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Our Ref.: 11215702-Howard-35

November 8, 2022

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

Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)

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) the northwest corner component of the Pre-Final 90% Remedial Design (90% RD Northwest Corner Component) for the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site, located in Harris County, Texas. This 90% RD - Northwest Corner Component is the final component of the Pre-Final 90% Remedial Design - Northern Impoundment (90% RD), submitted to the EPA on June 27, 2022. The 90% RD was prepared pursuant to the requirements of the Administrative Settlement Agreement and Order on Consent for Remedial Design (AOC), Docket No. 06-02-18, with an effective date of April 11, 2018, and was developed based on input from the Technical Working Groups established under the AOC.

To expedite the review process, this submittal is limited to design components related to the northwest corner of the Northern Impoundment, which have been inserted into the existing framework of the 90% RD and appear in black font. The text, figures, tables, appendices, etc. from the June 2022 90% RD submittal that are not pertinent to the northwest corner design and to which substantive changes were not made are not included in this submittal. The text, tables, appendices, etc. that have not been included are indicated by grey font in the submittal.

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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KJ/jlf/35

Encl.: Pre-Final 90% RD - Northern Impoundment (Northwest Corner Component)

cc: Lauren Poulos, EPA
Robert Appelt, EPA
Katie Delbecq, Texas Commission on Environmental Quality (TCEQ)
Brent Sasser, IPC
Judy Armour, MIMC

Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)

San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company &
McGinnes Industrial Maintenance Corporation

November 8, 2022

→ The Power of Commitment

Contents

Contents

Contents

Contents

Contents

Table index

Figure index

Appendices

List of Acronyms

AASHTO	-	American Association of State Highway and Transportation Officials
ACBM	-	Articulated Concrete Block Mat
AISC	-	American Institute of Steel Construction
AMSL	-	Average Mean Sea Level
AOC	-	Administrative Settlement Agreement and Order on Consent for Remedial Design
ARAR	-	Applicable or Relevant and Appropriate Requirements
ASCE	-	American Society of Civil Engineers
ASTM	-	American Society for Testing and Materials
ABM	-	Articulating Block Mat
BBL	-	Barrel, measurement unit for barges, equivalent to 42 gallons of liquid
bgs	-	Below Ground Surface
BHHRA	-	Baseline Human Health Risk Assessment
BMP	-	Best Management Practice
^{137}Cs	-	Cesium-137
CFR	-	Code of Federal Regulations
cm	-	Centimeter
cm/s	-	Centimeters per Second
cm/year	-	Centimeters per Year
CME	-	Central Mine Equipment
COD	-	Chemical Oxygen Demand
COPC	-	Constituent of Potential Concern
CPT	-	Cone Penetrometer Test
CQA/QCP	-	Construction Quality Assurance/Quality Control Plan
CU	-	Consolidated Undrained
CWA	-	Coastal Water Authority
CY	-	Cubic Yard
D	-	Dead Load
DI	-	Deionized
DPT	-	Direct Push Technology
DU	-	Decision Unit
EM	-	Engineer Manual by United States Army Corps of Engineers
EPA	-	Environmental Protection Agency
ERP	-	Emergency Response Plan
FSP	-	Field Sampling Plan
Evoqua	-	Evoqua Water Technologies LLC
F	-	Fluid Load
FEMA	-	Federal Emergency Management Agency
FS	-	Feasibility Study
ft	-	Feet, measurement unit for length, height, or distance
ft^2	-	Square Feet
ft^3	-	Cubic Feet
ft/day	-	Feet per Day
ft/s	-	Feet per Second
F_y	-	Yield Stress
GAC	-	Granular Activated Carbon
GCV	-	Generalized Cross Validation

GHD	-	GHD Services Inc.
GHG	-	Greenhouse Gas
gpd	-	Gallons per Day
gpm	-	Gallons per Minute
GPS	-	Global Positioning System
H	-	Lateral Earth Pressure
HASP	-	Health and Safety Plan
HCFCD	-	Harris County Flood Control District
HDPE	-	High-Density Polyethylene
I	-	Barge Impact
I-10	-	Interstate Highway-10
IBC	-	Intermediate Bulk Containers
IC	-	Institutional Control
ICIAP	-	Institutional Controls Implementation and Assurance Plan
IPC	-	International Paper Company
K_d	-	Wind Directionality
K_e	-	Ground Elevation Factor
kip	-	Kilopound
kip/ft	-	Kilopound per Foot
ksi	-	Kilopound per Square Inch
K_z	-	Velocity Pressure Exposure Coefficient
K_{zt}	-	Topographic Factor
lb	-	Pound
lb/ft^2	-	Pounds per Square Foot
lb/ft^3	-	Pounds per Cubic Foot
LC	-	Load Combination
$L_{SH,t}$	-	Rising or Falling Limb of the Hydrograph at the Sheldon Gage at Time, t
MARS	-	Multivariate Adaptive Regression Splines
MIMC	-	McGinnes Industrial Maintenance Corporation
mg/L	-	Milligrams per Liter
ML	-	Minimum Level
MNR	-	Monitored Natural Recovery
mph	-	Miles per Hour
MRI	-	Maximum Recurrence Interval
N	-	Number of Observations
N_e	-	Effective Number of Parameters
NAVD88	-	North American Vertical Datum of 1988
ng/kg	-	Nanograms per Kilogram
NTU	-	Nephelometric Turbidity Units
O&M	-	Operations and Maintenance
Pa	-	Pascal
^{210}Pb	-	Lead-210
PBR	-	Permit By Rule
PCBs	-	Polychlorinated Biphenyls
PCF	-	Pounds per Cubic Foot
PDI	-	Pre-Design Investigation
PDI-1	-	First Phase Pre-Design Investigation
PDI-2	-	Second Phase Pre-Design Investigation

PFD	-	Process Flow Diagram
pg/L	-	Picograms per Liter
PMT	-	Pressuremeter Test
POHA	-	Port of Houston Authority
psi	-	Pounds per Square Inch
PTW	-	Principal Threat Waste
PVC	-	Polyvinyl Chloride
QAPP	-	Quality Assurance Project Plan
q_z	-	Velocity Pressure
RA	-	Remedial Action
RAO	-	Remedial Action Objective
RC	-	Remedial Contractor
RCRA	-	Resource Conservation and Recovery Act
RD	-	Remedial Design
RDWP	-	Remedial Design Work Plan
RI	-	Remedial Investigation
RI/FS	-	Remedial Investigation/Feasibility Study
ROD	-	Record of Decision
ROW	-	Right-of-Way
RTK	-	Real-Time Kinetic
RPD	-	Relative Percent Difference
RSS	-	Residual Sum of Squares
SSA	-	Sand Separation Area
SDI	-	Supplemental Design Investigation
SF	-	Safety Factor
SM	-	Standard Method
SOW	-	Statement of Work
SPT	-	Standard Penetration Test
SVOC	-	Semi-volatile Organic Compound
SWMP	-	Site Wide Monitoring Plan
SWPPP	-	Stormwater Pollution Prevention Plan
TAC	-	Texas Administrative Code
TCDD	-	2,3,7,8-tetrachlorinated dibenzo-p-dioxin
TCEQ	-	Texas Commission on Environmental Quality
TCLP	-	Toxicity Characteristic Leaching Procedure
TCRA	-	Time Critical Removal Action
TDS	-	Total Dissolved Solids
$TEQ_{DF,M}$	-	TCDD Toxicity Equivalent for Mammals
TexTox	-	Texas Toxicity Screening
TOC	-	Total Organic Carbon
TODP	-	Transportation and Off-Site Disposal Plan
TSS	-	Total Suspended Solids
TSWP	-	Treatability Study Work Plan
TSWQS	-	Texas Surface Water Quality Standard
TWG	-	Technical Working Group
TxDOT	-	Texas Department of Transportation
USACE	-	United States Army Corps of Engineers
UCS	-	Unconfined Compressive Strength

USGS	-	United States Geological Survey
USCS	-	Unified Soil Classification System
UU	-	Unconsolidated Undrained
V_{100}	-	Design wind velocity with MRI of 100 years
V_{3000}	-	Design wind velocity with MRI of 3000 years
VOC	-	Volatile Organic Compound
WQBEL	-	Water Quality-Based Effluent Limitation
W	-	Wind Load
W_e	-	Wind Load, Exterior
W_i	-	Wind Load, Interior
$WSE_{SH,t}$	-	Water Surface Elevation at the Sheldon Gage at Time, t
$WSE_{SJ,t}$	-	Water Surface Elevation at the Northern Impoundment at Time, t
WTS	-	Water Treatment System
µm	-	Micron
µg/L	-	Micrograms per Liter

5. Remedial Design

5.1 Remedial Design Background

Approach B Water Treatability Testing

Supplemental Design Investigation

Risk of Hydraulic Heave

5.2 Remedial Approach

BMP Alignment and Lateral Excavation Extent

Seasonal Excavation, and Top of Wall Elevation

Excavation Approach

Excavation Methodology

Water Management

Re-Use of TCRA Armored Cap and Historic Berm Material

Northwest Corner

Preliminary RA Schedule

5.3 Basis of Design

5.3.1 Historic River Level Evaluation

5.3.2 Excavation Season and BMP Height

5.3.3 Geotechnical Conditions

5.3.4 Excavation Extent and BMP Alignment

Lateral Extent

Vertical Extent

5.4 Pre-RA Activities

5.4.1 Property Access

5.4.2 Northern Impoundment Preparation and Layout

Risk of Overtopping and Release During Excavation

BMP Alignment

Barge Impact Analysis

Availability of Materials

5.11.2.1 Water Treatment

Translation of Laboratory Testing to Field Implementation

Access to Property for Water Treatment System

5.11.3 Other Uncertainties

5.11.3.1 Stakeholders

Impacts on the Community and Environment

Obstruction in the Floodway

5.11.3.2 Cost

5.12 Northwest Corner

5.12.1 Background

The following sections provide a full Pre-Final 90% Remedial Design for the northwest corner of the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site (90% RD - Northwest Corner Component). The *Pre-Final (90%) Remedial Design - Northern Impoundment* (June 90% RD) for the remaining portion of the Northern Impoundment was submitted to the United States Environmental Protection Agency (EPA) on June 27, 2022 (GHD, 2022c). Below is a summary of correspondence, submissions, and meetings held between the Respondents and the EPA pertaining to the northwest corner and additional information developed regarding conditions in the northwest corner that were not otherwise described in the June 90% RD.

- On June 8, 2022, an in-person meeting between the EPA and International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC; referred to as the Respondents) took place at which the concerns and risks associated with the RD in the northwest corner were discussed. These concerns were further outlined in a letter to the EPA dated June 21, 2022 (IPC & MIMC, 2022b).
- An in-person meeting between Respondents, GHD, and EPA was scheduled for August 4, 2022, to discuss a path forward for the northwest corner design. On the day prior to the meeting, EPA provided to the Respondents a Memorandum to the File dated August 3, 2022, (Memo to File) in which the EPA provided clarification of the phrase “in the dry” used in the Record of Decision (ROD [EPA, 2017b]) in describing the selected remedy for the Northern Impoundment (EPA,2022c).
- During the August 4, 2022, meeting, the Respondents expressed the need to perform an updated hydraulic heave evaluation specifically focused on the northwest corner to confirm the conclusions of the previous investigation and to evaluate the level of water that would need to be maintained to overcome the risk of hydraulic heave in a dredging scenario.
- Following the August 4, 2022, meeting, the Respondents began the focused hydraulic heave evaluation, which resulted in a reduction of the area defined as the “northwest corner” and in a refinement of the assumptions for

the river elevation used in the hydraulic heave calculations. This evaluation is further discussed in Section 5.12.3 and in the attached Appendix B-1.

– Based upon the information provided in the August 3, 2022, EPA Memo to File, and the Respondents' discussions with the EPA during the August 4, 2022, meeting, the Respondents submitted a Request for Schedule Extension - Northwest Corner Component to the EPA on August 18, 2022 (GHD, 2022d). The EPA sent a letter to the Respondents dated August 31, 2022 (EPA, 2022d) which extended the deadline for the 90% RD - Northwest Corner Component to November 8, 2022.
– The EPA subsequently sent a letter to GHD dated September 14, 2022 (EPA, 2022e) that addressed, among other things, certain aspects of the 90% RD - Northwest Corner Component and a second letter to GHD dated September 28, 2022, (EPA, 2022f) regarding options for residuals management in a dredging scenario.
– The Respondents submitted a letter to EPA dated October 7, 2022, (IPC & MIMC, 2022c) with respect to their understanding of the Memo to File and to which EPA responded in a letter dated October 13, 2022 (EPA, 2022g). GHD submitted a letter to EPA dated October 27, 2022, (GHD, 2022e) regarding certain aspects of the September 14, 2022, letter, and Respondents also submitted a letter to EPA on that date regarding the September 14, 2022, letter (IPC & MIMC, 2022d).

The Respondents have prepared this 90% RD - Northwest Corner Component as part of the 90% RD submittal for the Northern Impoundment. To expedite the review process, this submittal is limited to the design components related to the northwest corner, which have been inserted into the existing framework of the June 90% RD. Except as noted below, text, figures, tables, appendices, etc. that are not pertinent to the northwest corner design remain unchanged from the June 90% RD submittal and have not been included herein. It is anticipated that the references in the June 90% RD submittal to the northwest corner will be updated to reflect and include content included in this submittal in the 100% RD submittal. As further discussed in Section 5.12.3, the development of this 90% RD - Northwest Corner Component resulted in a determination that the design river level to be considered in evaluating hydraulic heave risk should be +5 feet North American Vertical Datum of 1988 (ft NAVD88), which is higher than the level of +1.5 ft NAVD88 used in assessing hydraulic heave risk in the remainder of the Northern Impoundment included in the June 90% RD submittal. Due to the limited time for the preparation of this 90% RD - Northwest Corner Component, the potential implications of this change in design river level on the hydraulic heave risk in the remainder of the Northern Impoundment are still being evaluated. Preliminary results indicate that there could be several additional areas in other portions of the Northern Impoundment that are at risk of hydraulic heave.

5.12.2 Remedial Evaluation

5.12.2.1 Overview

The northwest corner of the Northern Impoundment excavation area contains approximately 20,000 cubic yards (CY) of impacted material. Following issuance of the ROD, during the remedial design (RD) phase, three design investigations were conducted (as summarized in Section 2) which resulted in a much larger dataset, a clear vertical and horizontal delineation of the Northern Impoundment, and other newly-identified information that significantly changed the characterization and understanding of the Northern Impoundment. Specific impacts of the newly-identified information on conditions in the northwest corner are addressed below in the context of potential remedial options for the northwest corner that have been evaluated (partial excavation in the dry with capping [dry excavation and capping] and removal using mechanical dredging).

5.12.2.2 Northwest Corner Challenges

In the northwest corner, the identified depth and expanse of contamination has increased significantly to an elevation of -28.45 ft NAVD88. This targeted depth of excavation could increase further if confirmation sampling shows that the clean-up target has not been achieved. In evaluating potential RD alternatives to achieve removal of material to this depth in the northwest corner, several issues were identified, the most significant of which is the potential for a catastrophic hydraulic heave condition to occur making excavation in the dry in this area technically impracticable. In a letter to GHD dated September 14, 2022, the EPA requested that issues identified regarding the practicability, safety,

or implementation of the remedy in the northwest corner should be noted and supported as part of this submittal. The challenges and risks specifically associated with the northwest corner are discussed below, building upon the site-wide uncertainties summarized in Section 5.11.

- ***Risk From Flooding:*** As summarized in Section 5.3.1, the Respondents conducted an extensive analysis of historical storm events and river levels, which served as the basis for the planned seasonal excavation schedule for the RD. This planned seasonal excavation schedule would limit work to the period from November to April each year to reduce the potential for hurricanes and high-water events involving the risk of flooding of open excavations and overtopping of the cofferdam wall (herein referred to as the best management practice [BMP] wall). While limiting construction activities to this period may reduce this risk, it does not eliminate it. This risk is even more acute in the northwest corner if a dredging alternative is implemented. In a dry excavation or dry excavation with capping scenario, if a storm is approaching and there is a risk that the BMP wall could be overtopped, the open excavations could be backfilled to avoid the risk of a release if uncontrolled overtopping of the BMP wall occurred (assuming adequate warning of a significant storm and sufficient time to backfill the excavation). Water that is required in the northwest corner to reduce the risk of hydraulic heave in a dredging scenario would be released if overtopping of the BMP wall occurred. Under a dredging scenario, there are no controls that could be implemented to prevent a release if uncontrolled overtopping of the BMP wall occurred.
- ***Increased Excavation Depth and Volume:*** Based on the results of the pre-design investigations (which provided eight times the data in this area than was available at the time of the ROD), the depth and expanse of the material to be excavated in the northwest corner has significantly increased by at least five feet to -28.45 ft NAVD88. The target excavation depth anticipated in the ROD, which was based on only one boring, has been shown to be deeper and to extend across a larger area than previously understood. Driven by changes required by the deeper depth and increased volume of material to be excavated (both within the northwest corner and in other areas of the Northern Impoundment), the BMP wall and other aspects of the RD involve significantly increased complexity and much greater risk than was assumed in the ROD, as discussed in Section 5.11. This is particularly true for the northwest corner, where the required design of the BMP wall is even more robust to account for the significant excavation depths and in which a specialized, and more challenging remedial technology like dredging would be required to achieve removal beyond what can be achieved using dry excavation.
- ***Risk of Hydraulic Heave:*** Because of the need for deeper excavations, a technical analysis was conducted to evaluate the potential for hydraulic heave to occur during excavation. As set forth in Section 5.1 and as described in Appendix B, that technical analysis concluded that significant portions of the Northern Impoundment, including the northwest corner, would be at an unacceptable risk of hydraulic heave - in which the bottom of an excavation could suddenly fail, and the excavation would fill with groundwater and flowing sands, putting the health and safety of workers at risk. A further risk associated with hydraulic heave is that once it occurs, no further excavation could take place in that location. Any impacted material greater than 30 nanograms per kilograms (ng/kg) 2,3,7,8-tetrachlorinated dibenzo-p-dioxin (TCDD) Toxicity Equivalent for Mammals ($TEQ_{DF,M}$) in that location or dispersed as a result of the hydraulic heave event could not be excavated and would have to be left in place. If a hydraulic heave event were to take place in a location near or adjoining the BMP wall, the uncontrolled nature of the heave event would also have the potential to impact the stability of the BMP wall. The initial analysis showed that the risk of hydraulic heave in the northwest corner is so significant that even dewatering the area to the elevation of the river bottom could result in a heave scenario. A focused hydraulic heave specifically focused on the northwest corner was performed for purposes of this submission, as further described in Section 5.12.3.3, and further supported the conclusions in the initial analysis.
- ***Schedule:*** The additional quantity of waste targeted for remediation, including in the northwest corner, has extended the overall remedial action (RA) schedule to a minimum of seven years for the Northern Impoundment. This extends the period over which extreme events can potentially adversely affect the project. This schedule is also subject to impacts from the proposed Interstate Highway-10 (I-10) bridge replacement project currently under design by the Texas Department of Transportation (TxDOT). As discussed in Section 5.11.1.1, this project could eliminate the only land access to the Northern Impoundment and effectively halt progress on the RA, and/or potentially necessitate major redesign of portions of the BMP wall to accommodate the bridge design. Even if

access to the ROW is made available, the coordination of work with the concurrent bridge construction project (and the associated restrictions on freeway access and traffic delays during the project) will further extend the time needed to complete the work, including in the northwest corner. Schedule delays could have an even greater impact in the northwest corner if a dredging alternative is implemented. In a dry excavation or dry excavation with capping scenario, if unforeseen conditions delay the progress of the seasonal removal, the open excavation could be temporarily capped until work begins the following season. Under a dredging scenario, this option is not available, so the schedule would have to provide ample time to manage the millions of gallons of contact water in the excavation before the completion of the excavation season, which may not allow sufficient time to complete the full excavation of material through the dredging scenario. If sufficient time is not available for water management, there could be the potential for millions of gallons of contact water to be released to the river if there were an overtopping of the BMP wall during a storm event.

- ***Increased Cost*:** Given the increase in the volume and depths of the material to be removed and the associated complexities in the design, increased costs significantly above the EPA estimate are anticipated. If dredging is required in the northwest corner, that alternative would have significantly increased costs associated with it due to the use of specialized equipment, the need to treat millions of gallons of impacted water, and the requirement to backfill the dredged area to mitigate hydraulic heave after the excavation is complete, as compared to other options.
- ***Challenge to Meet ROD Requirements:*** Removal of deeper material in the northwest corner will require mechanical dredging, which, because it cannot be conducted in the dry, could leave residuals in place above the 30 ng/kg $TEQ_{DF,M}$ threshold, even with the adoption of best management practices to minimize residuals. The post-ROD data demonstrates that, even with EPA's clarification in the August 3 Memo to File regarding the requirement for the ROD to be implemented "in the dry," a design cannot be implemented that meets requirements in the ROD for no discharges above the Texas Surface Water Quality Standard (TSWQS) and the removal of all material above 30 ng/kg $TEQ_{DF,M}$ and that is consistent with the ROD's emphasis on worker safety.

5.12.2.3 Remedial Approach Selection

Given the constraints identified based on the post-ROD information and analyses, and the identified challenges associated with dry excavation and a full removal in the northwest corner, potential alternatives were identified and evaluated to select one that is both protective of human health and the environment (both in the short- and long-term), can be safely implemented, is cost-effective, and satisfies the Remedial Action Objectives (RAOs) set forth in the ROD. The RAOs are as follows:

- ***RAO 1**:* Prevent releases of dioxins and furans above clean-up levels from the former waste impoundments to sediments and surface water of the San Jacinto River.
- ***RAO 2**:* Reduce human exposure to dioxins and furans from ingestion of fish by remediating sediments to appropriate clean-up levels.
- ***RAO 3**:* Reduce human exposure to dioxins and furans from direct contact with or ingestion of paper mill waste, soil, and sediment by remediating affected media to appropriate clean-up levels.
- ***RAO 4**:* Reduce exposures of benthic invertebrates, birds, and mammals to paper mill waste derived dioxins and furans by remediating affected media to appropriate clean-up levels.

The limited suite of general response actions for addressing waste material at aquatic sites are typically; No Action, Monitored Natural Recovery, Capping, Removal/Dredging, and Treatment. Of these, the remedy for the northwest corner that can meet the RAOs, can be constructed in the shortest time, and has the lowest potential for catastrophic failures is dry excavation and capping - which combines dry removal of as much material as can safely be excavated followed by capping of the remainder. EPA's September 14, 2022, letter stated that the Respondents were to fully evaluate mechanical dredging as a remedial alternative for the northwest corner. Accordingly, evaluations of dry excavation and capping and mechanical dredging relative to the ability to meet RAOs, short-term effectiveness, and implementability, are provided below.

5.12.2.3.1 Excavation and Capping Alternative

A capping remedy entails the placement of clean material over contaminated waste materials, which remain in place. With the dry excavation and capping approach, the material in the northwest corner above -13 ft NAVD88 would be excavated in the dry (approximately 9,800 CY), and the remaining material that cannot be excavated in the dry due to hydraulic heave concerns, would be capped. The rationale for the dry excavation elevation is further explained in Section 5.12.3. A robust engineered articulating block mat (ABM) cap would be placed over the remaining material that cannot be excavated in the dry (representing approximately 8 percent of the overall excavation surface area and less than 1.5 percent of the total dioxin mass of the Northern Impoundment). The water elevation in the northwest corner would be maintained at or slightly above -13 ft NAVD88 to control the potential for hydraulic heave prior to and during placement of the cap. The cap would be placed atop a geotextile liner and would consist of ABM type fabric-form concrete constructed of a woven, double layer synthetic fabric joined together into a matrix of rectangular compartments. A flowable, high-strength fine aggregate concrete mixture would be pumped into the compartments. The ABM would have interconnected polyester revetment cables embedded between the two layers of fabric to provide longitudinal and lateral binding of the finished articulating block mattress. This cap design would be significantly more robust than the existing time critical removal action (TCRA) armored cap, constructed in 2011 and would be similar to the ABM cap that was constructed on the steep slope of the northwest corner in May 2019 to control erosion, which has performed ideally to date. It would also be over a very small area (half an acre compared to the nearly 15-acre TCRA armored cap) and would be fully submerged year-round (submerged under at least 10 ft of water at all times) minimizing the risk of barge strikes, etc. Additional details on the capping alternative are provided in Section 5.12.4, below.

Ability to Meet RAOs

A cap would prevent direct contact between waste material and aquatic biota and human receptors (RAOs 2 to 4). A cap would also prevent resuspension and transport of waste materials away from the site (RAO 1). The initial cover layer of granular material placed would also mix in with surficial waste material, thereby effectively reducing the concentration of any dioxin at the waste material-cap interface. This mixing concept is acknowledged for the bioactive zone in the ROD (pages 18 and 19) for the Lower Passaic River in New Jersey (EPA, 2016). Since dioxin is virtually insoluble in water and typically absorbs to organic materials, the cap would prevent transport of dioxin in waste materials. Therefore, a robust cap, as described above, would meet the RAOs.

A recent example of the use of capping at a dioxin site is provided by the Kanawha River Site in West Virginia (EPA ID: WVSFN0305516). A series of caps placed over four areas and protected by armor stone was constructed at the site in 2020 to address dioxin-impacted sediment (GHD, 2021k). Bathymetric surveys of the caps were performed in 2021 following a 100-year flood (183,000 cubic feet per second [cfs]) and in 2022 as part of routine monitoring. The cap continues to function as intended, underscoring how the advanced state of capping technology has evolved through research and lessons learned over decades that has resulted in improved equipment, materials, techniques, and technologies.

Short-Term Effectiveness

In this case, dry excavation and capping would be taking place within the BMP wall and over an excavated surface so there should be no established biota that could be adversely impacted. The impacted area would also be significantly smaller than during the prior TCRA armored cap placement (half an acre compared with nearly 15 acres), and therefore the impact would be over a very limited area and over a short duration. Since the dry excavation and capping work will be conducted behind the BMP wall, there should not be exposure of humans or biota to waste material during the remedial activities in the short-term and the cap will prevent any exposures over the long-term.

Implementability

According to EPA (2005), subaqueous capping is a demonstrated technology (EPA, 2005), which has been widely and successfully applied at several aquatic sites across the world for more than two decades. Capping is the major component of the remedies constructed or adopted for a number of Superfund sites, including the Lower Passaic River (EPA, 2016) and the Kanawha River (Matlock, 2017; both with dioxins as the primary chemical of concern),

Portland Harbor (EPA, 2017a), Grasse River (EPA, 2013a), and Gowanus Canal (EPA, 2013b). Guidance for in-situ subaqueous capping has been developed jointly between EPA and the U.S. Army Corps of Engineers (USACE; Palermo, et al., 1998). The technology is well established with specialty equipment developed by several capping contractors. Materials are readily available, and personnel experienced in the design and construction oversight of capping remedies are available and have the necessary expertise. There is also precedence at this site for use of a similar ABM cap. The 6-inch ABM cap constructed along the steep slope of the northwest corner in 2019 has performed as designed and without any issues for more than 3 years. Added benefits of a dry excavation and capping approach include more limited excavation support, less need for dewatering, and less contact water to be managed. The schedule for a dry excavation and capping alternative would also be greatly expedited as compared to dredging. The estimated schedule to remove approximately 9,800 CY of material in the northwest corner in the dry and then install a robust engineered cap over the remaining material is approximately 14, 6-day working weeks. If excavation work was initiated at the beginning of November, work in the northwest corner could be complete by approximately the beginning of March, well before the start of hurricane season, and potentially with enough time to allow the remedial contractor (RC) to move on to other parts of the Northern Impoundment and expedite the overall RA process. This would also avoid the schedule issues associated with mechanical dredging which would require management of all the contact water in the excavation prior to the end of the excavation season.

5.12.2.3.2 Dredging Alternative

Under a dredging scenario, the water elevation in the northwest corner would be maintained above -13 ft NAVD88 to control the potential for hydraulic heave. The waste material above -13 ft NAVD88 would be excavated in the dry, similar to the capping scenario, then the remaining material would be mechanically dredged to the target elevations after the area had been flooded with millions of gallons of water to allow for dredging. The area to be dredged would be surrounded by double turbidity curtains to control migration of suspended sediments. After the target depths are reached, confirmation sampling would be performed, followed by a final clean dredge pass. This would be followed by the placement of a residuals management layer to an elevation of -13 ft NAVD88 while dewatering and treating approximately 4.6 million gallons of contact water. This residuals management layer would be up to 15 feet thick in some places. Additional details on the dredging alternative are provided in Section 5.12.4, below.

Ability to Meet RAOs

Excavation and dredging will not result in full removal of all impacted material in the northwest corner. In the *Contaminated Sediment Remediation Guidance for Hazardous Waste Sites* (2005) EPA notes that all dredging operations leave behind some residual contamination. “All dredging operations resuspend sediment, release contaminants, and generate residuals” (Schroeder, 2009). Palermo, et al. (2008) noted that no removal technology can remove every particle of contaminated sediment, and field results to date for completed environmental dredging pilots and full-scale projects suggest that post-dredging residual contamination levels have often not met desired clean-up levels. Dredging best practices, such as the use of smaller buckets, tighter location controls, reduced dredging rate, thinner and more frequent dredge cuts (e.g., <1 m), an overcut and/or a final clean-up dredge pass, and other operational practices can reduce residuals from mechanical dredging operations, but generated residuals cannot be eliminated (NRC, 2007; Patmont and Palermo, 2007; Gustavson, et al., 2008). It is possible that even after employing best practices to minimize residuals generation and migration, waste material with dioxin concentrations above 30 ng/kg $TEQ_{DF,M}$ would remain in the northwest corner following dredging, which would be inconsistent with the ROD.

Short-Term Effectiveness

The EPA (Stanislaus, 2017) urges engineers to design remedies to minimize short-term risks while achieving long-term protection. The major risk associated with dredging in the northwest corner is mitigating hydraulic heave and keeping the impacted material and contact water contained during the remediation activities. The breach of a constructed stormwater control berm could result in the transport of dioxin-containing waste material outside the northwest corner and an overtopping of the BMP wall during a major weather event could result in a release outside of the Northern Impoundment. Turbidity curtains and other residuals management methods, along with the BMP wall itself, should reduce the likelihood of a release and exposure to humans or biota during the remedial activities, and the

removal of the waste material and placement of a residuals management layer should minimize the exposures over the long-term.

Implementability

Mechanical dredging to remove contaminated submerged waste material is a common remedial practice, so there should not be a shortage of equipment and/or skilled labor. However, due to the potential for hydraulic heave and/or flooding of the impoundment with contact water, there is a limit to the depth to which material can safely be dredged. Furthermore, dredging activities would need to be completed within the tight six-month non-hurricane construction season. The estimated schedule to remove the approximately 20,000 CY of impacted material in the northwest corner (approximately half in the dry and half in the wet) is 24, 6-day working weeks. If dry excavation work was initiated at the beginning of November, work in the northwest corner would not be completed until the very end of April, pushing right to the limit of the non-hurricane working season. This estimated schedule would allow for only one round of confirmation sampling followed by one additional clean dredging pass and does not include any margin for error or delays during the working season for storms, equipment breakdowns, or the like.

In contrast to the dry excavation methodology planned for the rest of the Northern Impoundment, the volume of material that can be removed using dredging during an excavation season is not flexible. In an excavation season in which dry excavation is implemented, if unforeseen conditions cause significant delays that prohibit the target volume for that season from being removed, the area could be “buttoned up” as it is, and the excavation could be resumed the following excavation season. In the northwest corner, under a dredging scenario, as detailed in Section 5.12.5, a certain water level will have to be maintained throughout the dredging process to overcome the potential for hydraulic heave. At the end of removal activities, that now impacted contact water will have to be removed from the northwest corner to avoid having it spread residual contamination to other locations within the BMP wall or resulting in a release of dioxins above the TSWQS if there were an overtopping of the wall. Given the risk of hydraulic heave, the contact water cannot be pumped to the water treatment system (WTS) without replacing it with material to offset the weight of the water. Thus, approximately 11,250 CY of granular material would have to be used to replace the water as it is pumped off, bringing the northwest corner to an elevation of -13 ft NAVD88. The process of water removal and granular material placement will take approximately 46 working days to complete, or almost one-third of the excavation season. Given the lengthy process, it is essential that the entire volume in the northwest corner be removed in one excavation season. Extending the excavation season into the hurricane season is also not an option as that would leave the area at risk of high-water events, overtopping, and releases to the river before it has been properly covered and “buttoned up”.

Dredging also requires a large footprint (larger than that needed for a capping scenario) for materials staging, dewatering, solidification, water treatment, etc. which is a challenge given the space constraints of the Northern Impoundment, described in Section 5.2. The limited usable space could be further restricted depending upon the timing and footprint of TxDOT’s I-10 bridge replacement project, discussed in Section 5.12.2.2.

5.12.2.4 Evaluation Summary

A combined dry excavation and capping approach will utilize established capping technology that would meet the RAOs and could be designed to withstand extreme weather events. Capping would be performed over a shorter duration than dredging, would have significantly less implementation risk, would take up less space, and would be the less costly alternative while providing a similar level of protection as a dredging program.

Dry excavation and capping would have fewer short-term impacts, including a reduced potential for redistribution of impacted material during construction caused by an extreme weather event. Furthermore, under a dry excavation and capping alternative, there would be no need for confirmation sampling, reduced need for landfill space for disposal of excavated material, reduced need to transport material from the work site to a landfill, and no concern about dioxin being bioavailable after the waste is covered by the cap. The cap would be placed on an area representing approximately 8 percent of the overall excavation area of the Northern Impoundment that represents material containing less than 1.5 percent of the estimated total mass of dioxins in the Northern Impoundment. This means that more than 98.5 percent of the total mass of dioxins in the Northern Impoundment would be removed.

The depth to which dredging can safely occur is limited due to the potential for hydraulic heave. There is the potential that the elevation to which waste material can be safely dredged may preclude further clean passes and therefore result in residuals in excess of the target concentration remaining. Dredging will also take a longer time to implement, during which time the area will be susceptible to extreme weather events, which could be more frequent given climate change. Under a dredging scenario, the area would not be able to be buttoned up in anticipation of a storm event. It will also have the higher production of greenhouse gases and potential for accidents due to required material processing, water treatment, and offsite transport of waste. Dredging would also be more costly than capping and therefore not as cost-effective as the dry excavation with capping alternative.

For all of these reasons, excavation in the dry, followed by capping is proposed as the remedial alternative for the northwest corner. The detailed capping design is included in Section 5.12.4.

To address the EPA requirement to include a mechanical dredging alternative, as stated in the September 14, 2022 EPA letter, a detailed design for mechanical dredging in the northwest corner is included in Section 5.12.5.

5.12.3 Update to Basis of Design

As discussed in Section 5.12.1, it was determined that design of excavation in the dry in the northwest corner was technically impractical due the potential for hydraulic heave to occur as the waste is removed. To support a design for the northwest corner that addresses and controls the potential for hydraulic heave, a more focused evaluation of the conditions in the northwest corner was performed as discussed below.

