Table 3.** Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of sediment/soil samples.

| Parameter          | Detection Limit (µg/kg) | Reporting Limit (µg/kg) | Parameter                 | Detection Limit (µg/kg) | Reporting Limit (µg/kg) |
|--------------------|-------------------------|-------------------------|---------------------------|-------------------------|-------------------------|
| DDE                | 0.8                     | 9.9                     | Alpha-BHC (alpha-Lindane) | 0.4                     | 5.1                     |
| DDD                | 0.7                     | 9.9                     | Beta-BHC (beta-Lindane)   | 1.0                     | 5.1                     |
| DDT                | 1.0                     | 9.9                     | Delta-BHC (delta-Lindane) | 1.8                     | 5.1                     |
| Methoxychlor       | 1.2                     | 5.1                     | Gamma-BHC (gamma-Lindane) | 0.6                     | 5.1                     |
| Aldrin             | 0.7                     | 5.1                     | Gamma-Chlordane           | 0.8                     | 5.1                     |
| Dieldrin           | 0.7                     | 9.9                     | PCB - Aroclor1016         | 10                      | 50                      |
| Endosulfan 1       | 0.7                     | 5.1                     | PCB - Aroclor1260         | 10                      | 50                      |
| Endosulfan 2       | 0.8                     | 9.9                     | PCB - Aroclor1221         | 10                      | 50                      |
| Endosulfan Sulfate | 1.0                     | 9.9                     | PCB - Aroclor1248         | 10                      | 50                      |
| Endrin             | 1.0                     | 9.9                     | PCB - Aroclor1268         | 10                      | 50                      |
| Endrin Aldehyde    | 1.0                     | 9.9                     | PCB - Aroclor1232         | 10                      | 50                      |
| Endrin Ketone      | 0.8                     | 9.9                     | PCB - Aroclor1254         | 10                      | 50                      |
| Heptachlor         | 0.6                     | 5.1                     | PCB - Aroclor1242         | 10                      | 50                      |
| Heptachlor Epoxide | 0.8                     | 5.1                     | PCB - Aroclor1262         | 10                      | 50                      |
| Alpha-Chlordane    | 0.8                     | 5.1                     |                           |                         |                         |

**Table. 4.** Parameters to be Analyzed in Pre-Elutriate Water Samples and Unit Costs.

| Parameter*                                                              | Method    | Detection Limit | Analytical Cost |
|-------------------------------------------------------------------------|-----------|-----------------|-----------------|
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b>                                |           |                 |                 |
| Total Suspended Solids                                                  | EPA 160.1 | 5 mg/l          | \$10.95         |
| Turbidity                                                               | EPA 180.1 | 1 NTU           | 13.55           |
| <b>NUTRIENTS</b>                                                        |           |                 |                 |
| Nitrogen, Ammonia as N, Total                                           | EPA 350.1 | 0.02 mg/l       | 17.70           |
| Nitrogen, Total Kjeldahl as N                                           | EPA 351.3 | 0.2 mg/l        | 20.55           |
| Phosphorus, Total                                                       | SM4500PF  | 0.02 mg/l       | 18.80           |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>                                   |           |                 |                 |
| Carbon, Organic Total                                                   | EPA 415.1 | 0.4 mg/l        | 26.55           |
| <b>Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample</b> |           |                 | <b>\$108.10</b> |

**Table. 5.** Parameters to be Analyzed in Filtered Supernatant Elutriate Water Samples and Unit Costs.

| Parameter                                                                    | Method                       | Detection Limit | Analytical Cost |
|------------------------------------------------------------------------------|------------------------------|-----------------|-----------------|
| <b>SAMPLE PREPARATION</b>                                                    |                              |                 |                 |
| Elutriate Sample Preparation                                                 | 1:4 Sediment:Receiving Water | ----            | \$178.50        |
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b>                                     |                              |                 |                 |
| pH                                                                           | EPA 150.1                    | 0.1 S.U.*       | 7.45            |
| <b>NUTRIENTS</b>                                                             |                              |                 |                 |
| Nitrogen, Nitrate/Nitrite as N (mg/l)                                        | EPA 353.2                    | 0.02 mg/l       | 13.30           |
| Phosphorus, Dissolved                                                        | SM4500PF                     | 0.02 mg/l       | 18.80           |
| Ortho-Phosphorus, Dissolved                                                  | EPA 365.1                    | 0.02 mg/l       | 14.30           |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>                                        |                              |                 |                 |
| Chemical Oxygen Demand                                                       | ASTM D1252                   | 3 mg/l          | 18.25           |
| <b>METALS</b>                                                                |                              |                 |                 |
| Dissolved Metals Scan                                                        | EPA 6010B                    | See Table 6     | \$168.30        |
| <b>Total Laboratory Cost for Analyzing a Standard Elutriate Water Sample</b> |                              |                 | <b>\$418.90</b> |

\* Resolution limit.

**Table 6.** Detection and Reporting Limits for individual metals included in the Dissolved Metals Scan of elutriate and receiving water samples.

| Metal     | Detection Limit (µg/l) | Reporting Limit (µg/l) | Metal     | Detection Limit (µg/l) | Reporting Limit (µg/l) |
|-----------|------------------------|------------------------|-----------|------------------------|------------------------|
| Aluminum  | 25                     | 75                     | Lead      | 0.5                    | 2                      |
| Antimony  | 0.5                    | 2                      | Magnesium | 1,000                  | 3,000                  |
| Arsenic   | 1                      | 3                      | Manganese | 2                      | 10                     |
| Beryllium | 2                      | 5                      | Mercury   | 0.02                   | 0.1                    |
| Cadmium   | 0.2                    | 1                      | Nickel    | 10                     | 30                     |
| Calcium   | 1,000                  | 3,000                  | Selenium  | 1                      | 3                      |
| Chromium  | 1                      | 10                     | Silver    | 1                      | 3                      |
| Copper    | 1                      | 5                      | Thallium  | 0.5                    | 2                      |
| Cyanide   | 8                      | 20                     | Zinc      | 10                     | 30                     |
| Iron      | 7                      | 20                     |           |                        |                        |

**Table. 7.** Parameters to be Analyzed in Unfiltered Supernatant Elutriate Water Samples and Unit Costs.

| Parameter*                                                              | Method               | Detection Limit | Analytical Cost |
|-------------------------------------------------------------------------|----------------------|-----------------|-----------------|
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b>                                |                      |                 |                 |
| Total Suspended Solids                                                  | EPA 160.1            | 5 mg/l          | \$10.95         |
| Turbidity                                                               | EPA 180.1            | 1 NTU           | 13.55           |
| <b>NUTRIENTS</b>                                                        |                      |                 |                 |
| Nitrogen, Ammonia as N, Total                                           | EPA 350.1            | 0.02 mg/l       | 17.70           |
| Nitrogen, Total Kjeldahl as N                                           | EPA 351.3            | 0.2 mg/l        | 20.55           |
| Phosphorus, Total                                                       | SM4500PF             | 0.02 mg/l       | 18.80           |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>                                   |                      |                 |                 |
| Carbon, Organic Total                                                   | EPA 415.1            | 0.4 mg/l        | 26.55           |
| Carbonaceous Biochemical Oxygen Demand - CBOD                           | SM 5210.B            | 1 mg/l          | 29.15           |
| Atrazine (ug/l)                                                         | EPA 507              | 0.05 ug/l       | 159.15          |
| Organochlorine Pesticide and PCB Scan (ug/l)                            | EPA 8081<br>EPA 8082 | See Table 8     | 168.30          |
| <b>Total Laboratory Cost for Analyzing a Pre-Elutriate Water Sample</b> |                      |                 | <b>\$464.70</b> |

**Table 8.** Detection and Reporting Limits for individual parameters included in the Organochlorine Pesticide and PCB Scan of water samples.

| Parameter          | Detection Limit (µg/l) | Reporting Limit (µg/l) | Parameter                 | Detection Limit (µg/l) | Reporting Limit (µg/l) |
|--------------------|------------------------|------------------------|---------------------------|------------------------|------------------------|
| DDE                | 0.005                  | 0.1                    | Alpha-BHC (alpha-Lindane) | 0.009                  | 0.05                   |
| DDD                | 0.005                  | 0.1                    | Beta-BHC (beta-Lindane)   | 0.009                  | 0.05                   |
| DDT                | 0.004                  | 0.1                    | Delta-BHC (delta-Lindane) | 0.014                  | 0.05                   |
| Methoxychlor       | 0.005                  | 0.5                    | Gamma-BHC (gamma-Lindane) | 0.035                  | 0.05                   |
| Aldrin             | 0.008                  | 0.5                    | Gamma-Chlordane           | 0.006                  | 0.05                   |
| Dieldrin           | 0.004                  | 0.1                    | PCB - Aroclor1016         | 0.2                    | 1.0                    |
| Endosulfan 1       | 0.006                  | 0.05                   | PCB - Aroclor1260         | 0.2                    | 1.0                    |
| Endosulfan 2       | 0.003                  | 0.1                    | PCB - Aroclor1221         | 0.2                    | 2.0                    |
| Endosulfan Sulfate | 0.010                  | 0.1                    | PCB - Aroclor1248         | 0.3                    | 1.0                    |
| Endrin             | 0.003                  | 0.1                    | PCB - Aroclor1268         | 0.3                    | 1.0                    |
| Endrin Aldehyde    | 0.011                  | 0.1                    | PCB - Aroclor1232         | 0.2                    | 1.0                    |
| Endrin Ketone      | 0.006                  | 0.1                    | PCB - Aroclor1254         | 0.2                    | 1.0                    |
| Heptachlor         | 0.009                  | 0.05                   | PCB - Aroclor1242         | 0.2                    | 1.0                    |
| Heptachlor Epoxide | 0.007                  | 0.05                   | PCB - Aroclor1262         | 0.2                    | 1.0                    |
| Alpha-Chlordane    | 0.011                  | 0.05                   |                           |                        |                        |

**Table. 9.** Parameters to be Analyzed in Receiving Water Sample and Unit Costs.

| Parameter                                                             | Method               | Detection Limit | Analytical Cost |
|-----------------------------------------------------------------------|----------------------|-----------------|-----------------|
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b>                              |                      |                 |                 |
| Total Suspended Solids                                                | EPA 160.2            | 4 mg/l          | 10.95           |
| <b>NUTRIENTS</b>                                                      |                      |                 |                 |
| Nitrogen, Ammonia as N, Total (mg/l)                                  | EPA 350.1            | 0.02 mg/l       | 17.70           |
| Nitrogen, Total Kjeldahl as N (mg/l)                                  | EPA 351.3            | 0.2 mg/l        | 20.55           |
| Nitrogen, Nitrate/Nitrite as N (mg/l)                                 | EPA 353.2            | 0.02 mg/l       | 13.30           |
| Phosphorus, Dissolved                                                 | SM4500PF             | 0.02 mg/l       | 18.80           |
| Phosphorus, Total                                                     | SM4500PF             | 0.02 mg/l       | 18.80           |
| Ortho-Phosphorus, Dissolved                                           | EPA 365.1            | 0.02 mg/l       | 14.30           |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>                                 |                      |                 |                 |
| Carbonaceous Biochemical Oxygen Demand - CBOD (mg/l)                  | SM 5210.B            | 1 mg/l          | 29.15           |
| Chemical Oxygen Demand                                                | ASTM D1252           | 3 mg/l          | 18.25           |
| Organic Carbon, Total                                                 | EPA 415.1            | 0.4 mg/l        | 26.55           |
| <b>METALS</b>                                                         |                      |                 |                 |
| Dissolved Metals Scan                                                 | EPA 6010B            | See Table 6     | 168.30          |
| <b>PESTICIDES AND PCBs</b>                                            |                      |                 |                 |
| Organochlorine Pesticide and PCB Scan                                 | EPA 8081<br>EPA 8082 | See Table 8     | 168.30          |
| <b>Total Laboratory Cost for Analyzing the Receiving Water Sample</b> |                      |                 | <b>\$524.95</b> |

## 5.6. QUALITY CONTROL

Where applicable, field measurements and samples will be collected in accordance with SOPs developed by the USACE's Water Control and Water Quality Section.

