

# Appendix B

## Geotechnical Considerations

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## 1. Purpose

This appendix presents specific geotechnical study data relevant to the Crains Island project and future anticipated geotechnical analysis/design. Geotechnical data was secured from various sources related to the project site location in previous projects near the site. No subsurface information is available within the project boundaries.

## 2. Project Features

Key features of the project include enlarging the existing side channel in depth and width for side channel habitat, construction of a sediment deflection berm to reestablish bottomland hardwood species and floodplain forest habits, and depression wetlands. More detail on these features can be found in the main report.

## 3. Location

Crains Island is located in Randolph County, IL and Fayette County, MO. River Miles 103-107 on the right descending bank of the Mississippi River adjacent to Bois Brule Drainage and Levee District from Approximate Sta. 450+00 to 590+00. The boundary of Crains Island can be seen in the below figure.



Figure 1: Crains Island Project Boundary

## 4. Physiography

The soils in the project area are frequently flooded and are comprised of Riverwash, Darwin silty clay 0 to 2 percent slopes, Blake silty loam 0 to 2 percent slopes, Haynie silt loam 2 to 5 percent slopes, and Fluvaquents-Orthents complex. This information is from the NRCS web soils database. A full NRCS report is available upon request.

## 5. Subsurface Exploration

There has not been a geotechnical study and site investigation within the boundary of the project. A few borings were taken in April 2005 just outside the boundary for an unrelated project, but only limited information is available. These borings do not have ground surface elevations listed on the logs therefore it is unknown if conditions have since changed. The location of the borings are shown below.



Figure 2: Boring Locations

## 6. Geotechnical / Construction Considerations

The side channel and depressional wetland features included in this project are planned to lower the ground surface elevation 8 to 15 feet from that of the existing grade. An interim planning buffer of 600 feet is being used at this time which does not allow planned work to be within 600 feet of the riverside levee toe. The 600 feet buffer is the most critical effective seepage source distance ( $x_1$ ) used in past designs for this area. The seepage entrance conditions need to be evaluated further to better understand the potential risks and impacts to the Bois Brule Levee from the current feature configurations. These analyses will inform further decisions on the location, depth and construction methods necessary to provide habitat without increasing risk to the levee, and may affect the project scope and cost.

Underseepage analysis was originally completed in the 1950's. *TM-NO.3 430 Volume 2 dated 1956* which includes designed relief wells for this area of Bois Brule. The river entrance ( $L_1$ ) is shown 1250-1750 feet from the levee with an effective seepage source ( $x_1$ ) of 800 feet for design. Permeability of the pervious (sand) stratum ranged from 550 to 1200( $\text{cm}^4/\text{sec}$ ) and a maximum clay blanket thickness of 10 feet was used. This design resulted in the installation of 36 Relief wells, RW-57 thru RW-92, from levee stations 472+00 to 550+00 in 1953.