As has been previously discussed, hydraulic heave is a phenomenon that can occur when the downward forces associated with the weight of material (water, waste material, soil, etc.) are not great enough to overcome the upward forces exerted by an aquifer under pressure, as is the case with the Beaumont Sand underlying the Beaumont Clay. Magnifying this risk, in the northwest corner, previous geotechnical evaluations have identified the presence of a sand lens in the Beaumont Clay approximately 50 ft below ground surface (ft bgs). The pressure in the sand lens and potential connectivity to the river were evaluated based on potentiometric data from piezometers and historic river stage data. Safe levels for dry excavation and the required water elevation to be maintained in order to overcome hydraulic heave risk under a dredging scenario were then developed, taking into consideration these upward pressures and the soil conditions in the northwest corner.

5.12.3.1 Piezometric Pressure Evaluation

The sand lens within the Beaumont Clay plays a critical role in evaluating the potential for hydraulic heave in the northwest corner. The sand lens was observed in area borings and, based on potentiometric data from the underlying Beaumont Sand, is assumed to be hydraulically connected to the river. Beginning in August 2020, water level data were collected from on-site transducers placed both in the San Jacinto River and in a piezometer installed in the Beaumont Sand. These data showed that there was a direct correlation between the Beaumont Sand and the water level in the river, with the river elevation being approximately 4.2 ft higher than the piezometer elevation. Assuming that there is a dampening effect that is proportional to the clay thickness, the piezometric head gradient between the river and the Beaumont Sand was calculated to be approximately 0.11 ft per foot of clay. When this factor is applied to the upper sand lens where there are approximately 16 ft of clay, the estimated piezometric head in the sand lens would be 1.7 ft lower than the river elevation. Based on this evaluation, the upward pressure in the sand lens in the northwest corner for the hydraulic heave evaluation was estimated to be the river stage elevation minus the 1.7-ft differential. For example, when the river stage is at +5 ft NAVD88, the piezometric head in the sand lens is estimated to be +3.3 ft NAVD88. The conceptual dampening effect of the piezometric head is shown on Figure 5-L, below.

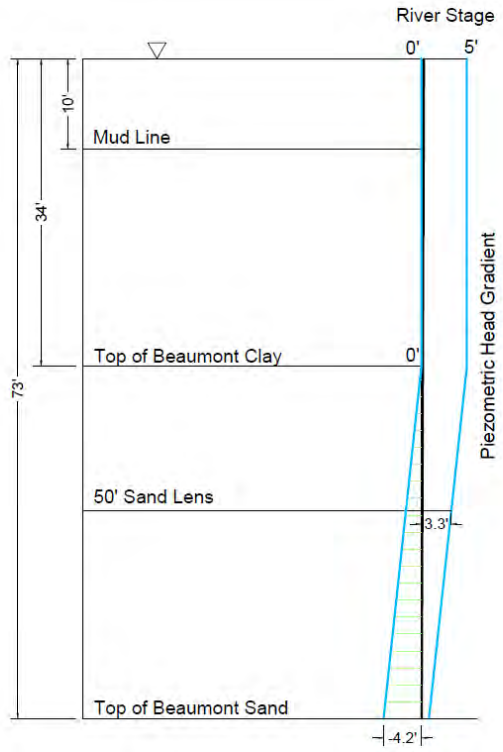

Figure 5-L *Conceptual Dampening Effect*

5.12.3.2 Hydraulic Heave Evaluation

As part of development of the northwest corner design, a focused hydraulic heave evaluation was conducted to better understand the elevation of water that would be necessary to maintain under a dredging scenario. The detailed hydraulic heave evaluation was conducted specifically for this area using inputs specific to the northwest corner. The evaluation is detailed in the Northwest Corner Hydraulic Heave Analysis, included as Appendix B-1, and is summarized below.

A design river level for the Extreme Case was selected as +9 ft NAVD88, which is the design height of the BMP wall that will surround the Northern Impoundment. Unit weights for the subsurface material were determined based on geotechnical data from the northwest corner, specifically the data from boring SJSB057-G. A unit weight of 95 pounds per cubic foot (pcf) was estimated for the sediments above the Beaumont Clay based on the laboratory measured moisture content and specific gravity data and a unit weight of 126 pcf was assumed for the Beaumont Clay based on the laboratory unit weight determinations for the boring. Due to the assumed horizontal connection between the sand lens in the Beaumont Clay and the San Jacinto River discussed above, the piezometric head difference between the sand lens and the river elevation at the northwest corner was assumed to be 1.7 ft. Assuming an Extreme Case design river level of +9 ft NAVD88, this results in a design head pressure of +7.3 ft NAVD88.

Based on this design head pressure, the critical elevation at which hydraulic heave becomes an unacceptable risk (with an insufficient safety factor [SF]) was calculated. This analysis demonstrated that the northwest corner can be excavated in the dry to an elevation of -13 ft NAVD88 while still maintaining an Extreme Case SF_{Total} of 1.15. The design river stage for the Reasonable Maximum Case and a SF_{Total} of 1.15 was then calculated considering the safe level of dry excavation calculated for the Extreme Case. The calculated design river stage for the Reasonable Maximum Case was calculated to be +5 ft NAVD88.

During dredging, sufficient water levels will need to be maintained in the excavation to offset the weight of the sediments being removed to overcome the heave potential. The safe water elevation to be maintained during dredging to the target removal elevations calculated for the Extreme Case (river stage +9 ft NAVD88) is -10.1 ft NAVD88 and the safe water elevation calculated for the Reasonable Maximum Case (river stage +5 ft NAVD88) is -10.9 ft NAVD88.

Prior to remedial activities in the Northern Impoundment, it is recommended that piezometers be installed in both the Beaumont Sand and the upper sand lens in the vicinity of the excavation to monitor actual piezometric pressure head in the strata before and during remedial activities. The assumptions used in the hydraulic calculations would then be evaluated based on the actual piezometer data. The northwest corner hydraulic heave evaluation is included as Appendix B-1. It should be noted that the calculated hydraulic heave limit of -13 ft NAVD88 is specific to only the northwest corner component of the Northern Impoundment. The change in the assumed design river level and associated piezometric head pressures will likely have implications on the risk of hydraulic heave in other parts of the Northern Impoundment. A more granular hydraulic heave evaluation for the rest of the Northern Impoundment, which incorporates the refined design inputs, is currently underway.

5.12.3.3 River Stage Evaluation

The heave evaluation described above identified the Reasonable Maximum Case for the river stage as +5 ft NAVD88 and the Extreme Case river stage as +9 ft NAVD88, which serve as the basis of the northwest corner RD presented herein. Further evaluation of the historical river stage data in relation to the measured and projected stage at the Northern Impoundment was conducted to determine whether these design assumptions were appropriate.

5.12.3.3.1 River Level Hindcasting

The Northern Impoundment is subject to both tidal fluctuations, as well as increases in river level from rainfall and tropical storm events. To better understand the river level locally, a transducer was installed on-site in July 2019. Prior to this, historical routine water level readings had not been collected at the Northern Impoundment. As discussed previously in Section 5.3.1, a hindcasted model was created to produce a dataset of calculated site-specific historical river levels dating back to 1996. The hindcasted model was developed based on publicly available historical United States Geological Survey (USGS) data from the Sheldon gage upstream of the Northern Impoundment. The hindcasted model utilizes a fixed data set of Sheldon gage inputs compared to site-specific data collected from the transducer at the Northern Impoundment to produce the hindcasted outputs. When new data becomes available, the model can then be re-hindcasted to reflect the additional data available and allow increased confidence in the hindcasted outputs. The original hindcasted data (provided in the 30% RD and the June 90% RD) was based on approximately 6 months worth of site-specific transducer data (July 2019 through December 2019) available at the time of the 30% RD.

As part of the aforementioned hydraulic heave evaluation for the northwest corner, the historical river levels and specific frequencies in which they occurred over the excavation season at the Northern Impoundment were further explored. To ensure that the most accurate data was being utilized, the hindcasted model was updated and rerun with a larger, more recent dataset from both the Sheldon gage and the on-site transducer (July 2019 through December 2021). The updated river level hindcasted data for the full year and the planned excavation season are shown on the attached Figures 5.4 and 5.5, respectively. The pink elevations represent the hindcasted river levels estimated at the Northern Impoundment. These two figures will effectively replace Figure 5.2 and 5.3, which were based on the more limited dataset. This change will be made in the 100% RD submittal.

5.12.3.3.2 Design River Level

Using the outputs from the updated hindcasted model, the number of times that a specific river level was reached or exceeded during the excavation season was quantified, as shown in Table 5-K.

Table 5-K Hindcasted River Levels On-Site During Excavation Season

Hindcasted River Level (feet NAVD88)	Number of Occurrences[1] (Since 1996)
+1.5	3,844
+3	261
+4	21
+5	5
+6	3
+9	1

Note:
[1] An occurrence is defined as an event that occurred a minimum of four days from another event, with the exception of the +1.5 ft river level which is an event that occurred a minimum of one day from another event (due to the frequency of river levels above +1.5 ft).

The +9 ft NAVD88 river stage has only been exceeded one time between the months of November and April since 1996 (in 1998), indicating a river stage of this elevation during these months is extremely rare, further supporting the appropriateness of using this river stage for the Extreme Case. The +5 ft NAVD88 river stage was exceeded five times between the months of November and April since 1996, or approximately on average once every 5 years. This estimated frequency suggests that it would be likely to experience a river stage of +5 ft NAVD88 at least once during the 7+ year RA activities, but it would still be an unlikely event, making it an appropriate elevation for the Reasonable Maximum Case.

5.12.3.4 Remedial Action Sequencing

Another basis of design assumption that is critical to the design and successful implementation of the RA in the northwest corner, regardless of the remedial alternative selected, is that the northwest corner be addressed in the first excavation season of the overall RA. This is necessary due to access issues and bathymetric conditions. If the other areas of the Northern Impoundment were completed first, it would eliminate land access to the Northwest Corner and make it very difficult to complete a remedy in that area. Completing the Northwest Corner first would also be appropriate due to the deep bathymetry in that area and the implications of that deep bathymetry on water management. This is further explained in Section 5.12.4.2.1.

5.12.4 Excavation and Capping

As discussed in Section 5.12.3, the water elevation within the northwest corner must be maintained at or above -13 ft NAVD88 to control the potential for hydraulic heave. Under an excavation and capping approach, the water level in the northwest corner will be dropped to -13 ft NAVD88, the impacted material above -13 ft NAVD88 will be excavated in the dry, granular material will be placed in the area below -13 ft NAV88 to provide a stable base for the cap, and an ABM cap will be constructed over the northwest corner. The following sections describe the procedures for dry excavation and capping in the northwest corner.

5.12.4.1 Site Preparation Activities

Prior to disturbing ground in the northwest corner, erosion control structures would be installed in conformance with the Stormwater Pollution Protection Plan (SWPPP) to be developed by the selected RC. A double turbidity curtain would be installed around the boundary of the area to be excavated and then capped to prevent any release of sediments to the open water area inside the BMP wall during the TCRA armored cap removal and dry excavation phases of the project. The site preparation activities would include constructing roads and truck loading area(s) for the dry excavation. A mixing pad would be constructed adjacent to the northwest corner at the loading area to solidify the excavated material, as necessary, prior to its transport off-site. To facilitate access for concrete trucks to pump concrete slurry to the work area and for trucks to place the granular base material during capping operations, access roads would be constructed. The RC would provide a plan that describes the details of the excavation and capping operations and associated roads and support facilities. The work in the northwest corner would have to take place prior to work in other areas so that access for vehicles and a mixing pad is available.

5.12.4.2 Excavation and Capping Procedures

5.12.4.2.1 Cell Dewatering

Following the installation of the BMP wall, river water would be trapped within the Northern Impoundment. Based on historical river stage data, it is assumed that the water elevation will be at approximately +/- 0 ft NAVD88 on both sides of the BMP wall prior to any waste removal. The water located inside the BMP wall would be pumped back into the river to achieve an elevation of -13 ft NAVD88 in the northwest corner. This would expose approximately 0.67 acres of the northwest corner that can be excavated using land-based equipment in relatively dry conditions. Once the water is pumped to -13 ft NAVD88, the existing bathymetry in the northwest corner would effectively form a natural bowl that will contain the water in this low spot and prevent it from flooding out into the surrounding areas of the Northern Impoundment. This is only possible if the northwest corner is addressed prior to the remainder of the Northern Impoundment. Maintaining the water level at -13 ft NAVD88 provides water to offset the heave potential in the remaining 0.33 acres where the mudline is deeper. Figure 5-M, below, shows the water extent within the northwest corner at a water elevation of -13 ft NAVD88 and the area to be excavated in the dry.

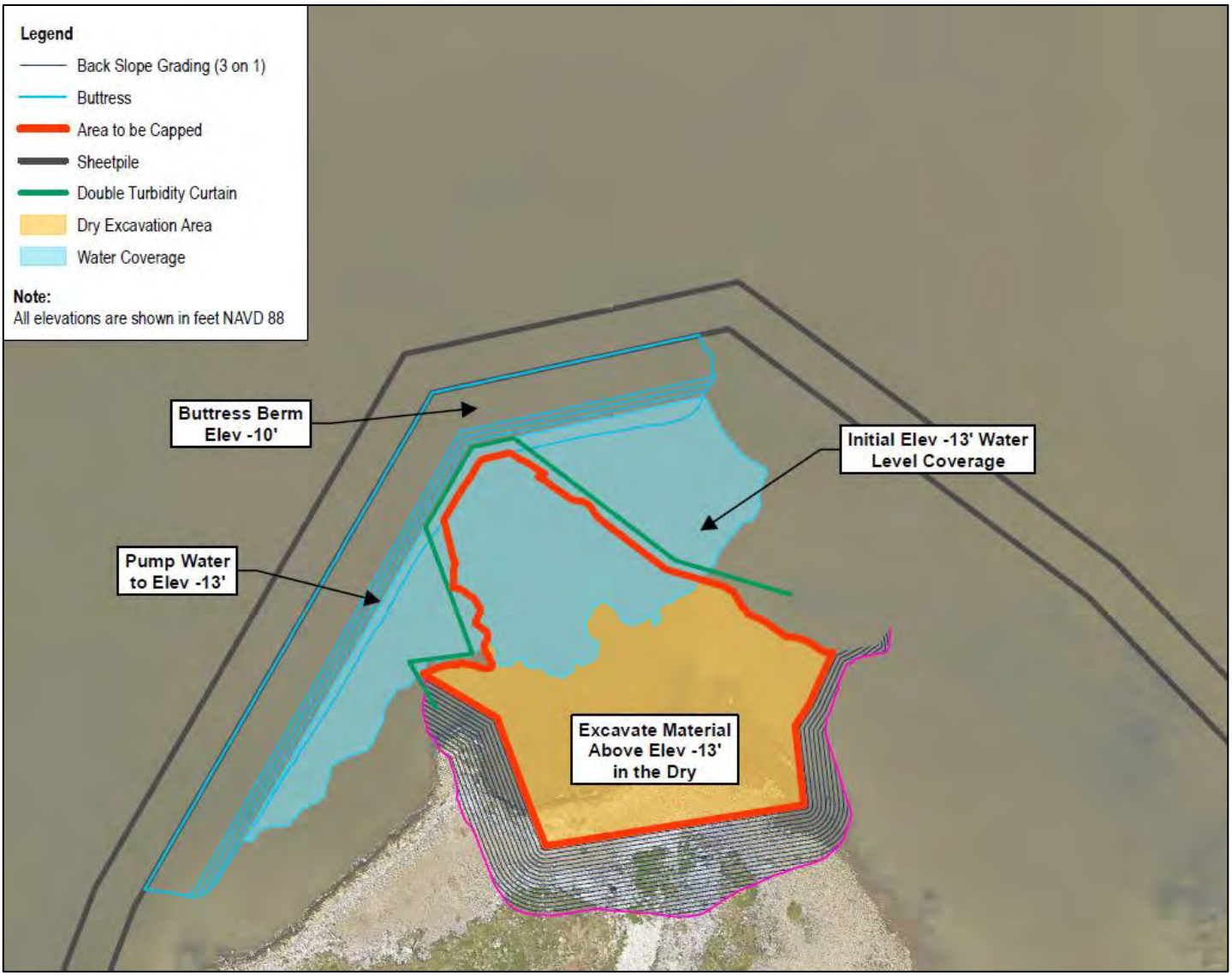

Figure 5-M Capping Area Flooded to -13 ft NAVD88

5.12.4.2.2 TCRA Armored Cap Removal Above -13 ft NAVD88

After pumping the water down to -13 ft NAVD88, and prior to dry excavation activities, the TCRA armored cap atop the exposed 0.67 acres would be removed using standard land-based excavation equipment to access the underlying waste material for excavation. The rock suitable for potential reuse would be staged on the Northern Impoundment or at a nearby location. Any geotextile and/or geomembrane barrier of the TCRA armored cap would be removed and disposed of off-site with other waste from the excavation.

5.12.4.2.3 Dry Excavation

Following removal of the TCRA armored cap, excavation of approximately 9,800 CY of waste material to an elevation of -13 ft NAVD88 would take place in the dry using excavation equipment. During the excavation activities, the excavator would be positioned so it can reach into the excavation and swing around to load trucks or place material directly into a mixing pad. Any excavated material that does not contain free liquids and/or does not require solidification would be loaded directly in haul trucks for off-site disposal. Excavated material that is too wet (i.e., would not pass the paint filter test) to be directly loaded into haul trucks would be temporarily staged and allowed to drain by gravity and dry naturally and/or be solidified on the mixing pad prior to loading for off-site disposal. An earthen ramp (in a location adjoining the TxDOT right-of-way) wouldl be constructed over the lip of the BMP wall to allow truck traffic into and out of the work area (see Drawings C-05 and C-45 in Appendix G-1).

SWPPP controls would be installed to control run-on and run-off from the excavation surface, as described in Section 5.9.2. Any water that contacts the excavation surface would be pumped out, as needed to maintain excavation operations, to a WTS where it would be treated and discharged to the river, as described in Section 5.8.

5.12.4.2.4 Capping

Following dry excavation activities, granular material would be placed atop the existing TCRA armored cap in the submerged area to a minimum elevation of -13 ft NAVD88 so that the entire area to be capped is above the water surface. A minimum of 6 inches of granular material would be placed on the excavated surface to provide a stable base for the cap. Granular material would also be placed in a low area located to the northeast of the capped area where there is a risk of hydraulic heave, as shown in green shading on Figure 5-N, below. The heave calculations indicate that, for this area, the heave potential during reasonable maximum conditions (+5 ft NAVD88 river level and a SF of 1.25) is within the level defined as acceptable for purposes of the RD, but there may be a potential for heave during extreme river level conditions near +9 ft NAVD88. Considering that this area may be dewatered for up to seven years during construction across the Northern Impoundment, approximately one foot of granular material would be added to this area during the granular material placement phase to offset this heave potential.

Following the placement of granular material, a nonwoven geotextile would be placed on top of the granular base in the area to be capped and a cap would be placed on top of the geotextile. The cap would consist of ABM type fabric-form concrete constructed of a woven, double layer, synthetic fabric joined together into a matrix of rectangular compartments. A flowable, high-strength fine aggregate concrete mixture consisting of Portland cement, sand, and water will be pumped into the compartments. The ABM would have interconnected polyester revetment cables embedded between the two layers of fabric to provide longitudinal and lateral binding of the finished articulating block mattress.

The ABM would have a nominal block dimension of 20 by 20 inches and a minimum average thickness of 6 inches, which provides a nominal mass per unit area of 68 pounds per square foot when filled with the fine aggregate concrete. The ABM would either be 6-inch ABM as manufactured by Construction Techniques, Inc. or AB600L as manufactured by Synthetex, or an approved equivalent. As mentioned in Section 5.12.2.3.1, this cap design would be sufficiently more robust than the existing TCRA armored cap that was constructed in 2011 and would be similar to the ABM cap that was constructed on the steep slope of the northwest corner in May 2019 to control erosion, which has performed ideally to date.

The ABM panels would be joined in the field by means of sewing using nylon or polyester thread or zippering closures to the dimension of the areas to be protected and secured using anchor trenches at the lateral limits of the northwest corner. Following the placement of the ABM, fine aggregate concrete would be pumped into the compartments of the

fabric form to a thickness of 6 inches. The end-state capped area is shown on Figure 5-N, below. The approximately 1-acre cap will be placed at elevation -13 ft NAVD88 and will be submerged beneath at least 10 ft of water at all times.

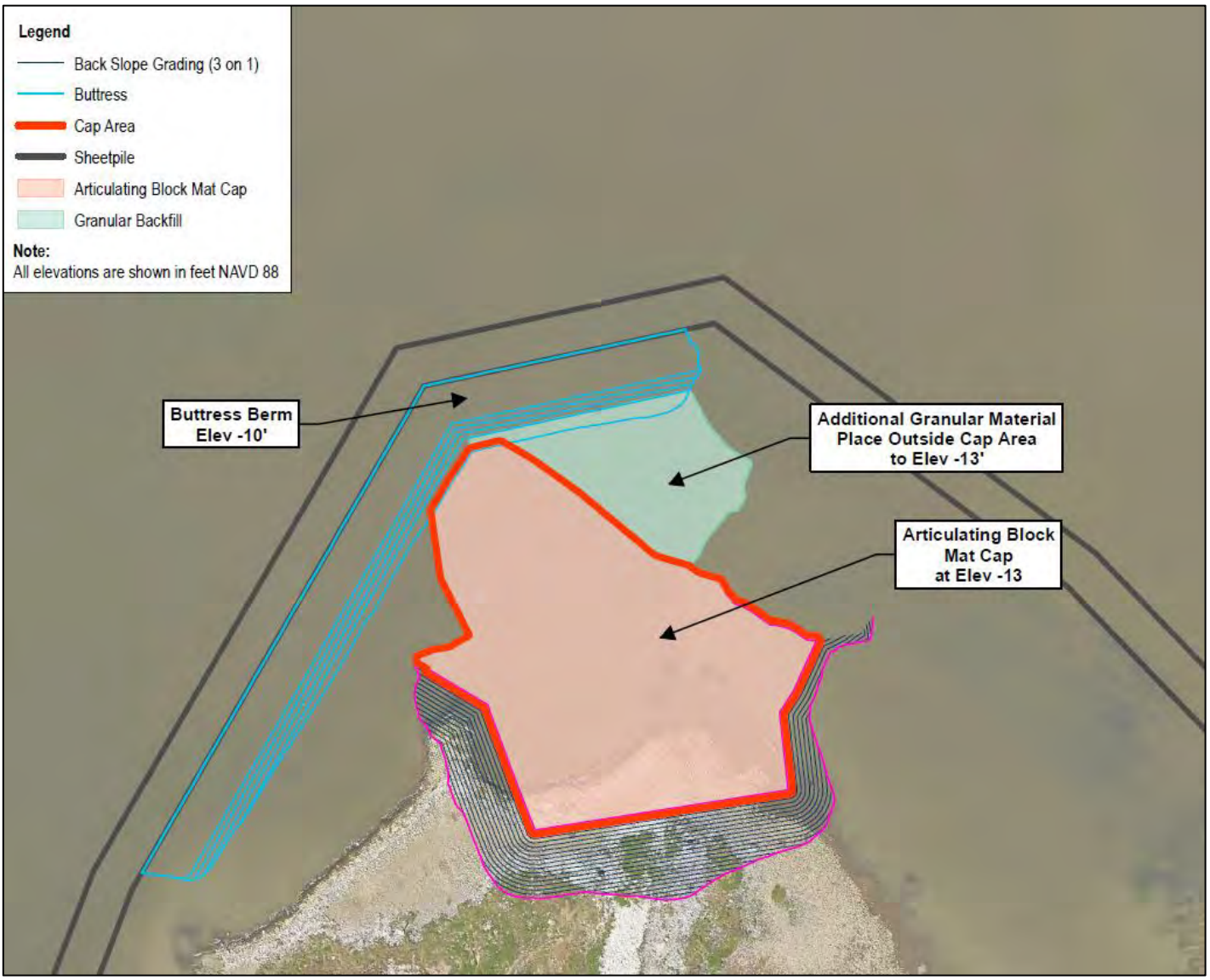

Figure 5-N End-State Capped Area

5.12.4.3 Monitoring and Controls

Monitoring and controls would be implemented during the RA for the northwest corner to prevent releases of impacted material to the surrounding land, water, or air as described in Section 5.9. Additional measures specific to the northwest corner capping operation are summarized below. The specific controls would be developed and/or refined in conjunction with the RC and would be included in revisions or modifications to the Site-Wide Monitoring Plan (SWMP; Appendix J; Attachment 5) and Construction Quality Assurance/Quality Control Plan (CQA/QCP; Appendix J; Attachment 6). An updated version of the CQA/QCP for the capping alternative has been included in the attached Appendix J-1, Attachment 5-A.

5.12.4.3.1 Turbidity Curtain

The RC would be required to install a series of two impermeable turbidity curtains on the northern boundary of the northwest corner to prevent any release of sediments to the remaining open water inside the BMP wall and outside the

area to be capped. The weighted impermeable curtain would extend the full length of the water column and be anchored to the bottom. The absence of flow within the BMP wall and the full length of the curtain means that the turbidity curtain should be effective at controlling migration of suspended solids. Visual inspections would be performed outside and between the curtains and adjustments would be made as necessary to contain the sediments.

5.12.4.3.2 Stormwater Pollution Prevention Plan (SWPPP) and Controls

After pumping the water down, and prior to beginning construction activities in the northwest corner, soil erosion and sediment controls would be implemented. When removing waste material for the dry excavation phase, the excavation would need to be maintained to be free of water as much as practicable. Measures that may be taken to keep water out of the open excavation include grading the excavation to drain stormwater away from the excavation and/or berm construction to prevent water from entering the excavation. As was discussed in Section 5.12.3, the effectiveness of these water management procedures depends in large part on the northwest corner being addressed prior to the other portions of the Northern Impoundment. To the extent practicable, measures would be put in place to segregate non-contact water (water that falls on the TCRA armored cap, soil buttress area just inside the BMP wall, and/or areas that have been confirmed clean) from contact water (water that has come into direct contact with waste material) to control the spread of impacted sediments. The RC would be required to develop a SWPPP for the Northern Impoundment prior to the start of the RA.

5.12.4.4 Drawings and Specifications

5.12.4.4.1 Design Drawings

All 90% RD design drawings are listed below. The drawings from the full June 90% RD submittal that included the northwest corner have been updated and are included in Appendix G-1, along with new drawings specific to the dry excavation and capping design for the northwest corner The drawings from the June 90% RD that have been updated to include the northwest corner and the new drawings specific to the dry excavation and capping design are indicated in black font below. The drawings indicated in grey font did not include the northwest corner and have not been included in Appendix G-1.

- Drawing G-01 - Cover Sheet.
- Drawing C-01 - Overall Plan.
- Drawing C-02 - Existing Conditions.
- Drawing C-03 - SSA Area and Northern Impoundment Works.
- Drawing C-04 - Soil Erosion and Sediment Control Plan - Overall.
- Drawing C-05 - Soil Erosion and Sediment Control Plan - Seasonal.
- Drawing C-06 - Soil Erosion and Sediment Control Details.
- Drawing C-07 - Project Traffic Control Plan.
- Drawing C-08 - Excavation Plan - Overall.
- Drawing C-09 - Excavation Plan Northwest.
- Drawing C-10 - Excavation Plan Northeast.
- Drawing C-11 - Excavation Plan Southeast.
- Drawing C-12 - Excavation Plan Southwest.
- Drawing C-13 - Excavation Section - 1 of 6.
- Drawing C-14 - Excavation Section - 2 of 6.
- Drawing C-15 - Excavation Section - 3 of 6.
- Drawing C-16 - Excavation Section - 4 of 6.
- Drawing C-17 - Excavation Section - 5 of 6.
- Drawing C-18 - Excavation Section - 6 of 6.

- Drawing C-19 - Typical Seasonal Excavation Sequencing.
- Drawing C-20 - Typical Excavation Sequencing - 1 of 2.
- Drawing C-21 - Typical Excavation Sequencing - 2 of 2.
- Drawing C-22 - Restoration Plan.
- Drawing C-23 - Typical Construction Sequencing - 1 of 2.
- Drawing C-24 - Typical Construction Sequencing - 2 of 2.
- Drawing C-25 - Typical Details - 1 of 3.
- Drawing C-26 - Typical Details - 2 of 3.
- Drawing C-27 - Typical Details - 3 of 3.
- Drawing C-28 - Pile Wall Layout Plan.
- Drawing C-29 - Double Pile Wall Plan and Profile - 1 of 4.
- Drawing C-30 - Double Pile Wall Plan and Profile - 2 of 4.
- Drawing C-31 - Double Pile Wall Plan and Profile - 3 of 4.
- Drawing C-32 - Double Pile Wall Plan and Profile - 4 of 4.
- Drawing C-33 - South Wall Plan and Profile - 1 of 2.
- Drawing C-34 - South Wall Plan and Profile - 2 of 2.
- Drawing C-35 - Double Pile Wall Sections - 1 of 7.
- Drawing C-36 - Double Pile Wall Sections - 2 of 7.
- Drawing C-37 - Double Pile Wall Sections - 3 of 7.
- Drawing C-38 - Double Pile Wall Sections - 4 of 7.
- Drawing C-39 - Double Pile Wall Sections - 5 of 7.
- Drawing C-40 - Double Pile Wall Sections - 6 of 7.
- Drawing C-41 - Double Pile Wall Sections - 7 of 7.
- Drawing C-42 - South Wall Sections - 1 of 3.
- Drawing C-43 - South Wall Sections - 2 of 3.
- Drawing C-44 - South Wall Sections - 3 of 3.
- Drawing C-45 - Capping Alternative Northwest Corner Works Plan.
- Drawing C-46 - Capping Alternative Northwest Corner Capping Controls.
- Drawing C-47 - Capping Alternative Northwest Corner Dry Excavation.
- Drawing C-48 - Capping Alternative Northwest Corner Fill Grade.
- Drawing C-49 - Capping Alternative Northwest Corner Sections - 1 of 2.
- Drawing C-50 - Capping Alternative Northwest Corner Sections - 2 of 2.
- Drawing C-51 - Capping Alternative Northwest Corner Sequencing - 1 of 2.
- Drawing C-52 - Capping Alternative Northwest Corner Sequencing - 2 of 2.
- Drawing C-53 - Capping Alternative Northwest Corner Final Grade.
- Drwaing C-54 - Capping Alternative Northwest Corner Capping Details.
- Drawing S-01 - Structural Notes.
- Drawing S-02 - Structural Layout Plan.
- Drawing S-03 - Structural Sections.
- Drawing S-04 - Structural Details 1 of 2.
- Drawing S-05 - Structural Details 2 of 2.
- Drawing P-00A - Water Treatment System Process Flow Diagram Symbols.

– Drawing P-00B - Water Treatment System Process Flow Diagram Schedules.
– Drawing P-01 - Water Treatment System Process Flow Diagram/Mass Balance.
– Drawing P-02 - Water Treatment System P&ID (1 of 4).
– Drawing P-03 - Water Treatment System P&ID (2 of 4).
– Drawing P-04 - Water Treatment System P&ID (3 of 4).
– Drawing P-05 - Water Treatment System P&ID (4 of 4).
– Drawing P-06 - Site Plan Water Treatment System Season 3-6.

As the means and methods for performing the Northern Impoundment remedy are further defined, these drawings, insofar as they reflect use of specific means and methods for carrying out the Northern Impoundment remedy, may be modified.

5.12.4.4.2 Technical Specifications

Technical specifications to address capping in the northwest corner have been added to the 90% RD design in Appendix H-1. The following specification has been added for the northwest corner:

– Section 31 35 26.50 - Articulating Block Fabric Formed Concrete.

5.12.4.5 Supporting Deliverables

5.12.4.5.1 Construction Quality Assurance/Quality Control Plan

The CQA/QCP (Appendix J-1, Attachment 6-A) is an updated version of the CQA/QCP. It describes the planned and systematic activities, including those related to the northwest corner for a dry excavation and capping, to be used during the Northern Impoundment RA to verify compliance with requirements consistent with clean-up goals and performance requirements.

5.12.5 Mechanical Dredging

As discussed in Section 5.12.3, the water elevation within the northwest corner must be maintained at or above -13 ft NAVD88 to control the potential for hydraulic heave. Under this approach, the water level in the northwest corner would be dropped to -13 ft NAVD88, the impacted material above -13 ft NAVD88 would be excavated in the dry, and the remainder of the material to the target removal elevations would be removed via mechanical dredging. The following sections describe the procedures for implementing mechanical dredging in the northwest corner.

5.12.5.1 Site Preparation Activities

Prior to disturbing ground in the northwest corner, erosion control structures would be installed in conformance with the SWPPP. A double turbidity curtain wouls be installed around the boundary of the area to be dredged to prevent any release of sediments to the open water area inside the BMP wall during the TCRA armored cap removal and dry excavation phases of the project. The site preparation activities would include constructing roads and truck loading area(s) for the dry excavation. A mixing pad would be constructed adjacent to the northwest corner at the loading area to solidify the excavated material, as necessary, prior to its transport off-site. For the dredging operation, a staging area would be constructed adjacent to the dredging location to support a crane that would assist with assembling the dredging equipment and placing the dredging equipment into the water. The size of the pad would be determined by the RC and is expected to be constructed of crushed concrete or similar over the top of geotextile fabric spread and rolled to provide a base to support the crane. The RC would provide a plan that describes the details of the excavation and dredging operations and associated roads and support facilities. The work in the northwest corner would have to take place prior to work in other areas so that access for vehicles and a mixing pad is available.

5.12.5.2 Excavation and Dredging Procedures

5.12.5.2.1 Cell Dewatering

Following the installation of the BMP, river water would be trapped within the Northern Impoundment. Based on historical river stage data, it is assumed that the water elevation would be at approximately +/- 0 ft NAVD88 on both sides of the BMP wall prior to any waste removal. Water located inside the BMP wall would be pumped back into the river to achieve an elevation of -13 ft NAVD88 in the northwest corner. This would expose approximately 0.67 acres of the northwest corner that can be excavated using land-based equipment in relatively dry conditions. Once the water is pumped to -13 ft NAVD88, the existing bathymetry in the northwest corner would effectively form a natural bowl that will contain the water in this low spot and prevent it from flooding out into the surrounding areas of the Northern Impoundment. This is only possible if the northwest corner is addressed prior to the remainder of the Northern Impoundment. Maintaining the water level at -13 ft NAVD88 provides water to offset the heave potential in the remaining 0.33 acres where the mudline is deeper. Figure 5-O, below shows the water extent within the northwest corner at a water elevation of -13 ft NAVD88 before and after the dry excavation work.