Laboratory quality control samples and data quality indicators will be utilized in accordance with the Contract Laboratory Quality Assurance Manual. Routine internal quality control checks are placed in the measurement system to assess the quality of the data generated. These checks typically include: with each preparative batch, a Method Blank, a Matrix Spike and Matrix Spike Duplicate, a Laboratory Duplicate, and a Laboratory Control Sample. Inclusion of the Matrix Spike, Matrix Spike Duplicate and Laboratory Duplicate are contingent on sufficient sample material being provided. In addition to the checks within the preparative batch there are analysis batch checks that are also completed (retained on file by the laboratory, but typically not reported in a standard data package) including Calibration Blanks, Initial Calibration Verifications, and Continuing Calibration Verifications. Additional samples are analyzed periodically (results retained on file) and may include reagent blanks, second source check standards and other performance checks. External quality control checks are provided in the form of Performance and System Audits and Surveillance. A laboratory Quality Assurance Report will be submitted to the District's Water Quality Unit on an appropriate basis.

## 6. DATA MANAGEMENT AND REPORTING

All water quality measurements and analyses will be verified, validated, and compiled. Once compiled, the results will be provided to Luke Wallace (CENWO-PM-AE).

## 7. PROJECTED COSTS FOR FIELD COLLECTION AND LABORATORY ANALYSIS OF ELUTRIATE SAMPLES

### Field Collection:

Preparation and collection of required samples 50 man hours @ \$100 = \$5,000

### Laboratory Analysis (Midwest Laboratories):

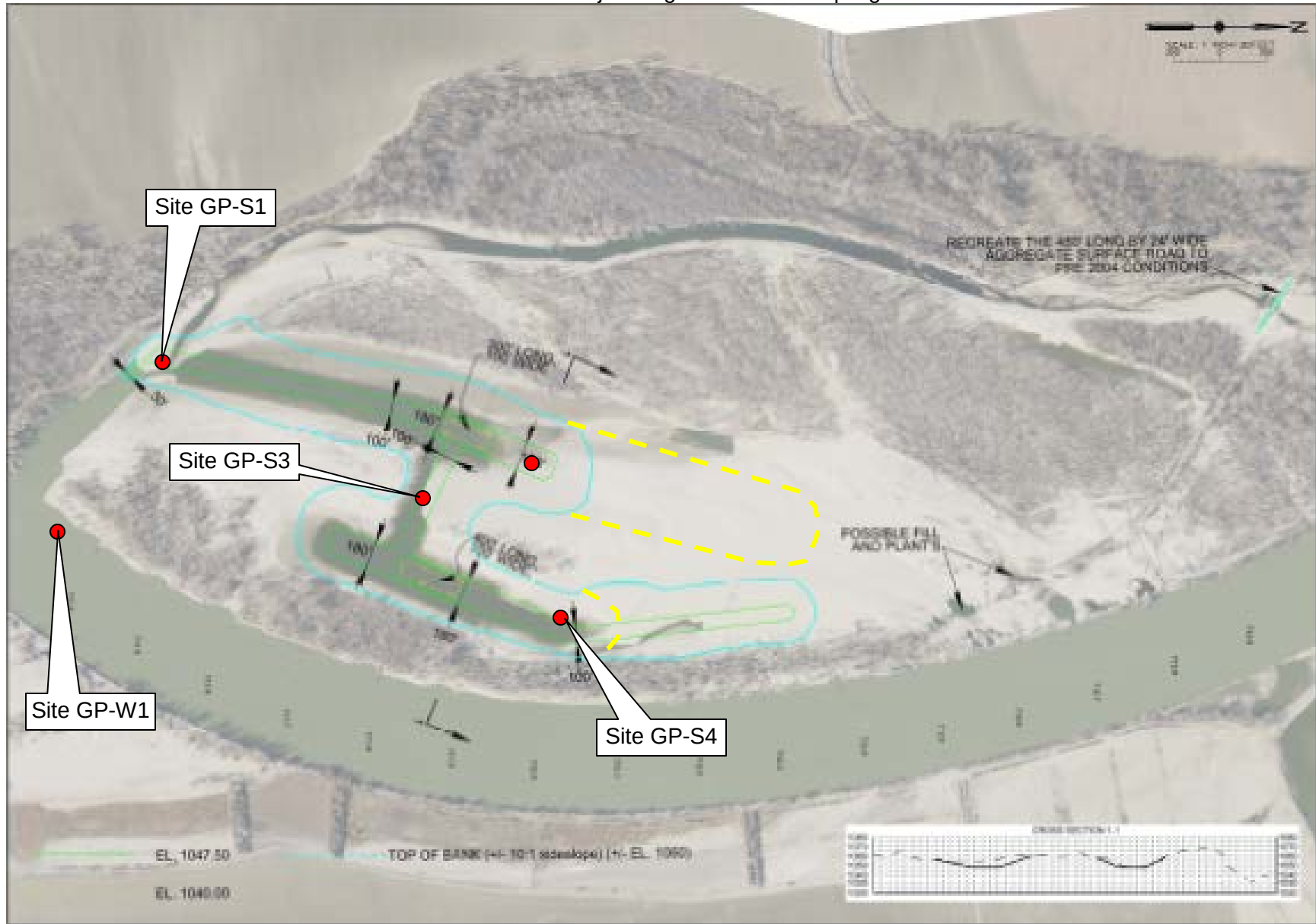
| Analyzed Media                     | Number of Samples | Unit Cost per Sample | Total Cost        |
|------------------------------------|-------------------|----------------------|-------------------|
| Soil                               | 4                 | \$627.25             | \$2,509.00        |
| Pre-Elutriate                      | 4                 | \$108.10             | \$432.40          |
| Elutriate – Filtered Supernatant   | 4                 | \$418.90             | \$1,675.60        |
| Elutriate – Unfiltered Supernatant | 4                 | \$464.70             | \$1,858.80        |
| Receiving Water                    | 1                 | 524.95               | \$524.95          |
| <b>TOTAL ANALYSTICAL COSTS</b>     |                   |                      | <b>\$7,000.75</b> |

Total Costs = \$2,000.00 (Field Collection) + \$7,000.75 (Lab Analysis) = \$9,000.75

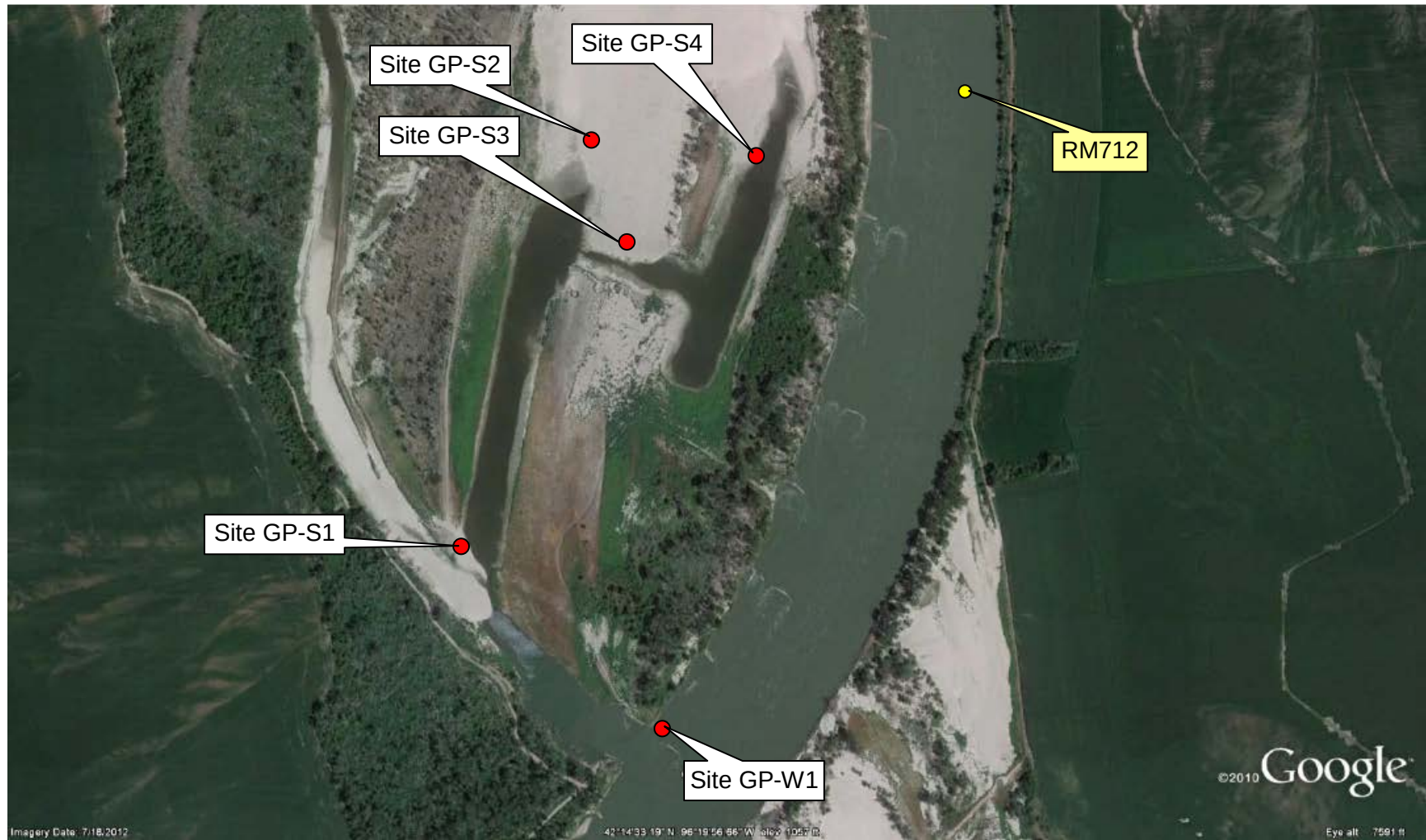
## 8. REFERENCES

**USEPA and USACE. 1998.** Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S. - Test Manual: Inland Testing Manual. EPA-823-B-98-004, February 1998. U.S. Environmental Protection Agency, Office of Water. Department of Army, U.S. Army Corps of Engineers. Washington, D.C

**ATTACHMENT 1.**    Glovers Point Bend Enhancement Project Alignment and Sampling Sites..



**ATTACHMENT 2.** Glovers Point Bend Enhancement Project Sampling Sites as shown on “Google Earth” 7/18/2012 imagery data.



