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Our Ref.: 11215702-Howard-16

December 9, 2021

Ms. Ashley Howard
Environmental Protection Agency Remedial Project Manager
1201 Elm Street, Suite 500
Dallas, Texas 75270

Hydraulic Heave Analysis

Dear Ms. Howard:

GHD Services Inc. (GHD), on behalf of International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC; collectively referred to as the Respondents), hereby submits to the United States Environmental Protection Agency (EPA) a Hydraulic Heave Analysis report. The report provides details on the geological and geotechnical context, methodology, and results of a hydraulic heave analysis performed by GHD on data collected at the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site.

GHD conducted a Supplemental Design Investigation (SDI) at the Northern Impoundment from June 28 through September 16, 2021, in accordance with the *Supplemental Design Investigation Sampling Plan - Revised*, approved by the EPA on June 4, 2021. The SDI included the installation of 25 analytical soil borings and 15 geotechnical soil borings, including 11 cone penetration test (CPT) borings and four piezometers. As preliminary data was received, GHD began evaluating and updating the understanding of the depths of impact (dioxins/furans concentrations above 30 nanograms per kilogram [ng/kg] TEQ) and the geological/geotechnical conditions at the Northern Impoundment. All preliminary (unvalidated) data was received by October 1, 2021. Data from the SDI indicated that exceedances of the clean-up level were present at deeper elevations than previously understood (as deep as -28.4 feet North American Vertical Datum of 1988 [NAVD88]) which raised concerns about the potential for hydraulic heave during excavation activities.

A preliminary evaluation of hydraulic heave was performed and presented at a Technical Working Group (TWG) meeting on October 19, 2021. Following that meeting, a more focused, detailed evaluation was performed. The results of this more detailed evaluation were presented during the November 16, 2021, TWG meeting. During this meeting the EPA indicated that the United States Army Corps of Engineers (USACE) would be performing a detailed review of GHD's hydraulic heave analysis and requested that the data and calculations used in the analysis be provided to them. GHD provided the requested raw data and analyses that had been completed at that time to the EPA and USACE on November 19, 2021. Following the Thanksgiving holiday on November 30, 2021, GHD participated in a call with the EPA, USACE, and the Texas Commission on Environmental Quality (TCEQ) to discuss the data provided and answer questions. Several additional documents were requested during that meeting. GHD provided those documents to the EPA and USACE on December 7, 2021.

The enclosed report includes a wholistic summary of the hydraulic heave evaluation performed, including data reviewed, methodology utilized, and the results and conclusions of the evaluation. This report is intended to provide context, clarity, and interpretation of the data that has already been provided to the EPA and USACE.

It is the Respondents' understanding that the EPA prefers to withhold approval of the Respondents' October 1, 2021, Request for Extension of the *Pre-Final 90% Remedial Design - Northern Impoundment* (Northern Impoundment 90% RD) until the USACE has completed its evaluation of the hydraulic heave analysis. While the enclosed report should help facilitate the timely completion of that review, the currently pending January 2022 deadline for the Northern Impoundment 90% RD is weeks away and the Respondents need to have written approval of an extension of that deadline issued without further delay. As detailed in the October 1, 2021, Request for Extension, the extension was necessitated by the need to collect, analyze, and incorporate the SDI data in the Northern Impoundment 90% RD, a process that was recognized months ago could not be completed by the current January 2022 deadline. The hydraulic heave issue is independent of the issues necessitating the extension and a review of the hydraulic heave analysis is not necessary, in order for the EPA to approve the extension. The Respondents request that the EPA proceed to approve the extension request without further delay.

Should you have any questions or require additional information regarding this submittal, please contact GHD at (225) 292-9007.

Regards,

GHD

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Hydraulic Heave Analysis

Northern Impoundment
San Jacinto River Waste Pits Superfund Site
Harris County, Texas

International Paper Company and McGinnes Industrial Maintenance Corporation

December 9, 2021

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1. Introduction

GHD Services Inc. (GHD), on behalf of the International Paper Company and McGinnes Industrial Maintenance Corporation (collectively referred to as the Respondents), submits to the United States Environmental Protection Agency (EPA) this *Hydraulic Heave Analysis* performed for the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site in Harris County, Texas.

Following completion and receipt of data from the Supplemental Design Investigation (SDI) in September and October 2021, GHD performed a hydraulic heave analysis to evaluate the geological and geotechnical conditions of the Northern Impoundment with respect to the Northern Impoundment 90% Remedial Design (RD). The Northern Impoundment 90% RD is being developed based on the 2017 EPA Record of Decision (ROD) which specifies that the selected remedy for the Northern Impoundment is the full removal of all waste material in the dry that exceeds the clean-up level of 30 nanograms per kilogram (ng/kg) for dioxins/furans. Data from the SDI found impacts above the clean-up level at deeper elevations than had been previously understood, prompting concern around the risk of hydraulic heave associated with the resulting excavation work. The geological and geotechnical context, methodology, and results of this analysis are described hereafter in this report.

2. Brief Geological Conditions Description

The San Jacinto River Waste Pits Site is located in Harris County, Texas, east of the City of Houston. The Northern Impoundment is located immediately north of the Interstate Highway 10 (I-10) bridge over the San Jacinto River.

The geology in the vicinity of the Northern Impoundment is somewhat variable given the natural meander of the San Jacinto River over time. Based on the Geologic Atlas of Texas, Houston (1982), the near surface of the western bank of the San Jacinto River is comprised predominantly by Holocene Alluvium, which is comprised of clay, silt, and sand, and can include organic matter. These alluvium deposits can be comprised of point-bar, natural levee, stream channel, back-swamp, and coastal marsh deposits. The near surface of the eastern bank of the San Jacinto River is comprised predominantly of the Pleistocene Beaumont Formation, which is made up of mostly clay, silt, and sand.

Historical topographic maps of the area from the United States Geological Survey (USGS) indicate that the near surface in the vicinity of the Northern Impoundment may have been comprised of backswamp and/or swamp deposits. It is unclear the extent to which these were scoured out and/or eroded over time, as well as how much was physically removed due to industrialization.

3. Geotechnical Conditions

3.1 Geotechnical Soundings

In order to define the geotechnical conditions of the Northern Impoundment, four geotechnical investigation events were carried out and are listed below:

- Remediation investigation (RI) in 2011.
- First Phase Pre-Design Investigation (PDI-1) in 2018.
- Second Phase Pre-Design Investigation (PDI-2) in 2019.
- SDI in 2021.

During these four investigations, a total of 43 geotechnical boreholes were drilled. During the recent SDI, four piezometers were installed and cone penetrations tests (CPT) were also performed at 13 locations in the Northern Impoundment. Figure 1 shows the locations of the geotechnical soundings.

Table 3.1 below presents the list of the deepest geotechnical soundings in which the Beaumont sand formation was reached. These soundings were used for the hydraulic heave assessment.

Table 3.1 Geotechnical Soundings Considered in the Hydraulic Heave Analysis

Geotechnical Investigation	Sounding ID	Termination Depth (feet below ground surface [ft bgs])	Coordinates (NAD83)		Ground Surface Elevation (ft NAVD88)
			Easting	Northing	
RI (2011)	SJGB-001	60	3216751.135	13857514.92	3.50
	SJGB-002	59.5	3216860.608	13857743.81	0.75
	SJGB-003	119.5	3217161.011	13857865.43	-10.67
	SJGB-004	59.5	3217397.812	13857774.85	-3.25
	SJGB-005	61.5	3217542.386	13857614.08	-4.50
	SJGB-007	119.5	3217417.804	13857330.12	-3.25
	SJGB-008	59.5	3217332.707	13857191.39	-3.0
PDI-1 (2018)	SJGB-018	52	3216809.986	13857802.24	-13.43
	SJGB-019	59	3216887.243	13857986.27	-14.82
	SJGB-020	62	3217105.993	13858004.5	-8.17
	SJGB-021	56	3217609.928	13857456.24	-5.15
	SJGB-022	47	3217485.032	13857183.95	-9.39
	SJGB-023	60	3216651.132	13857586.97	-1.86
PDI-2 (2019)	SJGB-047	100	3217421.371	13857278.32	-3.40
	SJGB-053	100	3217301.198	13857799.52	-9.70
	SJGB-057	100	3216960.196	13857956.45	-17.1
SDI (2021)	SJMW-16	70	3216869.538	13857581.37	5.0
	SJMW-17	72	3217204.371	13857083.84	5.0
	SJCPT-11	76	3216891.118	13857566.47	3.0

3.2 Subsurface Conditions

According to information provided by the various geotechnical investigations, the general subsurface stratigraphy noted within the Northern Impoundment is as follows:

– ***Surficial Alluvium Sediments:*** fairly heterogenous, consisting of silty sands, sands silts, lean clays, and sandy clays. When cohesive, the sediments are typically very soft to firm. When granular (cohesionless), these sediments are loose-to-compact.

– ***Beaumont Clay Formation:*** generally encountered at elevations ranging between -20 to -30 feet (ft) North American Vertical Datum of 1988 (NAVD88), this formation is composed of a stiff-to-very-stiff high plasticity clay (fat clay). Interspersed within this deposit are seams/lenses of sandy materials, as evidenced in the boring logs and photographs from three different borings, all in the vicinity of the northwest corner of the Northern Impoundment. The lateral extents of these particular features remain unknown.

– ***Beaumont Sand Formation:*** encountered at elevations ranging between -50 to -70 ft NAVD88, this formation is essentially composed of compact-to-dense silty sand to clayey sand.

Subsurface geological conditions are shown in two cross-sections included as Figures 2 and 3. The interpolated thickness of the Beaumont clay is shown on the attached Figure 4.

3.3 Hydraulic Conditions

During the SDI, piezometers were installed in boreholes SJMW-16 and SJMW-17 and the water levels were logged in these piezometers at regular time intervals. Figure 3.1 below shows the variation of the piezometric level (red line) in the piezometer (SJMW-16) installed in the Beaumont sand for the period between August 13 and September 13, 2021. The water level in the San Jacinto River (blue line) is also shown in this figure for the same period.

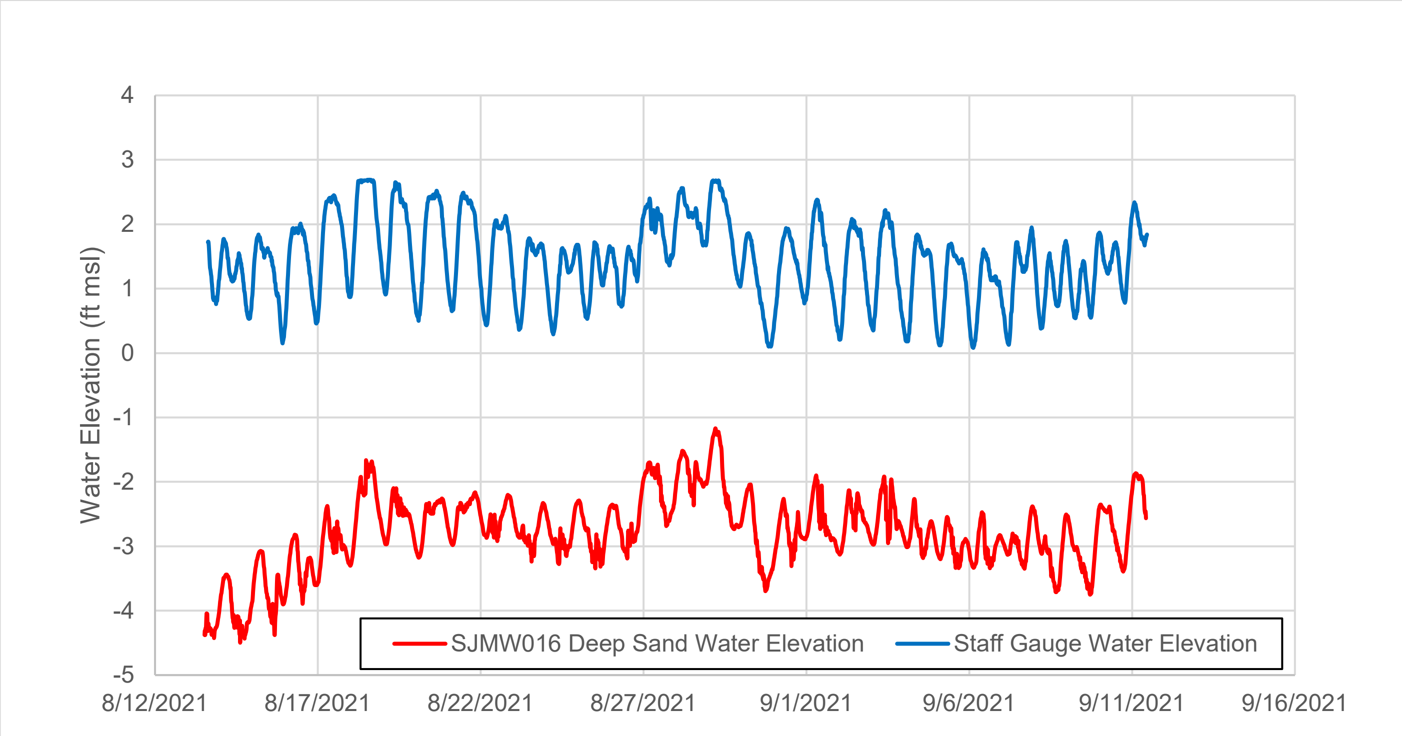


Figure 3.1 ***Variation of the Water Levels in the Beaumont Sand Formation and the San Jacinto River***

Water level readings shown on Figure 3.1 suggest that:

– The water level in the river fluctuates with the tides between 0 to 3 ft (with an average elevation of 1.5 ft).

– The piezometric level in the Beaumont sand fluctuates between -4 to -1 ft (with an average value of about -2.5 ft) and seems to be tidally connected.

The piezometer was removed from SJMW-16 on September 13, 2021, at the direction of the EPA in advance of an approaching hurricane.

4. Required Excavation Depths

The compiled analytical results show the presence of exceedances of the clean-up level at various depths in the surficial alluvium in the Northern Impoundment. Based on these results, the deepest exceedances have been detected at elevations close to -28.4 ft NAVD88 within the northwest corner of the Northern Impoundment.

A complete removal of the impacted material, as specified in the ROD would thus require excavation down to elevations of -28.4 ft NAVD88, and potentially to lower elevations depending on the results of post-confirmation testing to be done during excavation.

An assessment of the hydraulic heave risk assuming a complete removal of the impacted alluvions has been performed. The calculated factor of safety (FS) values at the location of each analytical borehole are presented in the attached Tables 1A and 1B. These tables present results that are based on Assumptions 1 and 2, respectively. Details on these assumptions are presented in Section 5.2.1.2.

5. Hydraulic Heave Assessment

5.1 Principle of Hydraulic Heave

5.1.1 Hydraulic Heave Mechanism

When an excavation is dug into a clay deposit underlain by a pervious stratum under artesian pressure, pressure and seepage may result, leading to instability of the excavation.

The above-mentioned conditions are illustrated for the Northern Impoundment case on Figure 5.1. The hydrostatic head in the deep Beaumont sand below the impervious Beaumont clay layer is higher than the bottom of the excavation. If the effective stress at point A approaches zero, the situation becomes unstable. Therefore, if the pore pressure at point A exceeds the total vertical stress at this point., heave may occur in the bottom of the excavation.

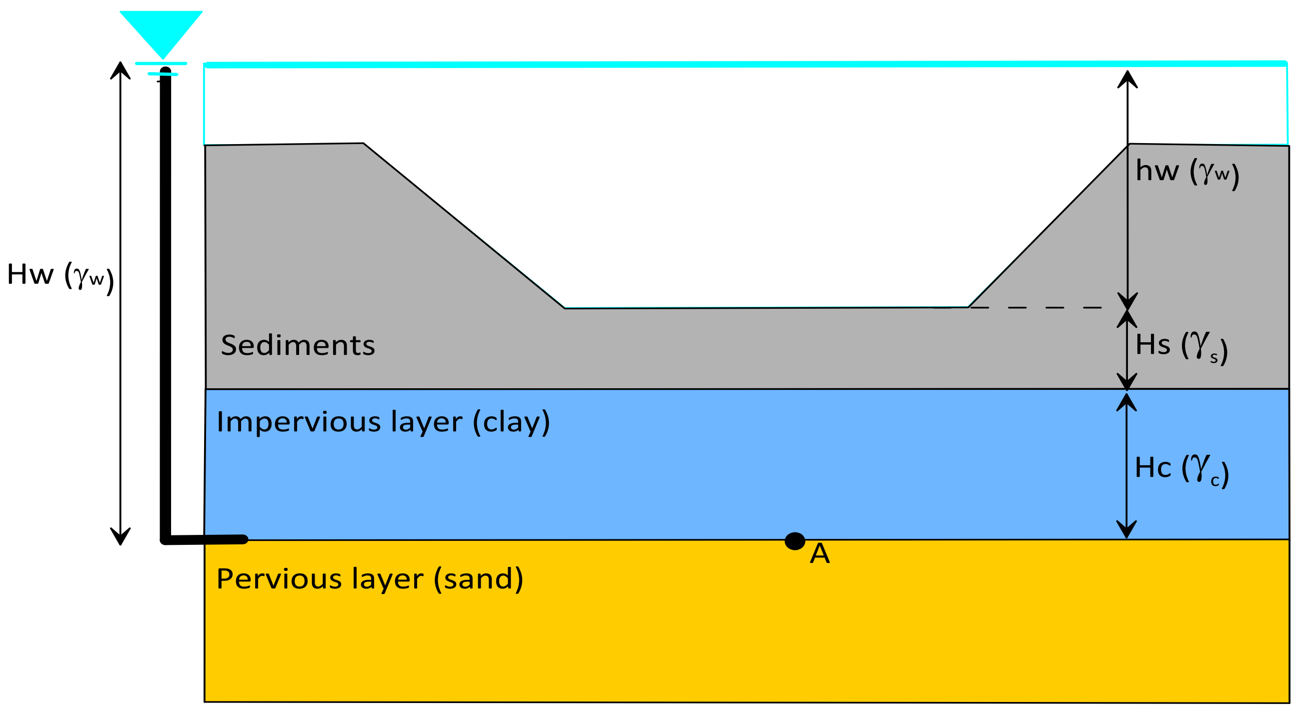


Figure 5.1 Artesian Groundwater Conditions Below Excavation

There are two accepted methods to evaluate uplift pressures which could result in a heave situation: the total stress approach and the effective stress approach. GHD initially limited this evaluation to the total stress approach as it is more appropriate evaluation for this application. At the request of the United States Army Corps of Engineers (USACE), GHD also performed the analysis using the effective stress approach to serve as a validation step. The results of both evaluations are included in Tables 1A, 1B, 2A, and 2B.