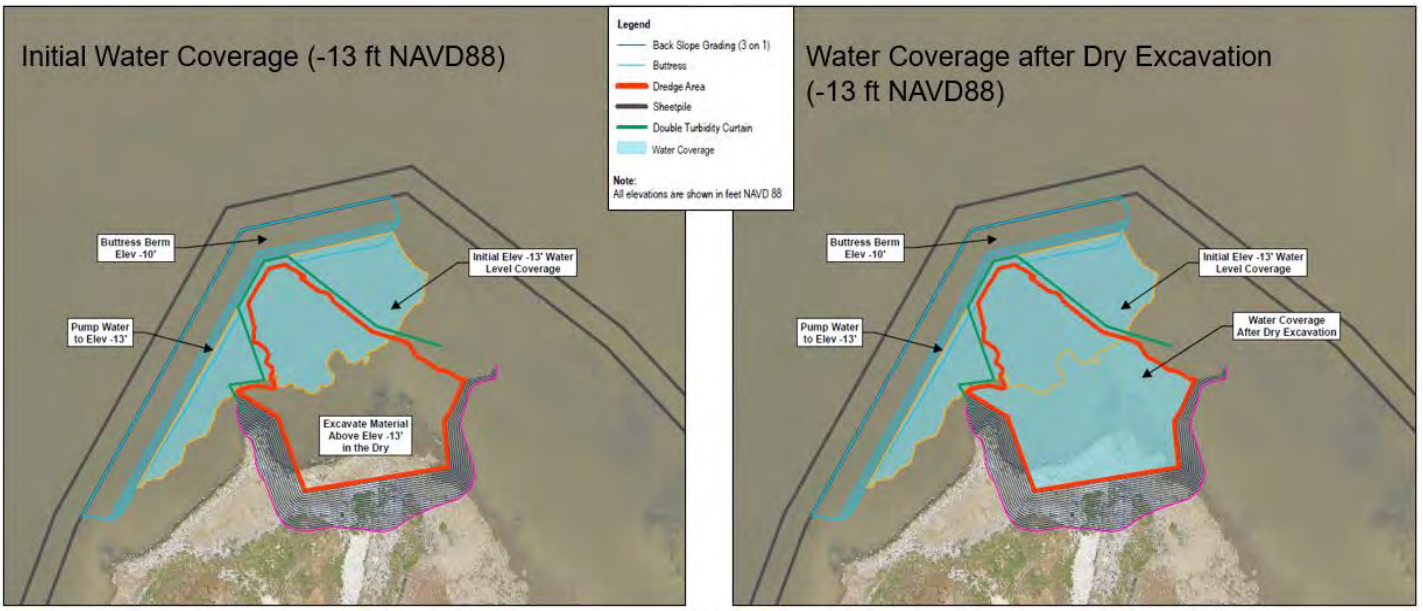

Figure 5-O Mechanical Dredging Area Flooded to -13 ft NAVD88 (Before and After Dry Excavation)

5.12.5.2.2 TCRA Armored Cap Removal Above -13 ft NAVD88

After pumping the water down to -13 ft NAVD88, and prior to excavation activities, the TCRA armored cap atop the exposed 0.67 acres would be removed using standard land-based excavation equipment to access the underlying waste material for excavation. The rock suitable for potential reuse would be staged on the Northern Impoundment or at a nearby location. Any geotextile and/or geomembrane barrier of the TCRA armored cap would be removed and disposed of off-site with the excavated material.

5.12.5.2.3 Dry Excavation

After removal of the TCRA armored cap, excavation of approximately 9,800 CY of waste material to an elevation of -13 ft NAVD88 would take place in the dry using excavation equipment. During the excavation activities, the excavator would be positioned so it can reach into the excavation and swing around to load trucks or place material directly into a mixing pad. Any waste material that does not contain free liquids and/or does not require solidification would be loaded directly in haul trucks for off-site disposal. Excavated material that is too wet (i.e., would not pass the paint filter test) to be directly loaded into haul trucks would be temporarily staged and allowed to drain by gravity and dry naturally and/or be solidified on the mixing pad prior to loading for off-site disposal. An earthen ramp would be

constructed over the lip of the BMP wall (in a location adjoining the TxDOT right-of-way) to allow truck traffic into and out of the work area (see Drawings C-05 and C-045 in Appendix G-2).

Within the northwest corner, SWPPP controls would be installed to control run-on and run-off from the excavation surface, as described in Section 5.9.2. Any water that contacts the excavation surface would be pumped out, as needed to maintain excavation operations, to a WTS where it will be treated and discharged, as described in Section 5.8.

5.12.5.2.4 Dredging Procedures

After completion of the dry excavation, the northwest corner would be prepared for mechanical dredging by raising the water to a minimum elevation of -9 ft NAVD88 by pumping water back into the northwest corner from the river. The higher water elevation is necessary to offset the heave potential when removing material to the deeper target depths in this area and to provide sufficient draft to float the dredge. In order to contain the water within the northwest corner once the water level is raised, an earthen berm would be installed in a low area on the eastern boundary of the northwest corner (as shown below in orange). Double impermeable turbidity curtains would be installed around the area to be dredged. The curtains would extend from above the water surface to the mudline. The inner curtain would be anchored approximately 10 ft outside the outer limits of the dredge area. The outer curtain would be positioned just outside the inner curtain. Both curtains would extend to the mudline and be anchored in place.

Figure 5-P, below, shows the limits of the flooded area at elevation -9 ft NAVD88, as contained by the natural bathymetry of the land around the northwest corner. It also shows the approximate locations of the turbidity curtains, and the location of the earthen berm to be installed on the eastern side to contain water.

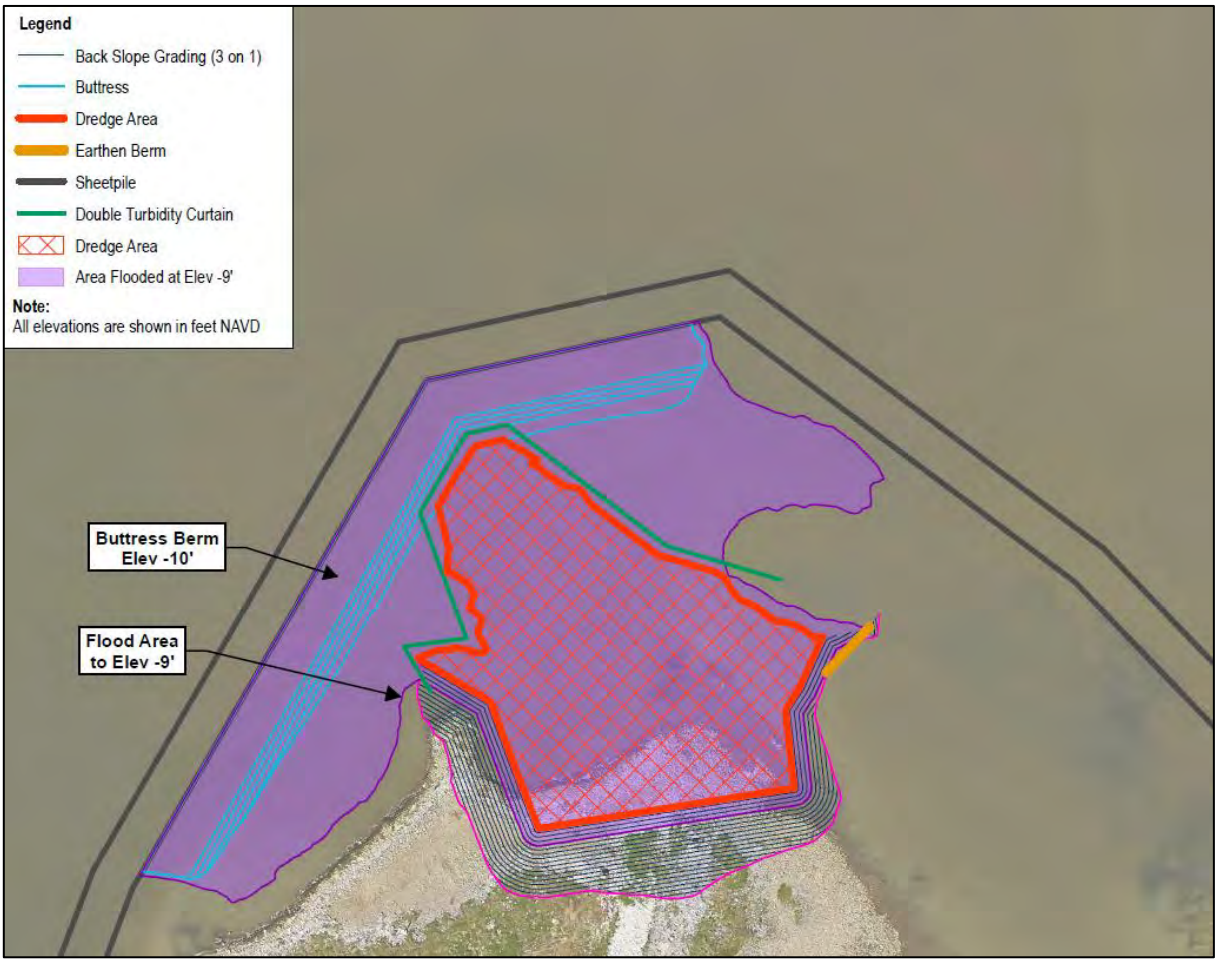

Figure 5-P Mechanical Dredging Area Flooded to -9 ft NAVD88

5.12.5.2.4.1 Dredging and Processing Equipment

Mobilization for the dredging operation would occur after construction of the staging area and concurrent with the dry excavation activities. Any equipment requiring assembly would likely require the assistance of a crane. It is expected that the dredge platform would be constructed of FlexiFloat sectional barges or similar and spuds would be installed on the platform for positioning purposes. After assembly of the FexiFloat dredge platform, the mechanical dredging excavator would be tracked onto the barge or placed onto the barge with the crane. Material barges would be placed into the water and assembled for the purpose of managing the dredge spoils and transporting the spoils to a location at the edge of the dredge area and within the northwest corner as shown on Drawing C-45 in Appendix G-2 for processing.

An aboveground solidification containment area would be constructed adjacent to the edge of the dredge area and would be sized, subject to space limitations, to manage at least 2 days of dredged materials based on the RC's planned production rate. The containment area would be lined and would contain a sump to remove free liquid. The decanted water would be pumped to the WTS where it would be treated and discharged, as described in Section 5.8 or used as make-up water for the dredging operation. The treated water may be pumped back to the northwest corner to serve as make-up water to maintain the required water elevation of -9 ft NAVD88 as waste material is being removed. The solidification containment area would be designed to manage both the solidification and loading operations. It would be situated within a larger bermed area that would also be lined to contain any spillage from the material management and loading operations.

The barge-mounted excavator would first remove the remaining TCRA armored cap material over the submerged portion of the northwest corner. The TCRA armored cap material would be loaded onto barges and transported to the edge of the dredge area for offloading and transportation off-site.

For the dredging operation, the excavator would be outfitted with an environmental bucket designed to minimize turbidity and resuspension of sediment. Managing resuspension and residuals is discussed further in Section 5.12.5.7.1. The dredged sediment would be removed and placed into sealed hopper barges, which would be moored to the dredge platform while they are being loaded. Once full, the hopper barges would be transported to the edge of the dredge area for offloading at the stabilization containment area.

5.12.5.2.4.2 Dredging and Verification Procedures

A pre-dredge bathymetric survey would be performed to develop the pre-dredge surface. The information from the survey, in combination with the CAD surface of the target remediation limits, would provide the basis for the dredge prisms and target volumes for the dredging production passes. Additional bathymetric surveys would be performed during the dredging to provide project operational data for routine evaluation of dredging operations and to allow for analysis of daily production, measurement of removal accuracy, and process adjustments.

For positioning and accuracy purposes, the dredge excavator would be equipped with real-time kinematic global positioning system (RTK-GPS) that would confirm that the removal activities met the horizontal and vertical requirements of the project. The RTK-GPS signals would be combined with various sensors located on the excavator to incorporate the numerous variables of an excavator's operation, including real-time adjustments for water fluctuations. The excavator includes sensors that would measure the angle of the stick and the boom, and the rotation of the bucket, as well as the pitch and roll of the machine itself. The desired design depths within the dredge prism would be displayed in real-time on a screen located on the dredge to assist the operator in determining target depths while operating the equipment. The information generated from the GPS system and the sensors would be processed in real-time using Hypack, Inc. Dredgepack® software or similar.

The dredging operation would require the addition of makeup water to maintain the -9 ft NAVD88 water elevation. The make-up water would either be pumped into the northwest corner directly from the river and/or pumped to the area from the clean WTS effluent.

5.12.5.3 Solidification and Loading

After loading material into hopper barges and pushing the barges to the staging area with work boats, the material would be allowed to gravity drain. Water that accumulates in the hopper barges would be pumped to a settling tank where the sediments would settle out. The water would then be removed and pumped to the WTS, as described in Section 5.8, or used as makeup water for the dredging operation. The accumulated sediments would be periodically removed from the settling tanks and incorporated in with the dredge spoils for solidification.

After the water is pumped from the hopper barges, a material handler or similar equipment, would be used to offload the dredge spoils from the hopper to the solidification containment area. The material would be mixed with a solidification agent in the stabilization containment area and allowed to cure, as needed, to meet the paint filter test. Section 3.3.5 provides the result of solidification treatability testing performed on the waste material; however, the RC would be required to perform its own treatability testing to define the reagents and mix ratios prior to the RA. After curing, the solidified material would be removed from the solidification containment area, loaded into haul trucks, and transported to the off-site landfill.

5.12.5.4 Post-Dredging Confirmation Sampling

As detailed in the updated Field Sampling Plan (FSP; Appendix J-2, Attachment 3-A), prior to conducting a final pass intended to remove remaining settled residuals, composite sampling across decision units (DUs) in the northwest corner would be used to demonstrate compliance with the cleanup standard. The sampling would also serve to inform the target depth of the final dredge pass, up to a maximum depth limit of two feet beyond the target excavation elevations. Consistent with the format provided herein, only newly added-information pertinent to the northwest corner has been included in the attached FSP.

Prior to confirmation sample collection, chemical additives would be mixed with the water in the northwest corner to promote settling of resuspended sediments from the water column to maximize residuals removal.

Following excavation of the northwest corner to the target elevations, the area would be divided into two approximately ½-acre DUs using a methodology similar to that used for the rest of the impoundment, as described in the FSP (Appendix J, Attachment 3). Six to eight (6 to 8) discrete 2-ft core samples would be collected from sample locations evenly spaced across the DU excavation bottom. Each 2-ft core discrete sample would be divided into two depth intervals (6 to 12 inches and 12 to 24 inches) after excluding the top approximately 6-inch layer of settled residuals (to be removed as part of the final pass as described in the sections below). A composite sample of the discrete samples from each depth interval would be prepared for laboratory analysis. The approved analytical laboratory (Approved Laboratory) would analyze the 6 to 12-inch composite first and would hold the 12 to 24-inch sample pending the results of the shallower sample.

Results will be evaluated, as described below:

– If the result of the 6 to 12-inch composite sample is below the clean-up level, a 6-inch overcut would be performed in that DU to serve as a final pass and remove any settled residuals.
– If the result of the 6 to 12-inch composite sample is above the clean-up level, the 12 to 24-inch composite sample that the Approved Laboratory is holding would be analyzed.
– If the result of the 12 to 24-inch composite sample is below the clean-up level, a 12-inch overcut would be performed in that DU to remove the remaining inventory and any settled residuals.
– If the result of the 12 to 24-inch composite sample is above the clean-up level, a 24-inch overcut would be performed in that DU to remove the remaining inventory and any settled residuals.

As the result of three pre-design investigations, there is an extensive dataset to give confidence in the horizontal and vertical delineation of the impacted area in the Northern Impoundment. Even still, as is the case in the remainder of the impoundment, the BMP wall around the northwest corner has been designed to allow for the removal of up to an additional 2 feet of material. Additionally, in the northwest corner as waste material is removed, make-up water must be added to offset the weight of the removed material. A water elevation of -9 ft NAVD88 is sufficient to compensate for removal of waste material to the target excavation elevations identified based on the existing dataset (that include

a maximum removal of -28.45 ft NAVD88) plus an additional 2-ft overcut, if necessary. If an additional dredging pass is required to remove material, the water level would have to be raised proportionately to offset the deeper removal. However, no more than 2 feet of additional removal are possible without compromising the structural integrity of the BMP wall. Further, due to a very tight schedule for the seasonal dredging in the northwest corner, only one round of sampling, analysis, and over-excavation would likely be possible. Given the deep, challenging conditions in the northwest corner, the time (as much as one-third of a season) required to close an excavation in this location, and the use of specialized dredging equipment which is only planned for use in this limited area of the Northern Impoundment, backfilling the northwest corner area and returning the next excavation season would not be practical. Any remaining residuals following the clean pass would be addressed by the residuals management layer, described in Section 5.12.5.6, which would be as thick as 15 ft in some places.

5.12.5.5 Final Dredging Pass

Based upon the results of the confirmation sampling described above and in the FSP, a final dredging pass would be conducted to remove the generated residuals (to the extent practicable) and any undredged inventory identified by confirmation sampling. A bathymetric survey would be performed to develop an updated bathymetric profile after settling of residuals. The information from the survey in combination with the updated remediation surface from the confirmation sampling would be used to create the dredge prisms for the final dredging pass.

The final dredging pass would use the same procedures for positioning the dredge and verification of removal as described in Section 5.12.5.2.4.1. Modifications may be made to the mechanical dredging bucket type and the dredging procedures for the final pass to optimize removal efficiency based on the thickness and condition of the material to be dredged.

5.12.5.6 Residual Management Layer

After the final dredging pass, chemical additives may be used again to promote a final round of settling of the resuspended sediments. The procedures for the final round of settling of resuspended sediments would be developed by the RC based on the condition of the water and the effectiveness of the additives during the first application described above in Section 5.12.5.4. Granular material would then be placed over the dredged area to achieve the following:

– Provide weight to offset the heave potential as the weight from the water is removed.
– Facilitate complete removal of contact water at the surface.
– Provide a residual management layer.

Similar to the capping alternative described in Section 5.12.4, granular material would also be placed in a low area located to the northeast of the dredging area where there is a risk of hydraulic heave, as shown in green shading on Figure 5-P, below. The heave calculations indicate that, for this area, the heave potential during reasonable maximum conditions (+5 ft NAVD88 river level and a SF of 1.25) is within the level defined as acceptable for purposes of the RD, but there may be a potential for heave during extreme river level conditions near +9 ft NAVD88. Considering that this area may be dewatered for up to 7 years during construction across the Northern Impoundment, approximately 1 foot of granular material would be added to this area during the granular material placement phase to offset this heave potential.

A bathymetric survey would be conducted to define the final dredge surface and periodic surveys would be conducted during material placement to measure progress. The material would first be placed over the low area located to the northeast of the dredged area in the northwest corner to an elevation of -13 ft NAVD88 with standard excavation equipment working from barges.

The residual management layer within the dredging limits would initially be placed using subaqueous capping techniques that distribute the granular material in thin lifts to effectively cover any residuals with minimal disturbance. After a minimum of 2 feet of granular material has been placed over the entire dredged surface, a bathymetric survey would be performed to confirm the granular material thickness. The material above the initial 2-ft layer may be placed

more quickly using methods such as placing the material in from the edge of the excavated area or placing with excavators.

During residual management layer placement, the water would be maintained between elevation -9 ft NAVD88 to -13 ft NAVD88 to continue to offset the heave potential while not allowing the water to flood beyond the -9 ft NAVD88 extent (see Figure 5-O). The water that is displaced by the granular material would be captured and pumped to the WTS for treatment, as described in Section 5.8. The granular cover material would be placed over the dredged area to a final grade of -13 ft NAVD88, constituting a residuals management layer that is up to 15 ft thick in some places.

Figure 5-Q, below, shows the limits of the granular material after placement.

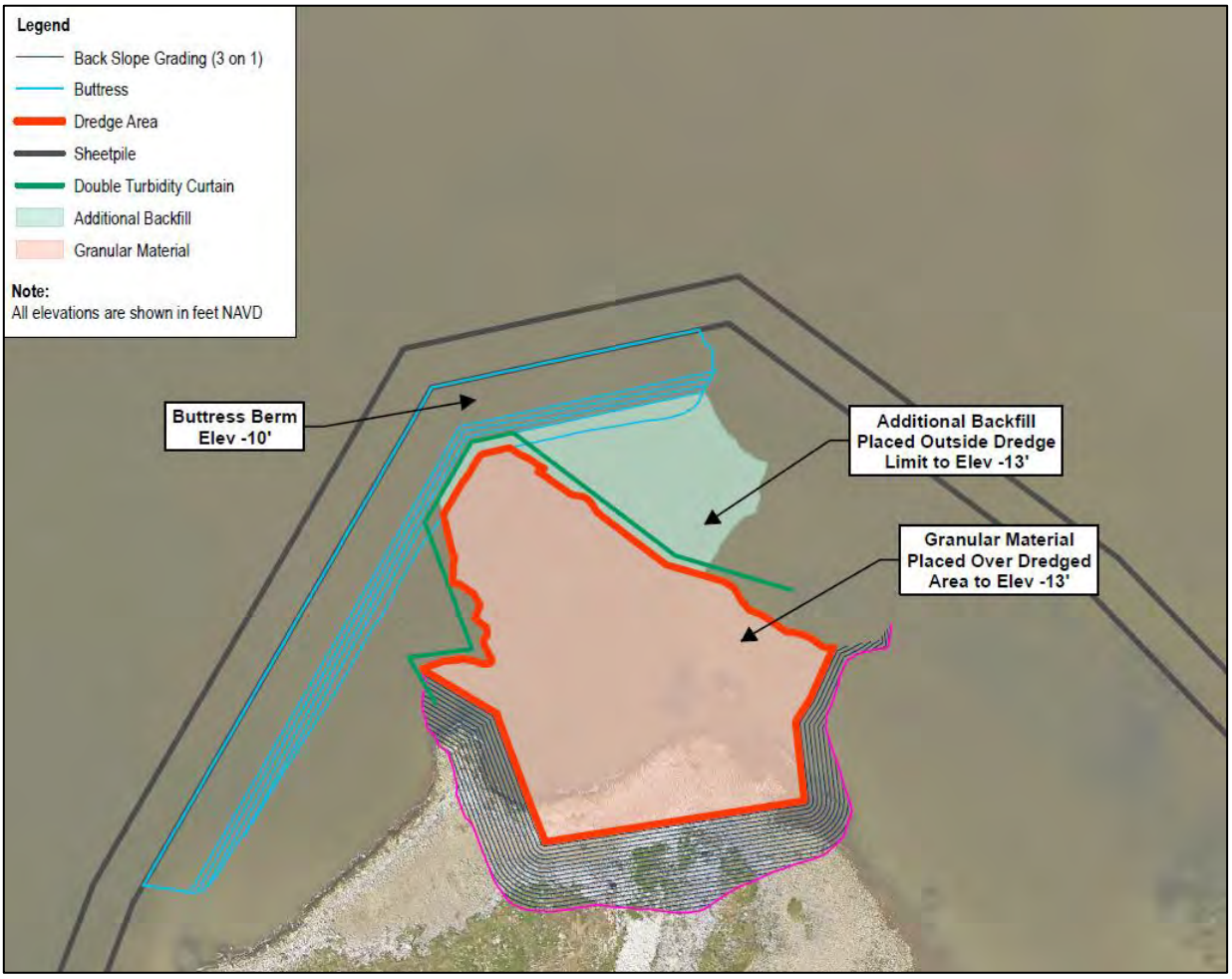

Figure 5-Q *Post-Dredging Fill Placement to -13 ft NAVD88*

5.12.5.7 Monitoring and Controls

5.12.5.7.1 Resuspension and Residuals Management

Several methods would be employed to control and manage resuspension of sediment and residuals during dredging activities, as listed below.

Construction of Earthen Berms - As previously stated, for the most part, the existing bathymetry in the northwest corner effectively forms a natural bowl that would contain the water and prevent it from flooding out into the surrounding areas of the Northern Impoundment. There is one area to the southeast that would require construction of an earthen berm to fill a low area and keep the water contained to the northwest corner. Construction of berms and

other best stormwater management practices would be implemented across the northwest corner where necessary to limit the spread of contact water and potential residuals.

Turbidity Curtains - Prior to dredging operations, double turbidity curtains would be installed around the area to be dredged. The turbidity curtains would be made of impermeable fabric to control migration of suspended solids from the dredging area during dredging and material placement. The curtains would extend from the water surface through the full extent of the water column to the mudline and would be weighted and/or anchored to the river bottom. The absence of flow within the BMP wall means that the turbidity curtain should be effective at controlling migration of suspended solids.

Dredging Procedures - The RC would be required to perform the mechanical dredging using an environmental dredging bucket that is specifically designed to reduce the release of sediments during closure and retrieval to minimize resuspension. Additional measures required during dredging to minimize resuspension and the generation of residuals include:

– Setting and sequencing production cuts to reduce concentrations in residuals.
– Placing bucket accurately so as not to allow missed sediments between bucket placement.
– Controlling bucket overpenetration and overfilling.

Use of Polymers, Coagulants and/or Other Additives - As a method to reduce the resuspended sediments in the water column for the northwest corner, polymers, coagulants and/or other additives to promote settling would be applied and mixed after the completion of production passes. Depending on the condition of the water and the effectiveness of the first application, a second application may also be performed after the final pass, prior to placement of the residuals management layer. A settling test treatability study was performed as part of the 2020 Approach B Water Filtration Testing (see Section 3.6.2). Polymer and coagulant were added to a tank with suspended solids from the Northern Impoundment simulating conditions in a dredging scenario. Using 250 parts per million (ppm) polyaluminum chloride and 25 ppm Nalco polymer 7194, the turbidity in the tank dropped quickly from 4,060 Nephelometric Turbidity Units (NTUs) to below 40 NTU after 30 minutes of settling. Final turbidity values after 3 hours of settling were between 4 and 5 NTUs. These results were compared to a controls test performed without the addition of polymers or coagulants, where the turbidity was above 75 NTUs after 60 hours (with an initial turbidity of 9,190 NTUs). Although results of the laboratory settling tests using polymers and coagulants were favorable (see Section 3.6.2), application of these additives in an area much larger than a laboratory setting could prove difficult to provide consistent application and proper mixing. The RC would evaluate the GHD treatability data and perform its own testing, as necessary to develop a plan for application and mixing of polymers, coagulants and/or other additives.

Final Pass - A targeted final pass would be conducted after completion of production passes to reduce or remove the thickness of the contaminated residuals layer and to address any remaining inventory, as informed by the confirmation sampling.

Residual Management Layer - To overcome the potential for hydraulic heave in the northwest corner while pumping out the contact water, imported granular material would be placed atop the dredged area to an elevation of -13 ft NAVD88. This fill material would also serve as a residuals management layer to cover the remaining residuals. The initial layers would be placed using subaqueous capping techniques that distribute the material in thin lifts to effectively cover any residuals while minimizing sediment resuspension. The residual management layer would be constructed to -13 ft NAVD88, which would provide as much as 15 ft of cover over the dredged area.

5.12.5.7.2 Stormwater Pollution Prevention Plan and Controls (SWPPP) and Controls

After pumping the water down, and prior to beginning construction activities in the northwest corner, soil erosion and sediment controls would be implemented. When removing waste material during the dry excavation phase, the area would need to be maintained to be free of water, as much as practicable. Measures that may be taken to keep water out of the open excavation include grading the excavation to drain stormwater away from the excavation and/or berm construction to prevent water from entering the excavation. As was discussed in Section 5.12.3, the effectiveness of these water management procedures depends in large part on the northwest corner being addressed prior to the other portions of the Northern Impoundment. To the extent practicable, measures would be put in place to segregate

non-contact water (water that falls on the TCRA armored cap, BMP wall soil buttress area, and/or areas that have been confirmed clean) from contact water (water that has come into direct contact with waste material) to control the spread of impacted sediments. The RC would be required to develop a SWPPP for the Northern Impoundment prior to the start of the RA.

5.12.5.8 Drawings and Specifications

5.12.5.8.1 Design Drawings

All 90% RD design drawings are listed below. The drawings from the full June 90% RD submittal that included the northwest corner have been updated and are included in Appendix G-2, along with new drawings specific to the mechanical dredging design for the northwest corner. The drawings from the June 90% RD that have been updated to include the northwest corner and the new drawings specific to the mechanical dredging design are indicated in black font below. The drawings indicated in grey font did not include the northwest corner and have not been included in Appendix G-2.

- Drawing G-01 - Cover Sheet.
- Drawing C-01 - Overall Plan.
- Drawing C-02 - Existing Conditions.
- Drawing C-03 - SSA Area and Northern Impoundment Works.
- Drawing C-04 - Soil Erosion and Sediment Control Plan - Overall.
- Drawing C-05 - Soil Erosion and Sediment Control Plan - Seasonal.
- Drawing C-06 - Soil Erosion and Sediment Control Details.
- Drawing C-07 - Project Traffic Control Plan.
- Drawing C-08 - Excavation Plan - Overall.
- Drawing C-09 - Excavation Plan Northwest.
- Drawing C-10 - Excavation Plan Northeast.
- Drawing C-11 - Excavation Plan Southeast.
- Drawing C-12 - Excavation Plan Southwest.
- Drawing C-13 - Excavation Section - 1 of 6.
- Drawing C-14 - Excavation Section - 2 of 6.
- Drawing C-15 - Excavation Section - 3 of 6.
- Drawing C-16 - Excavation Section - 4 of 6.
- Drawing C-17 - Excavation Section - 5 of 6.
- Drawing C-18 - Excavation Section - 6 of 6.
- Drawing C-19 - Typical Seasonal Excavation Sequencing.
- Drawing C-20 - Typical Excavation Sequencing - 1 of 2.
- Drawing C-21 - Typical Excavation Sequencing - 2 of 2.
- Drawing C-22 - Restoration Plan.
- Drawing C-23 - Typical Construction Sequencing - 1 of 2.
- Drawing C-24 - Typical Construction Sequencing - 2 of 2.
- Drawing C-25 - Typical Details - 1 of 3.
- Drawing C-26 - Typical Details - 2 of 3.
- Drawing C-27 - Typical Details - 3 of 3.
- Drawing C-28 - Pile Wall Layout Plan.
- Drawing C-29 - Double Pile Wall Plan and Profile - 1 of 4.

- Drawing C-30 - Double Pile Wall Plan and Profile - 2 of 4.
- Drawing C-31 - Double Pile Wall Plan and Profile - 3 of 4.
- Drawing C-32 - Double Pile Wall Plan and Profile - 4 of 4.
- Drawing C-33 - South Wall Plan and Profile - 1 of 2.
- Drawing C-34 - South Wall Plan and Profile - 2 of 2.
- Drawing C-35 - Double Pile Wall Sections - 1 of 7.
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- Drawing C-40 - Double Pile Wall Sections - 6 of 7.
- Drawing C-41 - Double Pile Wall Sections - 7 of 7.
- Drawing C-42 - South Wall Sections - 1 of 3.
- Drawing C-43 - South Wall Sections - 2 of 3.
- Drawing C-44 - South Wall Sections - 3 of 3.
- Drawing C-45 - Dredging Alternative Northwest Corner Works Plan.
- Drawing C-46 - Dredging Alternative Northwest Corner Dredging Controls.
- Drawing C-47 - Dredging Alternative Northwest Corner Dry Excavation.
- Drawing C-48 - Dredging Alternative Northwest Corner Wet Excavation.
- Drawing C-49 - Dredging Alternative Northwest Corner Sections - 1 of 2.
- Drawing C-50 - Dredging Alternative Northwest Corner Sections - 2 of 2.
- Drawing C-51 - Dredging Alternative Northwest Corner Sequencing - 1 of 3.
- Drawing C-52 - Dredging Alternative Northwest Corner Sequencing - 2 of 3.
- Drawing C-53 - Dredging Alternative Northwest Corner Sequencing - 3 of 3.
- Drawing C-54 - Dredging Alternative Northwest Corner Final Grade.
- Drawing C-55 - Dredging Alternative Northwest Corner Dredging Details.
- Drawing S-01 - Structural Notes.
- Drawing S-02 - Structural Layout Plan.
- Drawing S-03 - Structural Sections.
- Drawing S-04 - Structural Details 1 of 2.
- Drawing S-05 - Structural Details 2 of 2.
- Drawing P-00A - Water Treatment System Process Flow Diagram Symbols.
- Drawing P-00B - Water Treatment System Process Flow Diagram Schedules.
- Drawing P-01 - Water Treatment System Process Flow Diagram/Mass Balance.
- Drawing P-02 - Water Treatment System P&ID (1 of 4).
- Drawing P-03 - Water Treatment System P&ID (2 of 4).
- Drawing P-04 - Water Treatment System P&ID (3 of 4).
- Drawing P-05 - Water Treatment System P&ID (4 of 4).
- Drawing P-06 - Site Plan Water Treatment System Season 3-6.

5.12.5.8.2 Technical Specifications

A technical specification to address mechanical dredging in the northwest corner has been added to the 90% RD design in Appendix H-2. The following specification was added for the northwest corner:

– Section 35 24 00 - Dredging.

5.12.5.9 Supporting Deliverables

5.12.5.9.1 Field Sampling Plan

The FSP (Appendix J-2, Attachment 3-A) is an updated version of the FSP. It has been updated to describe the sampling activities for all media to be sampled during work to implement the Northern Impoundment RA, including northwest corner activities associated with dredging. The FSP provides the rationale for sample collection and describes the protocol for sample handling and analysis.

5.12.5.9.2 Construction Quality Assurance/Quality Control Plan

The CQA/QCP (Appendix J-2, Attachment 6-B) is an updated version of the CQA/QCP that describes the planned and systematic activities to be used during the Northern Impoundment RA, including the northwest corner activities involving mechanical dredging, to verify that requirements consistent with clean-up goals and performance requirements are met.