**ATTACHMENT 3.** Field Sheet for Glovers Point Bend Elutriate Monitoring Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

**FIELD DATA SHEET**

**Project Name:** Glovers Point Bend Elutriate Monitoring

**Project Number:** SPS-GVPTBD-002

**Trip Number:** \_\_\_\_\_

**Date:** \_\_\_\_\_

**Site Location:** Glovers Point Bend SWH Project, Missouri River (RM712)

**Site Numbers:** GP-W1, GP-S1, GP-S2, GP-S3, GP-S4

**Collectors:** \_\_\_\_\_

**GPS MEASUREMENTS**

GPS Device Used: \_\_\_\_\_

Site GP-W1: Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

Site GP-S1: Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

Site GP-S2: Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

Site GP-S3: Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

Site GP-S4: Latitude: \_\_\_\_\_ Longitude: \_\_\_\_\_

**WATER MEASUREMENTS**

**Water Quality Measurements:**

| Temp.<br>(°C) | pH<br>(S.U.) | Cond.<br>(umho/cm) | D.O.<br>(%Sat) | D.O.<br>(mg/l) | Turbidity<br>(NTUs) |
|---------------|--------------|--------------------|----------------|----------------|---------------------|
|               |              |                    |                |                |                     |

**SAMPLES COLLECTED**

| Sample Type  | Sample ID | Sampled Depth | Collection Time | Sampling Method |
|--------------|-----------|---------------|-----------------|-----------------|
| Water Sample | GP-W1     | Surface       |                 | Grab            |
| Soil Sample  | GP-S1     |               |                 | Composite Core  |
| Soil Sample  | GP-S2     |               |                 | Composite Core  |
| Soil Sample  | GP-S3     |               |                 | Composite Core  |
| Soil Sample  | GP-S4     |               |                 | Composite Core  |

**COMMENTS:**

**ATTACHMENT 4.** Analytical Request Form for Little Sioux Bend Monitoring Project.

(U.S. Army Corps of Engineers – Omaha District – Water Quality Unit)

## ANALYTICAL REQUEST FORM

|                                                              |                                       |
|--------------------------------------------------------------|---------------------------------------|
| <b>Project Name:</b> Glovers Point Bend Elutriate Monitoring | <b>Project Number:</b> SPS-GVPTBD-002 |
| <b>Trip Number:</b> _____                                    |                                       |

**Samples to be Analyzed:**

| Site Number | Sample Description              | Sample Identification Number | Collection Date | Collection Time | Number of Sample Containers |
|-------------|---------------------------------|------------------------------|-----------------|-----------------|-----------------------------|
| GP-W1       | Missouri River Overburden Water | LS-W1                        |                 |                 | 9*                          |
| GP-S1       | Soil Sample                     | GP-S1                        |                 |                 | 1                           |
| GP-S2       | Soil Sample                     | GP-S2                        |                 |                 | 1                           |
| GP-S3       | Soil Sample                     | GP-S3                        |                 |                 | 1                           |
| GP-S4       | Soil Sample                     | GP-S4                        |                 |                 | 1                           |

\* Assuming 1-gallon containers

**Total Number of Sample Containers Delivered to Lab:** \_\_\_\_\_

**Samples Collected By:** \_\_\_\_\_

**Samples Delivered By:** \_\_\_\_\_

**Samples Received By:** \_\_\_\_\_ **Date/Time Received:** \_\_\_\_\_

## REQUESTED LABORATORY ANALYSES (See Back of Page)

**Comments:**

| REQUESTED LABORATORY ANALYSES            |                 |      |                 |                     |                 |
|------------------------------------------|-----------------|------|-----------------|---------------------|-----------------|
| Parameter                                | Detection Limit | Soil | Receiving Water | Pre-Elutriate Water | Elutriate Water |
| <b>PHYSICAL AND AGGREGATE PROPERTIES</b> |                 |      |                 |                     |                 |
| pH                                       | ----            | X    |                 |                     | X               |
| Particle Size                            | -----           | X    |                 |                     |                 |
| Total Suspended Solids                   | 4 mg/l          |      | X               | X                   | X*              |
| Turbidity                                | 1 NTU           |      |                 | X                   | X*              |
| <b>NUTRIENTS</b>                         |                 |      |                 |                     |                 |
| Nitrogen, Ammonia as N, Total            | 0.02 mg/l       | X    | X               |                     | X*              |
| Nitrogen, Total Kjeldahl as N            | 0.2 mg/l        | X    | X               | X                   | X*              |
| Nitrogen, Nitrate/Nitrite as N)          | 0.02 mg/l       | X    | X               | X                   | X               |
| Phosphorus, Dissolved                    | 0.02 mg/l       |      | X               |                     | X               |
| Phosphorus, Total                        | 0.02 mg/l       | X    | X               | X                   | X*              |
| Ortho-Phosphorus, Dissolved              | 0.02 mg/l       |      | X               |                     | X               |
| <b>AGGREGATE ORGANIC CONSTITUENTS</b>    |                 |      |                 |                     |                 |
| CBOD                                     | 1 mg/l          |      | X               |                     | X*              |
| Chemical Oxygen Demand                   | 3 mg/l          |      | X               |                     | X               |
| Organic Carbon, Total                    | 0.4 mg/l        | X    | X               | X                   | X*              |
| <b>METALS (Dissolved)</b>                |                 |      |                 |                     |                 |
| Dissolved Metals Scan                    | -----           |      | X               |                     | X               |
| <b>METALS (Total)</b>                    |                 |      |                 |                     |                 |
| Arsenic, Total                           | 10 mg/kg        | X    |                 |                     |                 |
| Cadmium, Total                           | 0.2 mg/kg       | X    |                 |                     |                 |
| Chromium, Total                          | 1 mg/kg         | X    |                 |                     |                 |
| Copper, Total                            | 1 mg/kg         | X    |                 |                     |                 |
| Lead, Total                              | 13 mg/kg        | X    |                 |                     |                 |
| Mercury, Total                           | 0.1 mg/kg       | X    |                 |                     |                 |
| Nickel, Total                            | 1 mg/kg         | X    |                 |                     |                 |
| Zinc Total                               | 2 mg/kg         | X    |                 |                     |                 |
| <b>PESTICIDES and PCBs</b>               |                 |      |                 |                     |                 |
| Organochlorine Pesticide and PCB Scan    | -----           | X    | X               |                     | X*              |
| Atrazine (ug/l)                          | 0.05            | X    | X               |                     | X*              |

\* Determined on the "elutriate" supernatant prior to filtration.

## **ATTACHMENT 2.**

**Particle Size Distribution Reports for Collected Sediment/Soil Samples**

## Particle Size Distribution Report

**Project:** GLOVERS POINT BEND ELUTRIATE MONITORING TRIP EDXDEJ111512

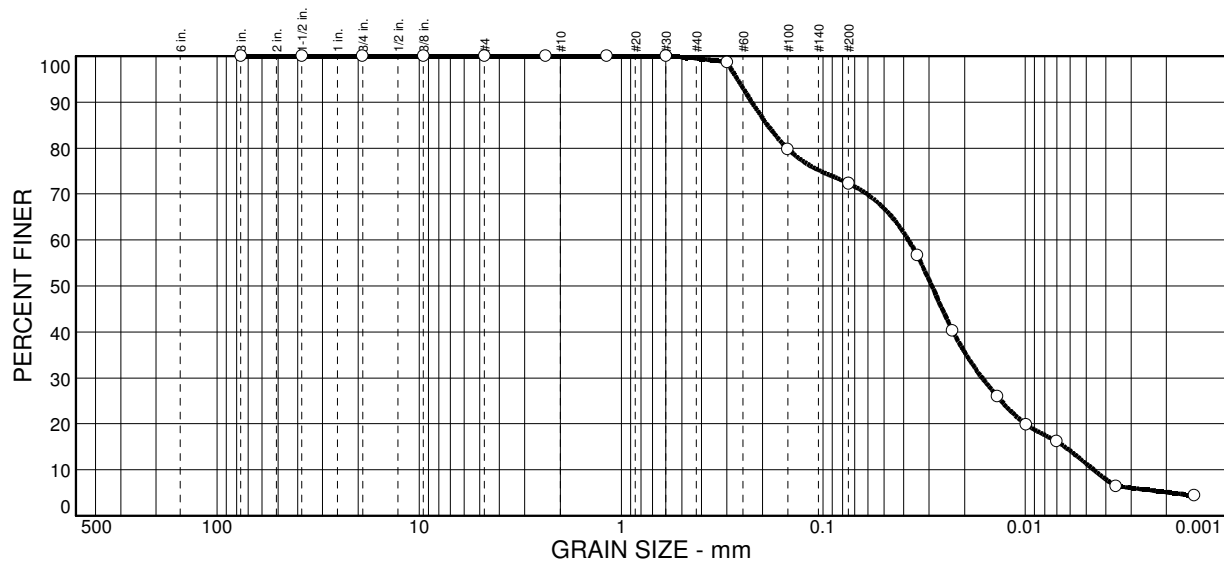
**Report No.:** 12-332-2018

**Client:** US ARMY CORPS OF ENGINEERS - PROJECT SPS-GVPTBD-002

**Sample No:** 2064962

**Source of Sample:**
**Date:** 11/14/2012

**Location:** GP-S1

**Elev./Depth:**


| % COBBLES | % GRAVEL |      | % SAND |        |      | % FINES |      |
|-----------|----------|------|--------|--------|------|---------|------|
|           | CRS.     | FINE | CRS.   | MEDIUM | FINE | SILT    | CLAY |
| 0.0       | 0.0      | 0.0  | 0.0    | 0.5    | 27.2 | 61.0    | 11.3 |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|------------|---------------|----------------|--------------|
| 3 in.      | 100.0         |                |              |
| 1.5 in.    | 100.0         |                |              |
| .75 in.    | 100.0         |                |              |
| .375 in.   | 100.0         |                |              |
| #4         | 100.0         |                |              |
| #8         | 100.0         |                |              |
| #16        | 100.0         |                |              |
| #30        | 100.0         |                |              |
| #50        | 98.7          |                |              |
| #100       | 79.8          |                |              |
| #200       | 72.3          |                |              |

### Soil Description

#### Atterberg Limits

PL=      LL=      PI=

#### Coefficients

D<sub>85</sub>= 0.189      D<sub>60</sub>= 0.0379      D<sub>50</sub>= 0.0290  
D<sub>30</sub>= 0.0164      D<sub>15</sub>= 0.0064      D<sub>10</sub>= 0.0046  
C<sub>u</sub>= 8.25      C<sub>c</sub>= 1.54

#### Classification

USCS=      AASHTO=

#### Remarks

\* (no specification provided)

**Figure**

## Particle Size Distribution Report

**Project:** GLOVERS POINT BEND ELUTRIATE MONITORING TRIP EDXDEJ111512

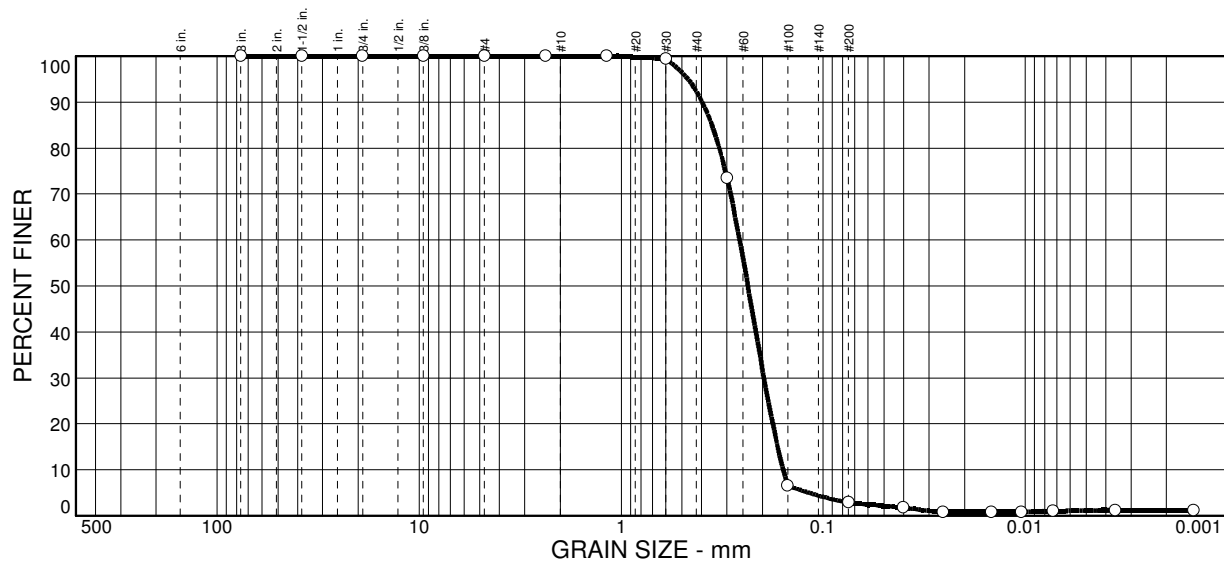
**Report No.:** 12-332-2019

**Client:** US ARMY CORPS OF ENGINEERS - PROJECT SPS-GVPTBD-002

**Sample No:** 2064963

**Source of Sample:**
**Date:** 11/14/2012

**Location:** GP-S2

**Elev./Depth:**


| % COBBLES | % GRAVEL |      | % SAND |        |      | % FINES |      |
|-----------|----------|------|--------|--------|------|---------|------|
|           | CRS.     | FINE | CRS.   | MEDIUM | FINE | SILT    | CLAY |
| 0.0       | 0.0      | 0.0  | 0.0    | 7.7    | 89.4 | 1.8     | 1.1  |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|------------|---------------|----------------|--------------|
| 3 in.      | 100.0         |                |              |
| 1.5 in.    | 100.0         |                |              |
| .75 in.    | 100.0         |                |              |
| .375 in.   | 100.0         |                |              |
| #4         | 100.0         |                |              |
| #8         | 100.0         |                |              |
| #16        | 100.0         |                |              |
| #30        | 99.4          |                |              |
| #50        | 73.5          |                |              |
| #100       | 6.6           |                |              |
| #200       | 2.9           |                |              |