5.1.2 Total Stress Approach

For the total stress approach, the heave assessment is solely based on the ratio of total stresses and uplift pore pressures.

For this approach, the FS protective of hydraulic heave is expressed using the following equation:

$$FS_{Total} = (Hs.\ \gamma_s + Hc.\ \gamma_c)/\ Hw.\ \gamma_w \quad [1]$$

In this equation, Hs and Hc are the thicknesses of the sediments and the clay layers, respectively and Hw is the water head in the pervious layer. γ_s and γ_c are the total unit weights of the sediments and the clay respectively. γ_w corresponds to the water unit weight.

In order to prevent hydraulic heave with a sufficient security margin, pore pressure at point A should not exceed 80 percent of the total vertical stress at this point, corresponding to a factor of safety (FS_{Total}) of 1.25.

5.1.3 Effective Stress Approach

When the difference in water heads between the bottom of the excavation and the surrounding soils outside the excavation reaches a critical value, hydraulic heave (potentially piping) may occur. In relation with Figure 5.1, the effective stress factor of safety ($FS_{Effective}$) is expressed by the following equation:

$$FS_{Effective} = (Hs.\ \gamma'_s + Hc.\ \gamma'_c)/\ (h_w.\ \gamma_w) \qquad [2]$$

In this equation, hw is the water head between the free water surface (river) and the bottom of the excavation while γ'_s and γ'_c are the buoyant unit weights of the sediments and the clay, respectively. For the effective stress approach, a FS of 1.5 was targeted.

5.2 Assessment Methodology

To assess the risk of hydraulic heave, the FS to protect against hydraulic heave was determined at the location of 77 boreholes (both geotechnical and analytical).

The evaluation of hydraulic heave FS requires the knowledge of (1) the thickness and unit weight of each stratigraphic units and (2) uplift pore pressures (water head) in the underlaying pervious sandy formation (Beaumont sand).

The methodology and the assumptions used for the determination of the required parameters are described in the following sections.

5.2.1 Stratigraphic Unit Thicknesses

5.2.1.1 Surficial Sediments Layer

The sediment layer thickness was defined and is known for all boreholes considered for the hydraulic heave FS assessment.

5.2.1.2 Beaumont Clay

The Beaumont clay thickness was only determined in the geotechnical boreholes listed in Table 3.1. At the location of the analytical boreholes, two assumptions were considered to define the interface elevation between the Beaumont Clay and the Beaumont Sand as shown on Figure 5.2:

– ***Assumption 1:*** Hs(A) + Hc(A) equals the thickness of the Beaumont clay measured in the closest geotechnical borehole.
– ***Assumption 2:*** The Clay/Sand interface (at the base of Hc(A)) was defined assuming that the elevation of the Beaumont sand for the considered analytical borehole is equal to the one measured in the closest geotechnical borehole.

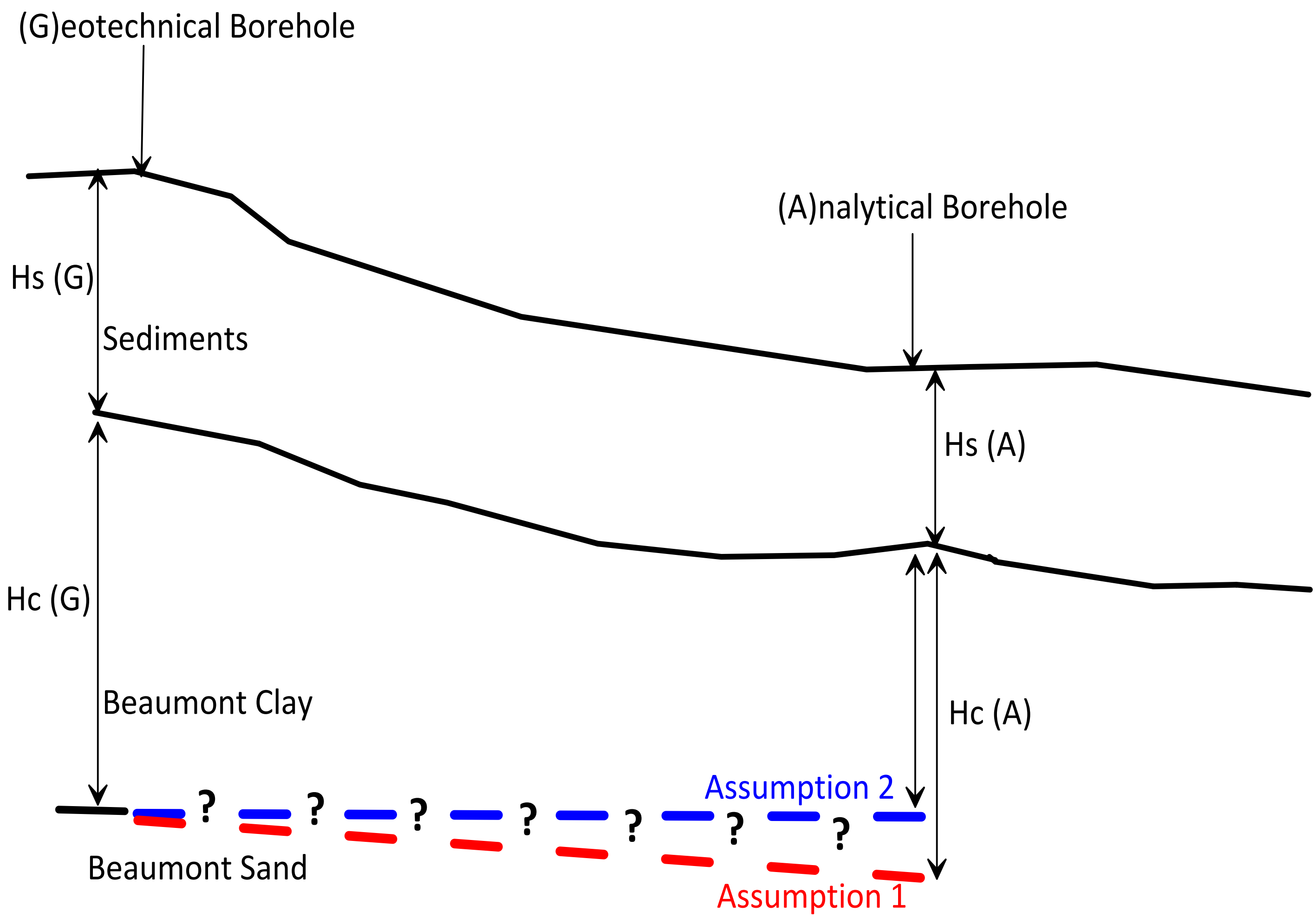


Figure 5.2 Assumptions 1 and 2 Considered to Estimate the Beaumont Clay Thickness

The data was evaluated using both assumptions and the results of each are included in Tables 1A, 1B, 2A, and 2B (the "A" tables correspond to Assumption 1 and the "B" tables correspond to Assumption 2).

As previously mentioned in Section 3.2, sand seams/lenses ranging from a few inches to few feet thick were encountered in the Beaumont clay layer at depths ranging between 35 to 60 feet below ground surface (ft bgs) corresponding to an elevation close to -50 to -70 ft. These lenses were found in boreholes SJGB-018, SJGB-019, SJGB-020, and SJGB-057 all drilled in the northwest corner of the Northern Impoundment. Photographs of these features are presented in Appendix A.

To calculate a FS at each analytical boring location, stratigraphic data from the closest geotechnical boring(s) was assumed for each analytical boring. In some instances, as shown in Tables 1A and 1B, the conditions at two geotechnical borings were applied to the target excavation elevations at a particular analytical boring to calculate the FS. In these situations, it is necessary to assume the more conservative conditions of the two to ensure that the design is sufficiently protective of hydraulic heave.

5.2.2 Geotechnical/Hydraulic Parameters

5.2.2.1 Unit Weights

The unit weights were evaluated based on the natural moisture content (w) and specific gravity (G) of samples recovered from the sediments and native clay deposit, and assuming that these soils are saturated. Figure 5.3 shows unit weight values for both deposits based on laboratory testing.

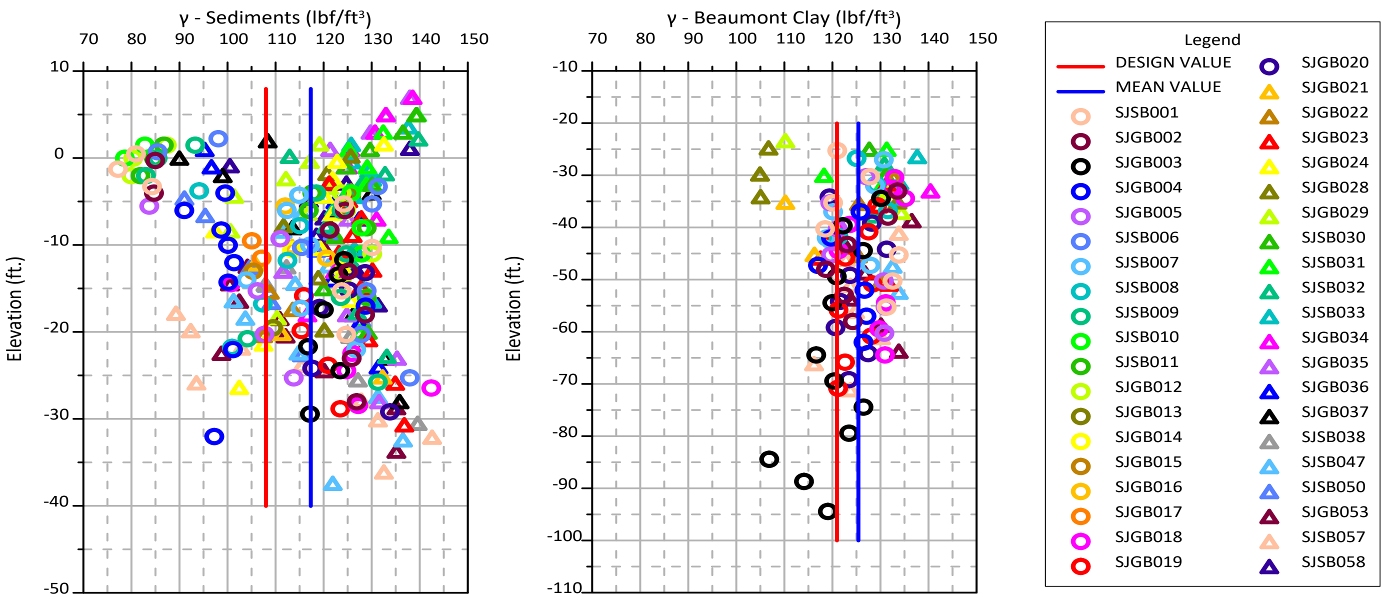


Figure 5.3 Variation of Unit Weights with Elevation

Table 5.1 below summarizes the mean and design values considered for the hydraulic heave assessment.

Table 5.1 Mean and Design Unit Weights

Stratigraphic Unit	Total Unit Weight, γ (pounds per cubic feet [pcf])	
	Mean Value	Design Value
Surficial alluvium	117	108
Beaumont clay formation	125	121

5.2.3 Uplift Pore Pressures

The uplift pore pressures were evaluated based on a piezometric level at elevation -2 ft (water level in the river - see Section 3.3). These uplift pore pressures were considered acting at the interface between the Beaumont clay and the underlaying sand. At the location of the analytical boreholes, where this interface was not defined, the interface elevation was estimated for both Assumptions 1 and 2 as described in Section 5.2.1.2.

In locations where sand lenses were encountered in the Beaumont clay, the top elevation of those sand lenses was assumed to be the interface elevation for uplift pore pressures.

Note, that the water conditions considered for the hydraulic heave assessment exclude water level variations induced by hurricanes and high water events.

5.3 Assessment Results

5.3.1 For a Complete Removal of Impacted Material

The FS values for an excavation surface down to the deepest elevations of impacted material are presented in the attached Tables 1A and 1B. The FS values show that for both assumptions for uplift pore pressures, the total and effective stress approach FS are larger than the target values in the majority of the Northern Impoundment. In the northwest corner, where sand lenses are present, FS values were lower than 1.0 for both the total and effective stress approaches (SJSB-057 and SJSB-098). Such values indicate that hydraulic heave will occur in this area if excavation activities are conducted to the deepest elevations of known impact.

While the majority of the area outside the northwest corner does not show calculated FS below the target values, much of this area is approaching elevations that would be at risk of heave. This is important to note, given that excavation depths could increase based upon post-confirmation sampling. The calculated FS values shown in the attached Tables 1A and 1B correspond to the minimum required depth of the excavation required to remove the impacted materials. If the results of confirmation testing indicate that deeper excavation is required, the currently assumed FS will be reduced.

5.3.2 Safe Hydraulic Heave Excavation Surface

A surface excavation for which both total and effective FS are higher than 1.25 and 1.5, respectively, was established. Tables 2A and 2B present the minimum excavation elevation at the location of each borehole that is protective of hydraulic heave. The two tables show the results of the assessments considering the two different assumptions for the clay thickness. Table 3 provides a consolidated set of values in which the more conservative elevation (shallower) was selected for each boring location.

Table 4 provides a summary of the data, including the excavation limits protective of hydraulic heave, the target excavation depth based on an approach to excavate everything above the clean-up level, and the delta (in feet) between the two elevations.

6. Conclusions

The hydraulic heave analysis indicates that there are areas of the Northern Impoundment in which excavation to the target elevations under a full removal scenario will result in an unacceptable risk of hydraulic heave. The presence of sand lenses is evident in logs and photographs from four geotechnical borings in the northwest corner so this reality must be taken into account when developing a design that is sufficiently protective of hydraulic heave risks.

While there are multiple areas across the Northern Impoundment that show FS values below the target values, the risk is most pronounced in the northwest corner where FS values are less than 1.0 for both the total and effective stress approaches. In this area, approximately 10 to 14 ft of waste material could not be removed based upon the elevations calculated to be protective against hydraulic heave, as shown in Table 4.

While the northwest corner presents the most pronounced risk of hydraulic heave, a significant portion of the rest of the Northern Impoundment is on the threshold of triggering the risk of hydraulic heave. Table 4 depicts the delta between the calculated excavation limit needed to maintain a FS of 1.25 and the target excavation elevations based on exceedances of the clean-up level. Values highlighted in red indicate the existence of hydraulic heave risk and valued highlighted in yellow indicate a high sensitivity (0 to 5 ft) to hydraulic heave. This will need to be taken into consideration when developing the approach to post-confirmation sampling.

7. Scope and Limitations

The recommendations made in this report are in accordance with our present understanding of the project, the ground surface elevations and current conditions at the Northern Impoundment, and are based on the work scope described in the report. The services were performed in a manner consistent with that level of care and skill ordinarily exercised by members of geotechnical engineering professions currently practicing under similar conditions in the same locality.

All details of design and construction are rarely known at the time of completion of a geotechnical study. The recommendations and comments made in this report are based on our subsurface investigation and resulting understanding of the project, as defined at the time of the study. GHD will review our recommendations when the remedial design drawings and specifications are complete.

It is important to emphasize that a soil investigation is, in fact, a random sampling of a site and the comments included in this report are based on the results obtained at the test locations only. The subsurface conditions confirmed at the test locations may vary at other locations.