9.5 Site-Wide Monitoring Plan

9.6 Construction Quality Assurance/Quality Control Plan

9.7 Institutional Controls Implementation and Assurance Plan

9.8 Transportation and Off-Site Disposal Plan

9.9 Monitored Natural Recovery Plan (Operations & Maintenance Plan)

9.10 Operations & Maintenance Manual

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Table 5-4

Northwest Corner Dredge Removal Elevations
Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)
San Jacinto River Waste Pits Site
Harris County, Texas

Starting Elevation (Mud-line)	-1.17	-0.61	-8.04	-13.36	-14.36	-18.39	-15.36	-15.64	-12.40	-4.29
	SJSB070	SJSB099	SJGB013	SJSB100	SJSB098	SJSB057	SJSB103	SJSB097[1]	SJSB056	SJSB056-C1
ELEVATION (feet NAVD88)										
+5										
+4										
+3										
+2										
+1										
0										
-1	**43900**	**53000**								
-2	**43900**	**53000**								
-3	**68600**	**54000**								
-4	**68600**	**54000**								0.79
-5	**45600**	**130**								0.79
-6	**45600**	**130**								1.14
-7	**24300**	13								1.14
-8	**24300**	13	**5100**							0.26
-9	**16700**	15	**5100**							0.26
-10	**16700**	15	**1740**							0.60
-11	**1000**	**210**	**1740**							0.60
-12	**1000**	**210**	**338**						3.35	1.4
-13	**609**	1.9	**338**	**110**					3.35	1.4
-14	**609**	1.9	**104**	**110**	**71**				1.65	1.33
-15	6.9	26	**104**	3.7	**71**		2.2		1.65	1.33
-16	6.9	26	25.2	3.7	**1900**		2.2	5.2	0.80	0.60
-17	4.69	14	25.2	9.2	**1900**		1.1	5.2	0.80	0.60
-18	4.69	14		9.2	**1800**	**24200**	1.1	1.2	0.78	0.62
-19				0.81	**1800**	**24200**	14	1.2	0.78	0.62
-20				0.81	**160**	**37600**	14	1.8	3.76	0.96
-21				2.3	**160**	**37600**	4.8	1.8	3.76	0.96
-22				2.3	**9600**	**3540**	4.8	1.4	0.93	
-23				0.58	**9600**	**3540**	3.9	1.4	0.93	
-24				0.58	**3900**	**372**	3.9	2.6	2.91	
-25				0.57	**3900**	**372**	0.49	2.6	2.91	
-26				0.57	**680**	7.6	0.49	0.77	4.44	
-27				0.51	**680**	7.6	0.46	0.77	4.44	
-28				0.51	11	2.93	0.46	1.4	0.46	
-29					11	2.93		1.4	0.46	
-30					0.16	15.9		0.29		
-31					0.16	15.9		0.29		
-32						1.59				
-33						1.59				
-34						1.5				
-35						1.5				
Calculated Excavation Elevation	**-15.17**	**-12.61**	**-14.04**	**-13.36**	**-28.36**	**-26.39**	**-16.99**	**-15.64**	**-12.40**	**-19.69**
Calculated Excavation Depth	**14**	**12**	**6**	**0**	**14**	**8**	**2**	**0**	**0**	**15**
Hydraulic Heave Elevation	**-22.4**	**-22.60**	**-17.00**	**-15.50**	**-13.00**	**-13.00**	**-13.00**	**-16.00**	**-16.00**	**-15.47**
Hydraulic Heave Depth	**21.23**	**21.99**	**8.96**	**2.14**	**-1.36**	**-5.39**	**-2.36**	**0.36**	**3.60**	**11.18**

Notes:

- Bold font indicates dioxins results >30 ng/kg TEQ.
- Yellow shading indicates material >30 ng/kg TEQ being removed.
- Green shading indicates material <30 ng/kg TEQ being removed.
- Red line indicates the elevation in each boring at which there is risk of hydraulic heave (Factor of Safety <1.25).
- Green line indicates the target removal elevation for each boring.

[1] Elevation at which there is risk of hydraulic heave is the same as the target removal elevation.

Legend

- Northern Impoundment Water Surface (Hindcasted)
- Sheldon Gage Water Surface (Measured)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

NAVD88 = North American Vertical Datum of 1988

San Jacinto River water surface data at the Northern Impoundment based upon data obtained from a transducer installed in the river on the west side of the Northern Impoundment in July, 2019

BMP = Best Management Practice (ie: cofferdam or sheetpile wall)"

Paper Size ANSI B

GHD

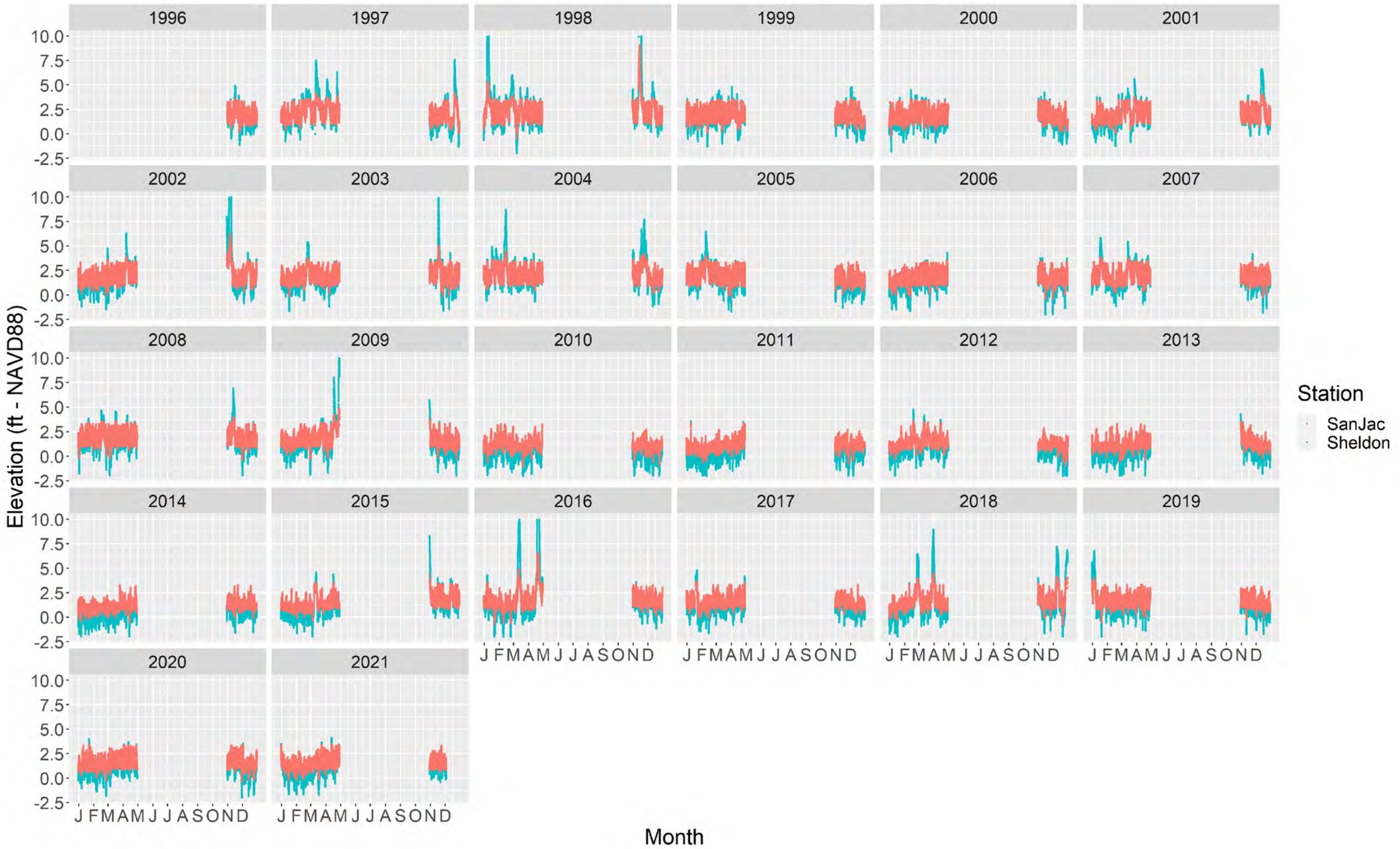
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - YEAR ROUND

Project No. **11215702**
Revision No. **-**
Date **Nov 1, 2022**

FIGURE 5-4

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS005-4.mxd



Legend

- Northern Impoundment Water Surface (Hindcasted)
- Sheldon Gage Water Surface (Measured)

Notes:
San Jacinto River water surface elevations measured at the Sheldon Gage (USGS #08072050)

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Paper Size ANSI B

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

Project No. **11215702**
Revision No. **-**
Date **Nov 1, 2022**

FIGURE 5-5

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS005-5.mxd

Appendices

Appendix B

Geotechnical Engineering Report

Appendix B-1

Northwest Corner Hydraulic Heave Evaluation

GEOTECHNICAL ENGINEERING REPORT ADDENDUM
HYDRAULIC HEAVE ANALYSIS – NORTHWEST CORNER
SAN JACINTO RIVER WASTE PITS
NORTHERN IMPOUNDMENT
HARRIS COUNTY, TEXAS

Ardaman & Associates, Inc.

NEW ORLEANS BRANCH

101 Teal Street, St. Rose, LA 70087 – Phone: (504) 835-2593

Branch Office Locations

Florida: Bartow, Cocoa, Fort Meyers, Miami, Orlando, Port St. Lucie, Sarasota, Tallahassee, Tampa, West Palm Beach
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American Council of Engineering Companies

November 7, 2022
AAI File: 18-2876-004

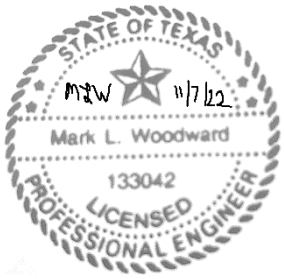
GHD Services Inc.
5551 Corporate Boulevard, Suite 200
Baton Rouge, Louisiana 70808

Attention: Mr. Charles W. Munce, P.E.
Project Manager

Re: Geotechnical Engineering Report Addendum
Northwest Corner Hydraulic Heave Analysis
San Jacinto River Waste Pits
Northern Impoundment
Harris County, Texas

We have completed our study and analyses based on the existing and available data received to date for the San Jacinto Waste Pits Superfund Site's Northern Impoundment Northwest Corner Hydraulic Heave Analysis. A summary of the methods of analysis and results are provided in the attached Geotechnical Engineering Report Addendum. The analyses were based on the information made available to Ardaman to date and may be subject to change in the future.

Sincerely,
ARDAMAN & ASSOCIATES, INC.
Texas Firm # 5822



CHAD D. ROE, P.E.
PROJECT ENGINEER

MARK L. WOODWARD, P.E.
PRINCIPAL GEOTECHNICAL ENGINEER

TABLE OF CONTENTS

GEOTECHNICAL ENGINEERING REPORT ADDENDUM
NORTHWEST CORNER HYDRAULIC HEAVE ANALYSIS
PRE-FINAL 90% REMEDIAL DESIGN
SAN JACINTO RIVER WASTE PITS
NORTHERN IMPOUNDMENT
HARRIS COUNTY, TEXAS

This Geotechnical Engineering Addendum summarizes the results of the hydraulic heave analyses to determine safe water levels within the northwest corner of the Northern Impoundment under a potential dredging alternative. Ardaman & Associates, Inc. (Ardaman) has worked with GHD Services Inc. (GHD), on behalf of the International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC), to develop a Pre-Final 90% Remedial Design (90% RD) for the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site located in Harris County, Texas (Site). The geotechnical analyses were developed based upon data obtained during the 2011 Remedial Investigation (RI), the 2018 First Phase Pre-Design Investigation (PDI-1), the 2019 Second Phase Pre-Design Investigation (PDI-2), and the 2021 Supplemental Design Investigation (SDI). The geotechnical investigation results from the RI and PDI-1 are provided in Attachment A, the geotechnical investigation results from PDI-2 are provided in Attachment B, and the SDI Geotechnical Data Report is provided as Attachment C of the Geotechnical Report dated June 27, 2022.

SECTION 1. GENERAL PROJECT INFORMATION

1.1 Project Description

This analysis was performed to supplement the previously submitted Geotechnical Report (submitted June 27, 2022 as part of the Pre-Final 90% RD) and to support the potential waste removal activities in the northwest corner of the Northern Impoundment.

1.2 Northern Impoundment Location and Description

The Northern Impoundment is located along the San Jacinto River and near Interstate Highway-10 (I-10).

1.3 Geology

The geology in the vicinity of the northwest corner of the Northern Impoundment is delineated by the geologic profile shown in Figure 1, below, which shows Alluvium deposits to approximately Elevation (EL) -27 ft North American Vertical Datum 1988 (NAVD88) underlain by the Beaumont Clays to EL -50 ft NAVD88. The geological profile indicates that borings SJGB018 and SJGB019 show the upper sand. The top of the upper sand in boring SJGB-19 is shown as EL -50 ft NAVD88 and EL -54 ft NAVD88 in boring SJGB018. CPT SJSCPT-01 shows the top of the upper sand at EL -50 ft NAVD88. CPT SJSCPT-01 also encountered a gravelly sand below the upper sand as shown in blue. The profile shows the potential that the gravelly sand is connected to the upper sand.

There is also potential for this gravelly sand to be connected to the Beaumont Sands or Pleistocene Lissie and Willis Formations or Chicot Aquifer.

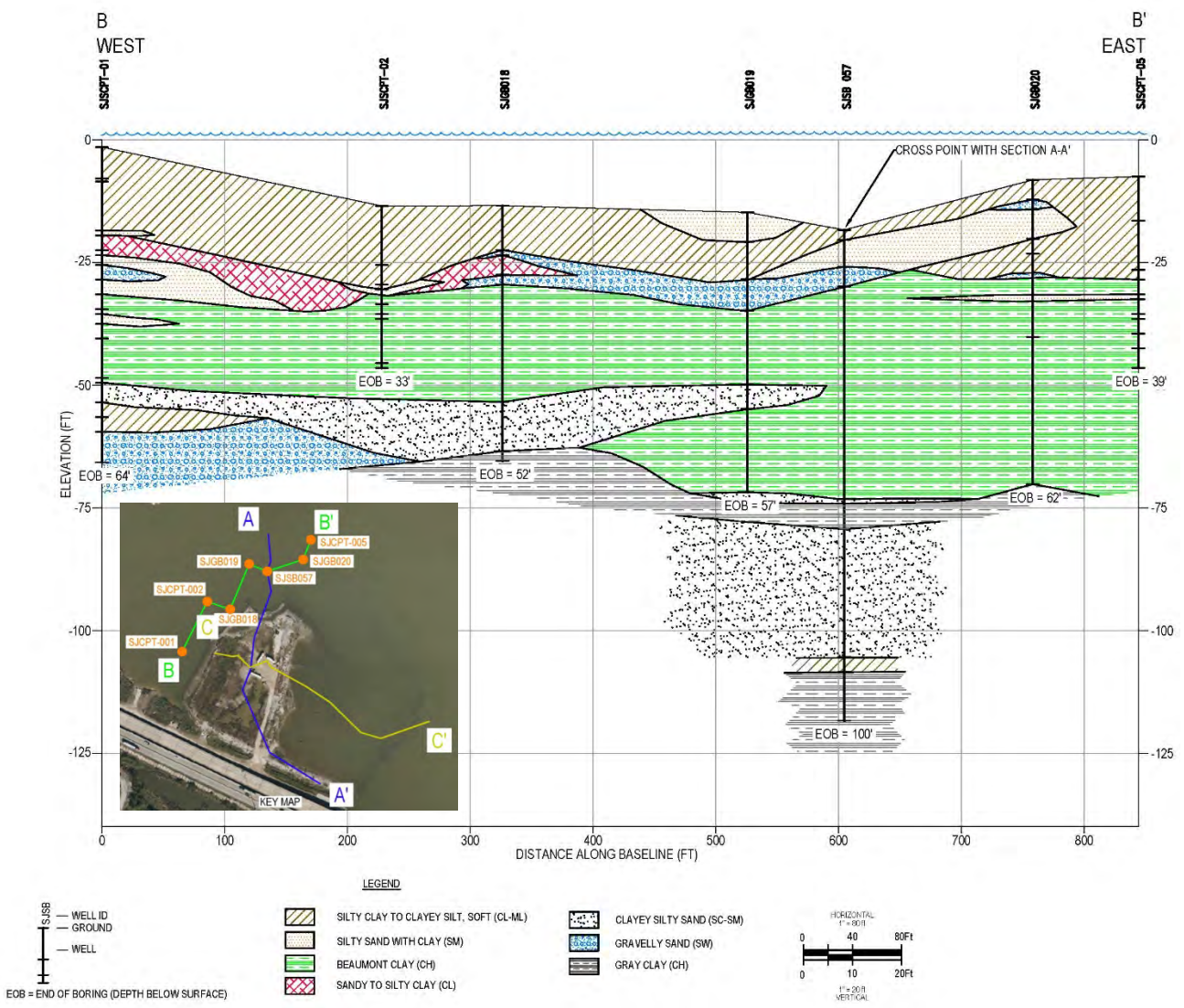


Figure 1: Typical Geologic Profile in the Northwest Corner

SECTION 2. HYDRAULIC HEAVE ANALYSIS

2.1.1 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 2. 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.

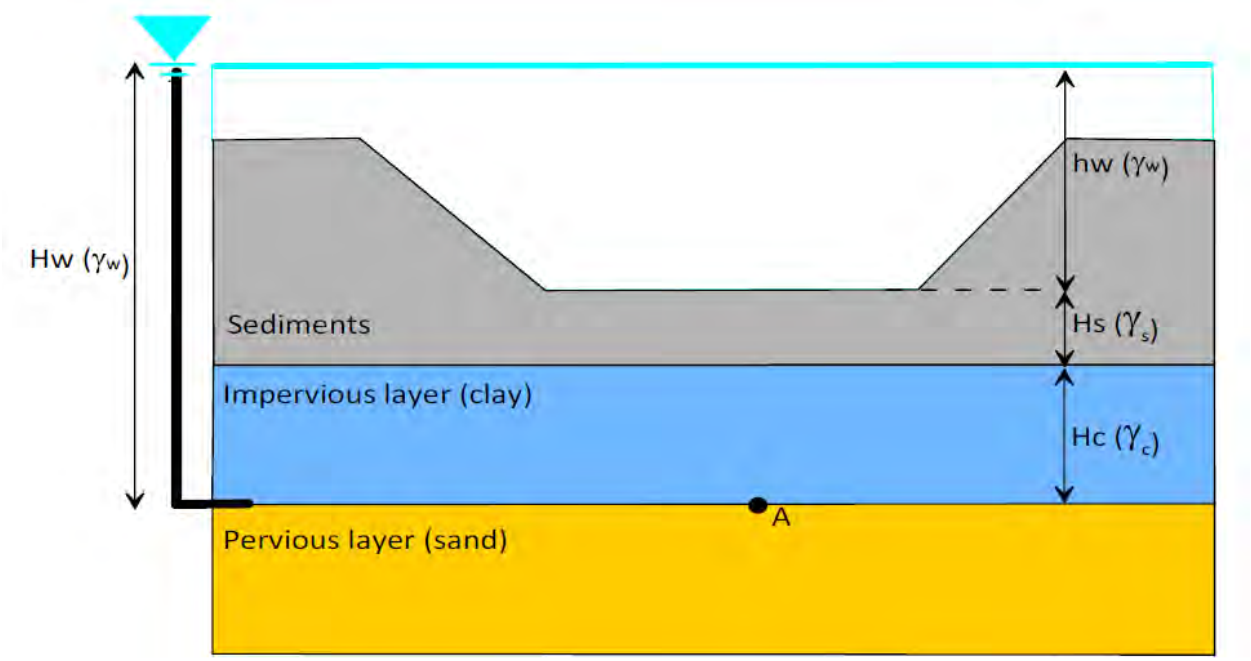


Figure 2: Artesian Groundwater Conditions Below Excavation

2.1.2 Methodology

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 Safety Factor (SF) protective of hydraulic heave is expressed using the following equation:

$$SF_{Total} = (H_s * \gamma_s + H_c * \gamma_c) / H_w * \gamma_w \qquad [1]$$

In this equation, H_s and H_c are the thicknesses of the sediments and the clay layers, respectively and H_w 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 SF_{Total} of 1.25 for the Reasonable Maximum Case and 87 percent or a SF_{Total} of 1.15 for the Extreme Case.

2.1.3 Design Parameters

Under a potential dredging scenario, waste material would be removed under a column of water. As the waste is removed, makeup water would be added to replace the weight of the removed material and maintain an adequate downward pressure to overcome hydraulic heave risk. In order to determine a safe water level within the excavation, the design water level and the unit weight of the material need to be established. A design river level for the Extreme Case was selected as EL +9 ft NAVD88, which is the design height of the BMP that will surround the Northern Impoundment during remediation. As mentioned in Section 1.3 there is potential that the sands below EL -50 ft NAVD88 in the northwest corner are connected to the deeper sand layer below the Beaumont Clays. Figure 3, below, compares the Beaumont Sands piezometric head at SJMW016 and the river level measured at the Northern Impoundment. Details of piezometer SJMW016 are presented in Attachment E of the June 27, 2022 Geotechnical Report. The data indicated that the piezometric head in the Beaumont Sand responded to the water level fluctuations in the river and appeared to be dampened by the overlying clay interval.

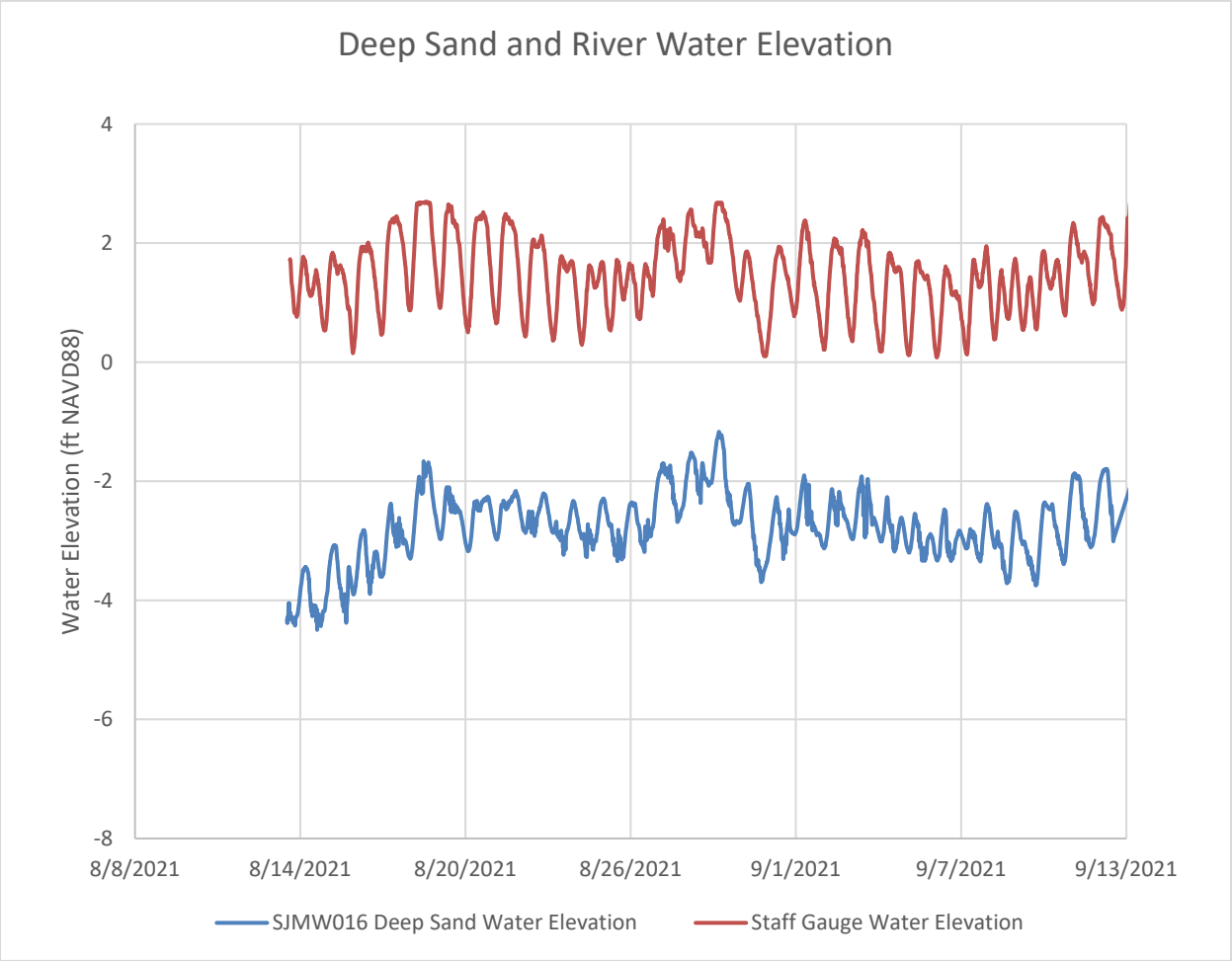


Figure 3: Piezometric Readings – River and Upper Sand Elevation

Based on these data, it is estimated that the piezometric head in the Beaumont Sands is dampened by approximately 0.11 feet per foot of overlying clay. Therefore, a difference of 1.7 feet between the river stage and the piezometric head at EL -50 ft NAVD88 beneath the northwest corner was conservatively assumed.

A unit weight of 95 pounds per cubic foot (pcf) was assumed for the sediments above EL -27 ft NAVD88. This unit weight was based upon moisture contents from boring SJSB057-G using an assumed Specific Gravity (Gs) at 100% saturation. A unit weight of 126 pcf was conservatively used for the Beaumont Clays between EL -27 ft NAVD88 and EL -50 ft NAVD88 based upon unit weight determinations for boring SJSB057-G. The boring log for boring SJSB057-G was provided in Attachment B of the June 27, 2022 Geotechnical Report. A plot of the unit weights between EL -17 ft NAVD88 and EL -50 ft NAVD88 is shown below in Figure 4.

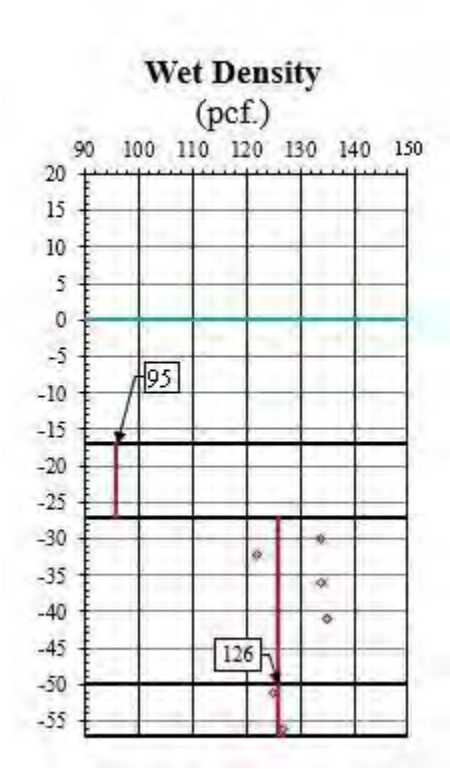


FIGURE 4: WET DENSITY BORING SJSB057

2.1.4 Heave Analysis

Based upon the design parameters discussed in Section 2.1.3, the design methodology and example are shown in Figure 5 below. The left side of the figure shows methodology for determining safe level that the water can be lowered to for dry excavation prior to dredging considering the EL +9 ft NAVD88 Extreme Case river level and the SF_{Total} of 1.15. The right side of the figure shows the methodology to calculate the design river stage for the Reasonable Maximum Case and 1.25 SF_{Total} considering the safe level of dry excavation calculated for the

Extreme Case. The calculated design river stage for the Reasonable Maximum case is calculated to be EL +5 ft NAVD88.

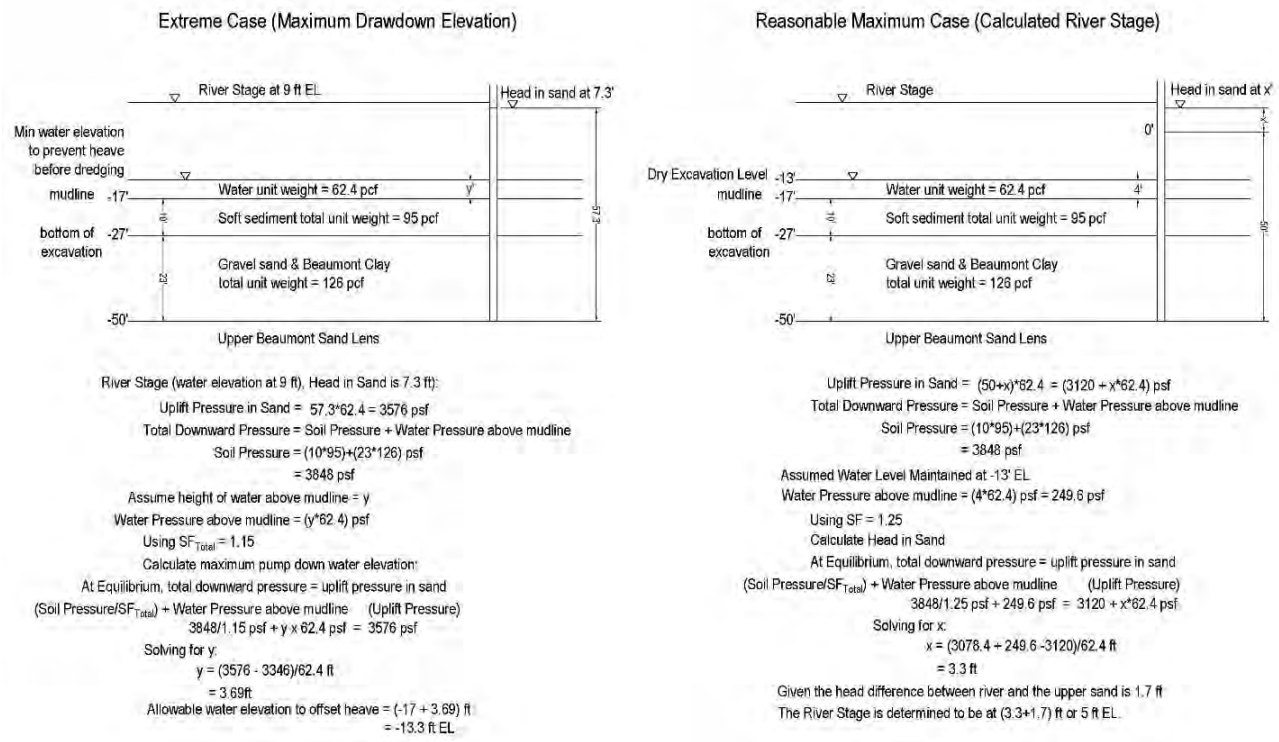


Figure 5: Heave Analysis Summary

During dredging, sufficient water will have to be maintained in the excavation to offset the heave potential considering the weight of the sediments that will be removed. The left side of the figure indicates that the safe water elevation required for the Extreme Case (river stage EL +9 ft NAVD88) is EL -10.1 ft NAVD88 and the safe water elevation required for the Reasonable Maximum Case (river stage EL +5 NAVD88) is EL -10.9 ft NAVD88.

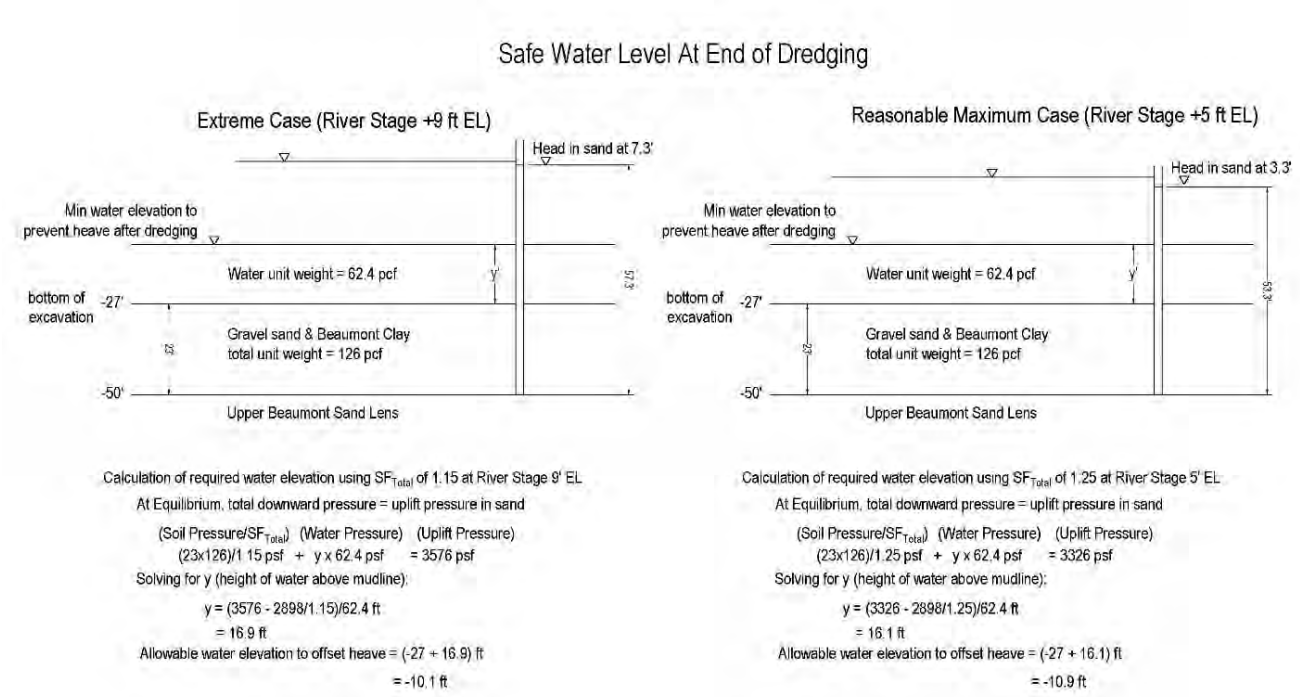


FIGURE 6: SAFE WATER ELEVATION CALCULATIONS FOR DREDGING

SECTION 3. ADDITIONAL CONSIDERATIONS.

The potential for hydraulic heave was investigated as presented above. Safe excavation depth limits were established across the northwest corner of the Northern Impoundment to ensure the piezometric head pressure in the sand layers beneath the proposed excavation would not lead to bottom instability. It is recommended that piezometers be installed into the deep sand below the Beaumont Clay as well as in the upper sand below EL -50 ft NAVD88 prior to construction and to continuously monitor the pressure head in those strata during construction.