### Soil Description

**Atterberg Limits**  
 PL=      LL=      PI=

**Coefficients**  
 D<sub>85</sub>= 0.356      D<sub>60</sub>= 0.260      D<sub>50</sub>= 0.237  
 D<sub>30</sub>= 0.197      D<sub>15</sub>= 0.169      D<sub>10</sub>= 0.158  
 C<sub>u</sub>= 1.64      C<sub>c</sub>= 0.94

**Classification**  
 USCS=      AASHTO=

### Remarks

\* (no specification provided)

Figure

## Particle Size Distribution Report

**Project:** GLOVERS POINT BEND ELUTRIATE MONITORING TRIP EDXDEJ111512

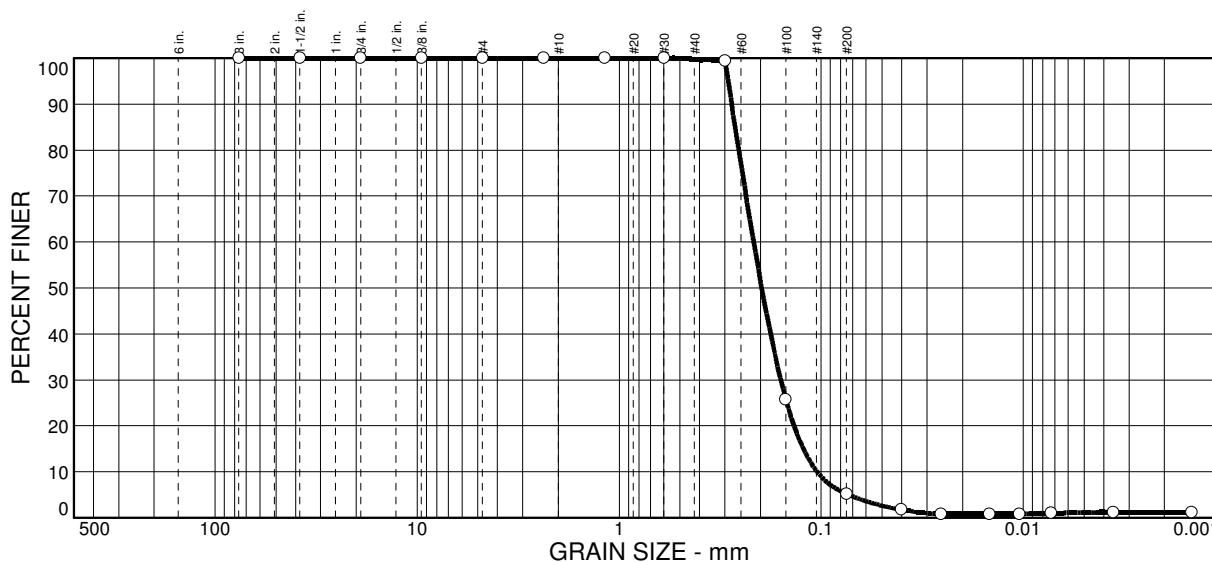
**Report No.:** 12-332-2020

**Client:** US ARMY CORPS OF ENGINEERS - PROJECT SPS-GVPTBD-002

**Sample No:** 2064964

**Source of Sample:**
**Date:** 11/14/2012

**Location:** GP-S3

**Elev./Depth:**


| % COBBLES | % GRAVEL |      | % SAND |        |      | % FINES |      |
|-----------|----------|------|--------|--------|------|---------|------|
|           | CRS.     | FINE | CRS.   | MEDIUM | FINE | SILT    | CLAY |
| 0.0       | 0.0      | 0.0  | 0.0    | 0.2    | 94.6 | 4.1     | 1.1  |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|------------|---------------|----------------|--------------|
| 3 in.      | 100.0         |                |              |
| 1.5 in.    | 100.0         |                |              |
| .75 in.    | 100.0         |                |              |
| .375 in.   | 100.0         |                |              |
| #4         | 100.0         |                |              |
| #8         | 100.0         |                |              |
| #16        | 100.0         |                |              |
| #30        | 100.0         |                |              |
| #50        | 99.4          |                |              |
| #100       | 25.8          |                |              |
| #200       | 5.2           |                |              |

| Soil Description        |                         |                         |
|-------------------------|-------------------------|-------------------------|
| <b>Atterberg Limits</b> |                         |                         |
| PL=                     | LL=                     | PI=                     |
| <b>Coefficients</b>     |                         |                         |
| D <sub>85</sub> = 0.267 | D <sub>60</sub> = 0.216 | D <sub>50</sub> = 0.197 |
| D <sub>30</sub> = 0.159 | D <sub>15</sub> = 0.123 | D <sub>10</sub> = 0.105 |
| C <sub>u</sub> = 2.06   | C <sub>c</sub> = 1.11   |                         |
| <b>Classification</b>   |                         |                         |
| USCS=                   | AASHTO=                 |                         |
| <b>Remarks</b>          |                         |                         |

\* (no specification provided)

Figure

## Particle Size Distribution Report

**Project:** GLOVERS POINT BEND ELUTRIATE MONITORING TRIP EDXDEJ111512

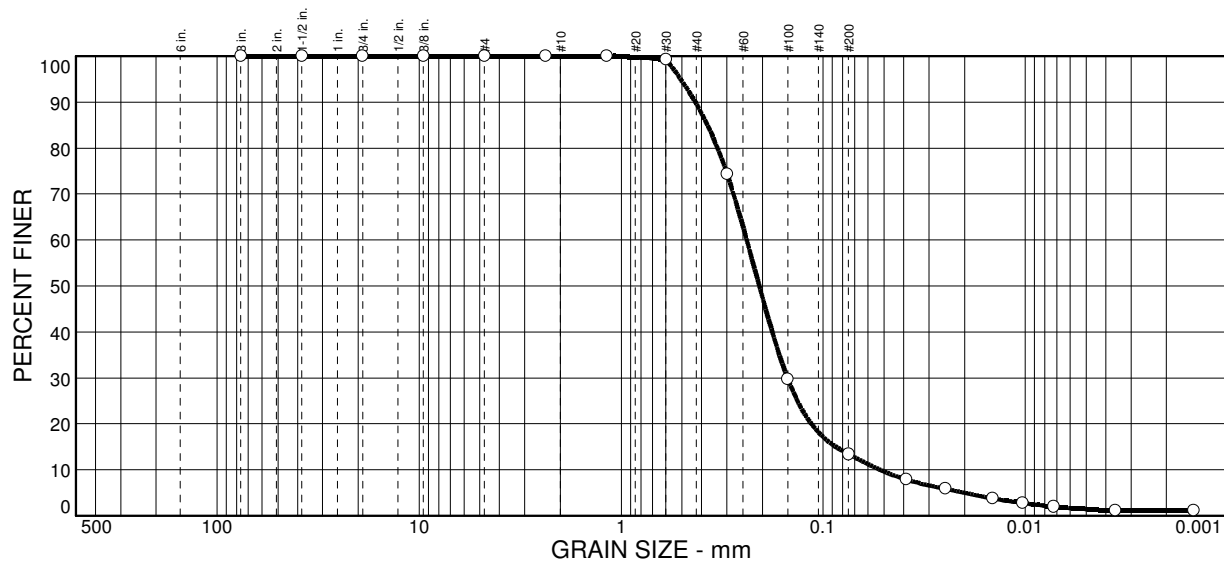
**Report No.:** 12-332-2021

**Client:** US ARMY CORPS OF ENGINEERS - PROJECT SPS-GVPTBD-002

**Sample No:** 2064965

**Source of Sample:**
**Date:** 11/14/2012

**Location:** GP-S4

**Elev./Depth:**


| % COBBLES | % GRAVEL |      | % SAND |        |      | % FINES |      |
|-----------|----------|------|--------|--------|------|---------|------|
|           | CRS.     | FINE | CRS.   | MEDIUM | FINE | SILT    | CLAY |
| 0.0       | 0.0      | 0.0  | 0.0    | 10.4   | 76.2 | 11.9    | 1.5  |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|------------|---------------|----------------|--------------|
| 3 in.      | 100.0         |                |              |
| 1.5 in.    | 100.0         |                |              |
| .75 in.    | 100.0         |                |              |
| .375 in.   | 100.0         |                |              |
| #4         | 100.0         |                |              |
| #8         | 100.0         |                |              |
| #16        | 100.0         |                |              |
| #30        | 99.3          |                |              |
| #50        | 74.4          |                |              |
| #100       | 29.8          |                |              |
| #200       | 13.4          |                |              |

### Soil Description

#### Atterberg Limits

PL= LL= PI=

#### Coefficients

D<sub>85</sub>= 0.375 D<sub>60</sub>= 0.240 D<sub>50</sub>= 0.208  
D<sub>30</sub>= 0.151 D<sub>15</sub>= 0.0867 D<sub>10</sub>= 0.0522  
C<sub>u</sub>= 4.59 C<sub>c</sub>= 1.81

#### Classification

USCS= AASHTO=

#### Remarks

\* (no specification provided)