Table 1A

Hydraulic Heave Safety Factors For Total Removal of Exceedances of Clean-Up Level - Assumption 1
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Location	Northing (NAD83)	Easting (NAD83)	Surface/Riverbed Elevation	Reference Borehole	BS Elevation in Reference Borehole (ft)	Distance From Borehole (ft)	Aquifer Piezo Elevation (ft)	BC Depth (ft)	BC Elevation (ft)	BS Depth (ft)	BS Elevation (ft)	Sediment Thickness (ft)	BC Thickness (ft)	Excavation Floor Elevation (ft)	Pressure Head (ft)	Uplift Porepressure (psf)	Remaining Sediment Thickness (ft)	Sediments Layer Total Pressure (psf)	BC Layer Total Pressure (psf)	FS (Total)	FS (Effective)
SJGB010	13857411.203	3216753.589	3.00	SJGB001	-56	107	-2	29	-26	59.5	-56.50	29	30.5	-6.3	54.5	3400	20	2132	3689	1.71	10.02
SJGB011	13857474.591	3216925.733	3.00	SJCPT-011	-53.4	83	-2	33	-30	58.4	-55.40	33	25.4	-9.6	53.4	3331	20	2208	3072	1.58	5.11
SJGB012	13857611.312	3216819.464	3.00	SJCPT-011	-53.4	93	-2	33	-30	58.4	-55.40	33	25.4	-7.6	53.4	3331	22	2424	3072	1.65	7.20
SJSB013	13857852.438	3216918.897	-12.4	SJGB018	-53.43	113	-2	30	-42.4	37.5	-49.90	30	7.5	-16	47.9	2988	26	2857	907	1.26	1.89
SJGB014	13857716.960	3217158.780	-1.50	SJGB053	-69	166	-2	15	-16.5	81	-82.50	15	66	-9.2	80.5	5022	7	790	7983	1.75	9.35
SJGB016	13857551.031	3217162.509	-0.50	SJCPT-011	-53.4	267	-2	33	-33.5	58.4	-58.90	33	25.4	-6.1	56.9	3550	27	2965	3072	1.70	10.73
SJGB017	13857352.164	3217191.717	-1.85	SJGB008	-61	207	-2	23	-24.85	58	-59.85	23	35	-17.85	57.85	3609	7	758	4233	1.38	2.40
SJSB028	13857067.126	3217256.398	1.25	SJGB008	-61	264	-2	23	-25.26	58	-56.75	23	32.8	-9.09	54.75	3416	16	1750	3967	1.67	6.02
SJSB029	13857119.314	3217153.087	2.68	SJGB008	-61	193	-2	23	-20.32	58	-55.32	23	35	2.68	53.32	3326	23	2489	4233	2.02	N/A
SJSB030	13857220.516	3216971.008	4.33	SJMW17	-60	120	-2	23	-18.67	63	-58.67	23	40	4.33	56.67	3535	23	2489	4838	2.07	N/A
SJSB031	13857295.051	3216774.912	5.12	SJMW17	-60	120	-2	23	-17.88	63	-57.88	23	40	5.12	55.88	3486	23	2489	4838	2.10	N/A
SJSB032	13857444.802	3216651.498	3.21	SJGB001	-56	120	-2	29	-25.79	59.5	-56.29	29	30.5	-8.3	54.29	3387	17	1893	3689	1.65	6.58
SJSB033	13857624.835	3216746.671	4.59	SJGB023	-61.66	100	-2	29.5	-24.91	59.8	-55.21	29.5	30.3	-8.9	53.21	3320	16	1733	3665	1.63	5.83
SJSB034	13857689.491	3217045.977	6.99	SJCPT-011	-53.4	200	-2	33	-26.01	58.4	-51.41	33	25.4	6.99	49.41	3083	33	3571	3072	2.16	N/A
SJSB035	13857460.903	3217021.623	6.64	SJCPT-011	-53.4	167	-2	33	-26.36	58.4	-51.76	33	25.4	6.64	49.76	3104	33	3571	3072	2.14	N/A
SJSB036	13857475.106	3216859.930	2.00	SJCPT-011	-53.4	97	-2	33	-31	58.4	-56.40	33	25.4	-10.75	54.4	3394	20	2191	3072	1.55	4.43
SJSB037	13857687.402	3216908.317	3.00	SJGB002	-58.75	73	-2	33.5	-30.5	59.5	-56.50	33.5	26	-9.6	54.5	3400	21	2262	3145	1.59	5.23
SJSB038	13857563.077	3217138.458	-0.50	SJCPT-011	-53.4	240	-2	33	-33.5	58.4	-58.90	33	25.4	-12.96	56.9	3550	21	2223	3072	1.49	3.55
SJSB045	13857135.810	3217343.067	-2.10	SJGB008	-61	57	-2	23	-25.1	58	-60.10	23	35	-2.1	58.1	3625	23	2489	4233	1.85	497.55
SJSB045-C1	13857149.350	3217285.350	-1.30	SJGB008	-61	63	-2	23	-24.3	58	-59.30	23	35	-13.3	57.3	3575	11	1190	4233	1.52	3.62
SJSB046	13857183.750	3217236.016	-2.00	SJGB008	-61	96	-2	23	-25	58	-60.00	23	35	-20	58	3618	5	541	4233	1.32	2.03
SJSB046-C1	13857229.000	3217174.000	-2.39	SJGB008	-61	150	-2	23	-25.39	58	-60.39	23	35	-20.4	58.39	3643	5	540	4233	1.31	1.98
SJSB047	13857278.320	3217421.371	-2.10	SJGB047	-53.4	0	-2	22	-24.1	50	-52.10	22	28	-2.1	50.1	3126	22	2381	3387	1.85	424.49
SJSB047-C1	13857302.550	3217340.988	-4.00	SJGB047	-53.4	80	-2	22	-26	50	-54.00	22	28	-20	52	3244	6	649	3387	1.24	1.71
SJSB048	13857396.530	3217503.368	-2.40	SJGB007	-67.75	107	-2	23	-25.4	64.5	-66.90	23	41.5	-2.4	64.9	4049	23	2489	5020	1.85	139.64
SJSB048-C1	13857398.780	3217445.299	-4.00	SJGB007	-67.75	67	-2	23	-27	64.5	-68.50	23	41.5	-22	66.5	4149	5	541	5020	1.34	2.13
SJSB049	13857406.390	3217395.258	-5.10	SJGB007	-67.75	77	-2	23	-28.1	64.5	-69.60	23	41.5	-19.1	67.6	4217	9	974	5020	1.42	2.66
SJSB050	13857546.330	3217527.884	-3.40	SJGB005	-65	67	-2	26	-29.4	60.5	-63.90	26	34.5	-3.4	61.9	3862	26	2814	4173	1.81	36.78
SJSB050-C1	13857558.160	3217389.116	-6.30	SJGB005	-65	120	-2	26	-32.3	60.5	-66.80	26	34.5	-6.3	64.8	4043	26	2814	4173	1.73	11.97
SJSB051	13857682.020	3217424.684	-2.70	SJGB004	-62.75	93	-2	28	-30.7	59.5	-62.20	28	31.5	-2.7	60.2	3756	28	3030	3810	1.82	71.63
SJSB052	13857661.470	3217319.770	-5.70	SJGB004	-62.75	133	-2	28	-33.7	59.5	-65.20	28	31.5	-5.7	63.2	3943	28	3030	3810	1.73	13.55
SJSB052-C1	13857626.750	3217222.469	-2.20	SJGB053	-66.7	190	-2	17	-19.2	57	-59.20	17	40	-2.2	57.2	3569	17	1840	4838	1.87	250.20
SJSB053	13857799.520	3217301.198	-9.70	SJGB053	-66.7	0	-2	17	-26.7	57	-66.70	17	40	-9.7	64.7	4036	17	1840	4838	1.65	6.50
SJSB053-C1	13857775.270	3217268.406	-7.40	SJGB053	-66.7	40	-2	17	-24.4	57	-64.40	17	40	-7.4	62.4	3893	17	1840	4838	1.72	9.27
SJSB054	13857745.960	3217282.887	-7.40	SJGB053	-66.7	57	-2	17	-24.4	57	-64.40	17	40	-23.4	62.4	3893	1	108	4838	1.27	1.79
SJSB055	13857915.360	3217183.420	-4.90	SJGB003	-95.17	60	-2	33	-37.9	84.5	-89.40	33	51.5	-13.5	87.4	5453	24	2641	6229	1.63	5.76
	13857915.360	3217183.420	-4.90	SJGB020	-48.17	113	1.5	22	-26.9	40	-44.90	22	18	-13.5	46.4	2895	13	1450	2177	1.25	1.78
SJSB055-C1	13857843.355	3217150.478	-9.54	SJGB003	-96.5	30	-2	33	-42.54	84.5	-94.04	33	51.5	-13.54	92.04	5742	29	3138	6229	1.63	6.04
SJSB056	13857942.460	3217077.154	-12.40	SJBG057	-73.1	113	-2	17	-29.4	56	-68.40	17	39	-12.4	66.4	4142	17	1840	4717	1.58	4.72
	13857942.460	3217077.154	-12.40	SJGB020	-48.17	100	1.5	22	-34.4	40	-52.40	22	18	-12.4	53.9	3363	22	2381	2177	1.36	2.38
SJSB056-C1	13857851.608	3217058.119	-4.29	SJSB003	-95.17	100	-2	33	-37.29	84.5	-88.79	33	51.5	-4.29	86.79	5415	33	3571	6229	1.81	31.70
SJSB057	13857956.449	3216960.196	-17.1	SJSB057	-73.1	0	-2	17	-34.1	56	-73.10	17	39	-26.4	71.1	4436	8	833	4717	1.25	1.73
	13857956.449	3216960.196	-17.1	SJGB019	-49.82	77	1.5	20	-37.1	35	-52.10	20	15	-26.4	53.6	3344	11	1158	1814	0.89	0.79
SJSB058	13857700.162	3216855.509	0.62	SJGB002	-58.7	43	-2	33.5	-32.88	59.5	-58.88	33.5	26	-17.4	56.88	3549	15	1675	3145	1.36	2.32
SJSB070	13857778.065	3216886.192	-1.17	SJGB002	-58.7	43	-2	33.5	-34.67	59.5	-60.67	33.5	26	-15.2	58.67	3660	19	2107	3145	1.43	2.93
SJSB071	13857719.189	3216821.133	-0.8	SJGB002	-58.7	43	-2	33.5	-34.3	59.5	-60.30	33.5	26	-18.8	58.3	3637	16	1677	3145	1.33	2.13
SJSB072	13857614.250	3216842.652	1.42	SJCPT-011	-53.4	67	-2	33	-31.58	58.4	-56.98	33.00	25.40	-20.56	54.98	3430	11	1193	3072	1.24	1.72
SJSB073	13857593.160	3216960.041	1.29	SJCPT-011	-53.4	67	-2	33	-31.71	58.4	-57.11	33.00	25.40	-10.71	55.11	3438	21	2273	3072	1.55	4.51
SJSB074	13857543.710	3216728.114	3.34	SJGB001	-56	33	-2	29	-25.66	59.5	-56.16	29.00	30.50	-4.66	54.16	3379	21	2273	3689	1.76	16.56
SJSB075	13857486.820	3216843.803	2.28	SJGB001	-56	93	-2	29	-26.72	59.5	-57.22	29.00	30.50	-9.72	55.22	3445	17	1840	3689	1.60	5.33
SJSB076	13857508.770	3216910.806	2.26	SJCPT-011	-53.4	60	-2	33	-30.74	58.4	-56.14	33.00	25.40	-9.74	54.14	3378	21	2273	3072	1.58	5.07
SJSB077	13857411.880	3216736.668	1.42	SJGB001	-56	100	-2	29	-27.58	59.5	-58.08	29.00	30.50	-14.58	56.08	3499	13	1407	3689	1.46	3.04
SJSB078	13857430.030	3216823.139	1.82	SJGB001	-56	107	-2	29	-27.18	59.5	-57.68	29.00	30.50	-20.18	55.68	3474	7	758	3689	1.28	1.86
SJSB079	13857381.900	3216888.271	1.05	SJMW17	-58	177	-2	23	-21.95	63	-61.95	23.00	40.00	-10.95	59.95	3740	11	1190	4838	1.61	5.10
SJSB080	13857320.220	3216827.045	1.77	SJMW17	-58	100	-2	23	-21.23	63	-61.23	23.00	40.00	-8.23	59.23	3695	13	1407	4838	1.69	7.56
SJSB081	13857276.460	3217054.335	-2.26	SJMW17	-58	120	-2	23	-25.26	63	-65.26	23.00	40.00	-14.26	63.26	3947	11	1190	4838	1.53	3.72
SJSB082	13857216.120	3217091.823	-1.75	SJMW17	-58	200	-2	23	-24.75	63	-64.75	23.00	40.00	-11.75	62.75	3915	13	1407	4838	1.60	4.83
SJSB083	13857242.260	3217187.497	-2.93	SJGB008	-61	153	-2	23	-25.93	58	-60.93	23.00	35.00	-14.93	58.93	3676	11	1190	4233	1.48	3.17
SJSB084	13857243.090	3217292.257	-3.86	SJGB008	-61	67	-2	23	-26.86	58	-61.86	23.00	35.00	-9.86	59.86	3734	17	1840	4233	1.63	5.77
SJSB085	13857350.670	3217370.887	-5.67	SJGB007	-67.75	53	-2	23	-28.67	64.5	-70.17	23.00	41.50	-13.67	68.17	4253	15	1623	5020	1.56	4.28
SJSB086	13857292.630	3217249.901	-2.72	SJGB008	-61	130	-2	23	-25.72	58	-60.72	23.00	35.00	-2.72	58.72	3663	23	2489	4233	1.84	69.10
SJSB087	13857311.470	3217114.943	-3.01	SJMW17	-58	240	-2	23	-26.01	63	-66.01	23.00	40.00	-19.01	64.01	3993	7	758	4838	1.40	2.51
SJSB088	13857488.390	3217119.275	-2.12	SJCPT-011	-53.4	240	-2	33	-35.12	58.4	-60.52	33.00	25.40	-20.52	58.52	3651	15	1580	3072	1.27	1.87
SJSB089	13857426.020	3217214.579	-2.88	SJGB007	-67.75	220	-2	23	-25.88	49.9	-52.78	23.00	26.90	-14.88	50.78	3168	11	1190	3254	1.40	2.59
SJSB090	13857506.130	3217218.409	-1.50	SJGB007	-67.75	267	-2	23	-24.50	49.9	-51.40	23.00	26.90	-11.50	49.40	3082	13	1407	3254	1.51	3.66
SJSB091	13857487.240	3217383.273	-3.58	SJGB007	-68.5	160	-2	23	-26.58	54.6	-58.18	23.00	31.60	-3.58	56.18	3505	23	2489	3822	1.80	29.47
SJSB092	13857618.600	3217303.607	-4.93	SJGB053	-66.7	187	-2	17	-21.93	57	-61.93	17.00	40.00	-18.93	59.93	3739	3	325	4838	1.38	2.35
SJSB093	13857582.780	3217129.479	-1.53	SJCPT-011	-66.7	200	-2	33	-34.53	58.4	-59.93	33.00	25.40	-15.53	57.93	3614	19	2056	3072	1.42	2.79
SJSB094	13857691.550	3217241.216	-4.22	SJSB053	-66.7	120	-2	17	-21.22	57	-61.22	17.00	40.00	-16.22	59.22	3695	5	541	4838	1.46	2.90
SJSB095	13857790.230	3217133.851	-2.07	SJGB003	-95.17	80	-2	33	-35.07	84.5	-86.57	33.00	51.50	-18.07	84.57	5276	17	1840	6229	1.53	3.79
SJSB096	13857798.660	3217196.291	-6.55	SJGB003	-95.17	73	-2	33	-39.55	84.5	-91.05	33.00	51.50	-18.55	89.05	5556	21	2273	6229	1.53	3.85
SJSB097	13857955.960	3217030.737	-15.64	SJSB057	-73.1	67	-2	17	-32.64	56	-71.64	17.00	39.00	-15.54	69.64	4345	17	1851	4717	1.51	3.63
	13857955.960	3217030.737	-15.64	SJGB020	-48.17	80	1.5	22	-37.64	32	-47.64	22.00	10.00	-15.54	49.14	3066	22	2392	1210	1.17	1.50
SJSB098	13857874.760	3216977.358	-14.36	SJGB019	-49.82	137	1.5	20	-34.36	35.1	-49.46	20.00	15.10	-28.36	50.96	3179	6	649	1826	0.78	0.62
	13857874.760	3216977.358	-14.36	SJSB057	-73.1	80	-2	17	-31.36	56	-70.36	17.00	39.00	-28.36	68.36	4265	3	325	4717	1.18	1.47
SJSB099	13857764.250	3216947.207	-0.61	SJGB002	-58.75	80	-2	34	-34.11	59.5	-60.11	33.50	26.00	-12.61	58.11	3625	22	2327	3145	1.51	3.79
SJSB100	13857919.310	3216899.688	-13.36	SJSB057	-73.1	67	-2	17	-30.36	56	-69.36	17.00	39.00	-15.36	67.36	4202	15	1623	4717	1.51	3.57
	13857919.310	3216899.688	-13.36	SJGB019	-48.82	67	1.5	20	-33.36	35	-48.36	20.00	15.00	-15.36	49.86	3111	18	1948	1814	1.21	1.62
SJSB101	13857709.580	3216809.881	-0.15	SJGB002	-58.75	63	-2	34	-33.65	59.5	-59.65	33.50	26.00	-12.15	57.65	3597	22	2327	3145	1.52	3.96
SJSB102	13857180.230	3217192.143	-2.05	SJGB008	-61	133	-2	23	-25.05	58	-60.05	23.00	35.00	-20.15	58.05	3622	5	530	4233	1.32	2.01
SJSB103	13857998.430	3216974.835	-15.36	SJSB057	-73.1	43	-2	17	-32.36	56	-71.36	17.00	39.00	-15.36	69.36	4327	17	1840	4717	1.52	3.68
	13857998.430	3216974.835	-15.36	SJGB020	-48.17	87	1.5	22	-37.36	32	-47.36	22.00	10.00	-15.36	48.86	3048	22	2381	1210	1.18	1.52
SJSB104	13857613.240	3217397.901	-5.49	SJBG005	-65	140	-2	26	-31.49	60.5	-65.99	26.00	34.50	-5.49	63.99	3992	26	2814	4173	1.75	14.75
SJSB105	13857485.550	3217440.440	-4.36	SJGB007	-67.75	153	-2	23	-27.36	64.5	-68.86	23.00	41.50	-20.36	66.86	4171	7	758	5020	1.39	2.40
SJSB106	13857469.990	3217311.018	-3.10	SJGB007	-67.75	173	-2	23	-26.10	64.5	-67.60	23.00	41.50	-5.10	65.60	4093	21	2273	5020	1.78	17.54

Total BC Unit Weight	19.0	kN/m^3	121.0	pcf
Total BC Unit Weight	19.5	kN/m^3	124.1	pcf
Total Sediment Unit Weight	17.0	kN/m^3	108.2	pcf
Water Unit Weight	9.8	kN/m^3	62.4	pcf
Total FS	1.25			
Effective BC Unit Weight	9.2	kN/m^3	58.6	pcf
Effective BS Unit Weight	9.7	kN/m^3	61.8	pcf
Effective Sediment Unit Weight	7.2	kN/m^3	45.8	pcf
Effective FS	1.5			
Conversion kN/m^3 to pcf	6.37			

Notes:
ft = feet
NAD83 = North American Datum of 1983
piezo = piezometer
BC = Beaumont Clay
BS = Beaumont Sand
psf = pounds per square foot
kN/m^3 = kilonewtons per cubic meter
pcf = pounds per cubic foot
FS = Factor of Safety
Orange highlighted rows indicate instances where geotechnical conditions from the closest two geotechnical borings were applied to those locations to assess hydraulic heave. The more conservative of the two assumptions will be carried forward for the basis of design.
Red highlighted rows indicate a FS that is less than the target FS protective of hydraulic heave.