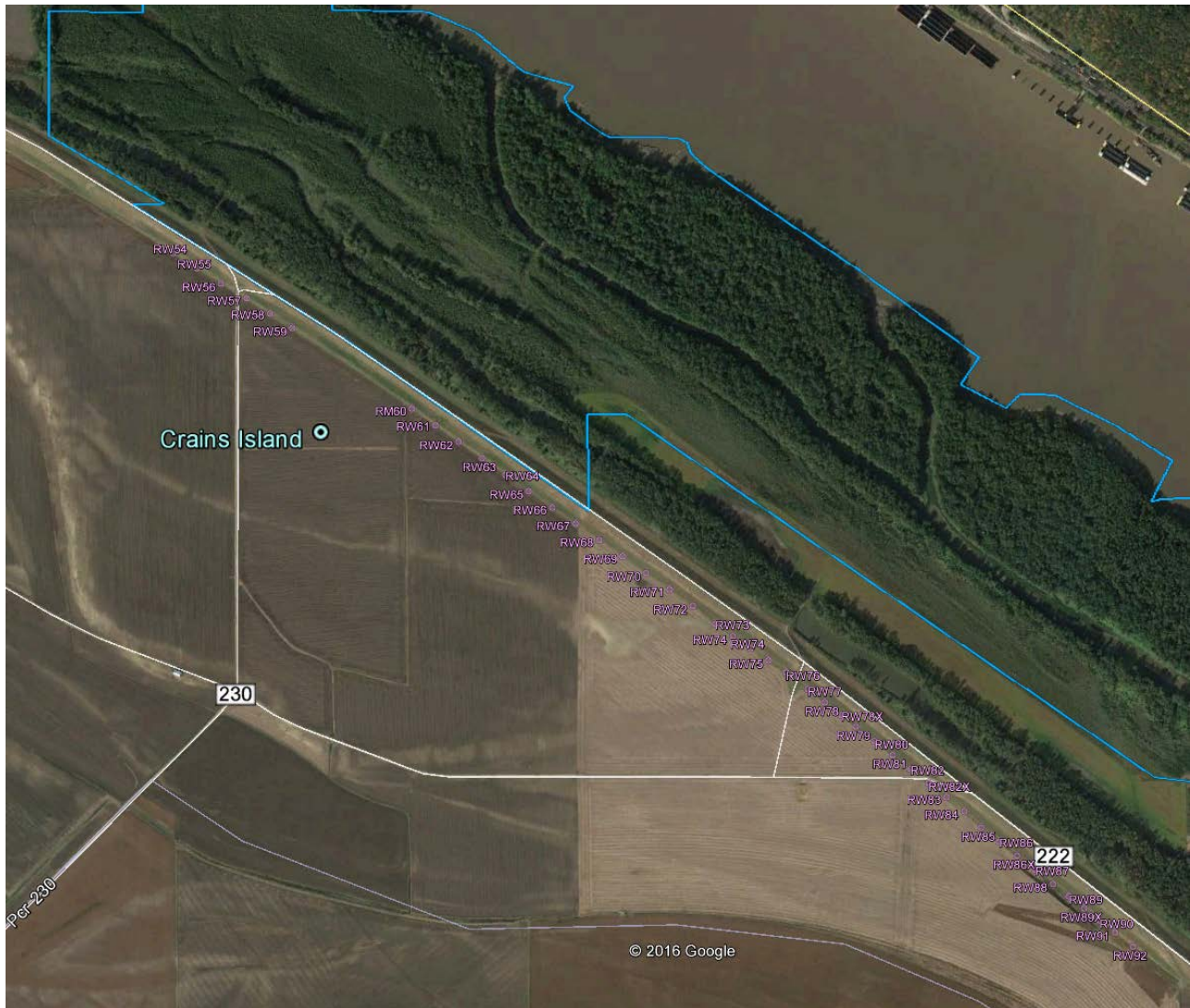


Figure 3: Relief Well Locations

During the 1993 flood heavy seepage with sand boils occurred between stations 542+00 to 556+00, mainly in the landside ditch. Problems have reappeared since 1993 during other high water events and have been documented in flood fights.

An underseepage analysis and report dated November 2003, *Deficiency Correction Report including Environmental Assessment Bois Brule Levee and Drainage District*, proposed to add 1 new well in reach 542+00 to 545+00 between the existing wells, 2 new wells in reach 545+00 to 550+00 between the existing wells, and 5 new wells between 550+00 to 556+00 on 150 foot centers. Ten additional relief wells, RW 577 to RW 586, were installed between stations 536+00 to 550+00 split spacing the existing wells.