Figure

## Particle Size Distribution Report

**Project:** GLOVERS POINT BEND ELUTRIATE MONITORING TRIP EDXDEJ111512

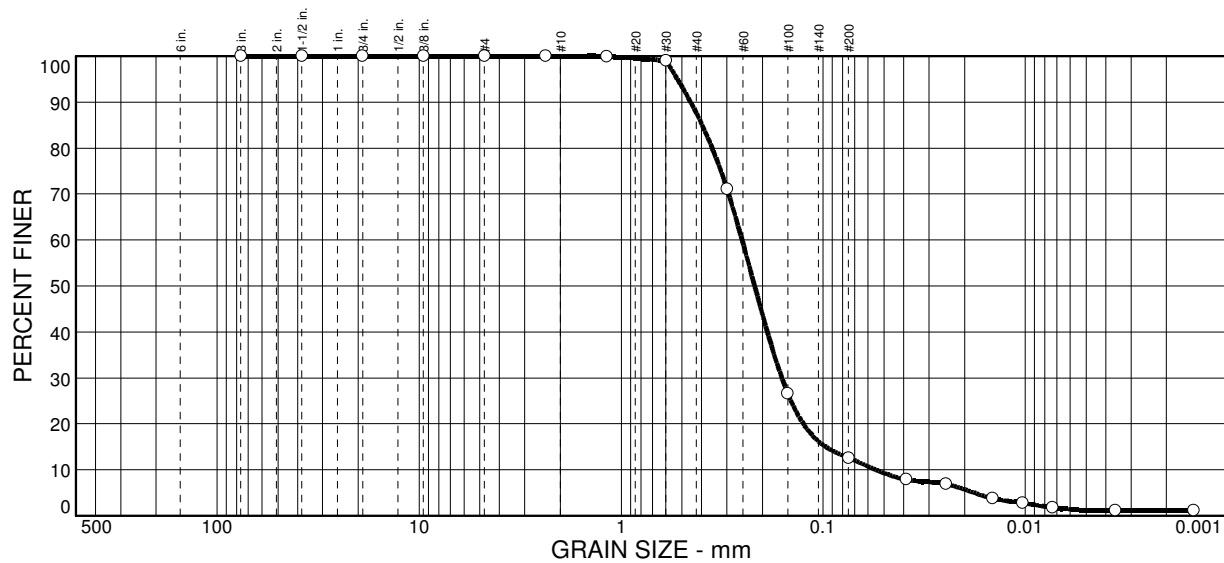
**Report No.:** 12-332-2021

**Client:** US ARMY CORPS OF ENGINEERS - PROJECT SPS-GVPTBD-002

**Sample No:** 2064965 DUP

**Source of Sample:**
**Date:** 11/14/2012

**Location:** GP-S4 DUP

**Elev./Depth:**


| % COBBLES | % GRAVEL |      | % SAND |        |      | % FINES |      |
|-----------|----------|------|--------|--------|------|---------|------|
|           | CRS.     | FINE | CRS.   | MEDIUM | FINE | SILT    | CLAY |
| 0.0       | 0.0      | 0.0  | 0.0    | 12.4   | 75.0 | 11.3    | 1.3  |

| SIEVE SIZE | PERCENT FINER | SPEC.* PERCENT | PASS? (X=NO) |
|------------|---------------|----------------|--------------|
| 3 in.      | 100.0         |                |              |
| 1.5 in.    | 100.0         |                |              |
| .75 in.    | 100.0         |                |              |
| .375 in.   | 100.0         |                |              |
| #4         | 100.0         |                |              |
| #8         | 100.0         |                |              |
| #16        | 99.9          |                |              |
| #30        | 99.0          |                |              |
| #50        | 71.1          |                |              |
| #100       | 26.6          |                |              |
| #200       | 12.6          |                |              |

| Soil Description        |                          |                          |
|-------------------------|--------------------------|--------------------------|
| <b>Atterberg Limits</b> |                          |                          |
| PL=                     | LL=                      | PI=                      |
| <b>Coefficients</b>     |                          |                          |
| D <sub>85</sub> = 0.398 | D <sub>60</sub> = 0.253  | D <sub>50</sub> = 0.219  |
| D <sub>30</sub> = 0.160 | D <sub>15</sub> = 0.0972 | D <sub>10</sub> = 0.0548 |
| C <sub>u</sub> = 4.61   | C <sub>c</sub> = 1.86    |                          |
| <b>Classification</b>   |                          |                          |
| USCS=                   | AASHTO=                  |                          |
| <b>Remarks</b>          |                          |                          |

\* (no specification provided)

Figure

## **ATTACHMENT 3.**

**Laboratory Reports of Results for Analysis of Collected Sediment, Soil, Receiving  
Water, and Prepared Elutriate Samples**



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Page 1 of 4

USACE  
DAVE JENSEN  
106 SOUTH 15TH STREET  
OMAHA NE 68102

Project Name: GLOVER POINT BEND  
Project #: SPS-GVPTBD-002  
Trip Number: EDXDEJ111412 ELUTRIATE MONITORING TRIP

| Lab Number:                       |             |                        |      |                            |       | 2064966    | 2064970      | 2064971               | 2064979                   | 2064975             |                           |                       |
|-----------------------------------|-------------|------------------------|------|----------------------------|-------|------------|--------------|-----------------------|---------------------------|---------------------|---------------------------|-----------------------|
| Sample ID:                        |             |                        |      |                            |       | GP-S1      | GP-W1        | GP-S1 ELUTRIATE       |                           |                     |                           |                       |
| Parameter                         | Method      | Method Detection Limit |      | Laboratory Reporting Limit |       | Units      | Soil         | Receiving Water Total | Receiving Water Dissolved | Pre-Elutriate Water | Elutriate Water Dissolved | Elutriate Water Total |
| Ammonia as N                      | EPA 350.2   | 2                      | 0.02 | 10                         | 0.1   | mg/kg mg/L | 79.6         | 0.08J                 | 0.07J                     | ---                 | 0.72                      | 0.82                  |
| Arsenic                           | EPA 200.8   | 0.1                    | 1    | 0.5                        | 3     | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Atrazine                          | GC-MS       | 0.01                   | 0.2  | 0.02                       | 5     | mg/kg µg/L | n.d.         | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Cadmium                           | EPA 200.8   | 0.5                    | 0.2  | 2                          | 1     | mg/kg µg/L | 0.67         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Carbonaceous BOD                  | SM 5210B    | 5                      | 2    | 25                         | 5     | mg/kg mg/L | ---          | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Chemical Oxygen Demand-COD        | ASTM 1252   | -                      | 3    | -                          | 10    | mg/L       | ---          | 13                    | ---                       | ---                 | ---                       | 15                    |
| Chromium                          | EPA 200.7   | 0.5                    | 4    | 2                          | 10    | mg/kg µg/L | 17.9         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Copper                            | EPA 200.7   | 0.2                    | 2    | 1.0                        | 10    | mg/kg µg/L | 22.1         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Dissolved Organic Carbon          | SM 5310B    | -                      | -    | 0.2                        | 1     | mg/kg µg/L | ---          | ---                   | 3.5                       | ---                 | 4.7                       | ---                   |
| Kjeldahl Nitrogen (Total or N)    | EPA 351.3   | 2                      | 0.2  | 10                         | 0.5   | mg/kg mg/L | 1207         | 0.41J                 | 0.34J                     | 63.4                | 1.2                       | 1.61                  |
| Lead                              | EPA 200.8   | 2                      | 0.5  | 5                          | 2     | mg/kg µg/L | 12           | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Mercury                           | EPA 245.1   | 0.02                   | 0.02 | 0.05                       | 0.05  | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | n.d.                  |
| Nickel                            | EPA 200.7   | 0.5                    | 2    | 2                          | 10    | mg/kg µg/L | 21           | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Nitrate/Nitrite Nitrogen          | EPA 353.2   | 0.2                    | 0.05 | 1                          | 0.20  | mg/kg mg/L | n.d.         | ---                   | 0.12J                     | 0.13J               | 0.12J                     | ---                   |
| Organochlorine Pesticides         | EPA 8081    | -                      | -    | *                          | *     | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Phosphorus, (dissolved ortho)     | SM4500-P-G  | -                      | 0.02 | -                          | 0.05  | mg/L       | ---          | ---                   | n.d.                      | ---                 | ---                       | ---                   |
| Phosphorus, (total, dissolved)    | SM 4500 P-H | -                      | 0.02 | -                          | 0.05  | mg/L       | ---          | ---                   | 0.05                      | ---                 | 0.05                      | ---                   |
| Polychlorinated Biphenyls (PCB's) | EPA 8082    | -                      | -    | *                          | *     | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Percent Solids                    | SM 2580B    | ---                    | ---  | ---                        | ---   | %          | 77.2         | ---                   | ---                       | ---                 | ---                       | ---                   |
| Particle Size                     | Sieve       | ---                    | ---  | ---                        | ---   | ---        | See Attached | ---                   | ---                       | ---                 | ---                       | ---                   |
| pH                                | SM 4500-H   | 0.1                    |      | 0.2                        |       | ---        | 7.7          | 8.34                  | ---                       | 7.68                | ---                       | 7.86                  |
| Total Organic Carbon - TOC        | SM 5310B    | 50                     | 0.2  | 100                        | 1     | mg/kg mg/L | 18,200.00    | 3.5                   | ---                       | 670                 | ---                       | 9.5                   |
| Total Phosphorus                  | SM 4500 P-F | 0.2                    | 0.02 | 1                          | 0.05  | mg/kg mg/L | 665          | n.d.                  | n.d.                      | 20.9                | ---                       | 0.26                  |
| Total Suspended Solids            | SM 2540D    | -                      | 4    | -                          | 10    | mg/L       | ---          | 34                    | ---                       | 51,100              | ---                       | 228                   |
| Turbidity                         | EPA 180.1   | -                      | 1    | -                          | 3     | NTU        | ---          | 15                    | n.d.                      | > 1000              | n.d.                      | 340                   |
| Zinc                              | EPA 200.7   | 1                      | 2    | 5                          | 10    | mg/kg µg/L | 59.2         | ---                   | 20                        | ---                 | 70                        | ---                   |
| Silver                            | EPA 200.7   | 0.32                   | 6    | 1                          | 10    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Aluminum                          | EPA 200.7   | 5                      | 40   | 10                         | 50    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Beryllium                         | EPA 200.7   | 0.02                   | 0.2  | 0.5                        | 5     | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Calcium                           | EPA 200.7   | 15                     | 0.06 | 100                        | 0.100 | mg/kg mg/L | ---          | ---                   | 55.8                      | ---                 | 85.5                      | ---                   |
| Magnesium                         | EPA 200.7   | 2.5                    | 0.05 | 10                         | 1     | mg/kg mg/L | ---          | ---                   | 23.8                      | ---                 | 21.1                      | ---                   |
| Manganese                         | EPA 200.7   | 0.12                   | 0.1  | 1                          | 2     | mg/kg µg/L | ---          | ---                   | 7                         | ---                 | ---                       | ---                   |
| Antimony                          | EPA 200.7   | 0.6                    | 6    | 5                          | 50    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Selenium                          | EPA 200.7   | 2                      | 10   | 5                          | 100   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Thallium                          | EPA 200.7   | 2.4                    | 10   | 5                          | 50    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Iron                              | EPA 200.7   | 6                      | 10   | 30                         | 50    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | 15                        | ---                   |

n.d. = Not Detected

--- Test not requested/Applicable

J = Estimated concentration below laboratory reporting limit.

\* See attached report

Note:

- Elutriate Extract were analyzed for organic analysis after settling time of one (1) hour and the samples were not filtered
- Pre-elutriate samples will be prepared the same as standard elutriate samples up through the point of vigorous mixing for 30 minutes. At that time the mixture will be allowed to settle "1-minute" (allow heavier, coarse material to settle). A sub-sample will be siphoned off without filtration and identified as a pre-elutriate sample.