Table 1B

Hydraulic Heave Safety Factors For Total Removal of Exceedances of Clean-Up Level - Assumption 2
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Location	Northing (NAD83)	Easting (NAD83)	Surface/Riverbed Elevation	Reference Borehole	BS Elevation in Reference Borehole (ft)	Distance From Borehole (ft)	Aquifer Piezo Elevation (ft)	BC Depth (ft)	BC Elevation (ft)	BS Depth (ft)	BS Elevation (ft)	Sediment Thickness (ft)	BC Thickness (ft)	Excavation Floor Elevation	Pressure Head (ft)	Uplift Porepressure (psf)	Remaining Sediment Thickness (ft)	Sediments Layer Total Pressure (psf)	BC Layer Total Pressure (psf)	FS (Total)	FS (Effective)
SJGB010	13857411.203	3216753.589	3.00	SJGB001	-56	107	-2	30	-27	59.5	-56	30	29	-6.3	54	3369	21	2240	3508	1.71	9.87
SJGB011	13857474.591	3216925.733	3.00	SJCPT-011	-53.4	83	-2	19.7	-16.7	58.4	-53.4	19.7	36.7	-9.6	51.4	3207	7	768	4439	1.62	5.22
SJGB012	13857611.312	3216819.464	3.00	SJCPT-011	-53.4	93	-2	19.7	-16.7	58.4	-53.4	19.7	36.7	-7.6	51.4	3207	9	985	4439	1.69	7.35
SJSB013	13857852.438	3216918.897	-12.4	SJGB018	-53.43	113	-2	19.7	-32.1	37.5	-53.43	19.7	21.33	-16	51.43	3209	16	1742	2580	1.35	2.28
SJGB014	13857716.960	3217158.780	-1.50	SJGB053	-66.7	166	-2	25.9	-27.4	81	-66.7	25.9	39.3	-9.2	64.7	4036	18	1970	4753	1.67	6.98
SJGB016	13857551.031	3217162.509	-0.50	SJCPT-011	-53.4	267	-2	19.7	-20.2	58.4	-53.4	19.7	33.2	-6.1	51.4	3207	14	1526	4016	1.73	10.13
SJGB017	13857352.164	3217191.717	-1.85	SJGB008	-61	207	-2	25	-26.85	58	-61	25	34.15	-17.85	59	3681	9	974	4131	1.39	2.44
SJSB028	13857067.126	3217256.398	1.25	SJGB008	-61	264	-2	23	-25.26	58	-61	23	32.8	-9.09	56.06	3497	16	1750	3967	1.63	6.02
SJSB029	13857119.314	3217153.087	2.68	SJGB008	-61	193	-2	23	-20.32	58	-61	23	40.68	2.68	59	3681	23	2489	4920	2.01	N/A
SJSB030	13857220.516	3216971.008	4.33	SJMW17	-60	120	-2	30	-25.67	63	-60	30	34.33	4.33	58	3618	30	3247	4152	2.04	N/A
SJSB031	13857295.051	3216774.912	5.12	SJMW17	-60	120	-2	30	-24.88	63	-60	30	35.12	5.12	58	3618	30	3247	4248	2.07	N/A
SJSB032	13857444.802	3216651.498	3.21	SJGB001	-56	120	-2	30	-26.79	59.5	-56	30	29.21	-8.3	54	3369	18	2001	3533	1.64	6.51
SJSB033	13857624.835	3216746.671	4.59	SJGB023	-61.66	100	-2	29.9	-25.31	59.8	-61.66	29.9	36.35	-8.9	59.66	3722	16	1776	4397	1.66	6.69
SJSB034	13857689.491	3217045.977	6.99	SJCPT-011	-53.4	200	-2	19.7	-12.71	58.4	-53.4	19.7	40.69	6.99	51.4	3207	20	2132	4922	2.20	N/A
SJSB035	13857460.903	3217021.623	6.64	SJCPT-011	-53.4	167	-2	19.7	-13.06	58.4	-53.4	19.7	40.34	6.64	51.4	3207	20	2132	4879	2.19	N/A
SJSB036	13857475.106	3216859.930	2.00	SJCPT-011	-53.4	97	-2	30	-10.75	58.4	-53.4	12.75	42.65	-10.75	51.4	3207	0	0	5159	1.61	4.58
SJSB037	13857687.402	3216908.317	3.00	SJGB002	-58.75	73	-2	34.4	-31.4	59.5	-58.75	34.4	27.35	-9.6	56.75	3540	22	2359	3308	1.60	5.49
SJSB038	13857563.077	3217138.458	-0.50	SJCPT-011	-53.4	240	-2	19.7	-20.2	58.4	-53.4	19.7	33.2	-12.96	51.4	3207	7	784	4016	1.50	3.33
SJSB045	13857135.810	3217343.067	-2.10	SJGB008	-61	57	-2	23	-25.1	58	-61	23	35.9	-2.1	59	3681	23	2489	4342	1.86	506.00
SJSB045-C1	13857149.350	3217285.350	-1.30	SJGB008	-61	63	-2	23	-24.3	58	-61	23	36.7	-13.3	59	3681	11	1190	4439	1.53	3.76
SJSB046	13857183.750	3217236.016	-2.00	SJGB008	-61	96	-2	23	-25	58	-61	23	36	-20	59	3681	5	541	4354	1.33	2.08
SJSB046-C1	13857229.000	3217174.000	-2.39	SJGB008	-61	150	-2	23	-25.39	58	-61	23	35.61	-20.4	59	3681	5	540	4307	1.32	2.02
SJSB047	13857278.320	3217421.371	-2.10	SJGB047	-53.4	0	-2	34	-36.1	50	-53.4	34	17.3	-2.1	51.4	3207	34	3680	2093	1.80	412.20
SJSB047-C1	13857302.550	3217340.988	-4.00	SJGB047	-53.4	80	-2	34	-38	50	-53.4	34	15.4	-20	51.4	3207	18	1948	1863	1.19	1.54
SJSB048	13857396.530	3217503.368	-2.40	SJGB007	-67.75	107	-2	25	-27.4	64.5	-67.75	25	40.35	-2.4	65.75	4102	25	2706	4880	1.85	140.62
SJSB048-C1	13857398.780	3217445.299	-4.00	SJGB007	-67.75	67	-2	25	-29	64.5	-67.75	25	38.75	-22	65.75	4102	7	758	4687	1.33	2.08
SJSB049	13857406.390	3217395.258	-5.10	SJGB007	-67.75	77	-2	25	-30.1	64.5	-67.75	25	37.65	-19.1	65.75	4102	11	1190	4554	1.40	2.54
SJSB050	13857546.330	3217527.884	-3.40	SJGB005	-65	67	-2	24.4	-27.8	60.5	-65	24.4	37.2	-3.4	63	3930	24	2641	4499	1.82	37.75
SJSB050-C1	13857558.160	3217389.116	-6.30	SJGB005	-65	120	-2	24.4	-30.7	60.5	-65	24.4	34.3	-6.3	63	3930	24	2641	4149	1.73	11.66
SJSB051	13857682.020	3217424.684	-2.70	SJGB004	-62.75	93	-2	24	-26.7	59.5	-62.75	24	36.05	-2.7	60.75	3790	24	2597	4360	1.84	73.54
SJSB052	13857661.470	3217319.770	-5.70	SJGB004	-62.75	133	-2	24	-29.7	59.5	-62.75	24	33.05	-5.7	60.75	3790	24	2597	3998	1.74	13.15
SJSB052-C1	13857626.750	3217222.469	-2.20	SJGB053	-66.7	190	-2	25.9	-28.1	57	-66.7	25.9	38.6	-2.2	64.7	4036	26	2803	4669	1.85	276.33
SJSB053	13857799.520	3217301.198	-9.70	SJGB053	-66.7	0	-2	25.9	-35.6	57	-66.7	25.9	31.1	-9.7	64.7	4036	26	2803	3762	1.63	6.26
SJSB053-C1	13857775.270	3217268.406	-7.40	SJGB053	-66.7	40	-2	25.9	-33.3	57	-66.7	25.9	33.4	-7.4	64.7	4036	26	2803	4040	1.70	9.33
SJSB054	13857745.960	3217282.887	-7.40	SJGB053	-66.7	57	-2	25.9	-33.3	57	-66.7	25.9	33.4	-23.4	64.7	4036	10	1071	4040	1.27	1.81
SJSB055	13857915.360	3217183.420	-4.90	SJGB003	-95.17	60	-2	18	-22.9	84.5	-95.17	18	72.27	-13.5	93.17	5813	9	1017	8741	1.68	6.50
	13857915.360	3217183.420	-4.90	SJGB020	-48.17	113	1.5	22	-26.9	40	-48.17	22	21.27	-13.5	49.67	3099	13	1450	2573	1.30	1.99
SJSB055-C1	13857843.355	3217150.478	-9.54	SJGB003	-96.5	30	-2	18	-27.54	84.5	-96.5	18	68.96	-13.54	94.5	5896	14	1515	8341	1.67	6.50
SJSB056	13857942.460	3217077.154	-12.40	SJBG057	-73.1	113	-2	18	-30.4	56	-73.1	18	42.7	-12.4	71.1	4436	18	1948	5165	1.60	5.13
	13857942.460	3217077.154	-12.40	SJGB020	-48.17	100	1.5	19.5	-31.9	40	-48.17	19.5	16.27	-12.4	49.67	3099	20	2110	1968	1.32	2.13
SJSB056-C1	13857851.608	3217058.119	-4.29	SJSB003	-95.17	100	-2	19.7	-23.99	84.5	-95.17	19.7	71.18	-4.29	93.17	5813	20	2132	8610	1.85	35.50
SJSB057	13857956.449	3216960.196	-17.1	SJSB057	-73.1	0	-2	19.7	-36.8	56	-73.1	19.7	36.3	-26.4	71.1	4436	10	1126	4391	1.24	1.71
	13857956.449	3216960.196	-17.1	SJGB019	-49.82	77	1.5	19.5	-36.6	35	-49.82	19.5	13.22	-26.4	51.32	3202	10	1104	1599	0.84	0.71
SJSB058	13857700.162	3216855.509	0.62	SJGB002	-58.7	43	-2	34.4	-33.78	59.5	-58.7	34.4	24.92	-17.4	56.7	3537	16	1773	3014	1.35	2.30
SJSB070	13857778.065	3216886.192	-1.17	SJGB002	-58.7	43	-2	23	-24.17	59.5	-58.7	23	34.53	-15.2	56.7	3537	9	971	4177	1.46	2.96
SJSB071	13857719.189	3216821.133	-0.8	SJGB002	-58.7	43	-2	34.4	-35.2	59.5	-58.7	34.4	23.5	-18.8	56.7	3537	16	1775	2842	1.31	2.03
SJSB072	13857614.250	3216842.652	1.42	SJCPT-011	-53.4	67	-2	19.7	-18.28	58.4	-53.40	19.70	35.12	-20.56	51.40	3207	-2	-247	4248	1.25	1.69
SJSB073	13857593.160	3216960.041	1.29	SJCPT-011	-53.4	67	-2	19.7	-18.41	58.4	-53.40	19.70	34.99	-10.71	51.40	3207	8	833	4232	1.58	4.42
SJSB074	13857543.710	3216728.114	3.34	SJGB001	-56	33	-2	29.8	-26.46	59.5	-56.00	29.80	29.54	-4.66	54.00	3369	22	2359	3573	1.76	16.45
SJSB075	13857486.820	3216843.803	2.28	SJGB001	-56	93	-2	34	-31.72	59.5	-56.00	34.00	24.28	-9.72	54.00	3369	22	2381	2937	1.58	5.05
SJSB076	13857508.770	3216910.806	2.26	SJCPT-011	-53.4	60	-2	19.7	-17.44	58.4	-53.40	19.70	35.96	-9.74	51.40	3207	8	833	4350	1.62	5.09
SJSB077	13857411.880	3216736.668	1.42	SJGB001	-56	100	-2	30.00	-28.58	59.5	-56.00	30.00	27.42	-14.58	54.00	3369	14	1515	3317	1.43	2.86
SJSB078	13857430.030	3216823.139	1.82	SJGB001	-56	107	-2	30.00	-28.18	59.5	-56.00	30.00	27.82	-20.18	54.00	3369	8	866	3365	1.26	1.76
SJSB079	13857381.900	3216888.271	1.05	SJMW17	-58	177	-2	19.7	-18.65	63	-58.00	19.70	39.35	-10.95	56.00	3494	8	833	4760	1.60	4.76
SJSB080	13857320.220	3216827.045	1.77	SJMW17	-58	100	-2	19.7	-17.93	63	-58.00	19.70	40.07	-8.23	56.00	3494	10	1050	4847	1.69	7.18
SJSB081	13857276.460	3217054.335	-2.26	SJMW17	-58	120	-2	23.00	-25.26	63	-58.00	23.00	32.74	-14.26	56.00	3494	11	1190	3960	1.47	3.17
SJSB082	13857216.120	3217091.823	-1.75	SJMW17	-58	200	-2	23.00	-24.75	63	-58.00	23.00	33.25	-11.75	56.00	3494	13	1407	4022	1.55	4.18
SJSB083	13857242.260	3217187.497	-2.93	SJGB008	-61	153	-2	23.00	-25.93	58	-61.00	23.00	35.07	-14.93	59.00	3681	11	1190	4242	1.48	3.17
SJSB084	13857243.090	3217292.257	-3.86	SJGB008	-61	67	-2	23.00	-26.86	58	-61.00	23.00	34.14	-9.86	59.00	3681	17	1840	4129	1.62	5.67
SJSB085	13857350.670	3217370.887	-5.67	SJGB007	-67.75	53	-2	25.00	-30.67	64.5	-67.75	25.00	37.08	-13.67	65.75	4102	17	1840	4485	1.54	4.05
SJSB086	13857292.630	3217249.901	-2.72	SJGB008	-61	130	-2	25.00	-27.72	58	-61.00	25.00	33.28	-2.72	59.00	3681	25	2706	4025	1.83	68.90
SJSB087	13857311.470	3217114.943	-3.01	SJMW17	-58	240	-2	19.7	-22.71	63	-58.00	19.70	35.29	-19.01	56.00	3494	4	400	4268	1.34	2.11
SJSB088	13857488.390	3217119.275	-2.12	SJCPT-011	-53.4	240	-2	19.7	-21.82	58.4	-53.40	19.70	31.58	-20.52	51.40	3207	1	141	3820	1.24	1.65
SJSB089	13857426.020	3217214.579	-2.88	SJGB007	-67.75	220	-2	25.00	-27.88	49.9	-67.75	25.00	39.87	-14.88	65.75	4102	13	1407	4822	1.52	3.65
SJSB090	13857506.130	3217218.409	-1.50	SJGB007	-67.75	267	-2	25.00	-26.50	49.9	-67.75	25.00	41.25	-11.50	65.75	4102	15	1623	4989	1.61	5.24
SJSB091	13857487.240	3217383.273	-3.58	SJGB007	-68.5	160	-2	24.40	-27.98	54.6	-68.50	24.40	40.52	-3.58	66.50	4149	24	2641	4901	1.82	35.42
SJSB092	13857618.600	3217303.607	-4.93	SJGB053	-66.7	187	-2	24.40	-29.33	57	-66.70	24.40	37.37	-18.93	64.70	4036	10	1126	4520	1.40	2.52
SJSB093	13857582.780	3217129.479	-15.53	SJCPT-011	-66.7	200	-2	19.7	-35.23	58.4	-66.70	19.70	31.47	-15.53	64.70	4036	20	2132	3806	1.47	3.25
SJSB094	13857691.550	3217241.216	-4.22	SJSB053	-66.7	120	-2	25.90	-30.12	57	-66.70	25.90	36.58	-16.22	64.70	4036	14	1504	4424	1.47	3.13
SJSB095	13857790.230	3217133.851	-2.07	SJGB003	-95.17	80	-2	18.00	-20.07	84.5	-95.17	18.00	75.10	-18.07	93.17	5813	2	216	9084	1.60	4.48
SJSB096	13857798.660	3217196.291	-6.55	SJGB003	-95.17	73	-2	21.90	-28.45	84.5	-95.17	21.90	66.72	-18.55	93.17	5813	10	1071	8070	1.57	4.22
SJSB097	13857955.960	3217030.737	-15.64	SJSB057	-73.1	67	-2	19.70	-35.34	56	-73.10	19.70	37.76	-15.54	71.10	4436	20	2143	4567	1.51	3.69
	13857955.960	3217030.737	-15.64	SJGB020	-48.17	80	1.5	22.00	-37.64	32	-48.17	22.00	10.53	-15.54	49.67	3099	22	2392	1274	1.18	1.53
SJSB098	13857874.760	3216977.358	-14.36	SJGB019	-49.82	137	1.5	19.50	-33.86	35.1	-49.82	19.50	15.96	-28.36	51.32	3202	6	595	1930	0.79	0.64
	13857874.760	3216977.358	-14.36	SJSB057	-73.1	80	-2	27.00	-41.36	56	-73.10	27.00	31.74	-28.36	71.10	4436	13	1407	3839	1.18	1.49
SJSB099	13857764.250	3216947.207	-0.61	SJGB002	-58.75	80	-2	34.40	-35.01	59.5	-58.75	34.40	23.74	-12.61	56.75	3540	22	2424	2871	1.50	3.65
SJSB100	13857919.310	3216899.688	-13.36	SJSB057	-73.1	67	-2	19.70	-33.06	56	-73.10	19.70	40.04	-15.36	71.10	4436	18	1916	4843	1.52	3.79
	13857919.310	3216899.688	-13.36	SJGB019	-49.82	67	1.5	19.70	-33.06	35	-49.82	19.70	16.76	-15.36	51.32	3202	18	1916	2027	1.23	1.70
SJSB101	13857709.580	3216809.881	-0.15	SJGB002	-58.75	63	-2	34.40	-34.55	59.5	-58.75	34.40	24.20	-12.15	56.75	3540	22	2424	2927	1.51	3.86
SJSB102	13857180.230	3217192.143	-2.05	SJGB008	-61	133	-2	23.00	-25.05	58	-61.00	23.00	35.95	-20.15	59.00	3681	5	530	4348	1.33	2.06
SJSB103	13857998.430	3216974.835	-15.36	SJSB057	-73.1	43	-2	19.70	-35.06	56	-73.10	19.70	38.04	-15.36	71.10	4436	20	2132	4601	1.52	3.76
	13857998.430	3216974.835	-15.36	SJGB020	-48.17	87	1.5	22.00	-37.36	32	-48.17	22.00	10.81	-15.36	49.67	3099	22	2381	1308	1.19	1.56
SJSB104	13857613.240	3217397.901	-5.59	SJBG005	-65	140	-2	24.40	-29.99	60.5	-65.00	24.40	35.01	-5.49	63.00	3930	25	2651	4235	1.75	14.57
SJSB105	13857485.550	3217440.440	-4.36	SJGB007	-67.75	153	-2	24.40	-28.76	64.5	-67.75	24.40	38.99	-20.36	65.75	4102	8	909	4716	1.37	2.33
SJSB106	13857469.990	3217311.018	-3.10	SJGB007	-67.75	173	-2	25.00	-28.10	64.5	-67.75	25.00	39.65	-5.10	65.75	4102	23	2489	4796	1.78	17.46