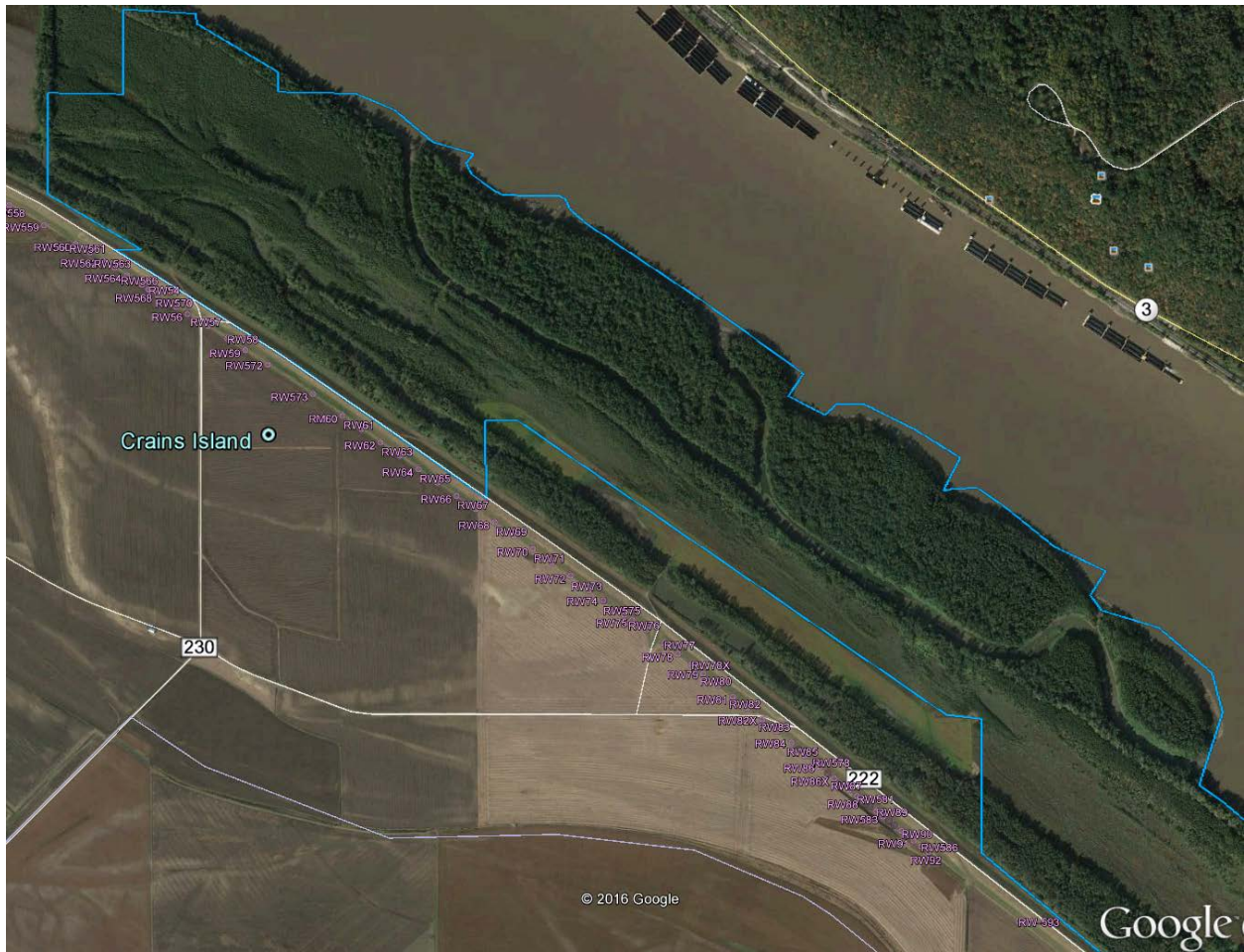


Figure 4: Relief Well Locations

Nineteen relief wells, RW 587 to RW 606, are currently under contract for installation between stations 550+00 to 582+00, shown in the figure below in yellow.





Figure 5: Planned Relief Well Locations

These nineteen relief wells were reanalyzed with updated information from 2015 pilot holes and testing to validate the above 2003 report. This information can be found in *DDR Relief Well Package #4 Bois Brule Levee and Drainage District*. An effective seepage source ( $x_1$ ) of 600 feet was used from Table 1 in the DIVR 1100 assuming a clay blanket of less than 5 feet. Borings were taken in 2005 mentioned in the above subsurface exploration section. At that time there was between 5 and 10 feet of clay in the majority of the borings, however there are no elevations recorded therefore we are unsure of changes in the ground surface. We are assuming the blanket is less than 5 feet of clay which is accurate based on clay blanket thickness landside of the levee. Therefore no modifications, to include grading, grubbing, stripping; of the riverside ground surface should be allowed within 600 feet ( $x_1$ ) measure toward the river channel.

The deflection berm project feature ties into the existing Bois Brule Levee. The deflection berm will be planted to encourage hardwood growth, however no planting can take place within 50 feet of the existing levee to prevent root damage to the levee.

## 7. Anticipated Future Geotechnical / Construction Considerations

Subsurface information will be needed on the riverside of the Bois Brule levee district. Borings taken riverside will be used to verify assumptions and run more accurate underseepage analyses of Bois Brule Levee adjacent to this work effort. Additional analyses will be ran in all areas where proposed depression wetlands are located to ensure 600 feet ( $x_1$ ) no work area is a sufficient distance from Bois Brule Levee to not enhance underseepage.

Potential adjustments would be adding a clay cap to the depression wetlands, relocating them, or removing them, but this will be finalized during the design.

The Crain's Island project, as proposed, should not induce risk from what is known at this time, but this will require further evaluation during design. The Bois Brule Levee District shall continually provide adequate operation and maintenance including the replacement of original relief wells to prevent this area from becoming more at risk than its current state.