*Prem N. Arora*

Prem N. Arora, Environmental Project Manager



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## REPORT OF ANALYSIS

Page 2 of 4

Report Number: 12-331-2062

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Lab number: 2064966

Sample ID: GP-S1 SOIL SAMPLE

Method: EPA 8081/8082

Units:

µg/Kg

Analyst: cjh

Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) | Analysis            | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) |
|-------------------|-------------|---------------------------|----------------------------|---------------------|-------------|---------------------------|----------------------------|
| 4,4'-DDE          | n.d.        | 0.003                     | 9.9                        | Endosulfan I        | n.d.        | 0.002                     | 5.1                        |
| 4,4'-DDD          | n.d.        | 0.0005                    | 9.9                        | Endosulfan II       | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-DDT          | n.d.        | 0.0003                    | 9.9                        | Endosulfan sulfate  | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-Methoxychlor | n.d.        | 0.002                     | 51                         | Endrin              | n.d.        | 0.002                     | 9.9                        |
| Aldrin            | n.d.        | 0.001                     | 5.1                        | Endrin aldehyde     | n.d.        | 0.0008                    | 9.9                        |
| Aroclor 1016      | n.d.        | 0.009                     | 50                         | Endrin ketone       | n.d.        | 0.003                     | 9.9                        |
| Aroclor 1221      | n.d.        | NA                        | 50                         | Heptachlor          | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1232      | n.d.        | NA                        | 50                         | Heptachlor epoxide  | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1242      | n.d.        | 0.02                      | 50                         | alpha-Chlordane     | n.d.        | 0.005                     | 5.1                        |
| Aroclor 1248      | n.d.        | 0.009                     | 50                         | alpha-BHC           | n.d.        | 0.00085                   | 5.1                        |
| Aroclor 1254      | n.d.        | 0.02                      | 50                         | beta-BHC            | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1260      | n.d.        | 0.02                      | 50                         | delta-BHC           | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1262      | n.d.        | NA                        | 50                         | gamma-BHC (Lindane) | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1268      | n.d.        | NA                        | 50                         | gamma-(Chlordane)   | n.d.        | 0.009                     | 5.1                        |
| Dieldrin          | n.d.        | 0.0003                    | 9.9                        |                     |             |                           |                            |



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## REPORT OF ANALYSIS

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Report Number: 12-338-2165

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXDEJ111412

Lab number: 2064970

Sample ID: GP-W1-MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082

Units: µg/L

Analyst: cjh

Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis           | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|--------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I       | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II      | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin             | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde    | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone      | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor         | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane    | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC          | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gama-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gama-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                    |             |                        |                        |



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## REPORT OF ANALYSIS

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Report Number: 12-338-2059

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Lab number: 2064975 Sample ID: GP-S1 ELUTRIATE

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |



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Page 1 of 4

USACE  
DAVE JENSEN  
106 SOUTH 15TH STREET  
OMAHA NE 68102

Project Name: GLOVER POINT BEND  
Project #: SPS-GVPTBD-002  
Trip Number: EDXDEJ111412 ELUTRIATE MONITORING TRIP

| Lab Number:                       |             |                        |      |                            |      | 2064967    | 2064970      | 2064972               | 2064980                   | 2064976             |                           |                       |
|-----------------------------------|-------------|------------------------|------|----------------------------|------|------------|--------------|-----------------------|---------------------------|---------------------|---------------------------|-----------------------|
| Sample ID:                        |             |                        |      |                            |      | GP-S2      | GP-W1        | GP-S2 ELUTRIATE       |                           |                     |                           |                       |
| Parameter                         | Method      | Method Detection Limit |      | Laboratory Reporting Limit |      | Units      | Soil         | Receiving Water Total | Receiving Water Dissolved | Pre-Elutriate Water | Elutriate Water Dissolved | Elutriate Water Total |
| Ammonia as N                      | EPA 350.2   | 2                      | 0.02 | 10                         | 0.1  | mg/kg mg/L | n.d.         | 0.08J                 | 0.07J                     | ---                 | 0.08J                     | 0.14                  |
| Arsenic                           | EPA 200.8   | 0.1                    | 1    | 0.5                        | 3    | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Atrazine                          | GC-MS       | 0.01                   | 2    | 0.02                       | 5    | mg/kg µg/L | n.d.         | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Cadmium                           | EPA 200.8   | 0.5                    | 0.2  | 2                          | 1    | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Carbonaceous BOD                  | SM 5210B    | 5                      | 2    | 25                         | 5    | mg/kg mg/L | ---          | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Chemical Oxygen Demand-COD        | ASTM 1252   | -                      | 3    | -                          | 10   | mg/L       | ---          | 13                    | ---                       | ---                 | ---                       | 10                    |
| Chromium                          | EPA 200.7   | 0.5                    | 4    | 2                          | 10   | mg/kg µg/L | 4.6          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Copper                            | EPA 200.7   | 0.2                    | 2    | 1.0                        | 10   | mg/kg µg/L | 2.2          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Dissolved Organic Carbon          | SM 5310B    | -                      | -    | 0.2                        | 1    | mg/kg µg/L | ---          | ---                   | 3.5                       | ---                 | 3.9                       | 4.1                   |
| Kjeldahl Nitrogen (Total or N)    | EPA 351.3   | 2                      | 0.2  | 10                         | 0.5  | mg/kg mg/L | 60.7         | 0.41J                 | 0.34J                     | 6.27                | 0.34J                     | 0.86                  |
| Lead                              | EPA 200.8   | 2                      | 0.5  | 5                          | 2    | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Mercury                           | EPA 245.1   | 0.02                   | 0.02 | 0.05                       | 0.05 | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | n.d.                  |
| Nickel                            | EPA 200.7   | 0.5                    | 2    | 2                          | 10   | mg/kg µg/L | 9.8          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Nitrate/Nitrite Nitrogen          | EPA 353.2   | 0.2                    | 0.05 | 1                          | 0.20 | mg/kg mg/L | n.d.         | ---                   | 0.12J                     | 0.15J               | 0.13J                     | ---                   |
| Organochlorine Pesticides         | EPA 8081    | -                      | -    | *                          | *    | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Phosphorus, (dissolved ortho)     | SM4500-P-G  | -                      | 0.02 | -                          | 0.05 | mg/L       | ---          | ---                   | ---                       | ---                 | ---                       | ---                   |
| Phosphorus, (total, dissolved)    | SM 4500 P-H | -                      | 0.02 | -                          | 0.05 | mg/L       | ---          | ---                   | 0.05                      | ---                 | 0.05                      | ---                   |
| Polychlorinated Biphenyls (PCB's) | EPA 8082    | -                      | -    | *                          | *    | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Percent Solids                    | SM 2580B    | ---                    | ---  | ---                        | ---  | %          | 81.49        | ---                   | ---                       | ---                 | ---                       | ---                   |
| Particle Size                     | Sieve       | ---                    | ---  | ---                        | ---  | ---        | See Attached | ---                   | ---                       | ---                 | ---                       | ---                   |
| pH                                | SM 4500-H   | 0.1                    |      | 0.2                        |      | ---        | 8.5          | 8.34                  | ---                       | 8.19                | ---                       | 8.19                  |
| Total Organic Carbon - TOC        | SM 5310B    | 50                     | 0.2  | 100                        | 1    | mg/kg mg/L | 2,200.00     | 3.5                   | ---                       | 113                 | ---                       | 7.8                   |
| Total Phosphorus                  | SM 4500 P-F | 0.2                    | 0.02 | 1                          | 0.05 | mg/kg mg/L | 307          | 0.05                  | ---                       | 4.8                 | ---                       | 0.3                   |
| Total Suspended Solids            | SM 2540D    | -                      | 4    | -                          | 10   | mg/L       | ---          | 34                    | ---                       | 6,027               | ---                       | 272                   |
| Turbidity                         | EPA 180.1   | -                      | 1    | -                          | 3    | NTU        | ---          | 15                    | n.d.                      | > 1000              | n.d.                      | 336                   |
| Zinc                              | EPA 200.7   | 1                      | 2    | 5                          | 10   | mg/kg µg/L | 20           | ---                   | 20                        | 840                 | 10                        | ---                   |
| Silver                            | EPA 200.7   | 0.32                   | 6    | 1                          | 10   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Aluminum                          | EPA 200.7   | 5                      | 40   | 10                         | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Beryllium                         | EPA 200.7   | 0.02                   | 0.2  | 0.5                        | 5    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Calcium                           | EPA 200.7   | 15                     | 0.06 | 100                        | 0.1  | mg/kg mg/L | ---          | ---                   | 55.8                      | ---                 | 59                        | ---                   |
| Magnesium                         | EPA 200.7   | 2.5                    | 0.05 | 10                         | 1    | mg/kg mg/L | ---          | ---                   | 23.8                      | ---                 | 26                        | ---                   |
| Manganese                         | EPA 200.7   | 0.12                   | 0.1  | 1                          | 2    | mg/kg µg/L | ---          | ---                   | 7                         | ---                 | 0.1 J                     | ---                   |
| Antimony                          | EPA 200.7   | 0.6                    | 6    | 5                          | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | 9 J                       | ---                   |
| Selenium                          | EPA 200.7   | 2                      | 10   | 5                          | 100  | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Thallium                          | EPA 200.7   | 2.4                    | 10   | 5                          | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Iron                              | EPA 200.7   | 6                      | 10   | 30                         | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | 13 J                      | ---                   |

n.d. = Not Detected

--- Test not requested/Applicable

J = Estimated concentration below laboratory reporting limit.

\* See attached report

Note:

- Elutriate Extract were analyzed for organic analysis after settling time of one (1) hour and the samples were not filtered
- Pre-elutriate samples will be prepared the same as standard elutriate samples up through the point of vigorous mixing for 30 minutes. At that time the mixture will be allowed to settle "1-minute" (allow heavier, coarse material to settle). A sub-sample will be siphoned off without filtration and identified as a pre-elutriate sample.

*Prem N. Arora*

Prem N. Arora, Environmental Project Manager



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## REPORT OF ANALYSIS

Page 2 of 4

Report Number: 12-331-2063

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Lab number: 2064967

Sample ID: GP-S2 SOIL SAMPLE

Method: EPA 8081/8082

Units:

µg/Kg

Analyst: cjh

Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) | Analysis            | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) |
|-------------------|-------------|---------------------------|----------------------------|---------------------|-------------|---------------------------|----------------------------|
| 4,4'-DDE          | n.d.        | 0.003                     | 9.9                        | Endosulfan I        | n.d.        | 0.002                     | 5.1                        |
| 4,4'-DDD          | n.d.        | 0.0005                    | 9.9                        | Endosulfan II       | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-DDT          | n.d.        | 0.0003                    | 9.9                        | Endosulfan sulfate  | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-Methoxychlor | n.d.        | 0.002                     | 51                         | Endrin              | n.d.        | 0.002                     | 9.9                        |
| Aldrin            | n.d.        | 0.001                     | 5.1                        | Endrin aldehyde     | n.d.        | 0.0008                    | 9.9                        |
| Aroclor 1016      | n.d.        | 0.009                     | 50                         | Endrin ketone       | n.d.        | 0.003                     | 9.9                        |
| Aroclor 1221      | n.d.        | NA                        | 50                         | Heptachlor          | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1232      | n.d.        | NA                        | 50                         | Heptachlor epoxide  | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1242      | n.d.        | 0.02                      | 50                         | alpha-Chlordane     | n.d.        | 0.005                     | 5.1                        |
| Aroclor 1248      | n.d.        | 0.009                     | 50                         | alpha-BHC           | n.d.        | 0.00085                   | 5.1                        |
| Aroclor 1254      | n.d.        | 0.02                      | 50                         | beta-BHC            | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1260      | n.d.        | 0.02                      | 50                         | delta-BHC           | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1262      | n.d.        | NA                        | 50                         | gamma-BHC (Lindane) | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1268      | n.d.        | NA                        | 50                         | gamma-(Chlordane)   | n.d.        | 0.009                     | 5.1                        |
| Dieldrin          | n.d.        | 0.0003                    | 9.9                        |                     |             |                           |                            |



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## REPORT OF ANALYSIS

Page 3 of 4

Report Number: 12-338-2165

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXDEJ111412

Lab number: 2064970 Sample ID: GP-W1-MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |



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## REPORT OF ANALYSIS

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Report Number: 12-338-2060

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310  
  
PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

Lab number: 2064976 Sample ID: GP-S2 ELUTRIATE WATER

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |



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Page 1 of 4

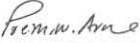
USACE  
DAVE JENSEN  
106 SOUTH 15TH STREET  
OMAHA NE 68102