Total BC Unit Weight	19.0	kN/m3	121.0	pcf
Total BC Unit Weight	19.5	kN/m3	124.1	pcf
Total Sediment Unit Weight	17.0	kN/m3	108.2	pcf
Water Unit Weight	9.8	kN/m3	62.4	pcf
Total FS	1.25			
Effective BC Unit Weight	9.2	kN/m3	58.6	pcf
Effective BS Unit Weight	9.7	kN/m3	61.8	pcf
Effective Sediment Unit Weight	7.2	kN/m3	45.8	pcf
Effective FS	1.5			
Conversion kN/m3 to pcf	6.37			

Notes:
ft = feet
NAD83 = North American Datum of 1983
piezo = piezometer
BC = Beaumont Clay
BS = Beaumont Sand
psf = pounds per square foot
kN/m^3 = kilonewtons per cubic meter
pcf = pounds per cubic foot
FS = Factor of Safety
Orange highlighted rows indicate instances where geotechnical conditions from the closest two geotechnical borings were applied to those locations to assess hydraulic heave. The more conservative of the two assumptions will be carried forward for the basis of design.
Red highlighted rows indicate a FS that is less than the target FS protective of hydraulic heave.

Table 2A

Elevations of Excavation to Maintain Hydraulic Heave Safety Factor of 1.25 - Assumption 1
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Location	Northing (NAD83)	Easting (NAD83)	Surface/Riverbed Elevation (ft)	Reference Borehole	BS Elevation in Reference Borehole (ft)	Distance From Borehole (ft)	Aquifer Piezo Elevation (ft)	BC Depth (ft)	BC Elevation (Ft)	BS Depth (ft)	BS Elevation (ft)	Sediment Thickness (ft)	BC Thickness (ft)	Pressure Head (ft)	Uplift Porepressure (psf)	BC Layer Total Pressure (psf)	FS	Required Sediment Thickness (ft)	Total Analysis Required Minimum Excavation Elevation (ft)	Corresponding Effective Analysis FS
SJGB010	13857411.203	3216753.589	3.00	SJGB001	-56	107	-2	29	-26	59.5	-56.50	29	30.5	54.5	3400	3689	1.25	5.18	-20.82	1.72
SJGB011	13857474.591	3216925.733	3.00	SJCPT-011	-53.4	83	-2	33	-30	58.4	-55.40	33	25.4	53.4	3331	3072	1.25	10.09	-19.91	1.75
SJGB012	13857611.312	3216819.464	3.00	SJCPT-011	-53.4	93	-2	33	-30	58.4	-55.40	33	25.4	53.4	3331	3072	1.25	10.09	-19.91	1.75
SJSB013	13857852.438	3216918.897	-12.5	SJGB018	-53.43	113	-2	30	-42.5	37.5	-50.00	30	7.5	48	2995	907	1.25	26.21	-16.29	1.84
SJGB014	13857716.960	3217158.780	-1.50	SJGB053	-66.7	166	-2	15	-16.5	81	-82.50	15	66	80.5	5022	7983	1.25	-15.76	-32.26	1.67
SJGB016	13857551.031	3217162.509	-0.50	SJCPT-011	-53.4	267	-2	33	-33.5	58.4	-58.90	33	25.4	56.9	3550	3072	1.25	12.61	-20.89	1.75
SJGB017	13857352.164	3217191.717	-0.50	SJGB008	-61	207	-2	23	-23.5	58	-58.50	23	35	56.5	3525	4233	1.25	1.60	-21.90	1.71
SJSB028	13857067.126	3217256.398	1.25	SJGB008	-61	264	-2	23	-25.26	58	-56.75	23	32.8	56.06	3497	3967	1.25	3.74	-21.48	1.72
SJSB029	13857119.314	3217153.087	2.64	SJGB008	-61	193	-2	23	-20.36	58	-55.36	23	35	53.36	3329	4233	1.25	-0.67	-21.03	1.70
SJSB030	13857220.516	3216971.008	4.33	SJMW17	-58	120	-2	23	-18.67	63	-58.67	23	40	56.67	3535	4838	1.25	-3.87	-22.54	1.69
SJSB031	13857295.051	3216774.912	6.00	SJMW17	-58	120	-2	23	-17	63	-57.00	23	40	55	3431	4838	1.25	-5.07	-22.07	1.68
SJSB032	13857444.802	3216651.498	3.21	SJGB001	-56	120	-2	29	-25.79	59.5	-56.29	29	30.5	54.29	3387	3689	1.25	5.03	-20.76	1.72
SJSB033	13857624.835	3216746.671	4.59	SJGB023	-61.66	100	-2	29.5	-24.91	59.8	-55.21	29.5	30.3	53.21	3320	3665	1.25	4.48	-20.43	1.72
SJSB034	13857689.491	3217045.977	8.00	SJCPT-011	-53.4	200	-2	33	-25	58.4	-50.40	33	25.4	48.4	3020	3072	1.25	6.49	-18.51	1.73
SJSB035	13857460.903	3217021.623	8.00	SJCPT-011	-53.4	167	-2	33	-25	58.4	-50.40	33	25.4	48.4	3020	3072	1.25	6.49	-18.51	1.73
SJSB036	13857475.106	3216859.930	2.00	SJCPT-011	-53.4	97	-2	33	-10.75	58.4	-56.40	12.75	45.65	54.4	3394	5522	1.25	-11.82	-22.57	1.66
SJSB037	13857687.402	3216908.317	2.00	SJGB002	-58.75	73	-2	33.5	-31.5	59.5	-57.50	33.5	26	55.5	3462	3145	1.25	10.93	-20.57	1.75
SJSB038	13857563.077	3217138.458	-0.50	SJCPT-011	-53.4	240	-2	33	-33.5	58.4	-58.90	33	25.4	56.9	3550	3072	1.25	12.61	-20.89	1.75
SJSB045	13857135.810	3217343.067	-2.10	SJGB008	-61	57	-2	23	-25.1	58	-60.10	23	35	58.1	3625	4233	1.25	2.75	-22.35	1.71
SJSB045-C1	13857149.350	3217285.350	-1.30	SJGB008	-61	63	-2	23	-24.3	58	-59.30	23	35	57.3	3575	4233	1.25	2.17	-22.13	1.71
SJSB046	13857183.750	3217236.016	-2.00	SJGB008	-61	96	-2	23	-25	58	-60.00	23	35	58	3618	4233	1.25	2.68	-22.32	1.71
SJSB046-C1	13857229.000	3217174.000	-2.39	SJGB008	-61	150	-2	23	-25.39	58	-60.39	23	35	58.39	3643	4233	1.25	2.96	-22.43	1.71
SJSB047	13857278.320	3217421.371	-2.10	SJGB047	-53.4	0	-2	22	-24.1	50	-52.10	22	28	50.1	3126	3387	1.25	4.81	-19.29	1.72
SJSB047-C1	13857302.550	3217340.988	-4.00	SJGB047	-53.4	80	-2	22	-26	50	-54.00	22	28	52	3244	3387	1.25	6.18	-19.82	1.73
SJSB048	13857396.530	3217503.368	-2.40	SJGB007	-67.75	107	-2	23	-25.4	64.5	-66.90	23	41.5	64.9	4049	5020	1.25	0.38	-25.02	1.70
SJSB048-C1	13857398.780	3217445.299	-4.00	SJGB007	-67.75	67	-2	23	-27	64.5	-68.50	23	41.5	66.5	4149	5020	1.25	1.54	-25.46	1.71
SJSB049	13857406.390	3217395.258	-5.10	SJGB007	-67.75	77	-2	23	-28.1	64.5	-69.60	23	41.5	67.6	4217	5020	1.25	2.33	-25.77	1.71
SJSB050	13857546.330	3217527.884	-3.40	SJGB005	-65	67	-2	26	-29.4	60.5	-63.90	26	34.5	61.9	3862	4173	1.25	6.05	-23.35	1.72
SJSB050-C1	13857558.160	3217389.116	-6.30	SJGB005	-65	120	-2	26	-32.3	60.5	-66.80	26	34.5	64.8	4043	4173	1.25	8.14	-24.16	1.73
SJSB051	13857682.020	3217424.684	-2.70	SJGB004	-62.75	93	-2	28	-30.7	59.5	-62.20	28	31.5	60.2	3756	3810	1.25	8.17	-22.53	1.73
SJSB052	13857661.470	3217319.770	-5.70	SJGB004	-62.75	133	-2	28	-33.7	59.5	-65.20	28	31.5	63.2	3943	3810	1.25	10.34	-23.36	1.74
SJSB052-C1	13857626.750	3217222.469	-2.20	SJGB053	-66.7	190	-2	17	-19.2	57	-59.20	17	40	57.2	3569	4838	1.25	-3.49	-22.69	1.69
SJSB053	13857799.520	3217301.198	-9.70	SJGB053	-66.7	0	-2	17	-26.7	57	-66.70	17	40	64.7	4036	4838	1.25	1.92	-24.78	1.71
SJSB053-C1	13857775.270	3217268.406	-7.40	SJGB053	-66.7	40	-2	17	-24.4	57	-64.40	17	40	62.4	3893	4838	1.25	0.26	-24.14	1.70
SJSB054	13857745.960	3217282.887	-7.40	SJGB053	-66.7	57	-2	17	-24.4	57	-64.40	17	40	62.4	3893	4838	1.25	0.26	-24.14	1.70
SJSB055	13857915.360	3217183.420	-4.90	SJGB003	-95.17	60	-2	33	-37.9	84.5	-89.40	33	51.5	87.4	5453	6229	1.25	5.42	-32.48	1.72
	13857915.360	3217183.420	-4.90	SJGB020	-48.17	113	1.5	22	-26.9	40	-44.90	22	18	46.4	2895	2177	1.25	13.32	-13.58	1.77
SJSB055-C1	13857843.355	3217150.478	-9.54	SJGB003	-95.17	30	-2	33	-42.54	84.5	-94.04	33	51.5	92.04	5742	6229	1.25	8.76	-33.78	1.72
SJSB056	13857942.460	3217077.154	-12.40	SJBG057	-73.1	113	-2	17	-29.4	63	-75.40	17	46	73.4	4579	5564	1.25	1.48	-27.92	1.71
	13857942.460	3217077.154	-12.40	SJGB020	-48.17	100	1.5	22	-34.4	40	-52.40	22	18	53.9	3363	2177	1.25	18.72	-15.68	1.78
SJSB056-C1	13857851.608	3217058.119	-4.29	SJSB003	-95.17	100	-2	33	-37.29	84.5	-88.79	33	51.5	86.79	5415	6229	1.25	4.98	-32.31	1.72
SJSB057	13857956.449	3216960.196	-17.1	SJSB057	-73.1	0	-2	17	-34.1	63	-80.10	17	46	78.1	4872	5564	1.25	4.87	-29.23	1.72
	13857956.449	3216960.196	-17.1	SJGB019	-49.82	77	1.5	20	-37.1	35.1	-52.20	20	15.1	53.7	3350	1826	1.25	21.82	-15.28	1.80
SJSB058	13857700.162	3216855.509	0.62	SJGB002	-58.75	43	-2	33.5	-32.88	59.5	-58.88	33.5	26	56.88	3549	3145	1.25	11.93	-20.95	1.75
SJSB070	13857778.065	3216886.192	-1.17	SJGB002	-58.75	43	-2	33.5	-34.67	59.5	-60.67	33.5	26	58.67	3660	3145	1.25	13.22	-21.45	1.75
SJSB071	13857719.189	3216821.133	-0.8	SJGB002	-58.75	43	-2	33.5	-34.3	59.5	-60.30	33.5	26	58.3	3637	3145	1.25	12.95	-21.35	1.75
SJSB072	13857614.250	3216842.652	1.42	SJCPT-011	-53.4	67	-2	33	-31.58	58.4	-56.98	33.00	25.40	54.98	3430	3072	1.25	11.23	-20.35	1.75
SJSB073	13857593.160	3216960.041	1.29	SJCPT-011	-53.4	67	-2	33	-31.71	58.4	-57.11	33.00	25.40	55.11	3438	3072	1.25	11.32	-20.39	1.75
SJSB074	13857543.710	3216728.114	3.34	SJGB001	-56	33	-2	29	-25.66	59.5	-56.16	29.00	30.50	54.16	3379	3689	1.25	4.94	-20.72	1.72
SJSB075	13857486.820	3216843.803	2.28	SJGB001	-56	93	-2	29	-26.72	59.5	-57.22	29.00	30.50	55.22	3445	3689	1.25	5.70	-21.02	1.73
SJSB076	13857508.770	3216910.806	2.26	SJCPT-011	-53.4	60	-2	33	-30.74	58.4	-56.14	33.00	25.40	54.14	3378	3072	1.25	10.62	-20.12	1.75
SJSB077	13857411.880	3216736.668	1.42	SJGB001	-56	100	-2	29	-27.58	59.5	-58.08	29.00	30.50	56.08	3499	3689	1.25	6.32	-21.26	1.73
SJSB078	13857430.030	3216823.139	1.82	SJGB001	-56	107	-2	29	-27.18	59.5	-57.68	29.00	30.50	55.68	3474	3689	1.25	6.03	-21.15	1.73
SJSB079	13857381.900	3216888.271	1.05	SJMW17	-60	177	-2	23	-21.95	63	-61.95	23.00	40.00	59.95	3740	4838	1.25	-1.51	-23.46	1.70
SJSB080	13857320.220	3216827.045	1.77	SJMW17	-60	100	-2	23	-21.23	63	-61.23	23.00	40.00	59.23	3695	4838	1.25	-2.03	-23.26	1.70
SJSB081	13857276.460	3217054.335	-2.26	SJMW17	-60	120	-2	23	-25.26	63	-65.26	23.00	40.00	63.26	3947	4838	1.25	0.88	-24.38	1.71
SJSB082	13857216.120	3217091.823	-1.75	SJMW17	-60	200	-2	23	-24.75	63	-64.75	23.00	40.00	62.75	3915	4838	1.25	0.51	-24.24	1.71
SJSB083	13857242.260	3217187.497	-2.93	SJGB008	-61	153	-2	23	-25.93	58	-60.93	23.00	35.00	58.93	3676	4233	1.25	3.35	-22.58	1.72
SJSB084	13857243.090	3217292.257	-3.86	SJGB008	-61	67	-2	23	-26.86	58	-61.86	23.00	35.00	59.86	3734	4233	1.25	4.02	-22.84	1.72
SJSB085	13857350.670	3217370.887	-5.67	SJGB007	-68.5	53	-2	23	-28.67	64.5	-70.17	23.00	41.50	68.17	4253	5020	1.25	2.74	-25.93	1.71
SJSB086	13857292.630	3217249.901	-2.72	SJGB008	-61	130	-2	23	-25.72	58	-60.72	23.00	35.00	58.72	3663	4233	1.25	3.20	-22.52	1.72
SJSB087	13857311.470	3217114.943	-3.01	SJMW17	-60	240	-2	23	-26.01	63	-66.01	23.00	40.00	64.01	3993	4838	1.25	1.42	-24.59	1.71
SJSB088	13857488.390	3217119.275	-2.12	SJCPT-011	-53.4	240	-2	33	-35.12	58.4	-60.52	33.00	25.40	58.52	3651	3072	1.25	13.78	-21.34	1.76
SJSB089	13857426.020	3217214.579	-2.88	SJGB007	-67.75	220	-2	23	-25.88	49.9	-52.78	23.00	26.90	50.78	3168	3254	1.25	6.53	-19.35	1.73
SJSB090	13857506.130	3217218.409	-1.50	SJGB007	-67.75	267	-2	23	-24.50	49.9	-51.40	23.00	26.90	49.40	3082	3254	1.25	5.53	-18.97	1.73
SJSB091	13857487.240	3217383.273	-3.58	SJGB007	-67.75	160	-2	23	-26.58	54.6	-58.18	23.00	31.60	56.18	3505	3822	1.25	5.17	-21.42	1.72
SJSB092	13857618.600	3217303.607	-4.93	SJGB053	-66.7	187	-2	17	-21.93	57	-61.93	17.00	40.00	59.93	3739	4838	1.25	-1.52	-23.45	1.70
SJSB093	13857582.780	3217129.479	-1.53	SJCPT-011	-53.4	200	-2	33	-34.53	58.4	-59.93	33.00	25.40	57.93	3614	3072	1.25	13.36	-21.17	1.76
SJSB094	13857691.550	3217241.216	-4.22	SJSB053	-69	120	-2	17	-21.22	57	-61.22	17.00	40.00	59.22	3695	4838	1.25	-2.03	-23.25	1.70
SJSB095	13857790.230	3217133.851	-2.07	SJGB003	-95.17	80	-2	33	-35.07	84.5	-86.57	33.00	51.50	84.57	5276	6229	1.25	3.38	-31.69	1.71
SJSB096	13857798.660	3217196.291	-6.55	SJGB003	-95.17	73	-2	33	-39.55	84.5	-91.05	33.00	51.50	89.05	5556	6229	1.25	6.61	-32.94	1.72
SJSB097	13857955.960	3217030.737	-15.64	SJSB057	-73.1	67	-2	17	-32.64	57	-72.64	17.00	40.00	70.64	4407	4838	1.25	6.20	-26.44	1.72
	13857955.960	3217030.737	-15.64	SJGB020	-48.17	80	-2	22	-37.64	32	-47.64	22.00	10.00	45.64	2847	1210	1.25	21.71	-15.93	1.82
SJSB098	13857874.760	3216977.358	-14.36	SJGB019	-49.82	137	1.5	20	-34.36	35.1	-49.46	20.00	15.10	50.96	3179	1826	1.25	19.84	-14.52	1.80
	13857874.760	3216977.358	-14.36	SJSB057	-73.1	80	-2	17	-31.36	58.2	-72.56	17.00	41.20	70.56	4402	4983	1.25	4.80	-26.56	1.72
SJSB099	13857764.250	3216947.207	-0.61	SJGB002	-58.75	80	-2	34	-34.11	59.5	-60.11	33.50	26.00	58.11	3625	3145	1.25	12.81	-21.30	1.75
SJSB100	13857919.310	3216899.688	-13.36	SJSB057	-73.1	67	-2	17	-30.36	63	-76.36	17.00	46.00	74.36	4639	5564	1.25	2.17	-28.19	1.71
	13857919.310	3216899.688	-13.36	SJGB019	-49.82	67	1.5	20	-33.36	35	-48.36	20.00	15.00	49.86	3111	1814	1.25	19.16	-14.20	1.79
SJSB101	13857709.580	3216809.881	-0.15	SJGB002	-58.75	63	-2	34	-33.65	59.5	-59.65	33.50	26.00	57.65	3597	3145	1.25	12.48	-21.17	1.75
SJSB102	13857180.230	3217192.143	-2.05	SJGB008	-61	133	-2	23	-25.05	58	-60.05	23.00	35.00	58.05	3622	4233	1.25	2.71	-22.34	1.71
SJSB103	13857998.430	3216974.835	-30.72	SJSB057	-73.1	43	-2	17	-47.72	57	-87.72	17.00	40.00	85.72	5348	4838	1.25	17.06	-30.66	1.75
	13857998.430	3216974.835	-15.35	SJGB020	-48.17	87	1.5	22	-37.35	32	-47.35	22.00	10.00	48.85	3048	1210	1.25	24.02	-13.33	1.82
SJSB104	13857613.240	3217397.901	-5.49	SJBG005	-65	140	-2	26	-31.49	60.5	-65.99	26.00	34.50	63.99	3992	4173	1.25	7.55	-23.94	1.73
SJSB105	13857485.550	3217440.440	-4.36	SJGB007	-67.75	153	-2	23	-27.36	64.5	-68.86	23.00	41.50	66.86	4171	5020	1.25	1.80	-25.56	1.71
SJSB106	13857469.990	3217311.018	-3.10	SJGB007	-67.75	173	-2	23	-26.10	64.5	-67.60	23.00	41.50	65.60	4093	5020	1.25	0.89	-25.21	1.71