Appendix G

Design Drawing Package

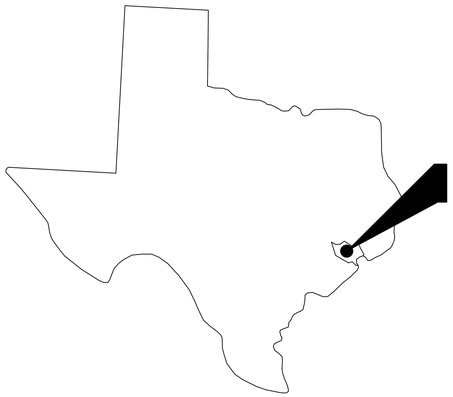
Appendix G-1

Design Drawing Package - Northwest Corner Capping

SAN JACINTO RIVER WASTE PITS
NORTHERN IMPOUNDMENT
(NORTHWEST CORNER COMPONENT)
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

NOVEMBER 2022

11215702



STATE OF TEXAS
VICINITY MAP

HARRIS COUNTY
VICINITY MAP

IMAGE - © 2020 Microsoft Corporation © 2020 Digital Globe © CNES (2020) Distribution Airbus DS

LOCATION MAP

DRAWING NUMBER	DRAWING NAME
GENERAL SERIES	
G-01	COVER SHEET
CIVIL SERIES	
C-01	OVERALL PLAN
C-02	EXISTING CONDITIONS
C-03	SSA AREA AND NORTHERN IMPOUNDMENT WORKS
C-04	SOIL EROSION AND SEDIMENT CONTROL PLAN - OVERALL
C-05	SOIL EROSION AND SEDIMENT CONTROL PLAN - SEASONAL
C-06	SOIL EROSION AND SEDIMENT CONTROL DETAILS
C-07	PROJECT TRAFFIC CONTROL PLAN
C-08	EXCAVATION PLAN - OVERALL
C-09	EXCAVATION PLAN NORTHWEST
C-10	EXCAVATION PLAN NORTHEAST
C-11	EXCAVATION PLAN SOUTHEAST
C-12	EXCAVATION PLAN SOUTHWEST
C-13	EXCAVATION SECTION - 1 OF 6
C-14	EXCAVATION SECTION - 2 OF 6
C-15	EXCAVATION SECTION - 3 OF 6
C-16	EXCAVATION SECTION - 4 OF 6
C-17	EXCAVATION SECTION - 5 OF 6
C-18	EXCAVATION SECTION - 6 OF 6
C-19	TYPICAL SEASONAL EXCAVATION SEQUENCING
C-20	TYPICAL EXCAVATION SEQUENCING - 1 OF 2
C-21	TYPICAL EXCAVATION SEQUENCING - 2 OF 2
C-22	RESTORATION PLAN
C-23	TYPICAL CONSTRUCTION SEQUENCING - 1 OF 2
C-24	TYPICAL CONSTRUCTION SEQUENCING - 2 OF 2
C-25	TYPICAL DETAILS - 1 OF 3
C-26	TYPICAL DETAILS - 2 OF 3
C-27	TYPICAL DETAILS - 3 OF 3
C-28	PILE WALL LAYOUT PLAN
C-29	DOUBLE PILE WALL PLAN AND PROFILE - 1 OF 4
C-30	DOUBLE PILE WALL PLAN AND PROFILE - 2 OF 4
C-31	DOUBLE PILE WALL PLAN AND PROFILE - 3 OF 4
C-32	DOUBLE PILE WALL PLAN AND PROFILE - 4 OF 4
C-33	SOUTH WALL PLAN AND PROFILE - 1 OF 2
C-34	SOUTH WALL PLAN AND PROFILE - 2 OF 2
C-35	DOUBLE PILE WALL SECTIONS - 1 OF 7
C-36	DOUBLE PILE WALL SECTIONS - 2 OF 7
C-37	DOUBLE PILE WALL SECTIONS - 3 OF 7
C-38	DOUBLE PILE WALL SECTIONS - 4 OF 7
C-39	DOUBLE PILE WALL SECTIONS - 5 OF 7
C-40	DOUBLE PILE WALL SECTIONS - 6 OF 7
C-41	DOUBLE PILE WALL SECTIONS - 7 OF 7
C-42	SOUTH WALL SECTIONS - 1 OF 3
C-43	SOUTH WALL SECTIONS - 2 OF 3
C-44	SOUTH WALL SECTIONS - 3 OF 3
C-45	CAPPING ALTERNATIVE NORTHWEST CORNER WORKS PLAN
C-46	CAPPING ALTERNATIVE NORTHWEST CORNER CAPPING CONTROLS
C-47	CAPPING ALTERNATIVE NORTHWEST CORNER DRY EXCAVATION
C-48	CAPPING ALTERNATIVE NORTHWEST CORNER FILL PLAN
C-49	CAPPING ALTERNATIVE NORTHWEST CORNER SECTIONS 1 OF 2
C-50	CAPPING ALTERNATIVE NORTHWEST CORNER SECTIONS 2 OF 2
C-51	CAPPING ALTERNATIVE NORTHWEST CORNER SEQUENCING 1 OF 3
C-52	CAPPING ALTERNATIVE NORTHWEST CORNER SEQUENCING 2 OF 3
C-53	CAPPING ALTERNATIVE NORTHWEST CORNER FINAL GRADE
C-54	CAPPING ALTERNATIVE NORTHWEST CORNER CAPPING DETAILS
STRUCTURAL SERIES	
S-01	STRUCTURAL NOTES
S-02	STRUCTURAL LAYOUT PLAN
S-03	STRUCTURAL SECTIONS
S-04	STRUCTURAL DETAILS 1 OF 2
S-05	STRUCTURAL DETAILS 2 OF 2
PROCESS FLOW AND INSTRUMENTATION SERIES	
P-00A	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM SYMBOLS
P-00B	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM SCHEDULES
P-01	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM/MASS BALANCE
P-02	WATER TREATMENT SYSTEM P&ID (1 OF 4)
P-03	WATER TREATMENT SYSTEM P&ID (2 OF 4)
P-04	WATER TREATMENT SYSTEM P&ID (3 OF 4)
P-05	WATER TREATMENT SYSTEM P&ID (4 OF 4)
P-06	SITE PLAN WATER TREATMENT SYSTEM SEASON 3-6

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
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Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
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Sheet No.
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Sheet - of -

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
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11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- ASPHALT

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

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Sheet - of -

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STATE OF TEXAS
CHARLES W. MUNCE
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11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
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- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
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- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
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- GRAVEL
- ASPHALT
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- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- SOIL TYPE S1

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

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Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Project No. 11215702

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SSA AREA AND NORTHERN IMPOUNDMENT WORKS

Sheet No.
C-03

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UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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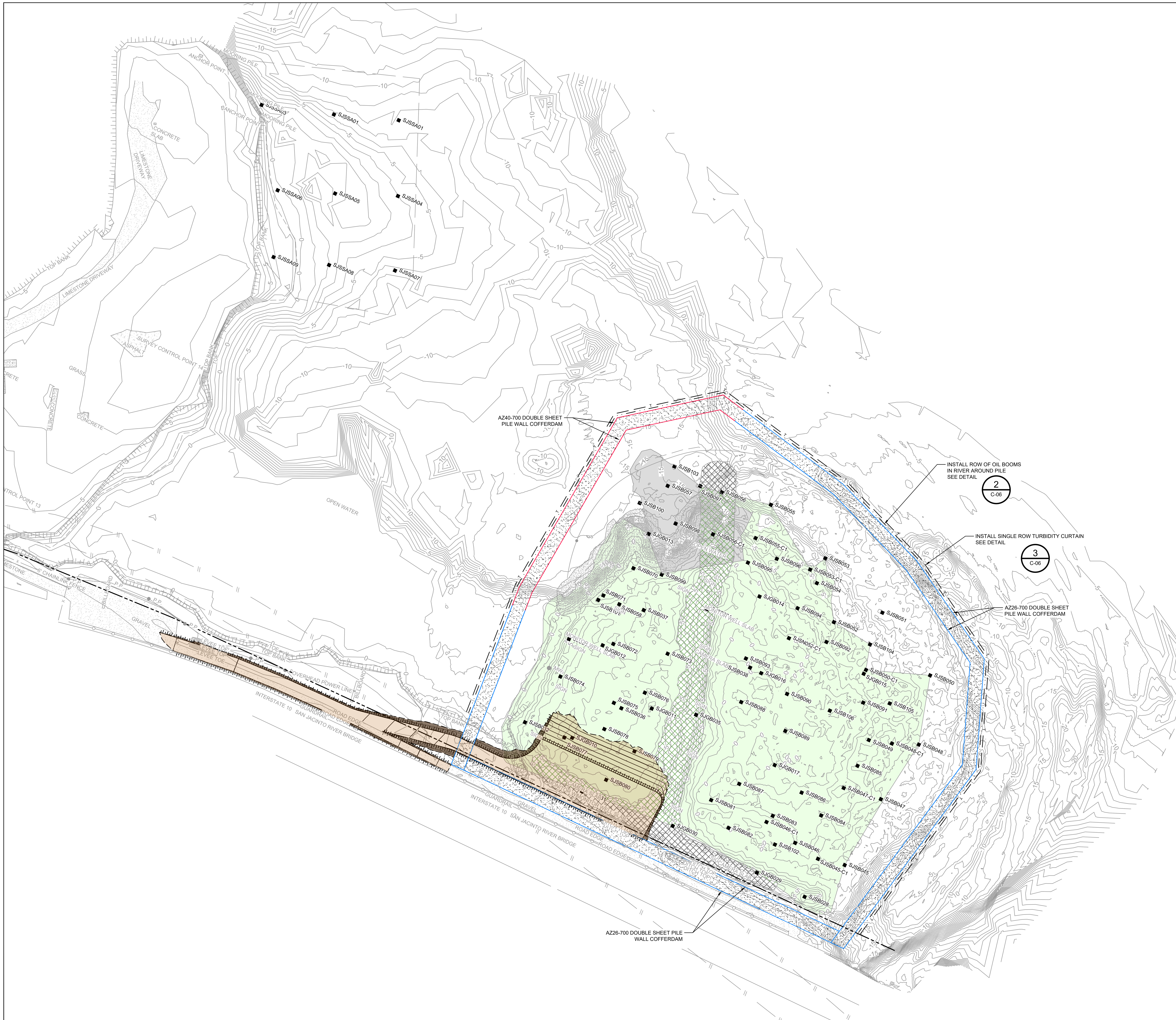

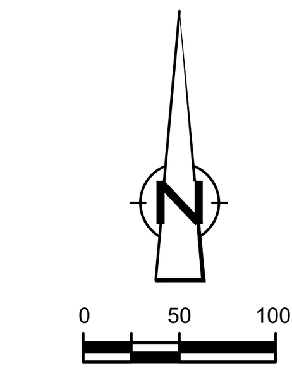

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STATE OF TEXAS
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LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE
- SILT FENCE
- TURBIDITY CURTAIN
- OIL BOOM
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER COMPONENT EPA REVIEW	MW	CM	11/8/2022

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 100'
Original Size	Arch D	Bar is one inch on original size drawing 0 1"	

Project No. 11215702

Title
SOIL EROSION AND SEDIMENT CONTROL PLAN OVERALL

Sheet No.
C-04

Sheet - of -

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. LOCATION AND TYPE OF SOIL EROSION AND SEDIMENT CONTROLS ARE SUBJECT TO CHANGE AND CAN VARY FROM SEASON TO SEASON.

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF EPA REVIEW UNDER THE AUTHORITY OF CHARLES W. MUNCE, P.E. 105542 ON 11/8/2022. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE OR SALES PURPOSES.

GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
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Baton Rouge Louisiana USA
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

ASSUMED TxDOT RIGHT OF WAY
TCRA CAP PERIMETER
EXISTING CONTOUR INTERVAL
FENCELINE
SHORELINE
TOP OF BANK
TOE OF SLOPE
OVERHEAD ELECTRICAL
GUARDRAIL
PIPELINE
SJSB002 BORING LOCATION
MW MONITORING WELL
P.P. POWER POLE
L.P. LIGHT POLE
WELL WELL
MATERIAL TO BE EXCAVATED
EXISTING BERM TO EXCAVATED
EXISTING BERM
MATERIAL TO BE ADDRESSED BY CAPPING
CONCRETE
GRAVEL
ASPHALT
AZ26-700 PILE
AZ40-700 PILE
SILT FENCE
TURBIDITY CURTAIN
OIL BOOM
PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client

SAN JACINTO RIVER WASTE PITS

Project

NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER COMPONENT EPA REVIEW	MW	CM	11/8/2022

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing 0 1"	

Project No. 11215702

Title

SOIL EROSION AND SEDIMENT CONTROL PLAN SEASONAL

Sheet No.

C-05

Sheet - of -

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE
- TRAFFIC FLOW
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. TRAFFIC ROUTES ARE PRELIMINARY. ASSUME USE OF TXDOT ACCESS ROAD.
3. ACCESS ROAD IMPROVEMENTS MAY BE NECESSARY AND WILL BE DETERMINED AT A LATER STAGE IN THE REMEDIAL DESIGN.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 100'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
PROJECT TRAFFIC CONTROL PLAN

Sheet No.
C-07

Sheet - of -

0 30 60 ft

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.
3. EXISTING ACBM COVER OUTSIDE OF THE TCRA CAP PERIMETER MAY BE REMOVED DURING THE REMEDIAL ACTION

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
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11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022

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Scale 1" = 60'

Original Size **Arch D**

Bar is one inch on original size drawing (0 — 1")

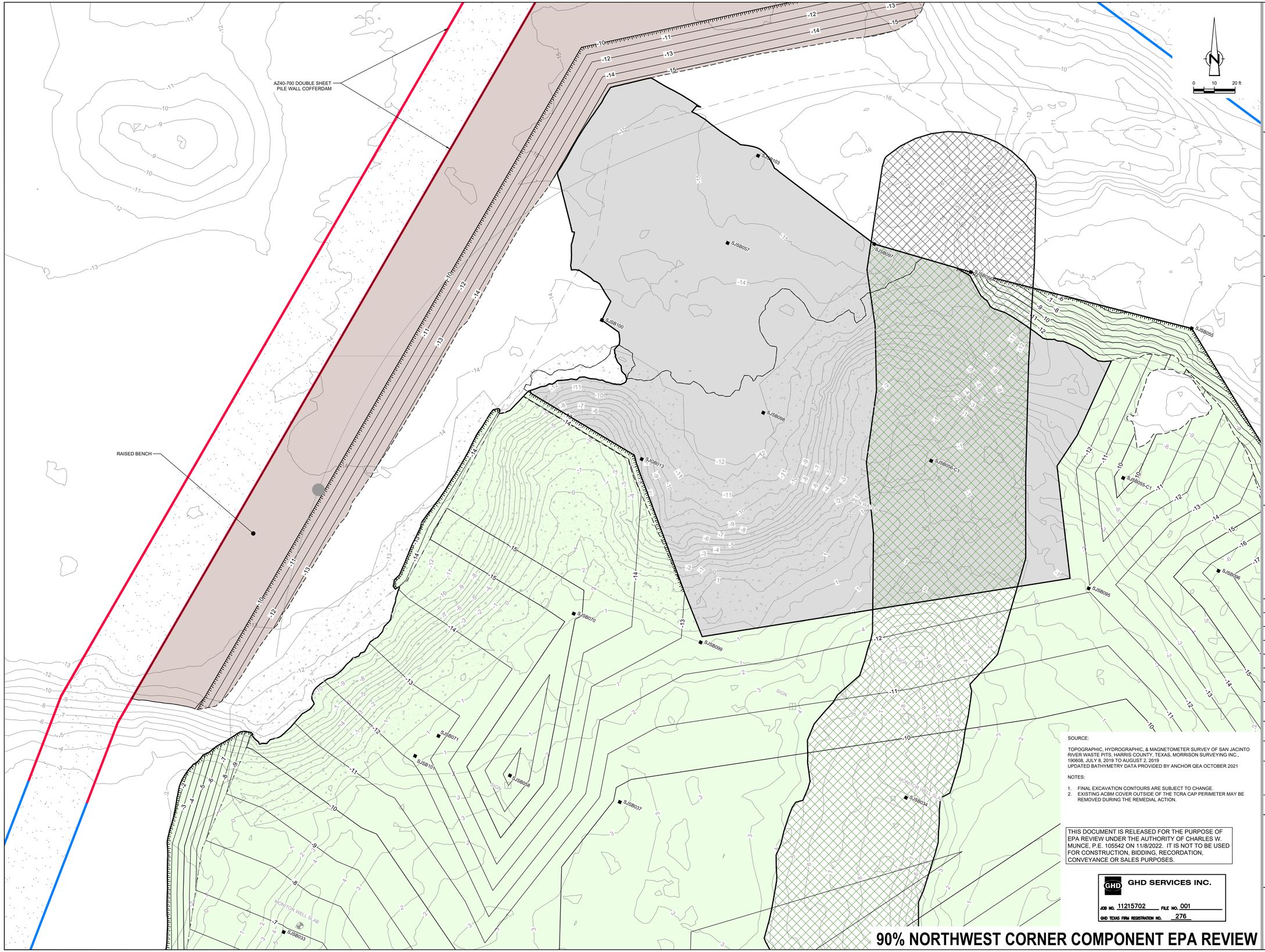
Project No. **11215702**

Title
EXCAVATION PLAN OVERALL

Sheet No.
C-08

Sheet - of -

Plot Date: 8 November 2022 - 9:42 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-011.dwg



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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.
2. EXISTING ACBM COVER OUTSIDE OF THE TCRA CAP PERIMETER MAY BE REMOVED DURING THE REMEDIAL ACTION.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 20'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

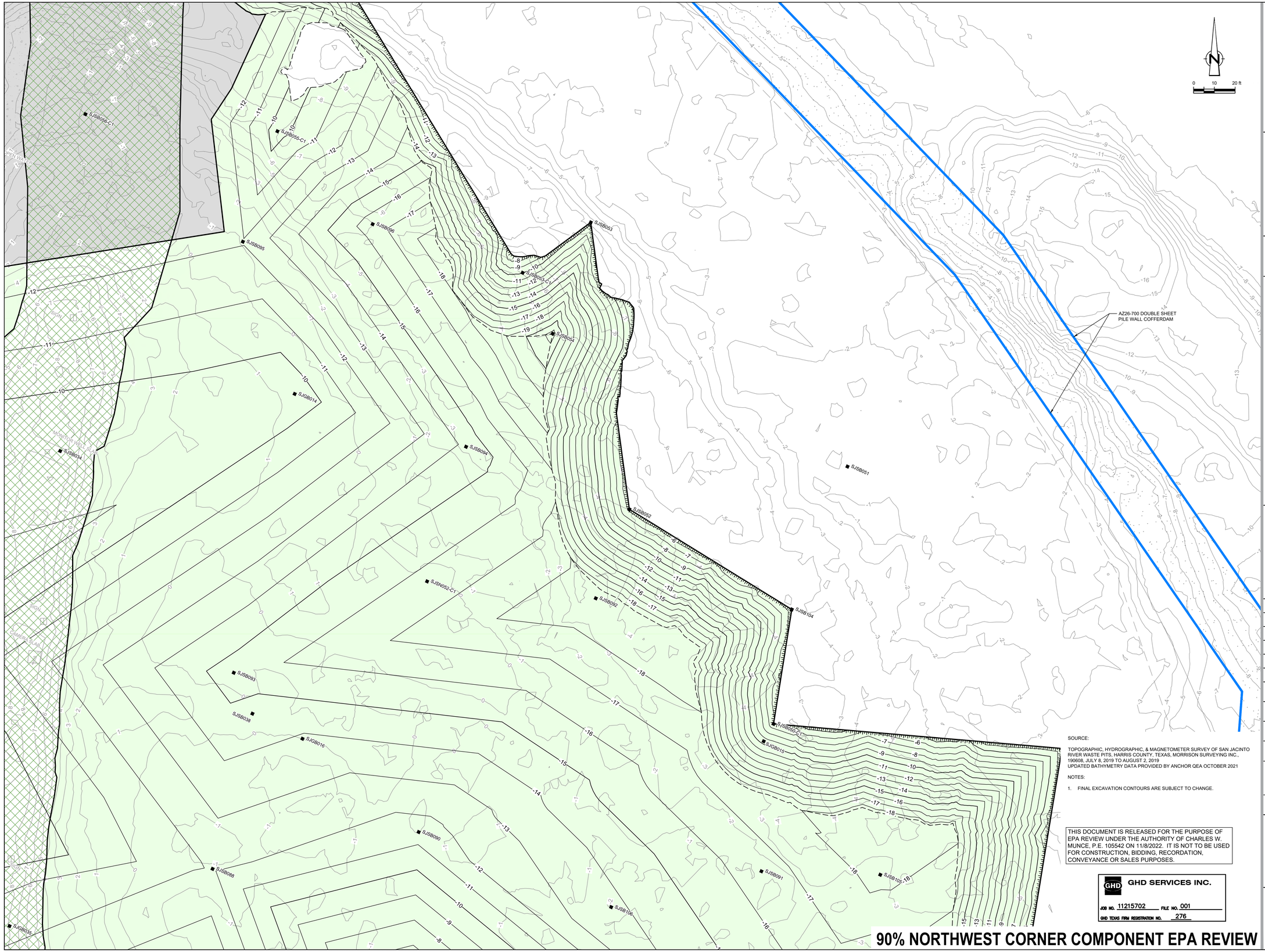
Project No. 11215702

Title
EXCAVATION PLAN NORTHWEST

Sheet No.
C-09

Sheet - of -

Plot Date: 8 November 2022 - 9:50 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-008.dwg



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

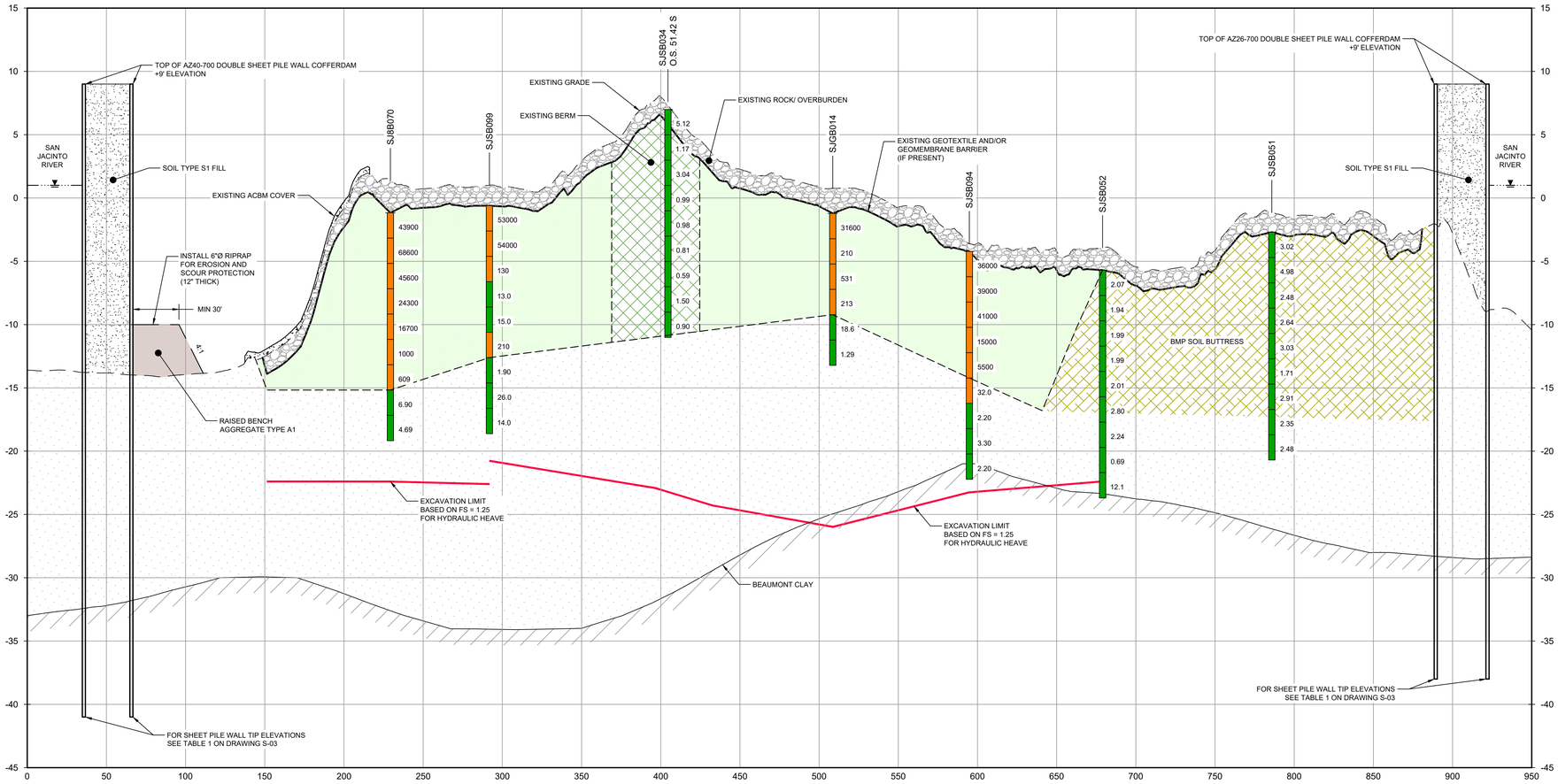
Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale 1" = 20'
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
EXCAVATION PLAN NORTHEAST

Sheet No.
C-10
Sheet - of -

Plot Date: 8 November 2022 - 9:46 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-009.dwg



SECTION A WEST/EAST (C-08)
HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.
2. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF EPA REVIEW UNDER THE AUTHORITY OF CHARLES W. MUNCE, P.E. 105542 ON 11/8/2022. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE OR SALES PURPOSES.

GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

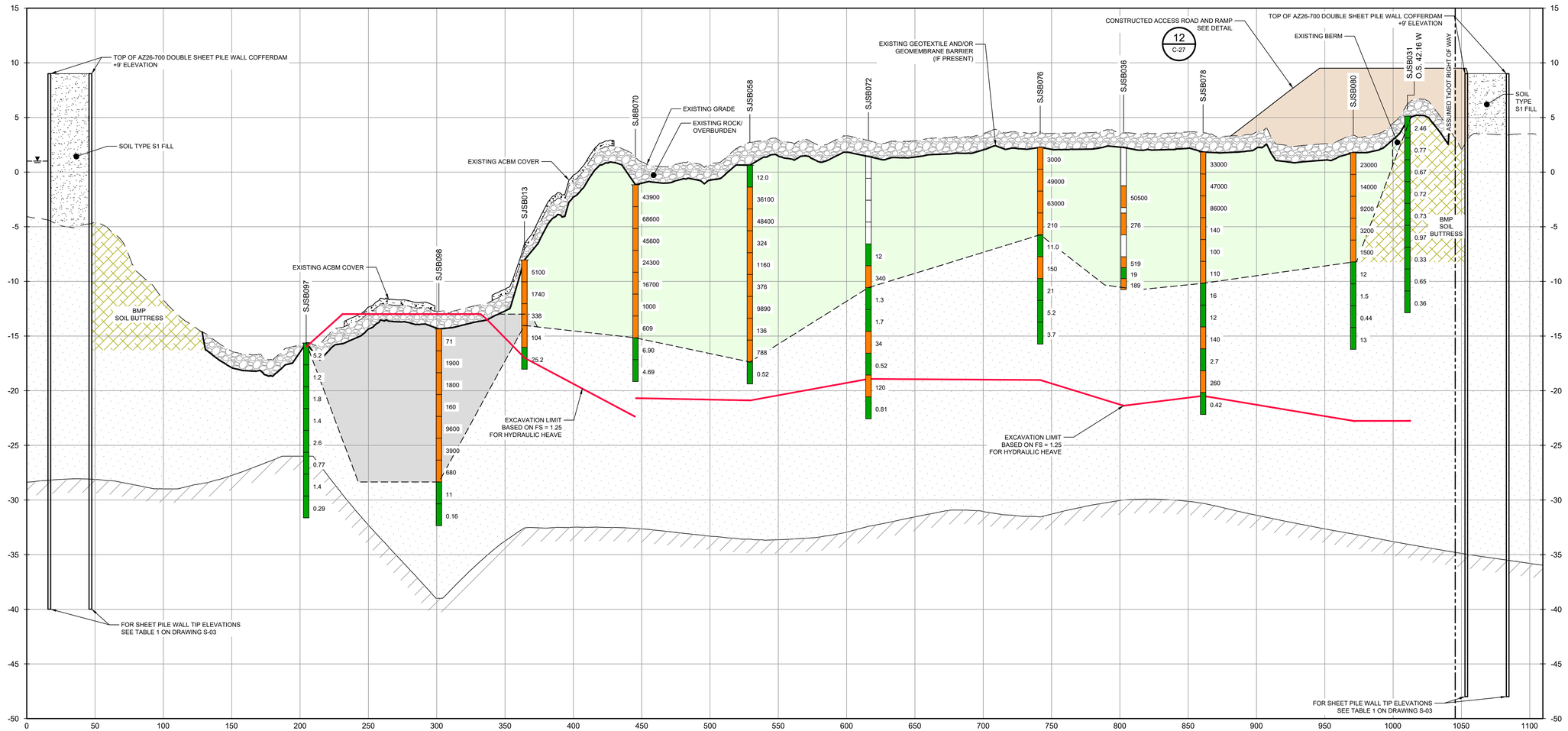
No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
EXCAVATION SECTION 1 OF 6

Sheet No.
C-13
Sheet - of -



SECTION D NORTH/SOUTH
C-08
HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.
3. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
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PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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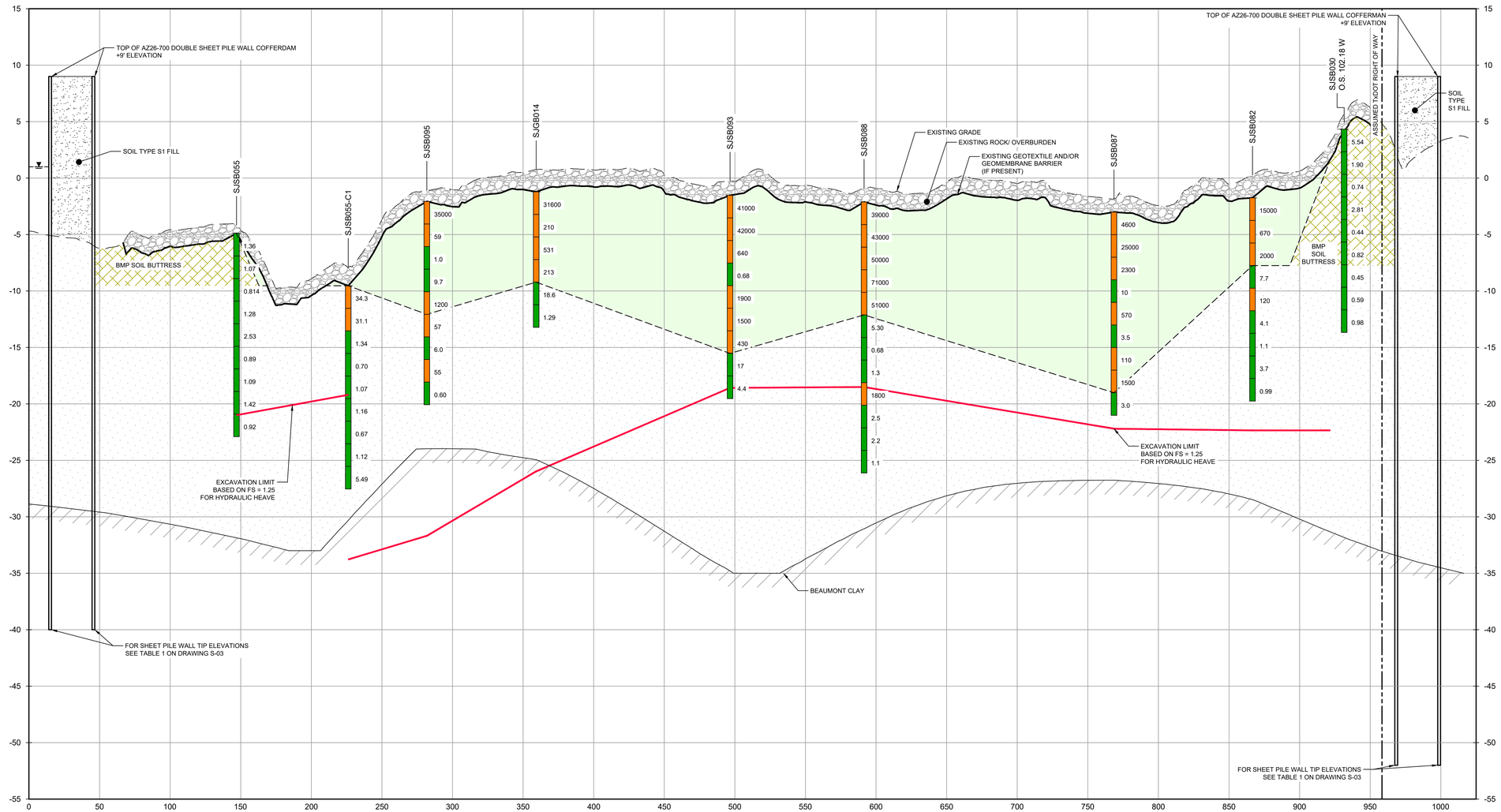
Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

Project No. 11215702

Title
EXCAVATION SECTION 4 OF 6

Sheet No.
C-16
Sheet - of -



SECTION E NORTH/SOUTH
C-08
HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.
3. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

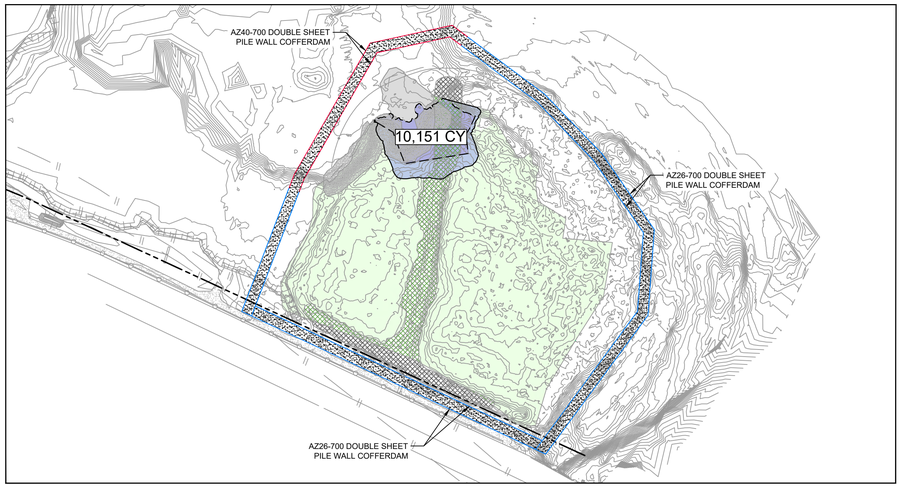
No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

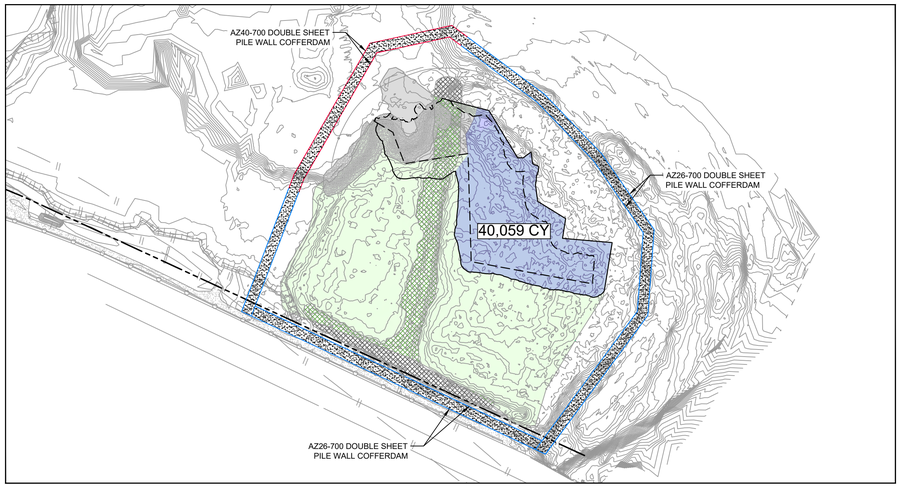
Project No. 11215702

Title
EXCAVATION SECTION 5 OF 6

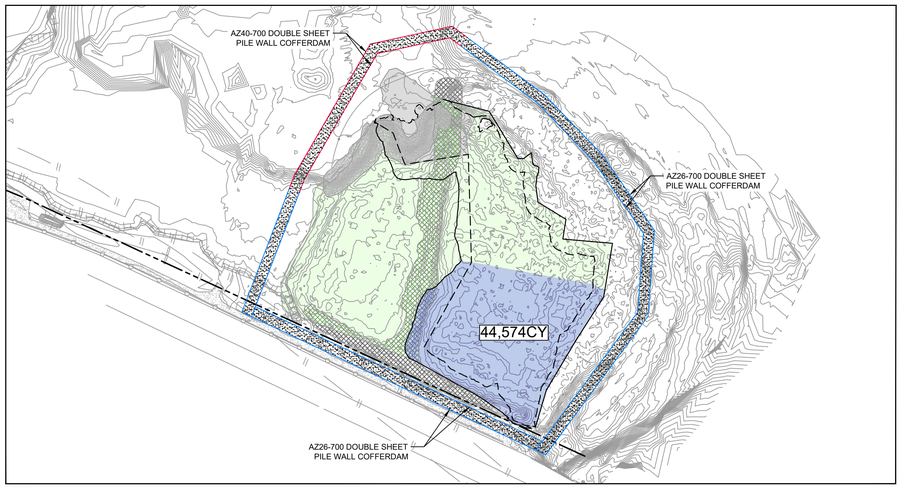
Sheet No.
C-17
Sheet - of -



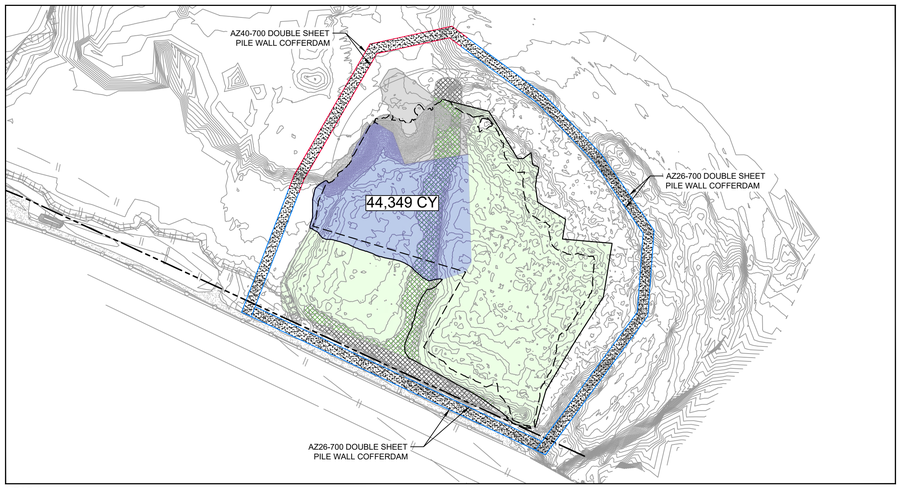
YEAR 2



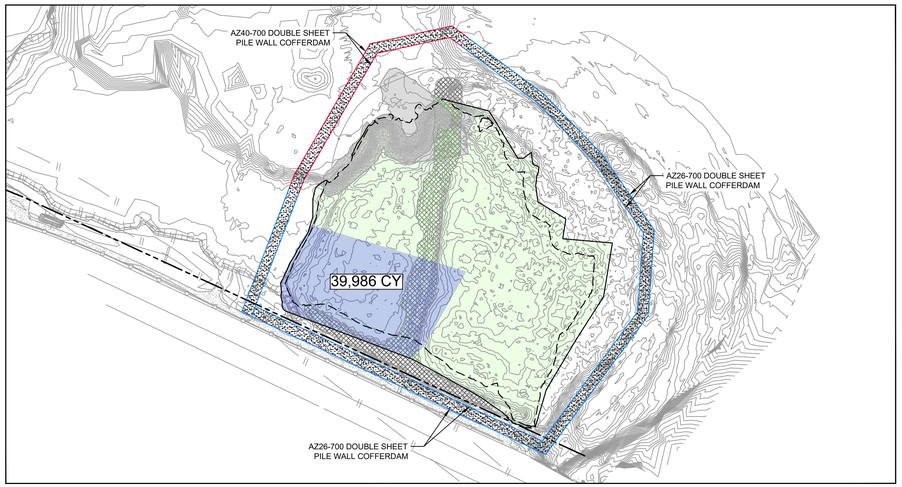
YEAR 3



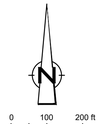
YEAR 4



YEAR 5



YEAR 6



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. TYPICAL EXCAVATION SEQUENCING ASSUMES BMP INSTALLATION AND SITE PREPARATION WILL BE COMPLETED IN YEAR 1, REMEDIATION OF THE NORTHWEST CORNER IN YEAR 2, AND BMP REMOVAL AND SITE RESTORATION WILL BE COMPLETED IN YEAR 7.
3. SEASONAL EXCAVATION AREAS, VOLUMES, AND SEQUENCING ARE APPROXIMATE AND SUBJECT TO CHANGE.