Project Name: GLOVER POINT BEND  
Project #: SPS-GVPTBD-002  
Trip Number: EDXDEJ111412 ELUTRIATE MONITORING TRIP

| Lab Number:                       |             |                        |      |                            |                 | 2064968  | 2064970               | 2064973                   | 2064981             | 2064977                   |                       |
|-----------------------------------|-------------|------------------------|------|----------------------------|-----------------|----------|-----------------------|---------------------------|---------------------|---------------------------|-----------------------|
| Sample ID:                        |             |                        |      |                            |                 | GP-S3    | GP-W1                 | GP-S3 ELUTRIATE           |                     |                           |                       |
|                                   |             | Method Detection Limit |      | Laboratory Reporting Limit |                 |          | Receiving Water Total | Receiving Water Dissolved | Pre-Elutriate Water | Elutriate Water Dissolved | Elutriate Water Total |
| Parameter                         | Method      |                        |      |                            | Units           | Soil     |                       |                           |                     |                           |                       |
| Ammonia as N                      | EPA 350.2   | 2                      | 0.02 | 10                         | 0.1 mg/kg mg/L  | n.d.     | 0.08J                 | 0.07J                     | ---                 | 0.07J                     | 0.12                  |
| Arsenic                           | EPA 200.8   | 0.1                    | 1    | 0.5                        | 3 mg/kg µg/L    | n.d.     | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Atrazine                          | GC-MS       | 0.01                   | 2    | 0.02                       | 5 mg/kg µg/L    | n.d.     | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Cadmium                           | EPA 200.8   | 0.5                    | 0.2  | 2                          | 1 mg/kg µg/L    | n.d.     | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Carbonaceous BOD                  | SM 5210B    | 5                      | 2    | 25                         | 5 mg/kg mg/L    | ---      | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Chemical Oxygen Demand-COD        | ASTM 1252   | -                      | 3    | -                          | 10 mg/L         | ---      | 13                    | ---                       | ---                 | ---                       | 14                    |
| Chromium                          | EPA 200.7   | 0.5                    | 4    | 2                          | 10 mg/kg µg/L   | 7.5      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Copper                            | EPA 200.7   | 0.2                    | 2    | 1.0                        | 10 mg/kg µg/L   | 3.5      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Dissolved Organic Carbon          | SM 5310B    | -                      | -    | 0.2                        | 1 mg/kg µg/L    | ---      | ---                   | 3.5                       | ---                 | 3.7                       | ---                   |
| Kjeldahl Nitrogen (Total or N)    | EPA 351.3   | 2                      | 0.2  | 10                         | 0.5 mg/kg mg/L  | 113      | 0.41J                 | 0.34J                     | 9.57                | 0.48J                     | 0.59                  |
| Lead                              | EPA 200.8   | 2                      | 0.5  | 5                          | 2 mg/kg µg/L    | n.d.     | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Mercury                           | EPA 245.1   | 0.02                   | 0.02 | 0.05                       | 0.05 mg/kg µg/L | n.d.     | ---                   | n.d.                      | ---                 | n.d.                      | n.d.                  |
| Nickel                            | EPA 200.7   | 0.5                    | 2    | 2                          | 10 mg/kg µg/L   | 13.1     | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Nitrate/Nitrite Nitrogen          | EPA 353.2   | 0.2                    | 0.05 | 1                          | 0.20 mg/kg mg/L | 1.5      | ---                   | 0.12J                     | 0.82                | 0.76                      | ---                   |
| Organochlorine Pesticides         | EPA 8081    | -                      | -    | *                          | *               | ---      | n.d.* Page 2          | n.d.* Page 3              | ---                 | ---                       | n.d.* Page 4          |
| Phosphorus, (dissolved ortho)     | SM4500-P-G  | -                      | 0.02 | -                          | 0.05 mg/L       | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Phosphorus, (total, dissolved)    | SM 4500 P-H | -                      | 0.02 | -                          | 0.05 mg/L       | ---      | ---                   | 0.05                      | ---                 | 0.05                      | ---                   |
| Polychlorinated Biphenyls (PCB's) | EPA 8082    | -                      | -    | *                          | *               | ---      | n.d.* Page 2          | n.d.* Page 3              | ---                 | ---                       | n.d.* Page 4          |
| Percent Solids                    | SM 2580B    | ---                    | ---  | ---                        | ---             | %        | 86.57                 | ---                       | ---                 | ---                       | -23.3                 |
| Particle Size                     | Sieve       | ---                    | ---  | ---                        | ---             | ---      | See Attached          | ---                       | ---                 | ---                       | ---                   |
| pH                                | SM 4500-H   | 0.1                    |      | 0.2                        | ---             | 8.5      | 8.34                  | ---                       | 8.06                | ---                       | 8.10                  |
| Total Organic Carbon - TOC        | SM 5310B    | 50                     | 0.2  | 100                        | 1 mg/kg mg/L    | 3,400.00 | 3.5                   | ---                       | 190                 | ---                       | 6                     |
| Total Phosphorus                  | SM 4500 P-F | 0.2                    | 0.02 | 1                          | 0.05 mg/kg mg/L | 388      | 0.05                  | ---                       | 9.5                 | ---                       | 0.23                  |
| Total Suspended Solids            | SM 2540D    | -                      | 4    | -                          | 10 mg/L         | ---      | 34                    | ---                       | 10,825              | ---                       | 184                   |
| Turbidity                         | EPA 180.1   | -                      | 1    | -                          | 3 NTU           | ---      | 15                    | n.d.                      | > 1000              | n.d.                      | 281                   |
| Zinc                              | EPA 200.7   | 1                      | 2    | 5                          | 10 mg/kg µg/L   | 28.4     | ---                   | 20                        | ---                 | 10                        | ---                   |
| Silver                            | EPA 200.7   | 0.32                   | 6    | 1                          | 10 mg/kg µg/L   | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Aluminum                          | EPA 200.7   | 5                      | 40   | 10                         | 50 mg/kg µg/L   | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Beryllium                         | EPA 200.7   | 0.02                   | 0.2  | 0.5                        | 5 mg/kg µg/L    | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Calcium                           | EPA 200.7   | 15                     | 0.06 | 100                        | 0.1 mg/kg mg/L  | ---      | ---                   | 55.8                      | ---                 | 62                        | ---                   |
| Magnesium                         | EPA 200.7   | 2.5                    | 0.05 | 10                         | 1 mg/kg mg/L    | ---      | ---                   | 23.8                      | ---                 | 23                        | ---                   |
| Manganese                         | EPA 200.7   | 0.12                   | 0.1  | 1                          | 2 mg/kg µg/L    | ---      | ---                   | 7                         | ---                 | 0.2 J                     | ---                   |
| Antimony                          | EPA 200.7   | 0.6                    | 6    | 5                          | 50 mg/kg µg/L   | ---      | ---                   | n.d.                      | ---                 | 8 J                       | ---                   |
| Selenium                          | EPA 200.7   | 2                      | 10   | 5                          | 100 mg/kg µg/L  | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Thallium                          | EPA 200.7   | 2.4                    | 10   | 5                          | 50 mg/kg µg/L   | ---      | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Iron                              | EPA 200.7   | 6                      | 10   | 30                         | 50 mg/kg µg/L   | ---      | ---                   | n.d.                      | ---                 | 23 J                      | ---                   |

n.d. = Not Detected  
--- Test not requested/Applicable  
J = Estimated concentration below laboratory reporting limit.  
\* See attached report

Note:  
- Elutriate Extract were analyzed for organic analysis after settling time of one (1) hour and the samples were not filtered  
- Pre-elutriate samples will be prepared the same as standard elutriate samples up through the point of vigorous mixing for 30 minutes.  
At that time the mixture will be allowed to settle "1-minute" (allow heavier, coarse material to settle). A sub-sample will be siphoned off without filtration and identified as a pre-elutriate sample.

  
Prem N. Arora, Environmental Project Manager



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## REPORT OF ANALYSIS

Page 2 of 4

Report Number: 12-331-2064

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012

Date Received: 11/14/2012

Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Lab number: 2064968

Sample ID: GP-S3 SOIL SAMPLE

Method: EPA 8081/8082

Units:

µg/Kg

Analyst: cjh

Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) | Analysis            | Level Found | Method<br>Detection Limit | Reporting Limit<br>(µg/Kg) |
|-------------------|-------------|---------------------------|----------------------------|---------------------|-------------|---------------------------|----------------------------|
| 4,4'-DDE          | n.d.        | 0.003                     | 9.9                        | Endosulfan I        | n.d.        | 0.002                     | 5.1                        |
| 4,4'-DDD          | n.d.        | 0.0005                    | 9.9                        | Endosulfan II       | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-DDT          | n.d.        | 0.0003                    | 9.9                        | Endosulfan sulfate  | n.d.        | 0.0008                    | 9.9                        |
| 4,4'-Methoxychlor | n.d.        | 0.002                     | 51                         | Endrin              | n.d.        | 0.002                     | 9.9                        |
| Aldrin            | n.d.        | 0.001                     | 5.1                        | Endrin aldehyde     | n.d.        | 0.0008                    | 9.9                        |
| Aroclor 1016      | n.d.        | 0.009                     | 50                         | Endrin ketone       | n.d.        | 0.003                     | 9.9                        |
| Aroclor 1221      | n.d.        | NA                        | 50                         | Heptachlor          | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1232      | n.d.        | NA                        | 50                         | Heptachlor epoxide  | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1242      | n.d.        | 0.02                      | 50                         | alpha-Chlordane     | n.d.        | 0.005                     | 5.1                        |
| Aroclor 1248      | n.d.        | 0.009                     | 50                         | alpha-BHC           | n.d.        | 0.00085                   | 5.1                        |
| Aroclor 1254      | n.d.        | 0.02                      | 50                         | beta- BHC           | n.d.        | 0.002                     | 5.1                        |
| Aroclor 1260      | n.d.        | 0.02                      | 50                         | delta-BHC           | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1262      | n.d.        | NA                        | 50                         | gamma-BHC (Lindane) | n.d.        | 0.0008                    | 5.1                        |
| Aroclor 1268      | n.d.        | NA                        | 50                         | gamma-(Chlordane)   | n.d.        | 0.009                     | 5.1                        |
| Dieldrin          | n.d.        | 0.0003                    | 9.9                        |                     |             |                           |                            |



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## REPORT OF ANALYSIS

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Report Number: 12-338-2165

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXDEJ111412

Lab number: 2064970

Sample ID: GP-W1-MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082

Units: µg/L

Analyst: cjh

Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |



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## REPORT OF ANALYSIS

Page 4 of 4

Report Number: 12-338-2062

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310  
PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