Total BC Unit Weight	19.0	kN/m3	121.0	pcf
Total BC Unit Weight	19.5	kN/m3	124.1	pcf
Total Sediment Unit Weight	17.0	kN/m3	108.2	pcf
Water Unit Weight	9.8	kN/m3	62.4	pcf
Total FS	1.25			
Effective BC Unit Weight	9.2	kN/m3	58.6	pcf
Effective BS Unit Weight	9.7	kN/m3	61.8	pcf
Effective Sediment Unit Weight	7.2	kN/m3	45.8	pcf
Effective FS	1.5			
Conversion kN/m3 to pcf	6.37			

Notes:
ft = feet
NAD83 = North American Datum of 1983
piezo = piezometer
BC = Beaumont Clay
BS = Beaumont Sand
psf = pounds per square foot
kN/m^3 = kilonewtons per cubic meter
pcf = pounds per cubic foot
FS = Factor of Safety
Orange highlighted rows indicate instances where geotechnical conditions from the closest two geotechnical borings were applied to those locations to assess hydraulic heave. The more conservative of the two assumptions will be carried forward for the basis of design.

Table 2B

Elevations of Excavation to Maintain Hydraulic Heave Safety Factor of 1.25 - Assumption 2
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Location	Northing (NAD83)	Easting (NAD83)	Surface/Riverbed Elevation	Reference Borehole	BS Elevation in Reference Borehole (ft)	Distance From Borehole (ft)	Aquifer Piezo Elevation (ft)	BC Depth (ft)	BC Elevation (ft)	BS Depth (ft)	BS Elevation (ft)	Sediment Thickness (ft)	BC Thickness (ft)	Pressure Head (ft)	Uplift Porepressure (psf)	BC Layer Total Pressure (psf)	FS	Required Sediment Thickness (ft)	Total Analysis Required Minimum Excavation Elevation (ft)	Corresponding Effective Analysis FS
SJGB010	13857411.203	3216753.589	3.00	SJGB001	-56	107	-2	29	-26	59.5	-56	29	30	54	3369	3629	1.25	5.38	-20.62	1.73
SJGB011	13857474.591	3216925.733	3.00	SJCPT-011	-53.4	83	-2	33	-30	58.4	-53.4	33	23.4	51.4	3207	2830	1.25	10.89	-19.11	1.75
SJGB012	13857611.312	3216819.464	3.00	SJCPT-011	-53.4	93	-2	33	-30	58.4	-53.4	33	23.4	51.4	3207	2830	1.25	10.89	-19.11	1.75
SJSB013	13857852.438	3216918.897	-12.5	SJGB018	-53.43	113	-2	30	-42.5	37.5	-53.43	30	10.93	51.43	3209	1322	1.25	24.84	-17.66	1.82
SJGB014	13857716.960	3217158.780	-1.50	SJGB053	-66.7	166	-2	15	-16.5	81	-66.7	15	50.2	64.7	4036	6072	1.25	-9.48	-25.98	1.67
SJGB016	13857551.031	3217162.509	-0.50	SJCPT-011	-53.4	267	-2	33	-33.5	58.4	-53.4	33	19.9	51.4	3207	2407	1.25	14.80	-18.70	1.77
SJGB017	13857352.164	3217191.717	-0.50	SJGB008	-61	207	-2	23	-23.5	58	-61	23	37.5	59	3681	4536	1.25	0.60	-22.90	1.71
SJSB028	13857067.126	3217256.398	1.25	SJGB008	-61	264	-2	23	-25.26	58	-61	23	32.8	56.06	3497	3967	1.25	3.74	-21.48	1.72
SJSB029	13857119.314	3217153.087	2.64	SJGB008	-61	193	-2	23	-20.36	58	-61	23	40.64	59	3681	4916	1.25	-2.91	-23.27	1.69
SJSB030	13857220.516	3216971.008	4.33	SJMW17	-58	120	-2	23	-18.67	63	-58	23	39.33	56	3494	4757	1.25	-3.60	-22.27	1.69
SJSB031	13857295.051	3216774.912	6.00	SJMW17	-58	120	-2	23	-17	63	-58	23	41	56	3494	4959	1.25	-5.47	-22.47	1.68
SJSB032	13857444.802	3216651.498	3.21	SJGB001	-56	120	-2	29	-25.79	59.5	-56	29	30.21	54	3369	3654	1.25	5.15	-20.64	1.72
SJSB033	13857624.835	3216746.671	4.59	SJGB023	-61.66	100	-2	29.5	-24.91	59.8	-61.66	29.5	36.75	59.66	3722	4445	1.25	1.92	-22.99	1.71
SJSB034	13857689.491	3217045.977	8.00	SJCPT-011	-53.4	200	-2	33	-25	58.4	-53.4	33	28.4	51.4	3207	3435	1.25	5.30	-19.70	1.73
SJSB035	13857460.903	3217021.623	8.00	SJCPT-011	-53.4	167	-2	33	-25	58.4	-53.4	33	28.4	51.4	3207	3435	1.25	5.30	-19.70	1.73
SJSB036	13857475.106	3216859.930	2.00	SJCPT-011	-53.4	97	-2	33	-10.75	58.4	-53.4	12.75	42.65	51.4	3207	5159	1.25	-10.63	-21.38	1.66
SJSB037	13857687.402	3216908.317	2.00	SJGB002	-58.75	73	-2	33.5	-31.5	59.5	-58.75	33.5	27.25	56.75	3540	3296	1.25	10.44	-21.06	1.74
SJSB038	13857563.077	3217138.458	-0.50	SJCPT-011	-53.4	240	-2	33	-33.5	58.4	-53.4	33	19.9	51.4	3207	2407	1.25	14.80	-18.70	1.77
SJSB045	13857135.810	3217343.067	-2.10	SJGB008	-61	57	-2	23	-25.1	58	-61	23	35.9	59	3681	4342	1.25	2.39	-22.71	1.71
SJSB045-C1	13857149.350	3217285.350	-1.30	SJGB008	-61	63	-2	23	-24.3	58	-61	23	36.7	59	3681	4439	1.25	1.50	-22.80	1.71
SJSB046	13857183.750	3217236.016	-2.00	SJGB008	-61	96	-2	23	-25	58	-61	23	36	59	3681	4354	1.25	2.28	-22.72	1.71
SJSB046-C1	13857229.000	3217174.000	-2.39	SJGB008	-61	150	-2	23	-25.39	58	-61	23	35.61	59	3681	4307	1.25	2.72	-22.67	1.71
SJSB047	13857278.320	3217421.371	-2.10	SJGB047	-53.4	0	-2	22	-24.1	50	-53.4	22	29.3	51.4	3207	3544	1.25	4.29	-19.81	1.72
SJSB047-C1	13857302.550	3217340.988	-4.00	SJGB047	-53.4	80	-2	22	-26	50	-53.4	22	27.4	51.4	3207	3314	1.25	6.41	-19.59	1.73
SJSB048	13857396.530	3217503.368	-2.40	SJGB007	-67.75	107	-2	23	-25.4	64.5	-67.75	23	42.35	65.75	4102	5122	1.25	0.05	-25.35	1.70
SJSB048-C1	13857398.780	3217445.299	-4.00	SJGB007	-67.75	67	-2	23	-27	64.5	-67.75	23	40.75	65.75	4102	4929	1.25	1.83	-25.17	1.71
SJSB049	13857406.390	3217395.258	-5.10	SJGB007	-67.75	77	-2	23	-28.1	64.5	-67.75	23	39.65	65.75	4102	4796	1.25	3.06	-25.04	1.71
SJSB050	13857546.330	3217527.884	-3.40	SJGB005	-65	67	-2	26	-29.4	60.5	-65	26	35.6	63	3930	4306	1.25	5.61	-23.79	1.72
SJSB050-C1	13857558.160	3217389.116	-6.30	SJGB005	-65	120	-2	26	-32.3	60.5	-65	26	32.7	63	3930	3955	1.25	8.85	-23.45	1.73
SJSB051	13857682.020	3217424.684	-2.70	SJGB004	-62.75	93	-2	28	-30.7	59.5	-62.75	28	32.05	60.75	3790	3877	1.25	7.96	-22.74	1.73
SJSB052	13857661.470	3217319.770	-5.70	SJGB004	-62.75	133	-2	28	-33.7	59.5	-62.75	28	29.05	60.75	3790	3514	1.25	11.31	-22.39	1.74
SJSB052-C1	13857626.750	3217222.469	-2.20	SJGB053	-66.7	190	-2	17	-19.2	57	-66.7	17	47.5	64.7	4036	5745	1.25	-6.47	-25.67	1.68
SJSB053	13857799.520	3217301.198	-9.70	SJGB053	-66.7	0	-2	17	-26.7	57	-66.7	17	40	64.7	4036	4838	1.25	1.92	-24.78	1.71
SJSB053-C1	13857775.270	3217268.406	-7.40	SJGB053	-66.7	40	-2	17	-24.4	57	-66.7	17	42.3	64.7	4036	5116	1.25	-0.65	-25.05	1.70
SJSB054	13857745.960	3217282.887	-7.40	SJGB053	-66.7	57	-2	17	-24.4	57	-66.7	17	42.3	64.7	4036	5116	1.25	-0.65	-25.05	1.70
SJSB055	13857915.360	3217183.420	-4.90	SJGB003	-95.17	60	-2	33	-37.9	84.5	-95.17	33	57.27	93.17	5813	6927	1.25	3.13	-34.77	1.71
	13857915.360	3217183.420	-4.90	SJGB020	-48.17	113	1.5	22	-26.9	40	-48.17	22	21.27	49.67	3099	2573	1.25	12.02	-14.88	1.76
SJSB055-C1	13857843.355	3217150.478	-9.54	SJGB003	-95.17	30	-2	33	-42.54	84.5	-95.17	33	52.63	93.17	5813	6366	1.25	8.32	-34.22	1.72
SJSB056	13857942.460	3217077.154	-12.40	SJBG057	-73.1	113	-2	17	-29.4	63	-73.1	17	43.7	71.1	4436	5286	1.25	2.39	-27.01	1.71
	13857942.460	3217077.154	-12.40	SJGB020	-48.17	100	1.5	22	-34.4	40	-48.17	22	13.77	49.67	3099	1666	1.25	20.40	-14.00	1.80
SJSB056-C1	13857851.608	3217058.119	-4.29	SJSB003	-95.17	100	-2	33	-37.29	84.5	-95.17	33	57.88	93.17	5813	7001	1.25	2.45	-34.84	1.71
SJSB057	13857956.449	3216960.196	-17.1	SJSB057	-73.1	0	-2	17	-34.1	63	-73.1	17	39	71.1	4436	4717	1.25	7.65	-26.45	1.73
	13857956.449	3216960.196	-17.1	SJGB019	-49.82	77	1.5	20	-37.1	35.1	-49.82	20	12.72	51.32	3202	1539	1.25	22.76	-14.34	1.81
SJSB058	13857700.162	3216855.509	0.62	SJGB002	-58.75	43	-2	33.5	-32.88	59.5	-58.75	33.5	25.87	56.75	3540	3129	1.25	11.98	-20.90	1.75
SJSB070	13857778.065	3216886.192	-1.17	SJGB002	-58.75	43	-2	33.5	-34.67	59.5	-58.75	33.5	24.08	56.75	3540	2913	1.25	13.98	-20.69	1.76
SJSB071	13857719.189	3216821.133	-0.8	SJGB002	-58.75	43	-2	33.5	-34.3	59.5	-58.75	33.5	24.45	56.75	3540	2957	1.25	13.57	-20.73	1.76
SJSB072	13857614.250	3216842.652	1.42	SJCPT-011	-53.4	67	-2	33	-31.58	58.4	-53.40	33.00	21.82	51.40	3207	2639	1.25	12.65	-18.93	1.76
SJSB073	13857593.160	3216960.041	1.29	SJCPT-011	-53.4	67	-2	33	-31.71	58.4	-53.40	33.00	21.69	51.40	3207	2623	1.25	12.80	-18.91	1.76
SJSB074	13857543.710	3216728.114	3.34	SJGB001	-56	33	-2	29	-25.66	59.5	-56.00	29.00	30.34	54.00	3369	3670	1.25	5.00	-20.66	1.72
SJSB075	13857486.820	3216843.803	2.28	SJGB001	-56	93	-2	29	-26.72	59.5	-56.00	29.00	29.28	54.00	3369	3542	1.25	6.19	-20.53	1.73
SJSB076	13857508.770	3216910.806	2.26	SJCPT-011	-53.4	60	-2	33	-30.74	58.4	-53.40	33.00	22.66	51.40	3207	2741	1.25	11.71	-19.03	1.75
SJSB077	13857411.880	3216736.668	1.42	SJGB001	-56	100	-2	29.00	-27.58	59.5	-56.00	29.00	28.42	54.00	3369	3438	1.25	7.15	-20.43	1.73
SJSB078	13857430.030	3216823.139	1.82	SJGB001	-56	107	-2	29.00	-27.18	59.5	-56.00	29.00	28.82	54.00	3369	3486	1.25	6.70	-20.48	1.73
SJSB079	13857381.900	3216888.271	1.05	SJMW17	-60	177	-2	23	-21.95	63	-60.00	23.00	38.05	58.00	3618	4602	1.25	-0.73	-22.68	1.70
SJSB080	13857320.220	3216827.045	1.77	SJMW17	-60	100	-2	23	-21.23	63	-60.00	23.00	38.77	58.00	3618	4689	1.25	-1.54	-22.77	1.70
SJSB081	13857276.460	3217054.335	-2.26	SJMW17	-60	120	-2	23.00	-25.26	63	-60.00	23.00	34.74	58.00	3618	4202	1.25	2.97	-22.29	1.71
SJSB082	13857216.120	3217091.823	-1.75	SJMW17	-60	200	-2	23.00	-24.75	63	-60.00	23.00	35.25	58.00	3618	4264	1.25	2.40	-22.35	1.71
SJSB083	13857242.260	3217187.497	-2.93	SJGB008	-61	153	-2	23.00	-25.93	58	-61.00	23.00	35.07	59.00	3681	4242	1.25	3.32	-22.61	1.72
SJSB084	13857243.090	3217292.257	-3.86	SJGB008	-61	67	-2	23.00	-26.86	58	-61.00	23.00	34.14	59.00	3681	4129	1.25	4.36	-22.50	1.72
SJSB085	13857350.670	3217370.887	-5.67	SJGB007	-68.5	53	-2	23.00	-28.67	64.5	-68.50	23.00	39.83	66.50	4149	4818	1.25	3.40	-25.27	1.71
SJSB086	13857292.630	3217249.901	-2.72	SJGB008	-61	130	-2	23.00	-25.72	58	-61.00	23.00	35.28	59.00	3681	4267	1.25	3.08	-22.64	1.71
SJSB087	13857311.470	3217114.943	-3.01	SJMW17	-60	240	-2	23	-26.01	63	-60.00	23.00	33.99	58.00	3618	4111	1.25	3.81	-22.20	1.72
SJSB088	13857488.390	3217119.275	-2.12	SJCPT-011	-53.4	240	-2	33	-35.12	58.4	-53.40	33.00	18.28	51.40	3207	2211	1.25	16.61	-18.51	1.78
SJSB089	13857426.020	3217214.579	-2.88	SJGB007	-67.75	220	-2	23.00	-25.88	49.9	-67.75	23.00	41.87	65.75	4102	5064	1.25	0.58	-25.30	1.71
SJSB090	13857506.130	3217218.409	-1.50	SJGB007	-67.75	267	-2	23.00	-24.50	49.9	-67.75	23.00	43.25	65.75	4102	5231	1.25	-0.96	-25.46	1.70
SJSB091	13857487.240	3217383.273	-3.58	SJGB007	-67.75	160	-2	23.00	-26.58	54.6	-67.75	23.00	41.17	65.75	4102	4980	1.25	1.37	-25.21	1.71
SJSB092	13857618.600	3217303.607	-4.93	SJGB053	-66.7	187	-2	17.00	-21.93	57	-66.70	17.00	44.77	64.70	4036	5415	1.25	-3.42	-25.35	1.69
SJSB093	13857582.780	3217129.479	-1.53	SJCPT-011	-53.4	200	-2	33	-34.53	58.4	-53.40	33.00	18.87	51.40	3207	2282	1.25	15.95	-18.58	1.77
SJSB094	13857691.550	3217241.216	-4.22	SJSB053	-69	120	-2	17.00	-21.22	57	-69.00	17.00	47.78	67.00	4180	5779	1.25	-5.12	-26.34	1.69
SJSB095	13857790.230	3217133.851	-2.07	SJGB003	-95.17	80	-2	33.00	-35.07	84.5	-95.17	33.00	60.10	93.17	5813	7269	1.25	-0.03	-35.10	1.70
SJSB096	13857798.660	3217196.291	-6.55	SJGB003	-95.17	73	-2	33.00	-39.55	84.5	-95.17	33.00	55.62	93.17	5813	6727	1.25	4.97	-34.58	1.72
SJSB097	13857955.960	3217030.737	-15.64	SJSB057	-73.1	67	-2	17.00	-32.64	57	-73.10	17.00	40.46	71.10	4436	4894	1.25	6.01	-26.63	1.72
	13857955.960	3217030.737	-15.64	SJGB020	-48.17	80	1.5	22.00	-37.64	32	-48.17	22.00	10.53	49.67	3099	1274	1.25	24.02	-13.62	1.82
SJSB098	13857874.760	3216977.358	-14.36	SJGB019	-49.82	137	1.5	20.00	-34.36	35.1	-49.82	20.00	15.46	51.32	3202	1870	1.25	19.70	-14.66	1.79
	13857874.760	3216977.358	-14.36	SJSB057	-73.1	80	-2	17.00	-31.36	58.2	-73.10	17.00	41.74	71.10	4436	5049	1.25	4.58	-26.78	1.72
SJSB099	13857764.250	3216947.207	-0.61	SJGB002	-58.75	80	-2	33.50	-34.11	59.5	-58.75	33.50	24.64	56.75	3540	2980	1.25	13.35	-20.76	1.76
SJSB100	13857919.310	3216899.688	-13.36	SJSB057	-73.1	67	-2	17.00	-30.36	63	-73.10	17.00	42.74	71.10	4436	5170	1.25	3.47	-26.89	1.71
	13857919.310	3216899.688	-13.36	SJGB019	-49.82	67	1.5	20.00	-33.36	35	-49.82	20.00	16.46	51.32	3202	1991	1.25	18.58	-14.78	1.79
SJSB101	13857709.580	3216809.881	-0.15	SJGB002	-58.75	63	-2	33.50	-33.65	59.5	-58.75	33.50	25.10	56.75	3540	3036	1.25	12.84	-20.81	1.75
SJSB102	13857180.230	3217192.143	-2.05	SJGB008	-61	133	-2	23.00	-25.05	58	-61.00	23.00	35.95	59.00	3681	4348	1.25	2.34	-22.71	1.71
SJSB103	13857998.430	3216974.835	-30.72	SJSB057	-73.1	43	-2	17.00	-47.72	57	-73.10	17.00	25.38	71.10	4436	3070	1.25	22.87	-24.85	1.78
	13857998.430	3216974.835	-15.35	SJGB020	-48.17	87	1.5	22.00	-37.35	32	-48.17	22.00	10.82	49.67	3099	1309	1.25	23.70	-13.65	1.82
SJSB104	13857613.240	3217397.901	-5.49	SJBG005	-65	140	-2	26.00	-31.49	60.5	-65.00	26.00	33.51	63.00	3930	4053	1.25	7.94	-23.55	1.73
SJSB105	13857485.550	3217440.440	-4.36	SJGB007	-67.75	153	-2	23.00	-27.36	64.5	-67.75	23.00	40.39	65.75	4102	4885	1.25	2.24	-25.12	1.71
SJSB106	13857469.990	3217311.018	-3.10	SJGB007	-67.75	173	-2	23.00	-26.10	64.5	-67.75	23.00	41.65	65.75	4102	5038	1.25	0.83	-25.27	1.71