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
5551 Corporate Boulevard Suite 200
Baton Rouge Louisiana USA
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- X FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

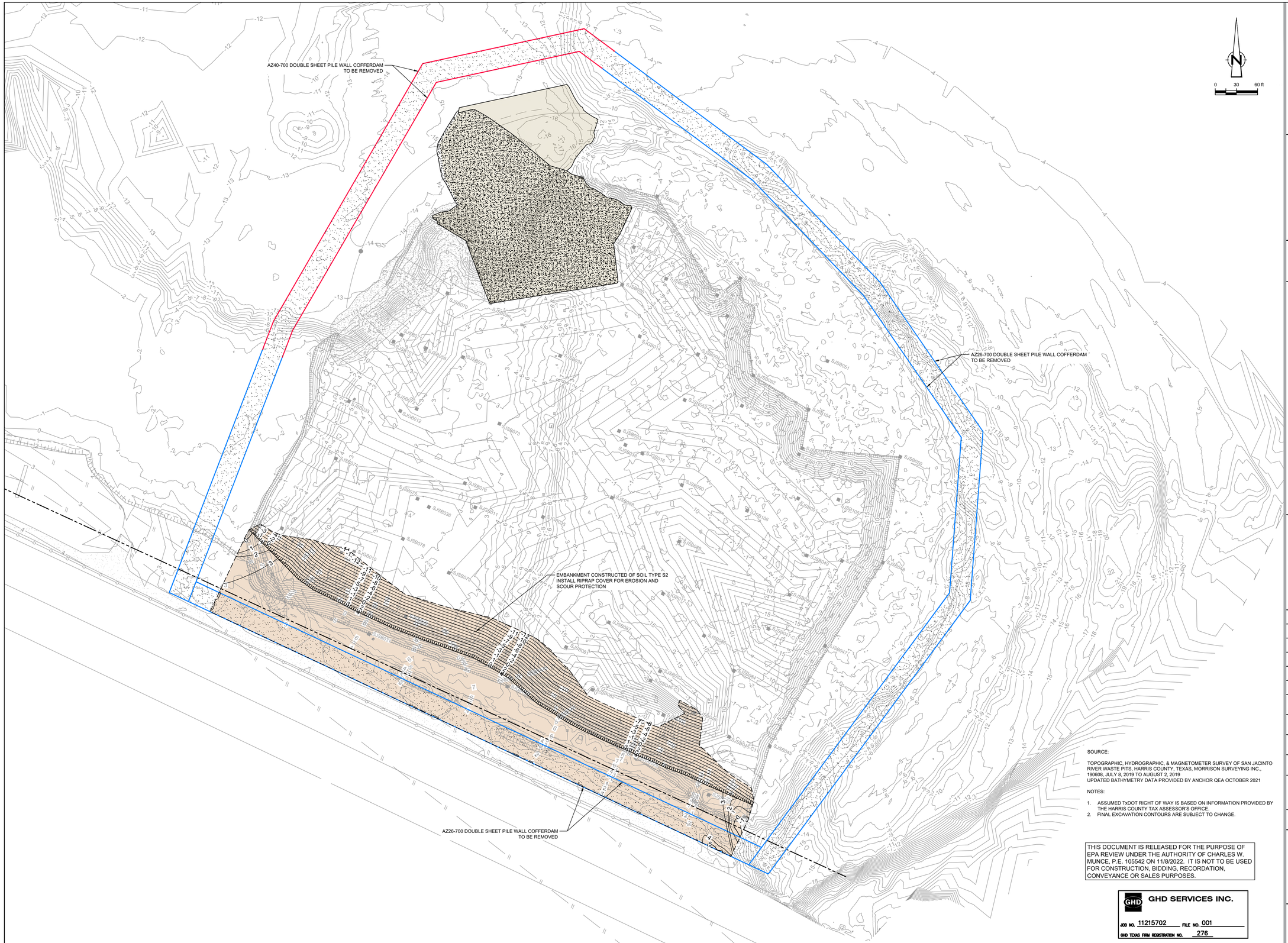
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 200'
Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

Project No. **11215702**

Title
TYPICAL SEASONAL EXCAVATION SEQUENCING

Sheet No.
C-19

Sheet - of -



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RESTORED AREA INCLUDING TOPSOIL PLACEMENT AND SEEDING TO RIVER LEVEL
- ARTICULATING BLOCK FABRIC FORMED CONCRETE
- GRANULAR MATERIAL

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

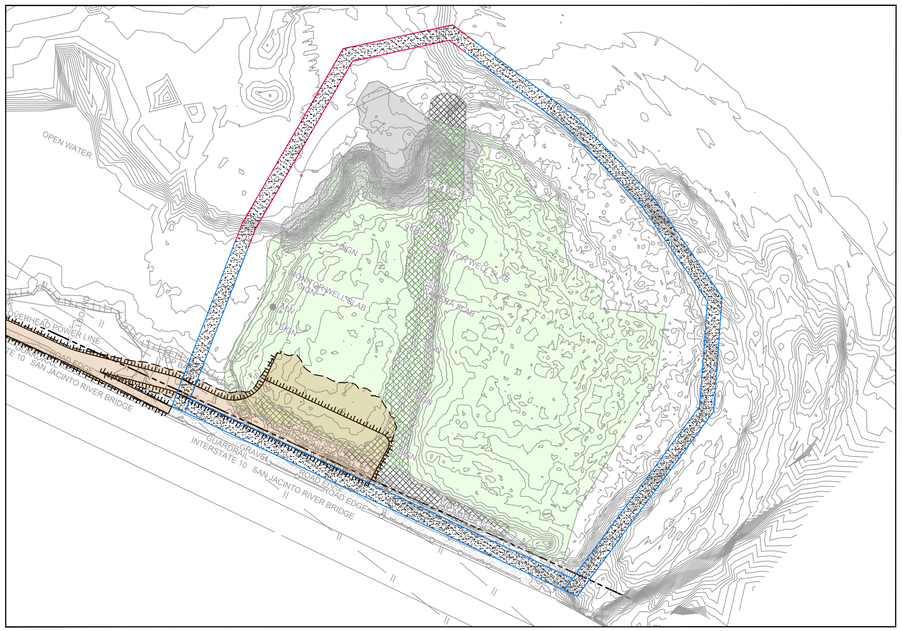
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 60'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

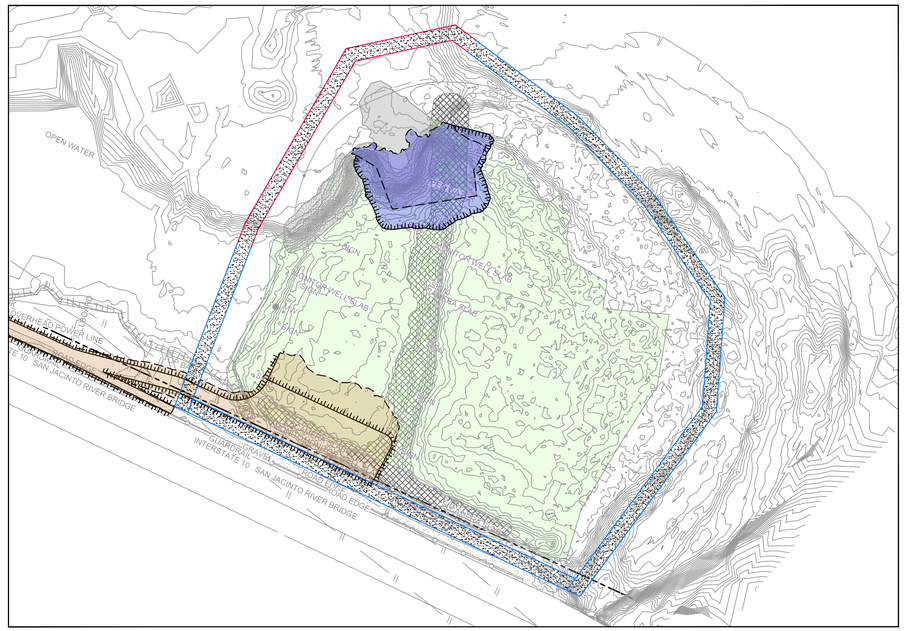
Title
RESTORATION PLAN

Sheet No.
C-22

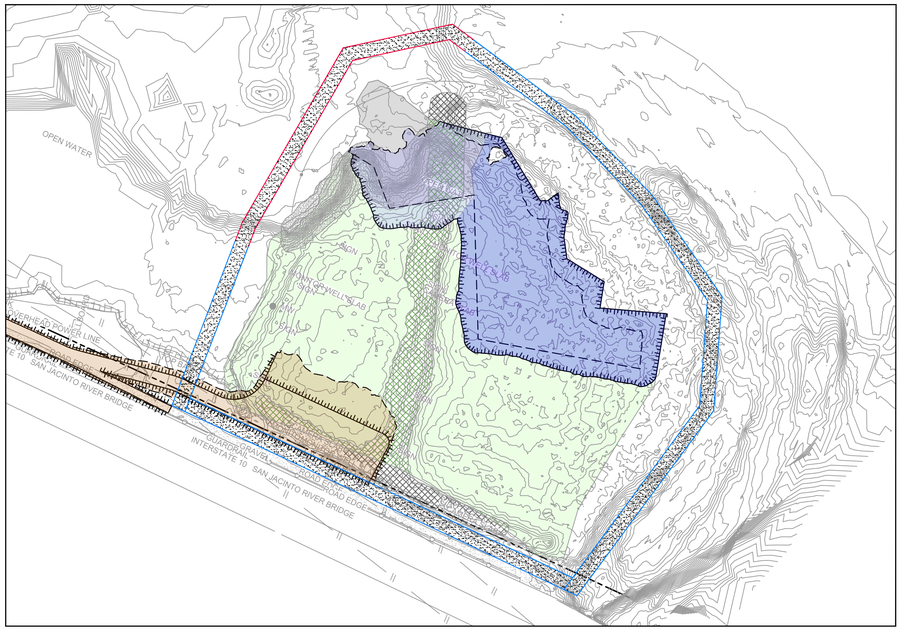
Sheet - of -



YEAR 1 - BMP INSTALLATION AND SITE PREPARATION



YEAR 2 - EXCAVATION SEASON 1



YEAR 3 - EXCAVATION SEASON 2

YEAR 4 - EXCAVATION SEASON 3

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019 UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

0 75 150 ft

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 150'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

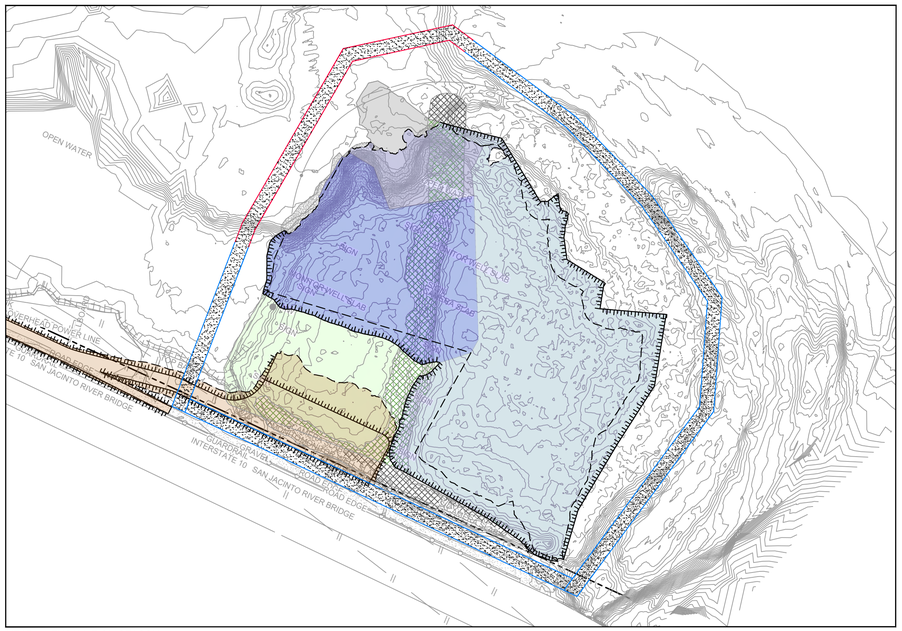
Project No. 11215702

Title
TYPICAL CONSTRUCTION SEQUENCING 1 OF 2

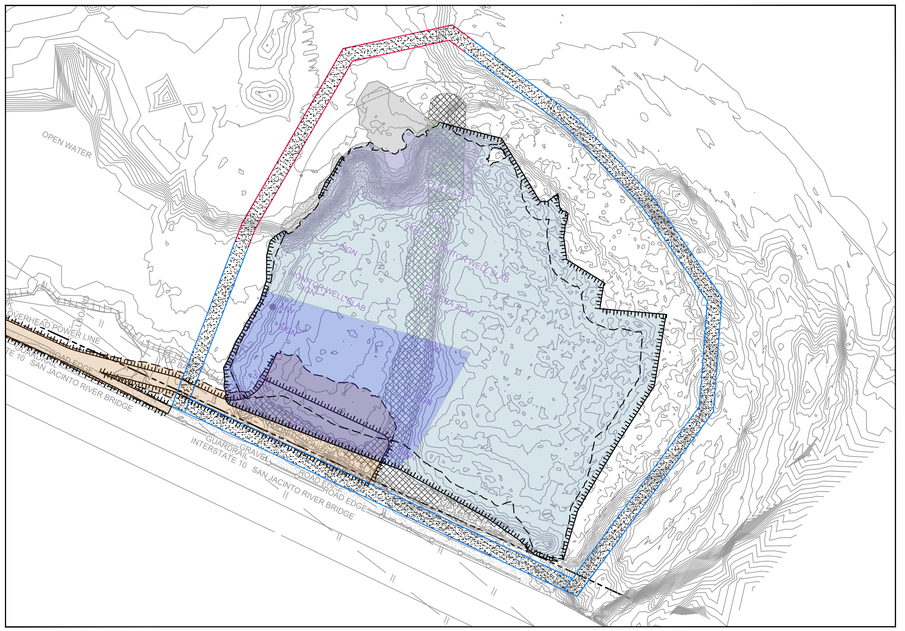
Sheet No.
C-23

Sheet - of -

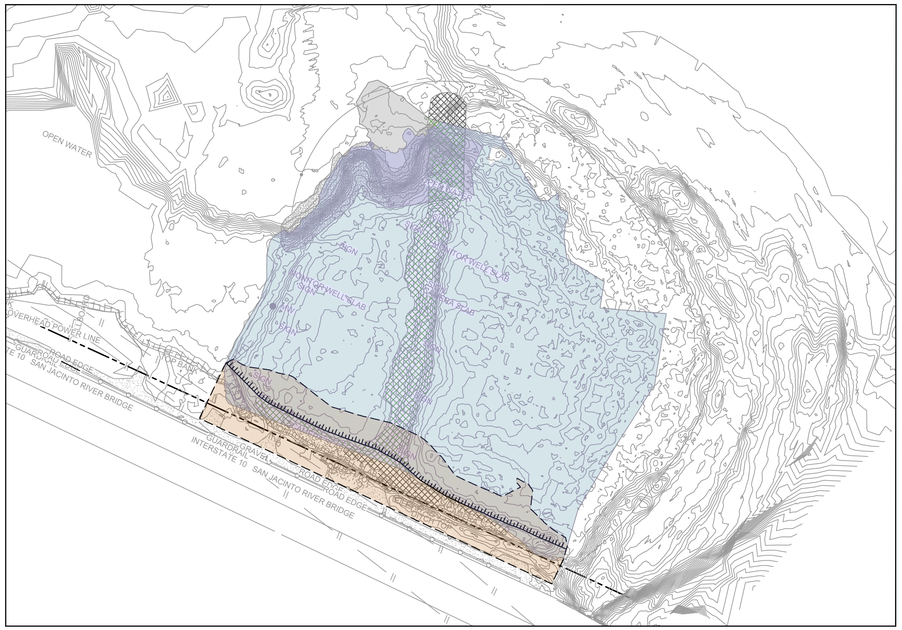
Plot Date: 8 November 2022 - 9:06 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-033.dwg



YEAR 5 - EXCAVATION SEASON 4



YEAR 6 - EXCAVATION SEASON 5



YEAR 7 - BMP REMOVAL AND SITE RESTORATION

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019 UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

N

0 75 150 ft

GHD
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Baton Rouge Louisiana USA
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- X FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

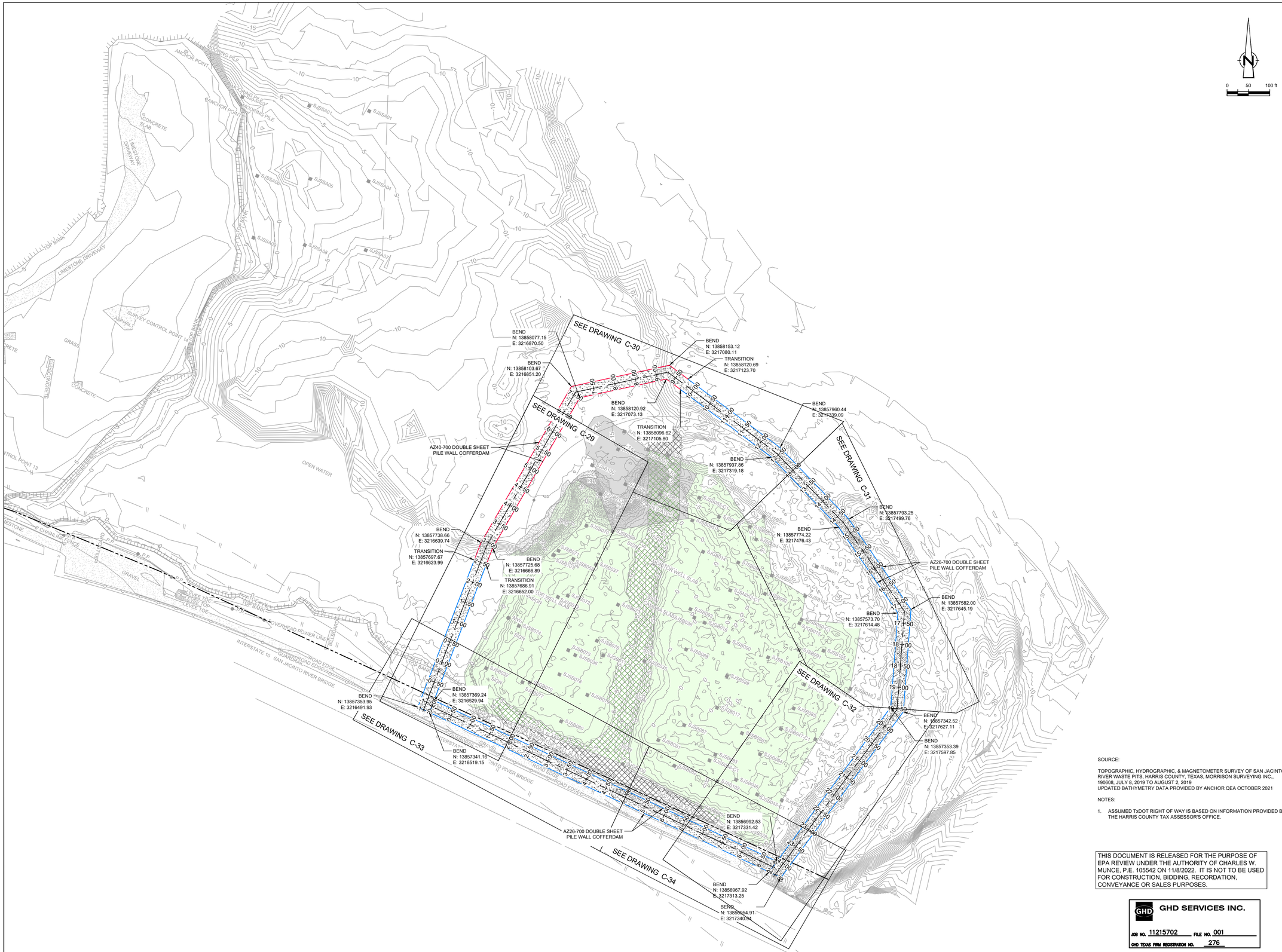
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 150'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
TYPICAL CONSTRUCTION SEQUENCING 2 OF 2

Sheet No.
C-24

Sheet - of -



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
5551 Corporate Boulevard Suite 200
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

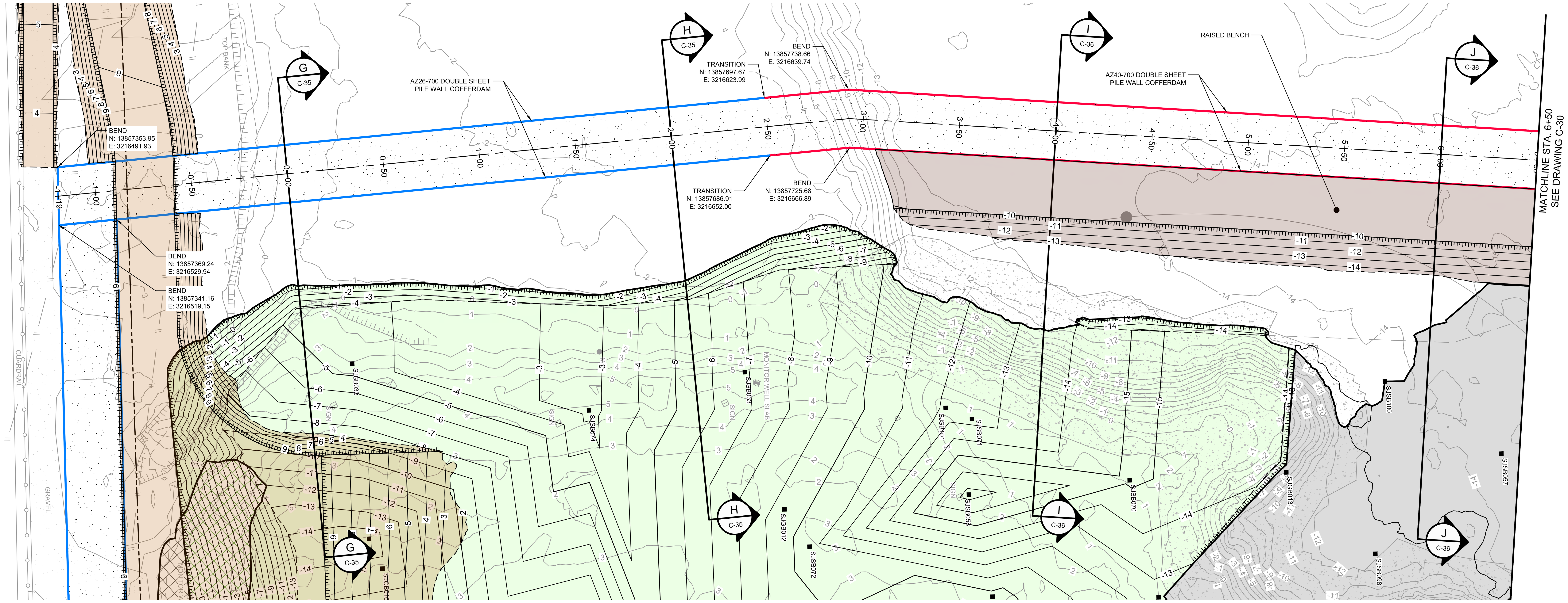
No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale 1" = 100'
Original Size Arch D	Bar is one inch on original size drawing (0 — 1")

Project No. 11215702

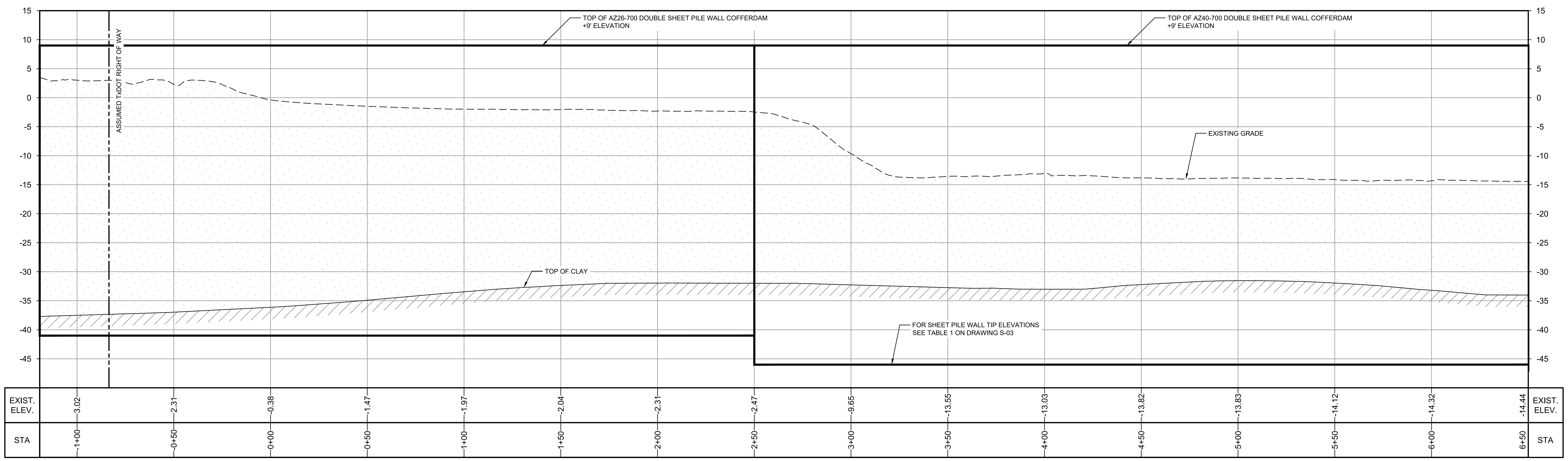
Title
PILE WALL LAYOUT PLAN

Sheet No.
C-28
Sheet - of -



PLAN

1" = 30'



PROFILE

HORIZ: 1" = 30'
VERT: 1" = 10'

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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5551 Corporate Boulevard Suite 200
Baton Rouge Louisiana USA
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STATE OF TEXAS — CHARLES W. MUNCE — 105542 — LICENSED PROFESSIONAL ENGINEER — 11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER COMPONENT EPA REVIEW	MW	CM	11/8/2022

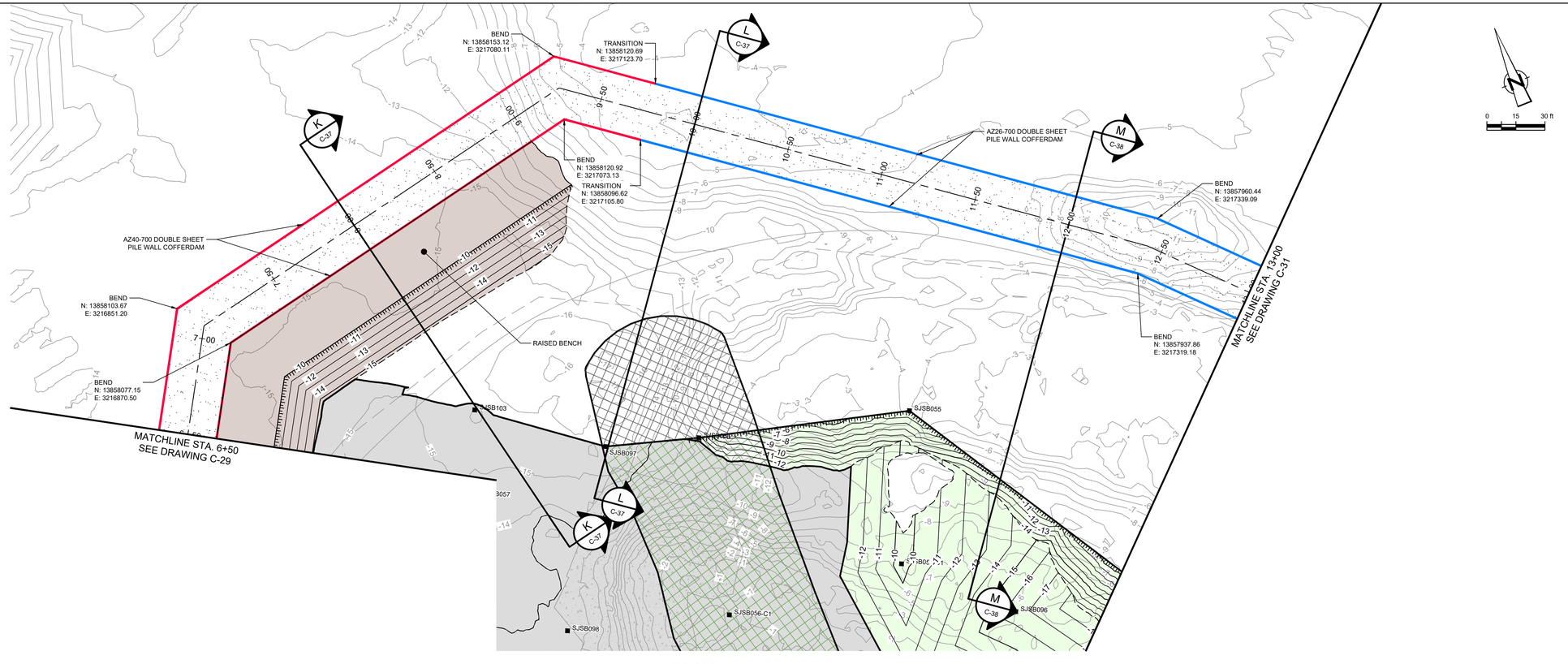
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing 0 1"	