Lab number: 2064977 Sample ID: GP-S3 ELUTRIATE WATER

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |



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Page 1 of 4

USACE  
DAVE JENSEN  
106 SOUTH 15TH STREET  
OMAHA NE 68102

Project Name: GLOVER POINT BEND  
Project #: SPS-GVPTBD-002  
Trip Number: EDXDEJ111412 ELUTRIATE MONITORING TRIP

| Lab Number:                       |             |                        |      |                            |      | 2064969    | 2064970      | 2064974               | 2064982                   | 2064978             |                           |                       |
|-----------------------------------|-------------|------------------------|------|----------------------------|------|------------|--------------|-----------------------|---------------------------|---------------------|---------------------------|-----------------------|
| Sample ID:                        |             |                        |      |                            |      | GP-S4      | GP-W1        | GP-S4 ELUTRIATE       |                           |                     |                           |                       |
| Parameter                         | Method      | Method Detection Limit |      | Laboratory Reporting Limit |      | Units      | Soil         | Receiving Water Total | Receiving Water Dissolved | Pre-Elutriate Water | Elutriate Water Dissolved | Elutriate Water Total |
| Ammonia as N                      | EPA 350.2   | 2                      | 0.02 | 10                         | 0.1  | mg/kg mg/L | n.d.         | 0.08J                 | 0.07J                     | ---                 | 0.08J                     | 0.19                  |
| Arsenic                           | EPA 200.8   | 0.1                    | 1    | 0.5                        | 3    | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Atrazine                          | GC-MS       | 0.01                   | 2    | 0.02                       | 5    | mg/kg µg/L | n.d.         | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Cadmium                           | EPA 200.8   | 0.5                    | 0.2  | 2                          | 1    | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Carbonaceous BOD                  | SM 5210B    | 5                      | 2    | 25                         | 5    | mg/kg mg/L | ---          | n.d.                  | ---                       | ---                 | ---                       | n.d.                  |
| Chemical Oxygen Demand-COD        | ASTM 1252   | -                      | 3    | -                          | 10   | mg/L       | ---          | 13                    | ---                       | ---                 | ---                       | 10                    |
| Chromium                          | EPA 200.7   | 0.5                    | 4    | 2                          | 10   | mg/kg µg/L | 7.2          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Copper                            | EPA 200.7   | 0.2                    | 2    | 1.0                        | 10   | mg/kg µg/L | 3.1          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Dissolved Organic Carbon          | SM 5310B    | -                      | -    | 0.2                        | 1    | mg/kg µg/L | ---          | ---                   | 3.5                       | ---                 | 4.1                       | ---                   |
| Kjeldahl Nitrogen (Total or N)    | EPA 351.3   | 2                      | 0.2  | 10                         | 0.5  | mg/kg mg/L | 121          | 0.41J                 | 0.34J                     | 18.6                | 0.34J                     | 0.79                  |
| Lead                              | EPA 200.8   | 2                      | 0.5  | 5                          | 2    | mg/kg µg/L | 6.0          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Mercury                           | EPA 245.1   | 0.02                   | 0.02 | 0.05                       | 0.05 | mg/kg µg/L | n.d.         | ---                   | n.d.                      | ---                 | n.d.                      | n.d.                  |
| Nickel                            | EPA 200.7   | 0.5                    | 2    | 2                          | 10   | mg/kg µg/L | 10.3         | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Nitrate/Nitrite Nitrogen          | EPA 353.2   | 0.2                    | 0.05 | 1                          | 0.20 | mg/kg mg/L | 1.8          | ---                   | 0.12J                     | 0.87                | 0.89                      | ---                   |
| Organochlorine Pesticides         | EPA 8081    | -                      | -    | *                          | *    | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Phosphorus, (dissolved ortho)     | SM4500-P-G  | -                      | 0.02 | -                          | 0.05 | mg/L       | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Phosphorus, (total, dissolved)    | SM 4500 P-H | -                      | 0.02 | -                          | 0.05 | mg/L       | ---          | ---                   | 0.05                      | ---                 | 0.06                      | ---                   |
| Polychlorinated Biphenyls (PCB's) | EPA 8082    | -                      | -    | *                          | *    | ---        | n.d.* Page 2 | n.d.* Page 3          | ---                       | ---                 | ---                       | n.d.* Page 4          |
| Percent Solids                    | SM 2580B    | ---                    | ---  | ---                        | ---  | %          | 91.1         | ---                   | ---                       | ---                 | ---                       | ---                   |
| Particle Size                     | Sieve       | ---                    | ---  | ---                        | ---  | ---        | See Attached | ---                   | ---                       | ---                 | ---                       | ---                   |
| pH                                | SM 4500-H   | 0.1                    |      | 0.2                        |      | ---        | 8.4          | 8.34                  | ---                       | 8.07                | ---                       | 8.01                  |
| Total Organic Carbon - TOC        | SM 5310B    | 50                     | 0.2  | 100                        | 1    | mg/kg mg/L | 3,600.00     | 3.5                   | ---                       | 278                 | ---                       | 6.9                   |
| Total Phosphorus                  | SM 4500 P-F | 0.2                    | 0.02 | 1                          | 0.05 | mg/kg mg/L | 403          | 0.05                  | ---                       | 13.7                | ---                       | 0.24                  |
| Total Suspended Solids            | SM 2540D    | -                      | 4    | -                          | 10   | mg/L       | ---          | 34                    | ---                       | 20,267              | ---                       | 148                   |
| Turbidity                         | EPA 180.1   | -                      | 1    | -                          | 3    | NTU        | ---          | 15                    | n.d.                      | > 1000              | n.d.                      | 269                   |
| Zinc                              | EPA 200.7   | 1                      | 2    | 5                          | 10   | mg/kg µg/L | 23.2         | ---                   | 20                        | ---                 | 10                        | ---                   |
| Silver                            | EPA 200.7   | 0.32                   | 6    | 1                          | 10   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Aluminum                          | EPA 200.7   | 5                      | 40   | 10                         | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Beryllium                         | EPA 200.7   | 0.02                   | 0.2  | 0.5                        | 5    | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Calcium                           | EPA 200.7   | 15                     | 0.06 | 100                        | 0.1  | mg/kg mg/L | ---          | ---                   | 55.8                      | ---                 | 73.1                      | ---                   |
| Magnesium                         | EPA 200.7   | 2.5                    | 0.05 | 10                         | 1    | mg/kg mg/L | ---          | ---                   | 23.8                      | ---                 | 17.3                      | ---                   |
| Manganese                         | EPA 200.7   | 0.12                   | 0.1  | 1                          | 2    | mg/kg µg/L | ---          | ---                   | 7                         | ---                 | 1 J                       | ---                   |
| Antimony                          | EPA 200.7   | 0.6                    | 6    | 5                          | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Selenium                          | EPA 200.7   | 2                      | 10   | 5                          | 100  | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Thallium                          | EPA 200.7   | 2.4                    | 10   | 5                          | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | n.d.                      | ---                   |
| Iron                              | EPA 200.7   | 6                      | 10   | 30                         | 50   | mg/kg µg/L | ---          | ---                   | n.d.                      | ---                 | 15 J                      | ---                   |

n.d. = Not Detected

--- Test not requested/Applicable

J = Estimated concentration below laboratory reporting limit.

\* See attached report

Note:

- Elutriate Extract were analyzed for organic analysis after settling time of one (1) hour and the samples were not filtered
- Pre-elutriate samples will be prepared the same as standard elutriate samples up through the point of vigorous mixing for 30 minutes. At that time the mixture will be allowed to settle "1-minute" (allow heavier, coarse material to settle). A sub-sample will be siphoned off without filtration and identified as a pre-elutriate sample.

*Prem N. Arora*  
Prem N. Arora, Environmental Project Manager



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## REPORT OF ANALYSIS

Page 2 of 4

Report Number: 12-331-2065

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

Lab number: 2064969 Sample ID: GP-S4 SOIL SAMPLE

Method: EPA 8081/8082 Units: µg/Kg Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Reporting Limit (µg/Kg) | Analysis           | Level Found | Reporting Limit (µg/L) |
|-------------------|-------------|-------------------------|--------------------|-------------|------------------------|
| 4,4'-DDE          | n.d.        | 9.9                     | Endosulfan I       | n.d.        | 5.1                    |
| 4,4'-DDD          | n.d.        | 9.9                     | Endosulfan II      | n.d.        | 9.9                    |
| 4,4'-DDT          | n.d.        | 9.9                     | Endosulfan sulfate | n.d.        | 9.9                    |
| 4,4'-Methoxychlor | n.d.        | 51                      | Endrin             | n.d.        | 9.9                    |
| Aldrin            | n.d.        | 5.1                     | Endrin aldehyde    | n.d.        | 9.9                    |
| Aroclor 1016      | n.d.        | 50                      | Endrin ketone      | n.d.        | 9.9                    |
| Aroclor 1221      | n.d.        | 50                      | Heptachlor         | n.d.        | 5.1                    |
| Aroclor 1232      | n.d.        | 50                      | Heptachlor epoxide | n.d.        | 5.1                    |
| Aroclor 1242      | n.d.        | 50                      | alpha-Chlordane    | n.d.        | 5.1                    |
| Aroclor 1248      | n.d.        | 50                      | alpha-BHC          | n.d.        | 5.1                    |
| Aroclor 1254      | n.d.        | 50                      | beta- BHC          | n.d.        | 5.1                    |
| Aroclor 1260      | n.d.        | 50                      | delta-BHC          | n.d.        | 5.1                    |
| Aroclor 1262      | n.d.        | 50                      | gama-BHC (Lindane) | n.d.        | 5.1                    |
| Aroclor 1268      | n.d.        | 50                      | gama-(Chlordane)   | n.d.        | 5.1                    |
| Dieldrin          | n.d.        | 9.9                     |                    |             |                        |



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## REPORT OF ANALYSIS

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Report Number: 12-338-2165

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXDEJ111412

Lab number: 2064970 Sample ID: GP-W1-MISSOURI RIVER OVERBURDEN WATER

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis           | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|--------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I       | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II      | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin             | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde    | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone      | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor         | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane    | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC          | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta- BHC          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gama-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gama-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                    |             |                        |                        |



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## REPORT OF ANALYSIS

Page 4 of 4

Report Number: 12-338-2063

Reported to: US ARMY CORPS OF  
ENGINEERS  
DAVE JENSEN  
CENWO-ED-HA  
1616 CAPITOL AVE 5TH FLOOR  
OMAHA NE 68102

For: (20061) US ARMY CORPS OF ENGINEERS  
(402) 995-2310

Date Reported: 12/12/2012  
Date Received: 11/14/2012  
Date Sampled: 11/14/2012

PO/Proj. #: SPS-GVPTBD-002  
GLOVER POINT BEND ELUTRIATE MONITORING  
TRIP NUMBER EDXEJ111412

Lab number: 2064978 Sample ID: GP-S4 ELUTRIATE WATER

Method: EPA 8081A/8082 Units: µg/L Analyst: cjh Date of Analysis: 11/20/2012

| Analysis          | Level Found | Method Detection Limit | Reporting Limit (µg/L) | Analysis            | Level Found | Method Detection Limit | Reporting Limit (µg/L) |
|-------------------|-------------|------------------------|------------------------|---------------------|-------------|------------------------|------------------------|
| 4,4'-DDE          | n.d.        | 0.003                  | 0.10                   | Endosulfan I        | n.d.        | 0.005                  | 0.05                   |
| 4,4'-DDD          | n.d.        | 0.004                  | 0.10                   | Endosulfan II       | n.d.        | 0.003                  | 0.10                   |
| 4,4'-DDT          | n.d.        | 0.009                  | 0.10                   | Endosulfan sulfate  | n.d.        | 0.002                  | 0.10                   |
| 4,4'-Methoxychlor | n.d.        | 0.01                   | 0.50                   | Endrin              | n.d.        | 0.004                  | 0.10                   |
| Aldrin            | n.d.        | 0.004                  | 0.50                   | Endrin aldehyde     | n.d.        | 0.004                  | 0.10                   |
| Aroclor 1016      | n.d.        | 0.08                   | 1.00                   | Endrin ketone       | n.d.        | 0.006                  | 0.10                   |
| Aroclor 1221      | n.d.        | 0.01                   | 2.00                   | Heptachlor          | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1232      | n.d.        | 0.01                   | 1.00                   | Heptachlor epoxide  | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1242      | n.d.        | 0.01                   | 1.00                   | alpha-Chlordane     | n.d.        | 0.04                   | 0.05                   |
| Aroclor 1248      | n.d.        | 0.01                   | 1.00                   | alpha-BHC           | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1254      | n.d.        | 0.01                   | 1.00                   | beta-BHC            | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1260      | n.d.        | 0.01                   | 1.00                   | delta-BHC           | n.d.        | 0.005                  | 0.05                   |
| Aroclor 1262      | n.d.        | 0.01                   | 1.00                   | gamma-BHC (Lindane) | n.d.        | 0.001                  | 0.05                   |
| Aroclor 1268      | n.d.        | 0.01                   | 1.00                   | gamma-(Chlordane)   | n.d.        | 0.005                  | 0.05                   |
| Dieldrin          | n.d.        | 0.01                   | 0.10                   |                     |             |                        |                        |