Total BC Unit Weight	19.0	kN/m3	121.0	pcf
Total BC Unit Weight	19.5	kN/m3	124.1	pcf
Total Sediment Unit Weight	17.0	kN/m3	108.2	pcf
Water Unit Weight	9.8	kN/m3	62.4	pcf
Total FS	1.25			
Effective BC Unit Weight	9.2	kN/m3	58.6	pcf
Effective BS Unit Weight	9.7	kN/m3	61.8	pcf
Effective Sediment Unit Weight	7.2	kN/m3	45.8	pcf
Effective FS	1.5			
Conversion kN/m3 to pcf	6.37			

Notes:
- ft = feet
- NAD83 = North American Datum of 1983
- piezo = piezometer
- BC = Beaumont Clay
- BS = Beaumont Sand
- psf = pounds per square foot
- kN/m^3 = kilonewtons per cubic meter
- pcf = pounds per cubic foot
- FS = Factor of Safety
- Orange highlighted rows indicate instances where geotechnical conditions from the closest two geotechnical borings were applied to those locations to assess hydraulic heave. The more conservative of the two assumptions will be carried forward for the basis of design.

Table 3

Elevations of Excavation to Maintain Hydraulic Heave Safety Factor of 1.25 - Assumption 1 and 2
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Boring Location	Required Elevations for Assumption 1 (')	Required Elevations for Assumption 2 (')	Recommended Elevations for Excavation Surface (')
SJGB010	-20.82	-20.62	**-20.62**
SJGB011	-19.91	-19.11	**-19.11**
SJGB012	-19.91	-19.11	**-19.11**
SJSB013	-16.29	-17.66	**-16.29**
SJGB014	-32.26	-25.98	**-25.98**
SJGB016	-20.89	-18.70	**-18.70**
SJGB017	-21.90	-22.90	**-21.90**
SJSB028	-21.48	-21.48	**-21.48**
SJSB029	-21.03	-23.27	**-21.03**
SJSB030	-22.54	-22.27	**-22.27**
SJSB031	-22.07	-22.47	**-22.07**
SJSB032	-20.76	-20.64	**-20.64**
SJSB033	-20.43	-22.99	**-20.43**
SJSB034	-18.51	-19.70	**-18.51**
SJSB035	-18.51	-19.70	**-18.51**
SJSB036	-22.57	-21.38	**-21.38**
SJSB037	-20.57	-21.06	**-20.57**
SJSB038	-20.89	-18.70	**-18.70**
SJSB045	-22.35	-22.71	**-22.35**
SJSB045-C1	-22.13	-22.80	**-22.13**
SJSB046	-22.32	-22.72	**-22.32**
SJSB046-C1	-22.43	-22.67	**-22.43**
SJSB047	-19.29	-19.81	**-19.29**
SJSB047-C1	-19.82	-19.59	**-19.59**
SJSB048	-25.02	-25.35	**-25.02**
SJSB048-C1	-25.46	-25.17	**-25.17**
SJSB049	-25.77	-25.04	**-25.04**
SJSB050	-23.35	-23.79	**-23.35**
SJSB050-C1	-24.16	-23.45	**-23.45**
SJSB051	-22.53	-22.74	**-22.53**
SJSB052	-23.36	-22.39	**-22.39**
SJSB052-C1	-22.69	-25.67	**-22.69**
SJSB053	-24.78	-24.78	**-24.78**
SJSB053-C1	-24.14	-25.05	**-24.14**
SJSB054	-24.14	-25.05	**-24.14**
SJSB055	-32.48	-34.77	**-13.58**
	-13.58	-14.88	
SJSB055-C1	-33.78	-34.22	**-33.78**
SJSB056	-27.92	-27.01	**-14.00**
	-15.68	-14.00	
SJSB056-C1	-32.31	-34.84	**-32.31**
SJSB057	-29.23	-26.45	**-14.34**
	-15.28	-14.34	
SJSB058	-20.95	-20.90	**-20.90**
SJSB070	-21.45	-20.69	**-20.69**
SJSB071	-21.35	-20.73	**-20.73**
SJSB072	-20.35	-18.93	**-18.93**
SJSB073	-20.39	-18.91	**-18.91**
SJSB074	-20.72	-20.66	**-20.66**
SJSB075	-21.02	-20.53	**-20.53**
SJSB076	-20.12	-19.03	**-19.03**
SJSB077	-21.26	-20.43	**-20.43**
SJSB078	-21.15	-20.48	**-20.48**
SJSB079	-23.46	-22.68	**-22.68**
SJSB080	-23.26	-22.77	**-22.77**
SJSB081	-24.38	-22.29	**-22.29**
SJSB082	-24.24	-22.35	**-22.35**
SJSB083	-22.58	-22.61	**-22.58**
SJSB084	-22.84	-22.50	**-22.50**
SJSB085	-25.93	-25.27	**-25.27**
SJSB086	-22.52	-22.64	**-22.52**
SJSB087	-24.59	-22.20	**-22.20**
SJSB088	-21.34	-18.51	**-18.51**
SJSB089	-19.35	-25.30	**-19.35**
SJSB090	-18.97	-25.46	**-18.97**
SJSB091	-21.42	-25.21	**-21.42**
SJSB092	-23.45	-25.35	**-23.45**
SJSB093	-21.17	-18.58	**-18.58**
SJSB094	-23.25	-26.34	**-23.25**
SJSB095	-31.69	-35.10	**-31.69**
SJSB096	-32.94	-34.58	**-32.94**
SJSB097	-26.44	-26.63	**-13.62**
	-15.93	-13.62	
SJSB098	-14.52	-14.66	**-14.52**
	-26.56	-26.78	
SJSB099	-21.30	-20.76	**-20.76**
SJSB100	-28.19	-26.89	**-14.20**
	-14.20	-14.78	
SJSB101	-21.17	-20.81	**-20.81**
SJSB102	-22.34	-22.71	**-22.34**
SJSB103	-30.66	-24.85	**-13.33**
	-13.33	-13.65	
SJSB104	-23.94	-23.55	**-23.55**
SJSB105	-25.56	-25.12	**-25.12**
SJSB106	-25.21	-25.27	**-25.21**

Table 4

Hydraulic Heave Evaluation Summary
Hydraulic Heave Analysis
Northern Impoundment - San Jacinto River Waste Pits Superfund Site

Boring Location	FS = 1.25 Excavation Limit (')	Minimum Excavation Elevation (')*	Heave Concern (Delta ')	Elevation of Water Level Needed to Counter Heave (')
SJGB010	-20.62	-6.32	-14.30	-
SJGB011	-19.11	-9.59	-9.52	-
SJGB012	-19.11	-7.57	-11.54	-
SJSB013	-16.29	-16.04	**-0.25**	-
SJGB014	-25.98	-9.22	-16.76	-
SJGB016	-18.70	-6.07	-12.63	-
SJGB017	-21.90	-17.85	**-4.05**	-
SJSB028	-21.48	-1.52	-19.96	-
SJSB029	-21.03	2.68	-23.71	-
SJSB030	-22.27	4.33	-26.60	-
SJSB031	-22.07	5.12	-27.19	-
SJSB032	-20.64	-8.29	-12.35	-
SJSB033	-20.43	-8.88	-11.55	-
SJSB034	-18.51	6.99	-25.50	-
SJSB035	-18.51	6.64	-25.15	-
SJSB036	-21.38	-10.75	-10.63	-
SJSB037	-20.57	-9.57	-11.00	-
SJSB038	-18.70	-12.98	-5.72	-
SJSB045	-22.35	-2.10	-20.25	-
SJSB045-C1	-22.13	-13.30	-8.83	-
SJSB046	-22.32	-20.00	**-2.32**	-
SJSB046-C1	-22.43	-20.39	**-2.04**	-
SJSB047	-19.29	-2.10	-17.19	-
SJSB047-C1	-19.59	-20.00	**0.41**	-
SJSB048	-25.02	-2.40	-22.62	-
SJSB048-C1	-25.17	-22.00	**-3.17**	-
SJSB049	-25.04	-19.10	-5.94	-
SJSB050	-23.35	-3.40	-19.95	-
SJSB050-C1	-23.45	-6.30	-17.15	-
SJSB051	-22.53	-2.70	-19.83	-
SJSB052	-22.39	-5.70	-16.69	-
SJSB052-C1	-22.69	-2.20	-20.49	-
SJSB053	-24.78	-9.70	-15.08	-
SJSB053-C1	-24.14	-7.40	-16.74	-
SJSB054	-24.14	-23.40	**-0.74**	-
SJSB055	-13.58	-4.90	-8.68	-
SJSB055-C1	-33.78	-13.54	-20.24	-
SJSB056	-14.00	-12.40	**-1.60**	-
SJSB056-C1	-32.31	-4.29	-28.02	-
SJSB057	-14.34	-26.39	**12.05**	**-7.50**
SJSB058	-20.90	-17.38	**-3.52**	-
SJSB070	-20.69	-15.17	-5.52	-
SJSB071	-20.73	-18.80	**-1.93**	-
SJSB072	-18.93	-20.58	**1.65**	-
SJSB073	-18.91	-10.71	-8.20	-
SJSB074	-20.66	-4.66	-16.00	-
SJSB075	-20.53	-9.72	-10.81	-
SJSB076	-19.03	-9.74	-9.29	-
SJSB077	-20.43	-14.58	-5.85	-
SJSB078	-20.48	-20.18	**-0.30**	-
SJSB079	-22.68	-10.95	-11.73	-
SJSB080	-22.77	-8.23	-14.54	-
SJSB081	-22.29	-14.26	-8.03	-
SJSB082	-22.35	-11.75	-10.60	-
SJSB083	-22.58	-14.93	-7.65	-
SJSB084	-22.50	-9.86	-12.64	-
SJSB085	-25.27	-13.67	-11.60	-
SJSB086	-22.52	-2.72	-19.80	-
SJSB087	-22.20	-19.01	**-3.19**	-
SJSB088	-18.51	-20.12	**1.61**	-
SJSB089	-19.35	-14.88	**-4.47**	-
SJSB090	-18.97	-11.50	-7.47	-
SJSB091	-21.42	-3.58	-17.84	-
SJSB092	-23.45	-18.93	**-4.52**	-
SJSB093	-18.58	-15.53	**-3.05**	-
SJSB094	-23.25	-16.22	-7.03	-
SJSB095	-31.69	-18.07	-13.62	-
SJSB096	-32.94	-18.55	-14.39	-
SJSB097	-13.62	-15.64	**2.02**	-
SJSB098	-14.52	-28.36	**13.84**	**-4.45**
SJSB099	-20.76	-12.61	-8.15	-
SJSB100	-14.20	-15.36	**1.16**	-
SJSB101	-20.81	-12.15	-8.66	-
SJSB102	-22.34	-20.05	**-2.29**	-
SJSB103	-13.33	-15.36	**2.03**	-
SJSB104	-23.55	-5.49	-18.06	-
SJSB105	-25.12	-20.36	**-4.76**	-
SJSB106	-25.21	-5.10	-20.11	-