Project No. 11215702

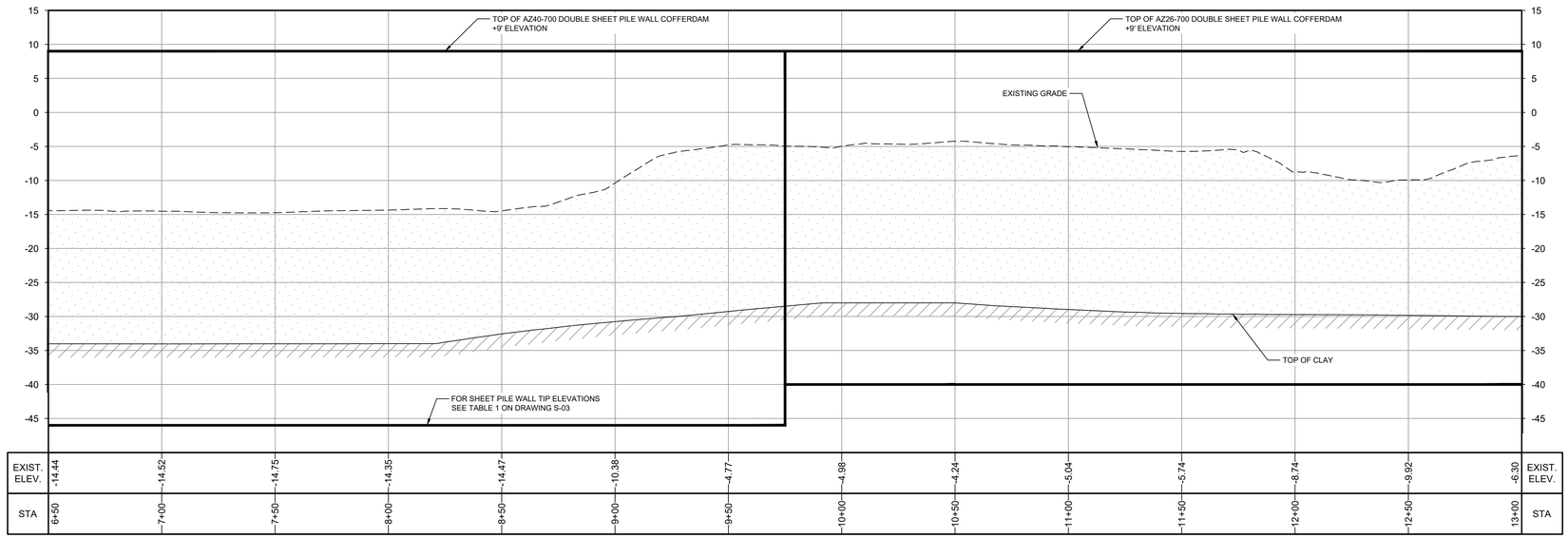
Title
DOUBLE PILE WALL PLAN AND PROFILE 1 OF 4

Sheet No.
C-29

Sheet - of -



PLAN
1" = 30'



PROFILE
HORIZ: 1" = 30'
VERT: 1" = 10'

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190808, JULY 8, 2019 TO AUGUST 2, 2019.
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

0 15 30 ft

GHD
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM
- MATERIAL TO BE ADDRESSED BY CAPPING
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

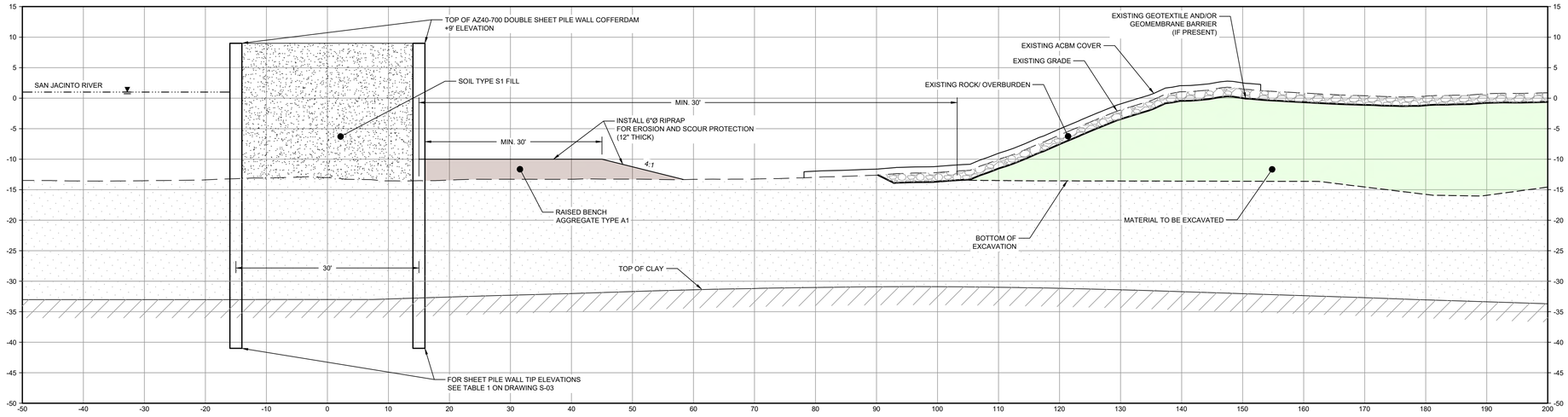
Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale AS SHOWN
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

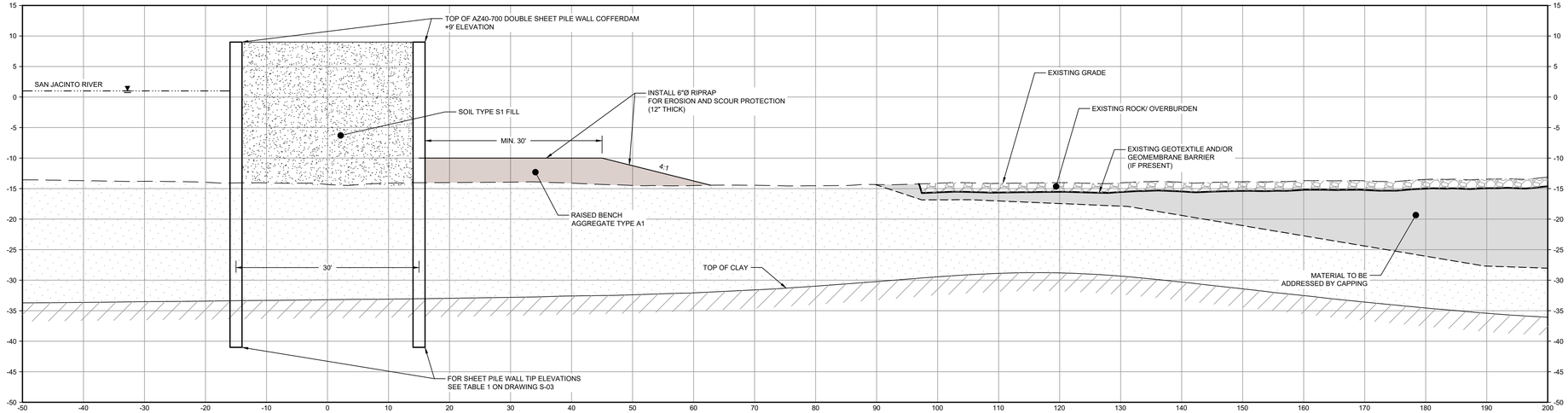
Title
DOUBLE PILE WALL PLAN AND PROFILE 2 OF 4

Sheet No.
C-30
Sheet - of -

Plot Date: 8 November 2022 - 9:32 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-026.dwg



SECTION I STA. 4+00.00
SCALE: 1"=10'
C-29



SECTION J STA. 6+00.00
SCALE: 1"=10'
C-29

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
5551 Corporate Boulevard Suite 200
Baton Rouge Louisiana USA
T 225 292 9007 F 225 952 2978 W www.ghd.com

STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- BMP SOIL BUTTRESS
- RAISED BENCH
- MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

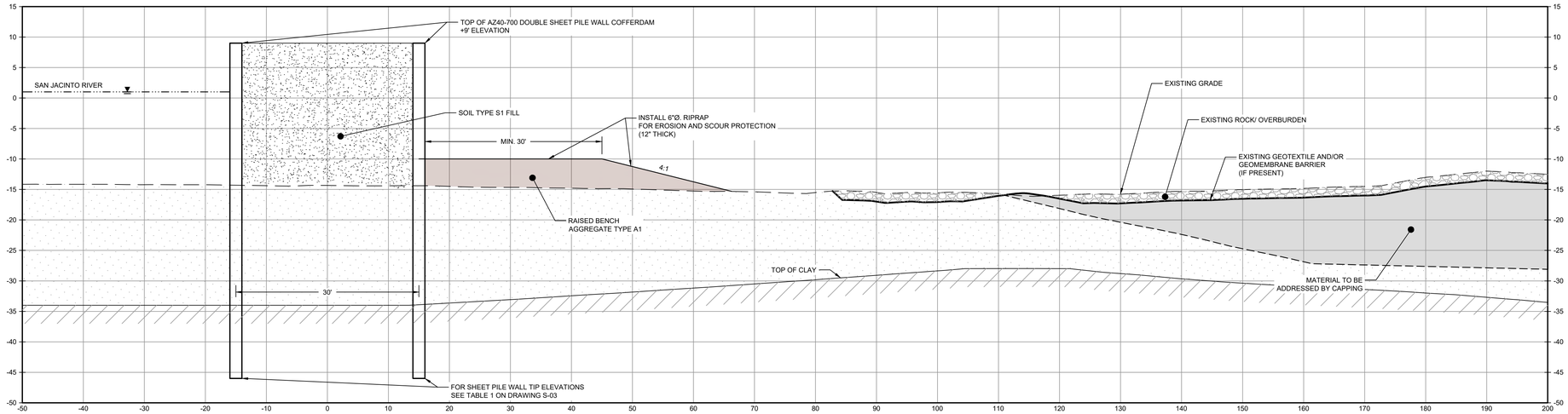
Project No. 11215702

Title
DOUBLE PILE WALL SECTIONS 2 OF 7

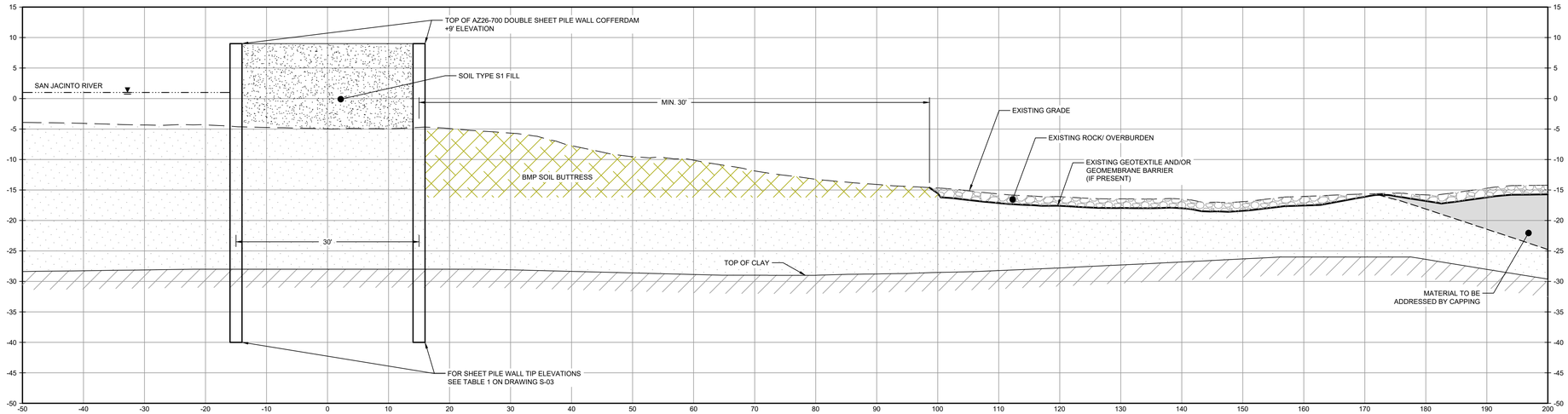
Sheet No.
C-36

Sheet - of -

Plot Date: 8 November 2022 - 9:36 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-024.dwg



SECTION K STA. 8+00.00
SCALE: 1"=10'
C-30



SECTION L STA.10+00.00
SCALE: 1"=10'
C-30

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LEGEND
- MATERIAL TO BE EXCAVATED
- BMP SOIL BUTTRESS
- RAISED BENCH
- MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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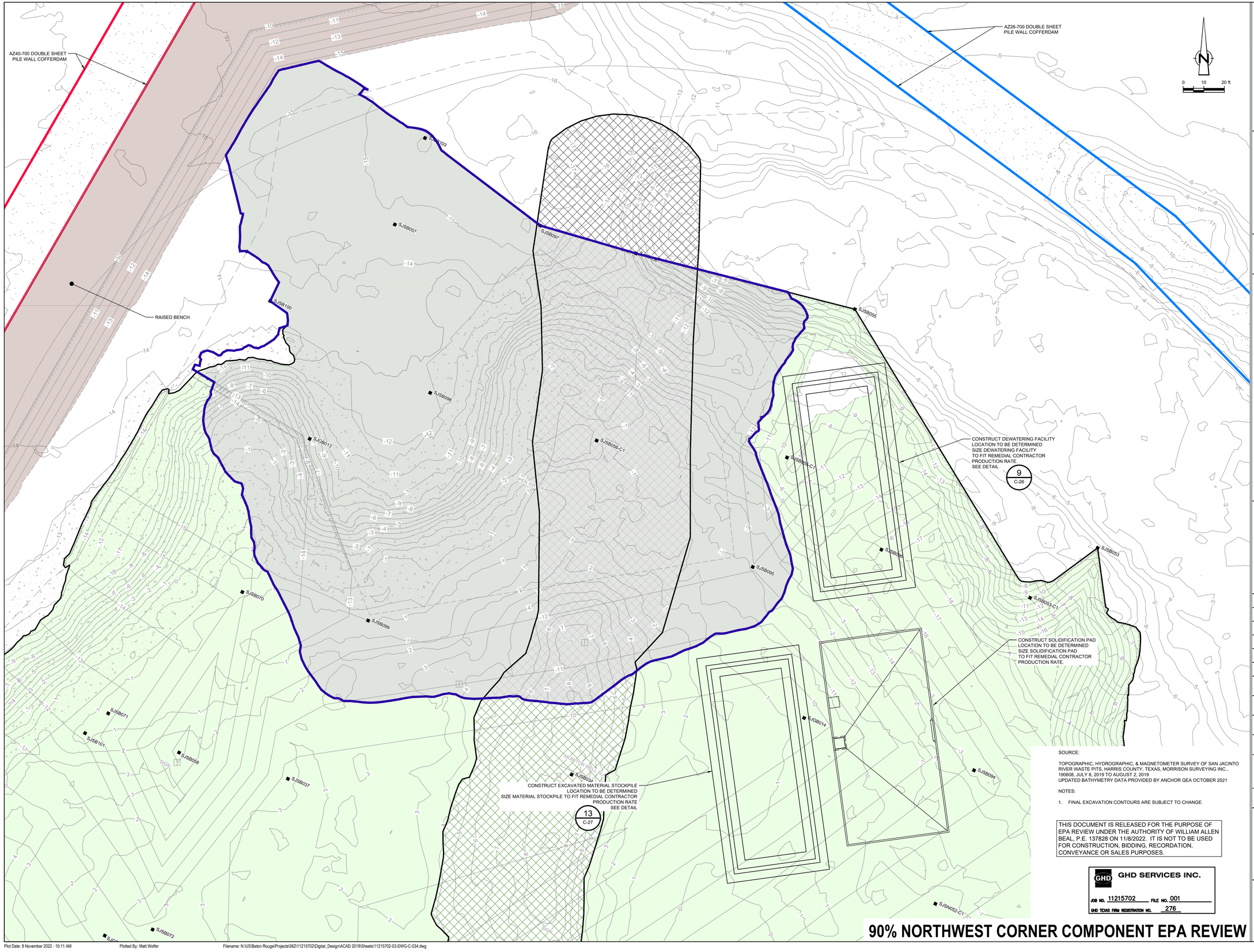
Project No. 11215702

Title
DOUBLE PILE WALL SECTIONS 3 OF 7

Sheet No.
C-37

Sheet - of -

Plot Date: 8 November 2022 - 9:36 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-024.dwg



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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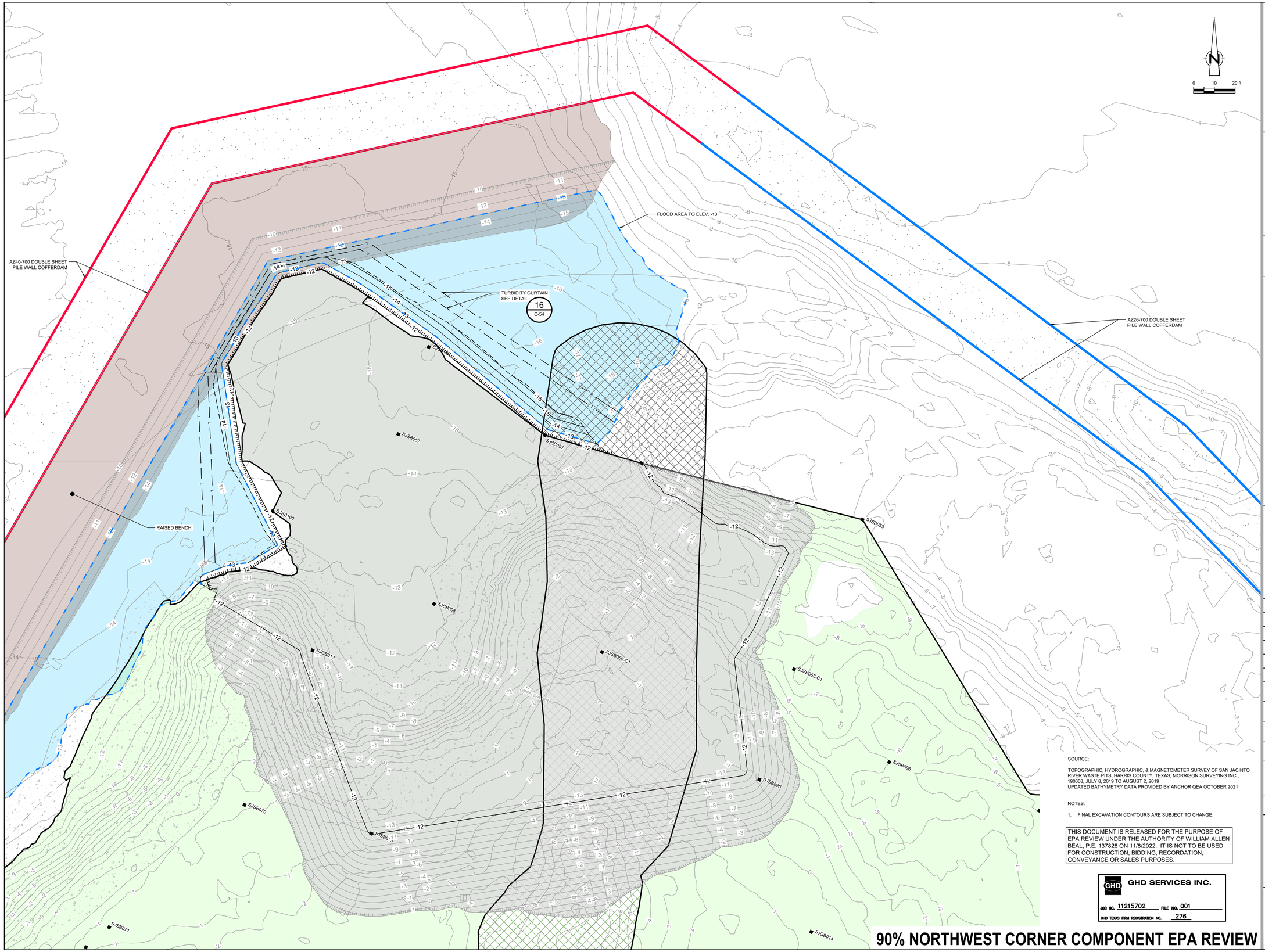
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER WORKS PLAN

Sheet No.
C-45
Sheet - of -



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10- EXISTING CONTOUR INTERVAL
- -x- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- -OH- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- FLOOD AREA TO ELEV. -13
- TURBIDITY CURTAIN

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

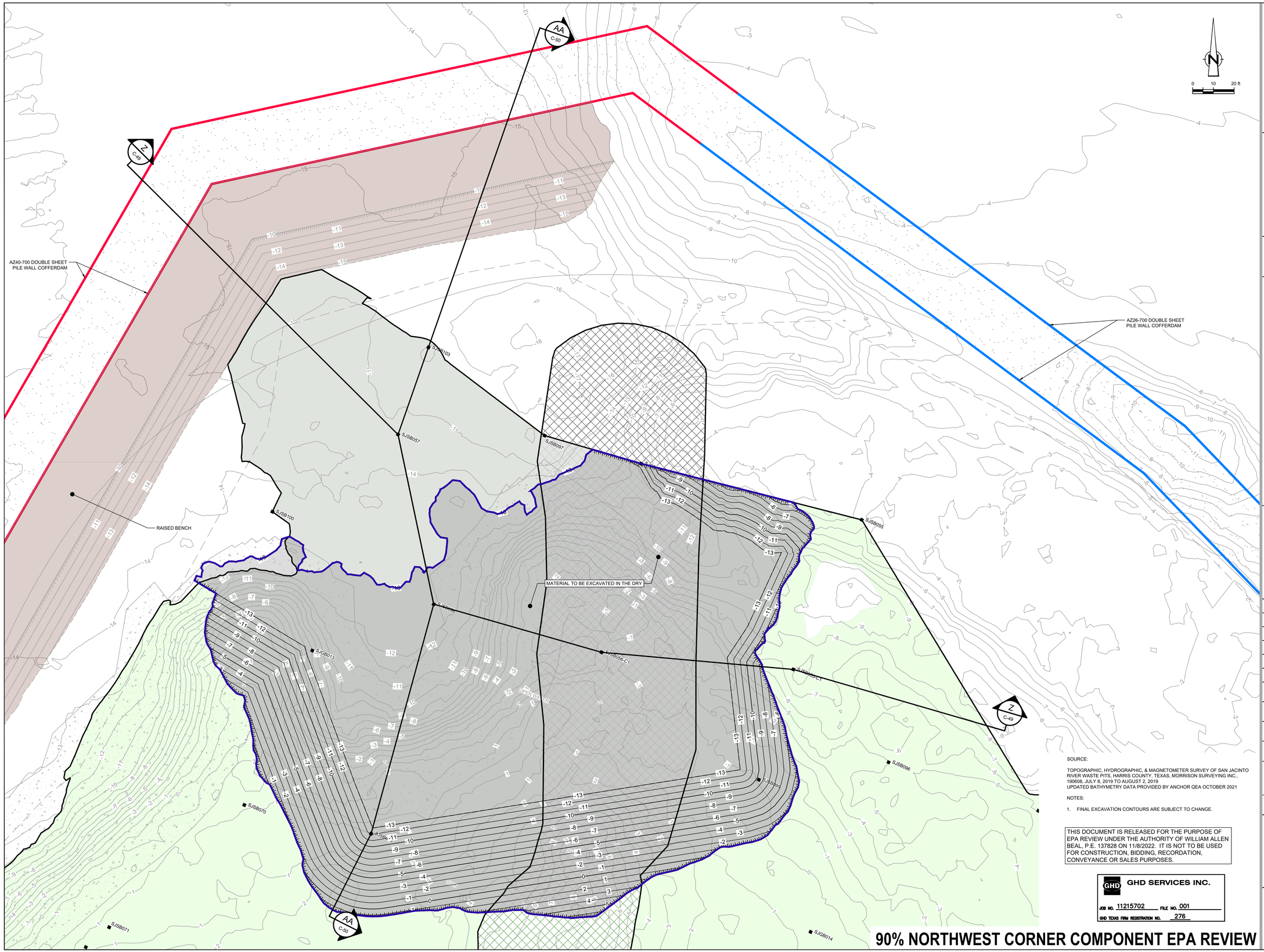
Project No. **11215702**

Title
CAPPING ALTERNATIVE NORTHWEST CORNER CAPPING CONTROLS

Sheet No.
C-46

Sheet - of -

Plot Date: 8 November 2022 - 2:37 PM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-035.dwg



90% NORTHWEST CORNER COMPONENT EPA REVIEW

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10- EXISTING CONTOUR INTERVAL
- -X- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- -OH- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- MATERIAL TO BE EXCAVATED - DRY

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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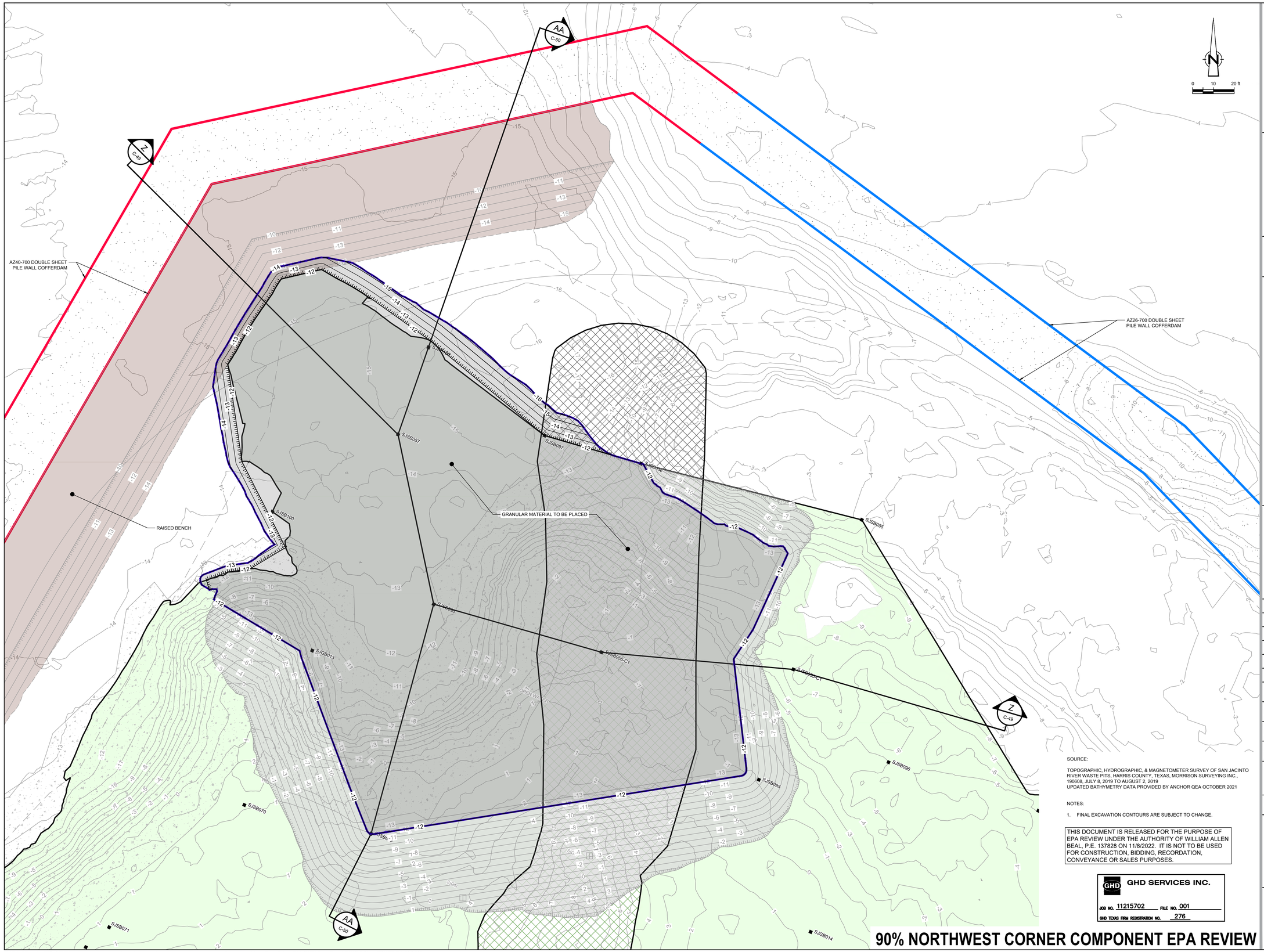
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER DRY EXCAVATION

Sheet No.
C-47

Sheet - of -



90% NORTHWEST CORNER COMPONENT EPA REVIEW

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
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GHD TEXAS FIRM REGISTRATION NO. 276

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10 EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- GRANULAR MATERIAL TO BE PLACED

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

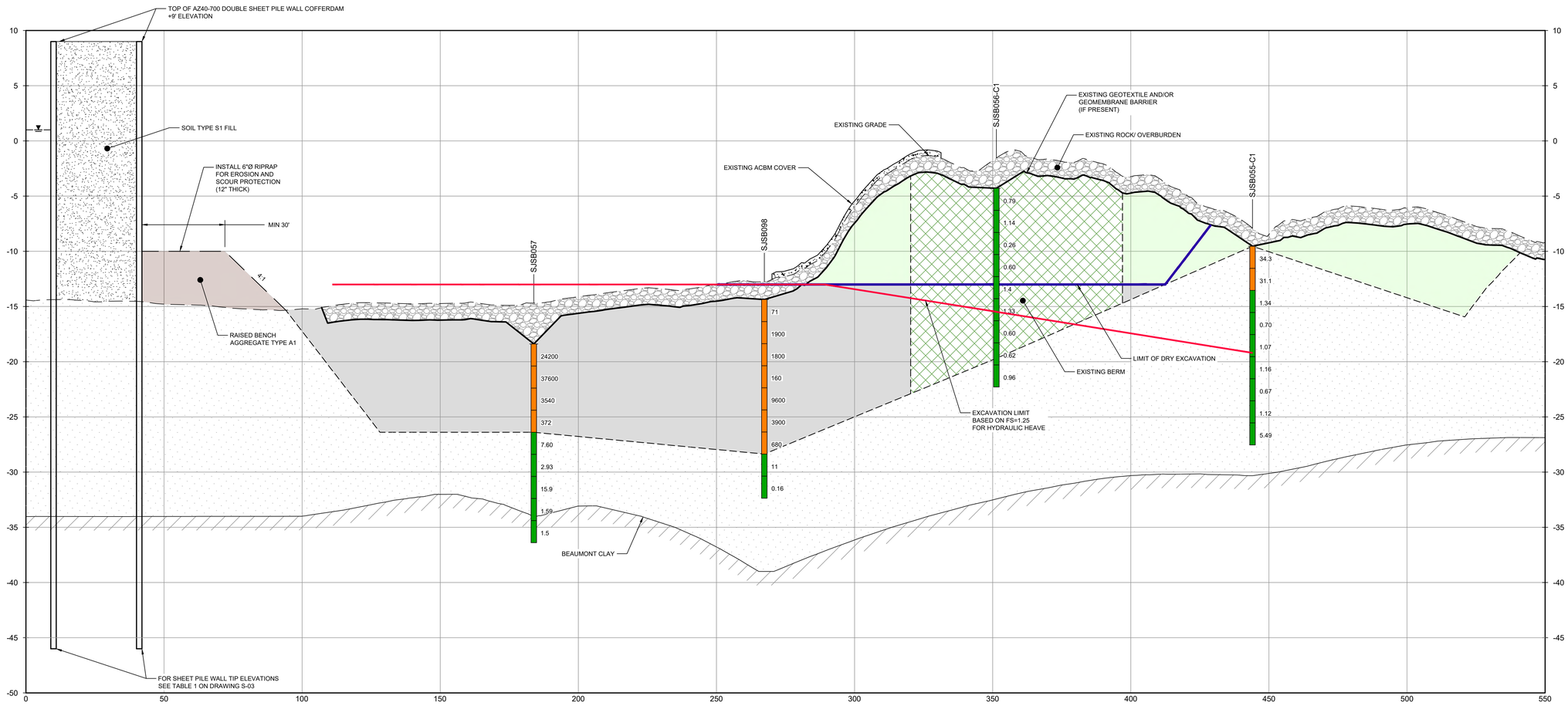
Project No. **11215702**

Title
CAPPING ALTERNATIVE NORTHWEST CORNER FILL PLAN

Sheet No.
C-48

Sheet - of -

Plot Date: 8 November 2022 - 2:42 PM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-037.dwg



SECTION Z WEST/EAST
C-47,C-48
HORIZ: 1"=20'
VERT: 1"=5'

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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11/8/2022

LEGEND
MATERIAL TO BE EXCAVATED
MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
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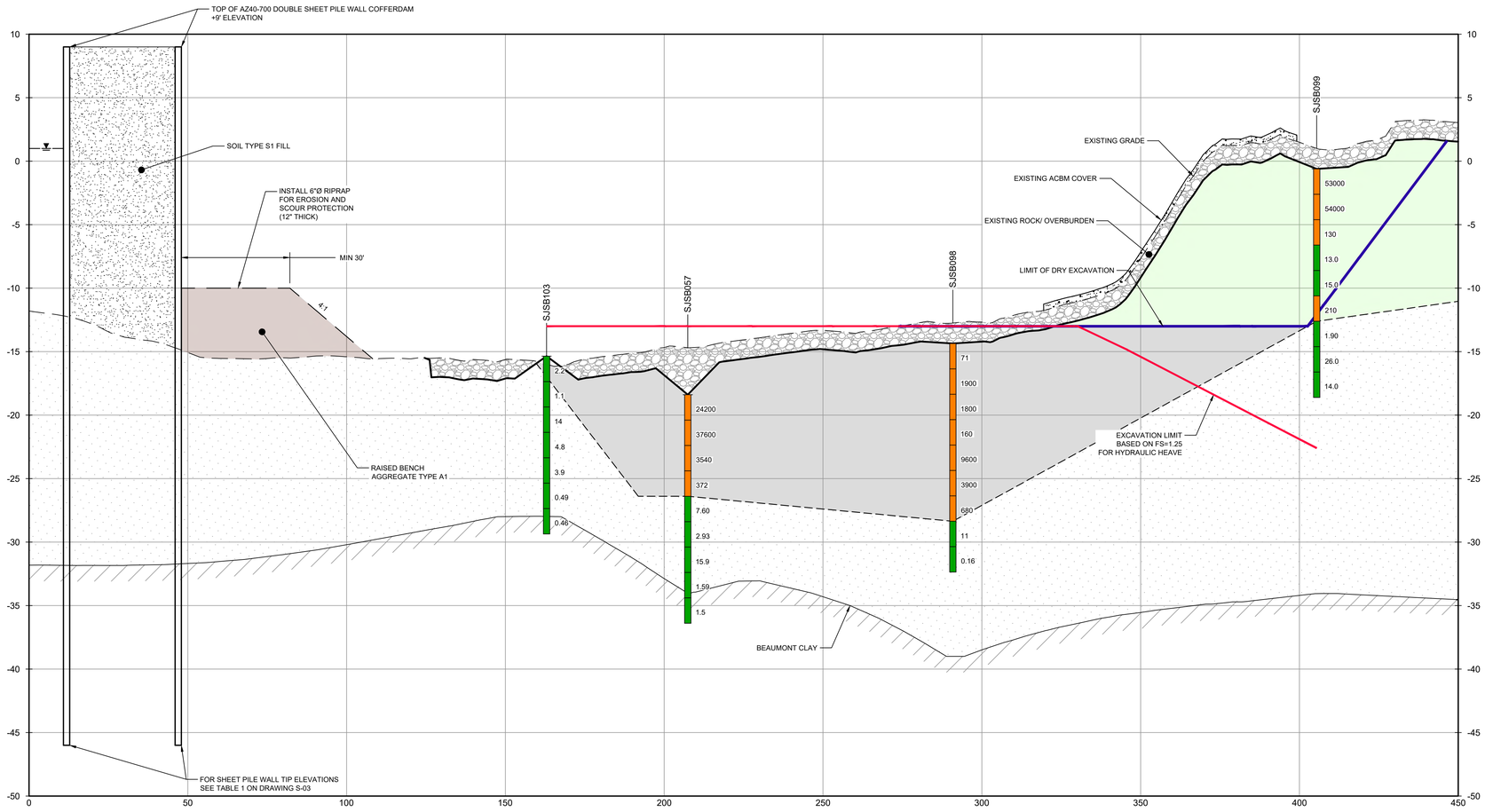
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER SECTIONS 1 OF 2