Note:
* Elevation of deepest concentration >30 nanograms per kilogram (ng/kg) TEQ. Some boring locations may require deeper excavation based on the final grading plan.
FS = Factor of Safety

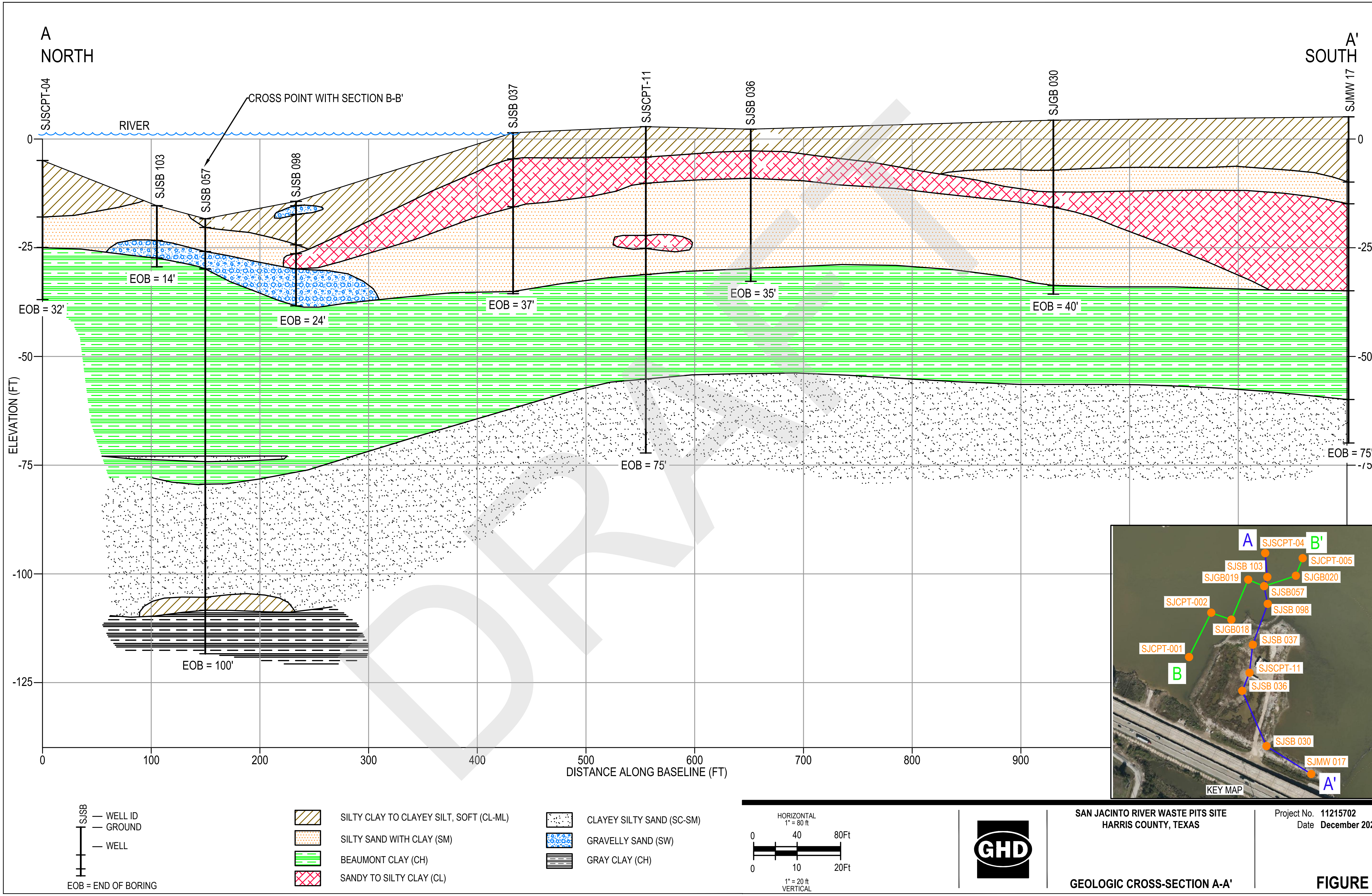
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

Project No. 11215702
Revision No. -
Date Dec 7, 2021

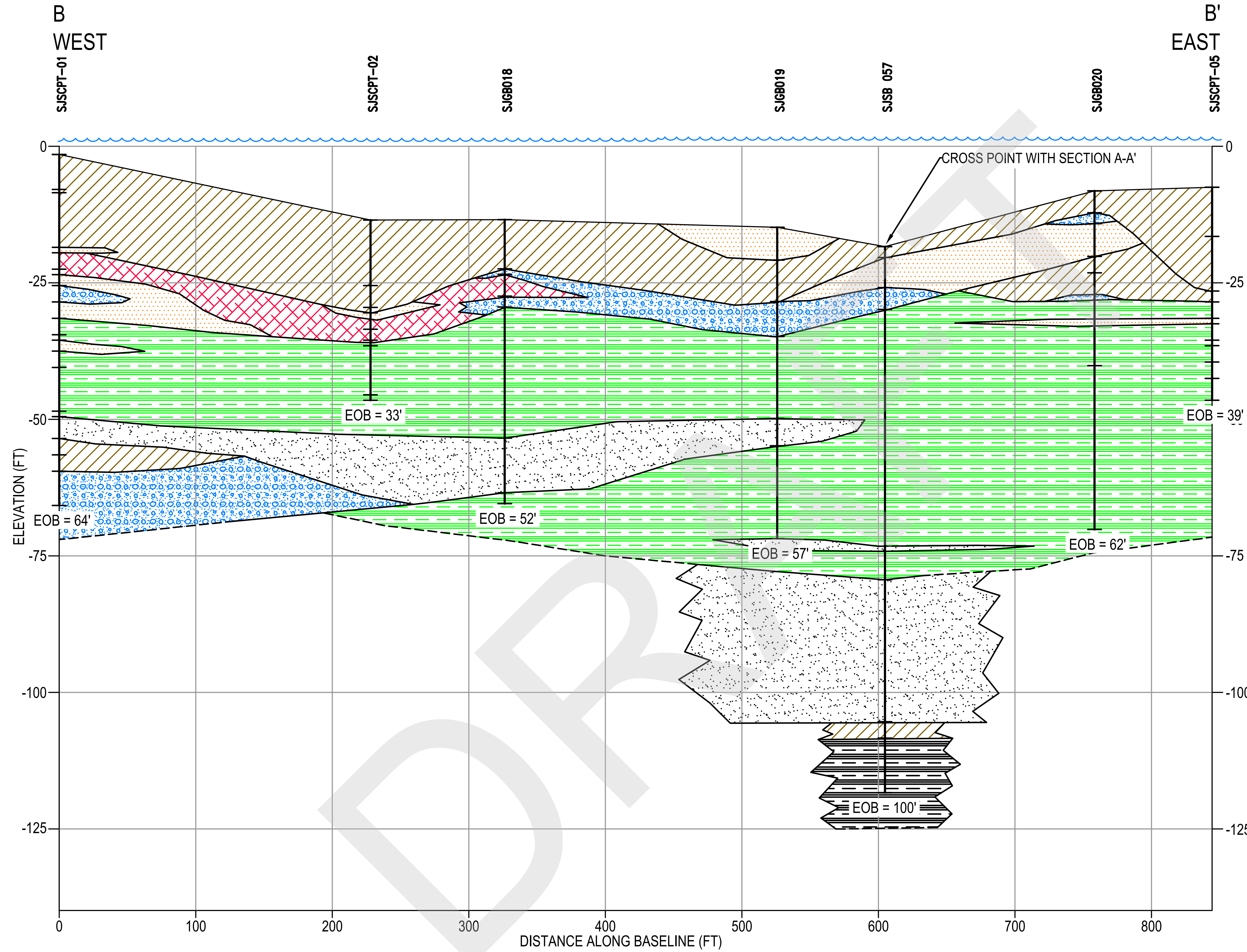
SITE LOCATIONS PLAN - SOUNDING LOCATIONS

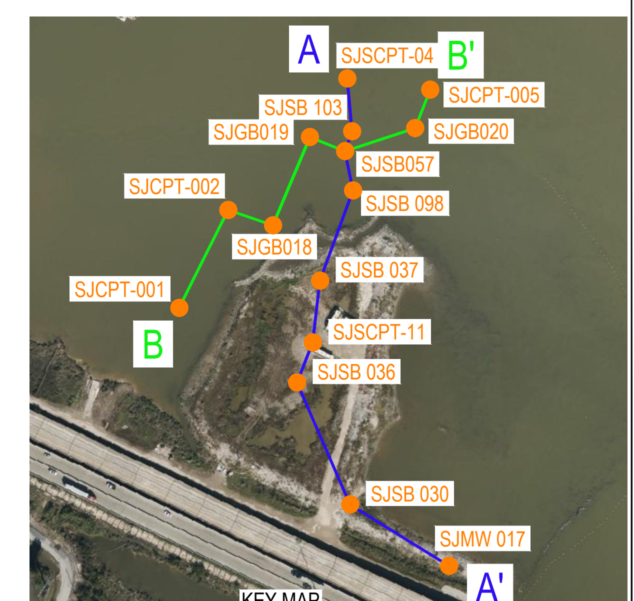
FIGURE 1

Data source: Imagery - Google, 2019.



Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Figures\MISC-001\11215702-GHD-0000-MISC-0101_DE-001.dwg
Plot Date: 07 December 2021 9:52 AM





SJSB — WELL ID
— GROUND
— WELL

EOB = END OF BORING

- SILTY CLAY TO CLAYEY SILT, SOFT (CL-ML)
- SILTY SAND WITH CLAY (SM)
- BEAUMONT CLAY (CH)
- SANDY TO SILTY CLAY (CL)
- CLAYEY SILTY SAND (SC-SM)
- GRAVELLY SAND (SW)
- GRAY CLAY (CH)

HORIZONTAL
1" = 80 ft
0 40 80Ft

0 10 20Ft
1" = 20 ft
VERTICAL

GHD

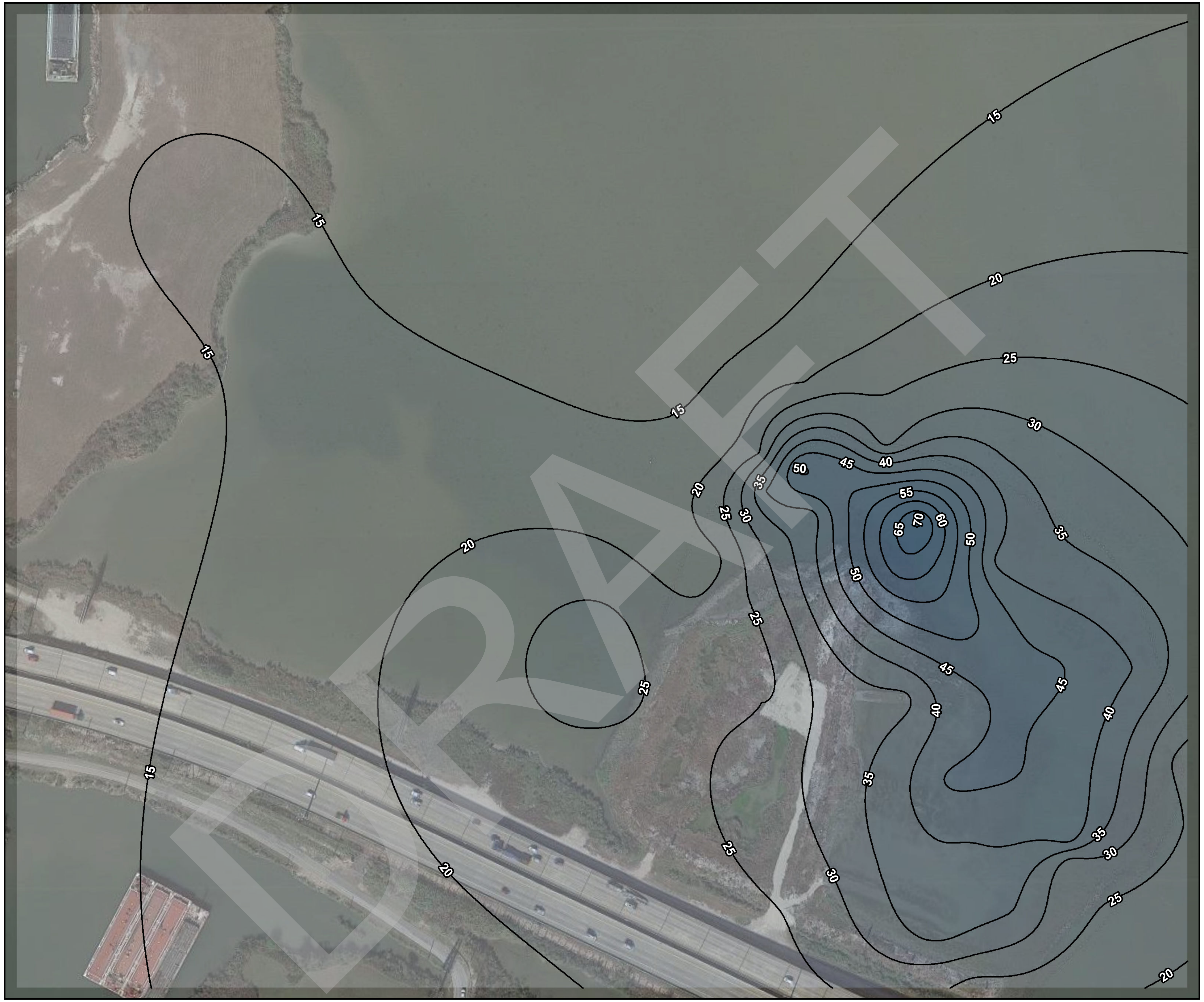
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

GEOLOGIC CROSS-SECTION B-B'

Project No. **11215702**
Date **December 2021**

FIGURE 3

Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Figures\MISC-001\11215702-GHD-0000-MISC-0101_DE-001.dwg
Plot Date: 07 December 2021 9:53 AM



Legend

Contour

Thickness (ft)

- 0 - 15
- 15 - 20
- 20 - 25
- 25 - 30
- 30 - 35
- 35 - 40
- 40 - 45
- 45 - 50
- 50 - 55
- 55 - 60
- 60 - 65
- 65 - 70
- 70 - 75

Paper Size ANSI B

0 50 100 150 200

Feet

N

Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

GHD

SAN JACINTO RIVER WASTE PITS
CHANNELVIEW, HARRIS COUNTY, TEXAS

BEAUMONT CLAY
THICKNESS CONTOUR

Project No. **11215702**
Revision No. **-**
Date **Dec 6, 2021**

FIGURE 4

Q:\GIS\PROJECTS\11215000s\11215702\Beaumont Clay\11215702_202111_BeaumontClay_GIS004.mxd

Data source: Google Earth, Imagery Date 11/16/2020

Appendices

Appendix A

Beaumont Clay Sample Photographs

Site Photographs

Photo 1 *Figure D.1: Sample G11 (40 to 42 feet (ft) deep in borehole SJSB-018).*

Photo 2 *Figure D.2: Sample G07 (30 to 32 ft deep in borehole SJSB-019).*

Photo 3 ***Figure D.3: Sample G14 (40 to 42 ft deep) in borehole SJSB-020.***

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The Power of Commitment