Sheet No.
C-49
Sheet - of -



SECTION AA NORTH/ SOUTH
C-47,C-48
HORIZ: 1"=20'
VERT: 1"=5'

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PROFESSIONAL ENGINEER
11/8/2022

LEGEND
MATERIAL TO BE EXCAVATED
MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW		Designer RH	
Drafting Check NQ		Design Check WB	
Project Coordinator CM		Date Nov 8, 2022	
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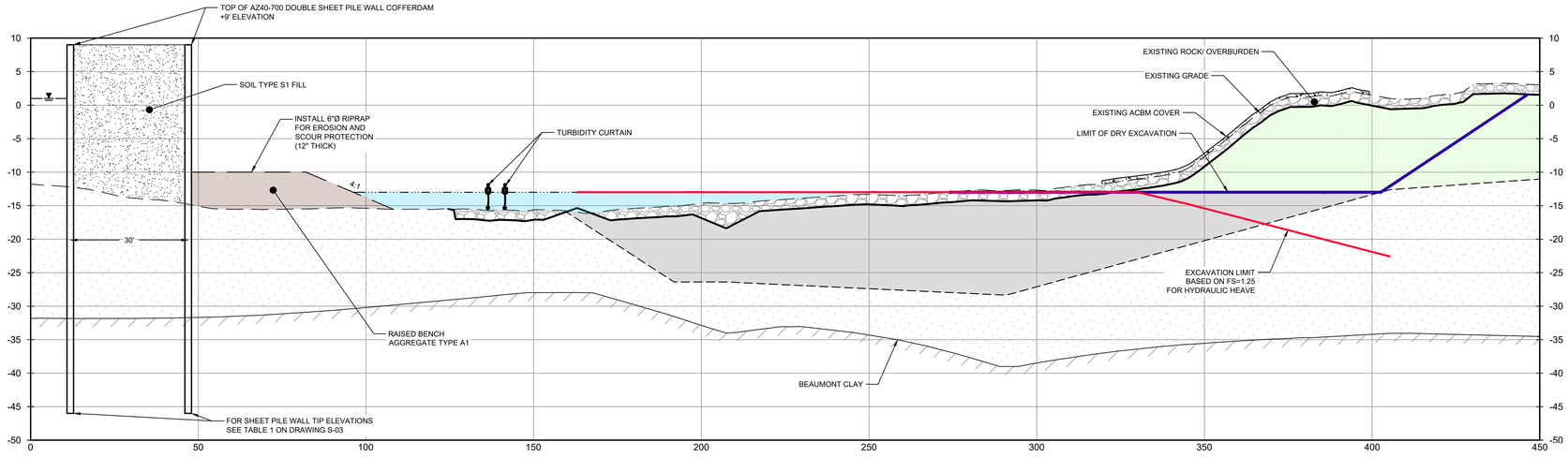
Original Size Arch D		Bar is one inch on original size drawing 0 1"	

Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER SECTIONS 2 OF 2

Sheet No.
C-50
Sheet - of -

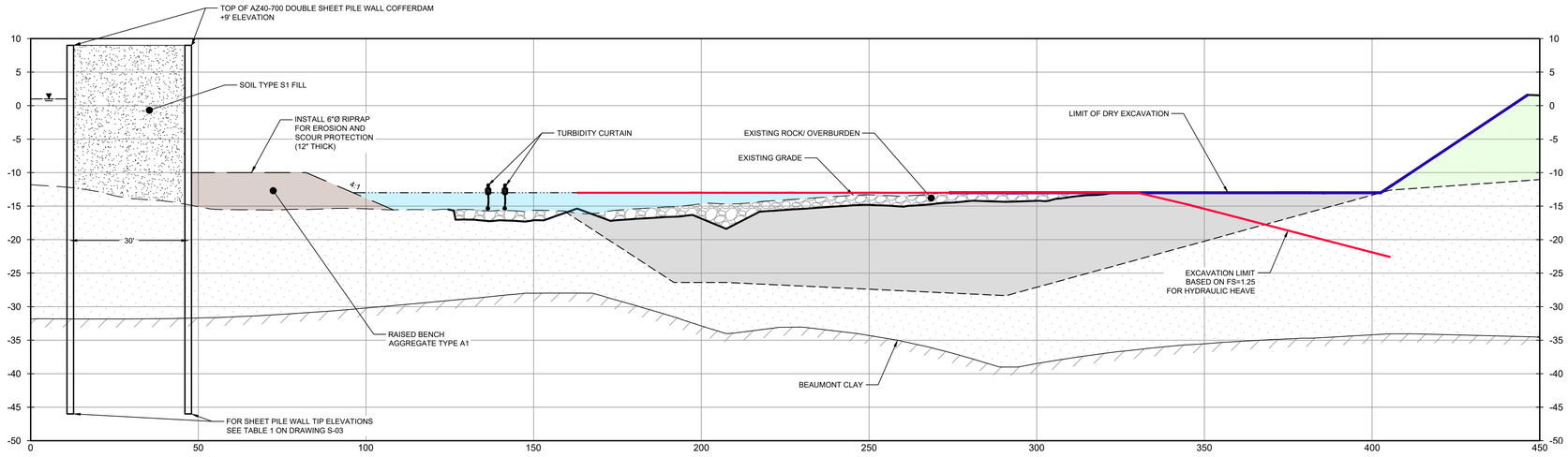


NOTES:

1. DEWATER NORTHWEST CORNER TO EXCAVATION LIMIT BASED ON FS = 1.25 FOR HYDRAULIC HEAVE.

PHASE 1

HORIZ: 1" = 20'
VERT: 1" = 10'



NOTES:

1. REMOVE ROCK LAYER TO BE STOCKPILED ON SITE. REUSED AS TEMPORARY COVER AT END OF SEASONAL EXCAVATION.
2. REMOVE GEOMEMBRANE/ GEOTEXTILE / ACBM (IF PRESENT), EXCAVATE MATERIAL ABOVE LIMIT OF DRY EXCAVATION AND DISPOSE OF OFFSITE.

PHASE 2

HORIZ: 1" = 20'
VERT: 1" = 10'

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LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

MATERIAL TO BE EXCAVATED

MATERIAL TO BE ADDRESSED BY CAPPING

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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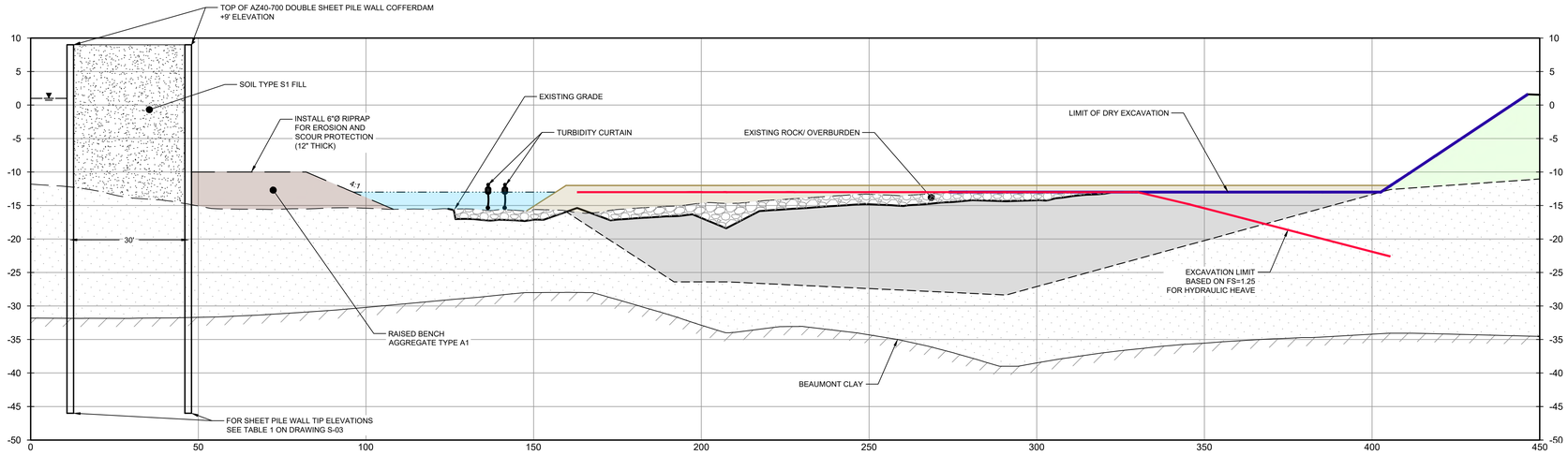
Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER SEQUENCING 1 OF 2

Sheet No.
C-51

Sheet - of -

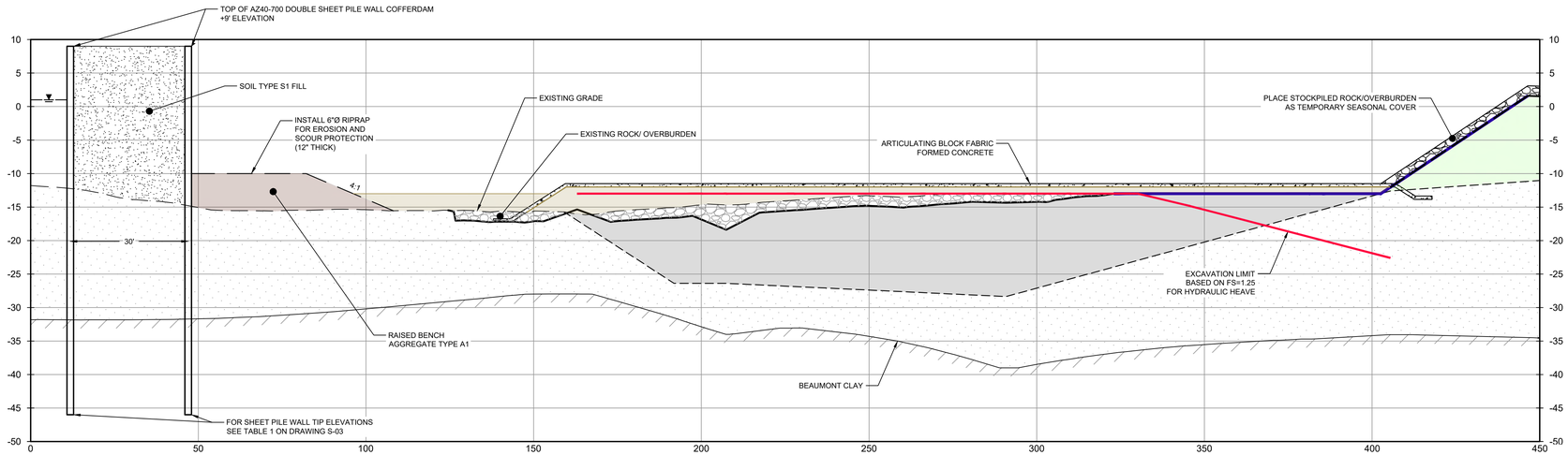


NOTES:

1. GRANULAR MATERIAL PLACED TO MINIMUM 1' THICKNESS.
2. WATER LEVEL TO BE MAINTAINED AT HYDRAULIC HEAVE LIMIT BASED ON FS=1.25 DURING GRANULAR FILL PLACEMENT.

PHASE 3

HORIZ: 1" = 20'
VERT: 1" = 10'



NOTES:

1. ARTICULATING BLOCK FABRIC FORMED CONCRETE PLACED TO CREATE CAP.
2. WATER TO BE PUMPED OFF AND TREATED UPON COMPLETION OF GRANULAR FILL PLACEMENT.

PHASE 4

HORIZ: 1" = 20'
VERT: 1" = 10'

NOTES:

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

- MATERIAL TO BE EXCAVATED
- MATERIAL TO BE ADDRESSED BY CAPPING
- GRANULAR MATERIAL

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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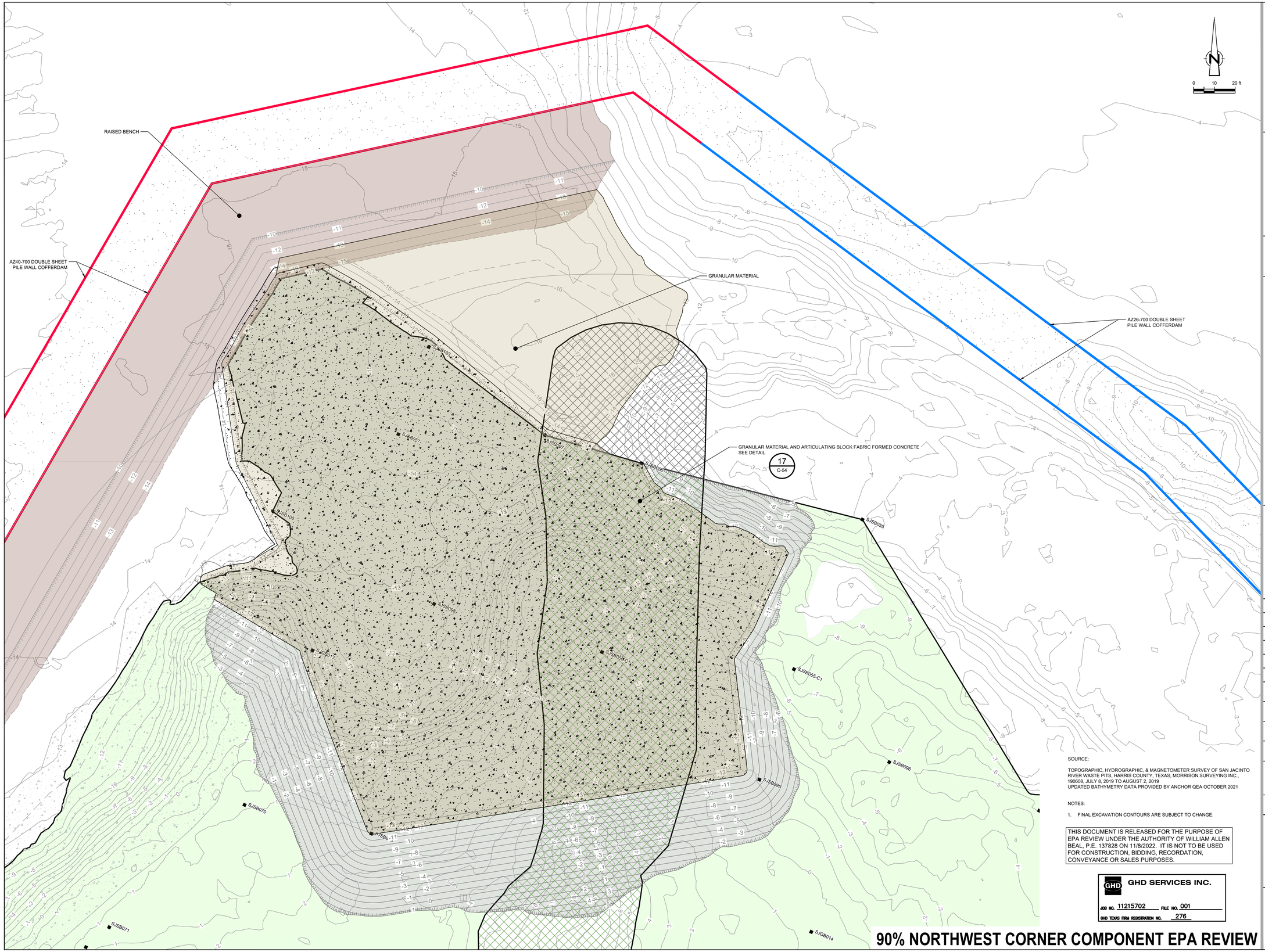
Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

Project No. 11215702

Title
CAPPING ALTERNATIVE NORTHWEST CORNER SEQUENCING 2 OF 2

Sheet No.
C-52

Sheet - of -



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER

11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10- EXISTING CONTOUR INTERVAL
- -X- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- -OH- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- GRANULAR MATERIAL
- ARTICULATING BLOCK FABRIC FORMED CONCRETE

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
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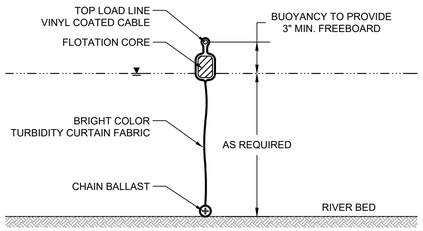
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

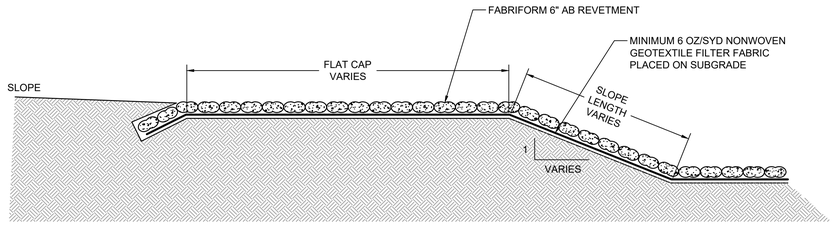
Title
CAPPING ALTERNATIVE NORTHWEST CORNER FINAL GRADE

Sheet No.
C-53
Sheet - of -

Plot Date: 8 November 2022 - 10:51 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-03-DWG-C-040.dwg



DETAIL 16 CAPPING TURBIDITY CURTAIN
N.T.S. C-46



DETAIL 17 ARTICULATING BLOCK FABRIC FORMED CONCRETE
N.T.S. C-53

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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Project No. 11215702

Title
CAPPING ALTERNATIVE
NORTHWEST CORNER
CAPPING DETAILS

Sheet No.
C-54

Sheet - of -

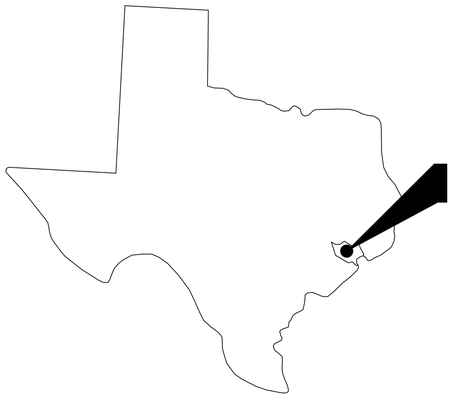
Appendix G-2

Design Drawing Package - Northwest Corner Mechanical Dredging

SAN JACINTO RIVER WASTE PITS
NORTHERN IMPOUNDMENT
(NORTHWEST CORNER COMPONENT)
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

NOVEMBER 2022

11215702



STATE OF TEXAS
VICINITY MAP

HARRIS COUNTY
VICINITY MAP

IMAGE - © 2020 Microsoft Corporation © 2020 Digital Globe © CNES (2020) Distribution Airbus DS

LOCATION MAP

DRAWING NUMBER	DRAWING NAME
GENERAL SERIES	
G-01	COVER SHEET
CIVIL SERIES	
C-01	OVERALL PLAN
C-02	EXISTING CONDITIONS
C-03	SSA AREA AND NORTHERN IMPOUNDMENT WORKS
C-04	SOIL EROSION AND SEDIMENT CONTROL PLAN - OVERALL
C-05	SOIL EROSION AND SEDIMENT CONTROL PLAN - SEASONAL
C-06	SOIL EROSION AND SEDIMENT CONTROL DETAILS
C-07	PROJECT TRAFFIC CONTROL PLAN
C-08	EXCAVATION PLAN - OVERALL
C-09	EXCAVATION PLAN NORTHWEST
C-10	EXCAVATION PLAN NORTHEAST
C-11	EXCAVATION PLAN SOUTHEAST
C-12	EXCAVATION PLAN SOUTHWEST
C-13	EXCAVATION SECTION - 1 OF 6
C-14	EXCAVATION SECTION - 2 OF 6
C-15	EXCAVATION SECTION - 3 OF 6
C-16	EXCAVATION SECTION - 4 OF 6
C-17	EXCAVATION SECTION - 5 OF 6
C-18	EXCAVATION SECTION - 6 OF 6
C-19	TYPICAL SEASONAL EXCAVATION SEQUENCING
C-20	TYPICAL EXCAVATION SEQUENCING - 1 OF 2
C-21	TYPICAL EXCAVATION SEQUENCING - 2 OF 2
C-22	RESTORATION PLAN
C-23	TYPICAL CONSTRUCTION SEQUENCING - 1 OF 2
C-24	TYPICAL CONSTRUCTION SEQUENCING - 2 OF 2
C-25	TYPICAL DETAILS - 1 OF 3
C-26	TYPICAL DETAILS - 2 OF 3
C-27	TYPICAL DETAILS - 3 OF 3
C-28	PILE WALL LAYOUT PLAN
C-29	DOUBLE PILE WALL PLAN AND PROFILE - 1 OF 4
C-30	DOUBLE PILE WALL PLAN AND PROFILE - 2 OF 4
C-31	DOUBLE PILE WALL PLAN AND PROFILE - 3 OF 4
C-32	DOUBLE PILE WALL PLAN AND PROFILE - 4 OF 4
C-33	SOUTH WALL PLAN AND PROFILE - 1 OF 2
C-34	SOUTH WALL PLAN AND PROFILE - 2 OF 2
C-35	DOUBLE PILE WALL SECTIONS - 1 OF 7
C-36	DOUBLE PILE WALL SECTIONS - 2 OF 7
C-37	DOUBLE PILE WALL SECTIONS - 3 OF 7
C-38	DOUBLE PILE WALL SECTIONS - 4 OF 7
C-39	DOUBLE PILE WALL SECTIONS - 5 OF 7
C-40	DOUBLE PILE WALL SECTIONS - 6 OF 7
C-41	DOUBLE PILE WALL SECTIONS - 7 OF 7
C-42	SOUTH WALL SECTIONS - 1 OF 3
C-43	SOUTH WALL SECTIONS - 2 OF 3
C-44	SOUTH WALL SECTIONS - 3 OF 3
C-45	DREDGING ALTERNATIVE NORTHWEST CORNER WORKS PLAN
C-46	DREDGING ALTERNATIVE NORTHWEST CORNER DREDGING CONTROLS
C-47	DREDGING ALTERNATIVE NORTHWEST CORNER DRY EXCAVATION
C-48	DREDGING ALTERNATIVE NORTHWEST CORNER WET EXCAVATION
C-49	DREDGING ALTERNATIVE NORTHWEST CORNER SECTIONS 1 OF 2
C-50	DREDGING ALTERNATIVE NORTHWEST CORNER SECTIONS 2 OF 2
C-51	DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 1 OF 3
C-52	DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 2 OF 3
C-53	DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 3 OF 3
C-54	DREDGING ALTERNATIVE NORTHWEST CORNER FINAL GRADE
C-55	DREDGING ALTERNATIVE NORTHWEST CORNER DREDGING DETAILS
STRUCTURAL SERIES	
S-01	STRUCTURAL NOTES
S-02	STRUCTURAL LAYOUT PLAN
S-03	STRUCTURAL SECTIONS
S-04	STRUCTURAL DETAILS 1 OF 2
S-05	STRUCTURAL DETAILS 2 OF 2
PROCESS FLOW AND INSTRUMENTATION SERIES	
P-00A	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM SYMBOLS
P-00B	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM SCHEDULES
P-01	WATER TREATMENT SYSTEM PROCESS FLOW DIAGRAM/MASS BALANCE
P-02	WATER TREATMENT SYSTEM P&ID (1 OF 4)
P-03	WATER TREATMENT SYSTEM P&ID (2 OF 4)
P-04	WATER TREATMENT SYSTEM P&ID (3 OF 4)
P-05	WATER TREATMENT SYSTEM P&ID (4 OF 4)
P-06	SITE PLAN WATER TREATMENT SYSTEM SEASON 3-6

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
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Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
COVER SHEET

Sheet No.
G-01

Sheet - of -

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- ASPHALT

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022

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Original Size **Arch D**

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Project No. **11215702**

Title
EXISTING CONDITIONS

Sheet No.
C-02

Sheet - of -

Plot Date: 8 November 2022 - 8:39 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-002.dwg

N

0 50 100 ft

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PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
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- WELL WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- SOIL TYPE S1

Client

SAN JACINTO RIVER WASTE PITS

Project

NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER COMPONENT EPA REVIEW	MW	CM	11/8/2022

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
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Project No. 11215702

Title

SSA AREA AND NORTHERN IMPOUNDMENT WORKS

Sheet No.

C-03

Sheet - of -

SOURCE:

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UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. LOCATION OF OVERBURDEN STOCKPILE, DECONTAMINATION PAD, SOLIDIFICATION PAD, AND DEWATERING FACILITY ARE SUBJECT TO CHANGE AND CAN VARY FROM SEASON TO SEASON.

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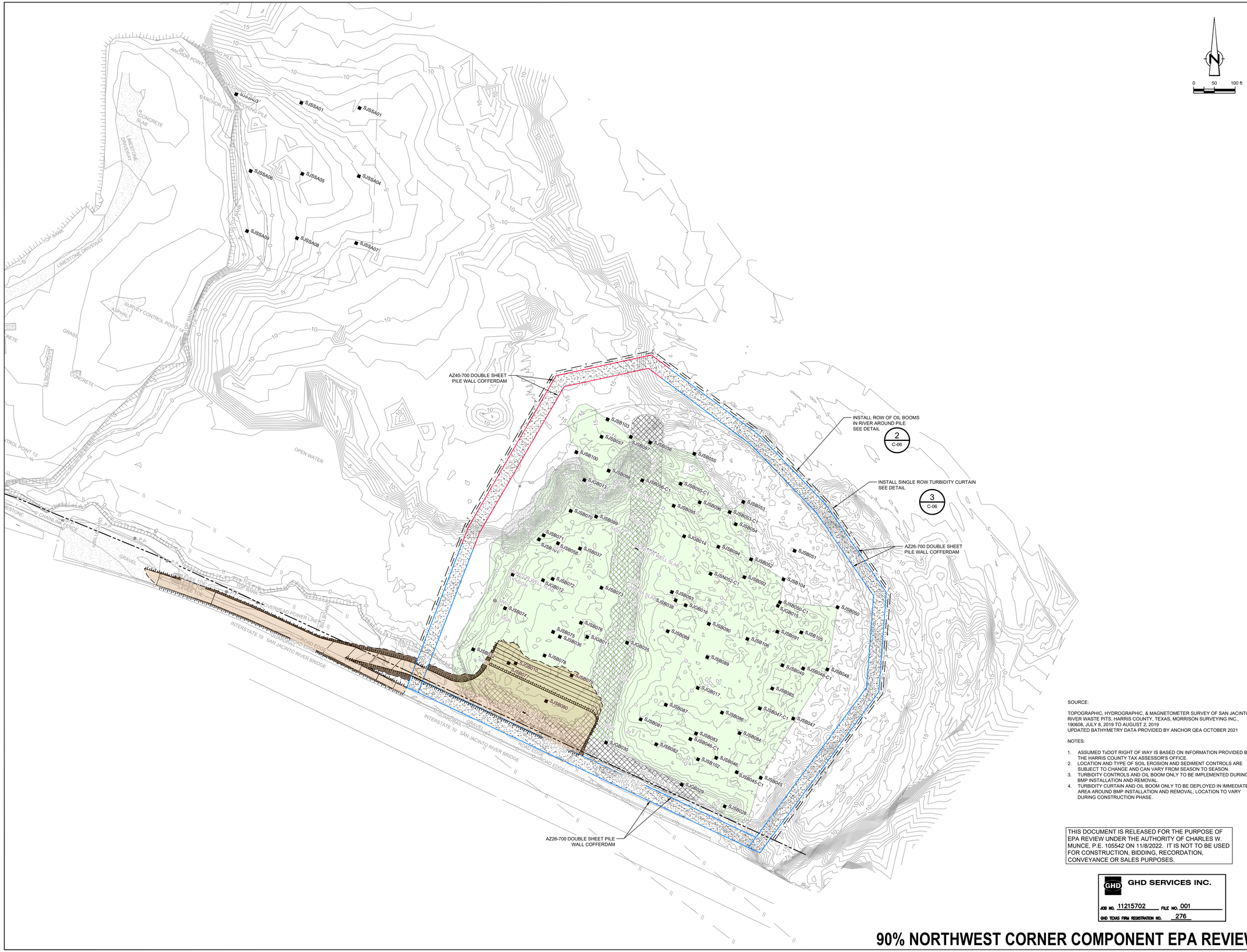
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW



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NOTES:

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2. LOCATION AND TYPE OF SOIL EROSION AND SEDIMENT CONTROLS ARE SUBJECT TO CHANGE AND CAN VARY FROM SEASON TO SEASON.
3. TURBIDITY CONTROLS AND OIL BOOM ONLY TO BE IMPLEMENTED DURING BMP INSTALLATION AND REMOVAL.
4. TURBIDITY CURTAIN AND OIL BOOM ONLY TO BE DEPLOYED IN IMMEDIATE AREA AROUND BMP INSTALLATION AND REMOVAL; LOCATION TO VARY DURING CONSTRUCTION PHASE.

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11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
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- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE
- SILT FENCE
- TURBIDITY CURTAIN
- OIL BOOM
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
SOIL EROSION AND SEDIMENT CONTROL PLAN OVERALL

Sheet No.
C-04
Sheet - of -

0 50 100 ft

SOURCE:

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UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

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STATE OF TEXAS
CHARLES W. MUNCE
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11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
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- AZ26-700 PILE
- AZ40-700 PILE
- SILT FENCE
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- OIL BOOM
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022

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Scale 1" = 100'

Original Size **Arch D**

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0 1"

Project No. **11215702**

Title
SOIL EROSION AND SEDIMENT CONTROL PLAN SEASONAL

Sheet No.
C-05

Sheet - of -

SOURCE:

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UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. TRAFFIC ROUTES ARE PRELIMINARY. ASSUME USE OF TXDOT ACCESS ROAD.
3. ACCESS ROAD IMPROVEMENTS MAY BE NECESSARY AND WILL BE DETERMINED AT A LATER STAGE IN THE REMEDIAL DESIGN.

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STATE OF TEXAS
CHARLES W. MUNCE
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LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE
- TRAFFIC FLOW
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 100'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
PROJECT TRAFFIC CONTROL PLAN

Sheet No.
C-07

Sheet - of -

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.
3. EXISTING ACBM COVER OUTSIDE OF THE TCRA CAP PERIMETER MAY BE REMOVED DURING THE REMEDIAL ACTION

THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF EPA REVIEW UNDER THE AUTHORITY OF CHARLES W. MUNCE, P.E. 105542 ON 11/8/2022. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE OR SALES PURPOSES.

GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
5551 Corporate Boulevard Suite 200
Baton Rouge Louisiana USA
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022

This document shall not be used for construction unless signed and sealed for construction.

Scale 1" = 60'

Original Size **Arch D**

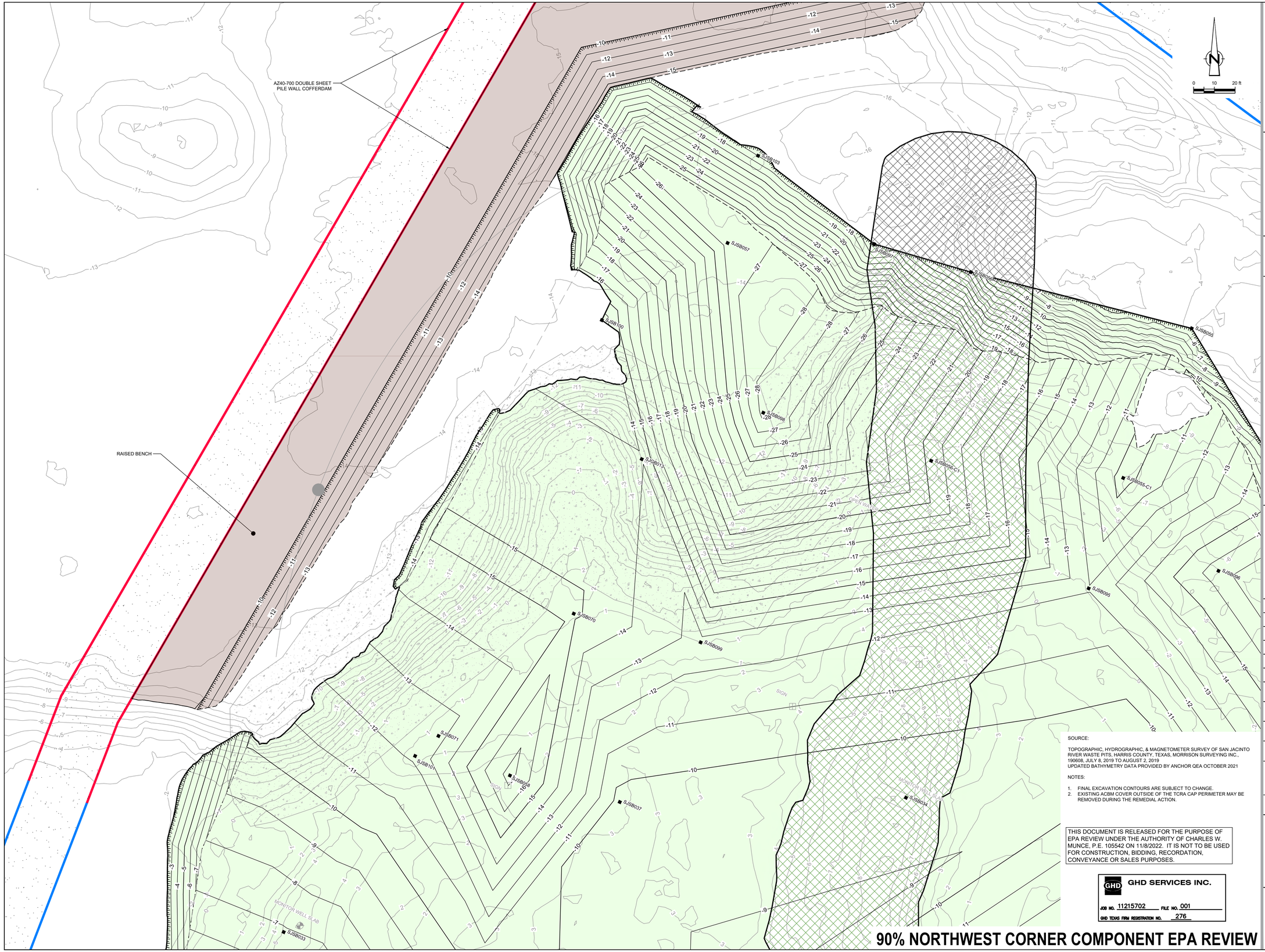
Bar is one inch on original size drawing (0 — 1")

Project No. **11215702**

Title
EXCAVATION PLAN OVERALL

Sheet No.
C-08

Sheet - of -



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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 20'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

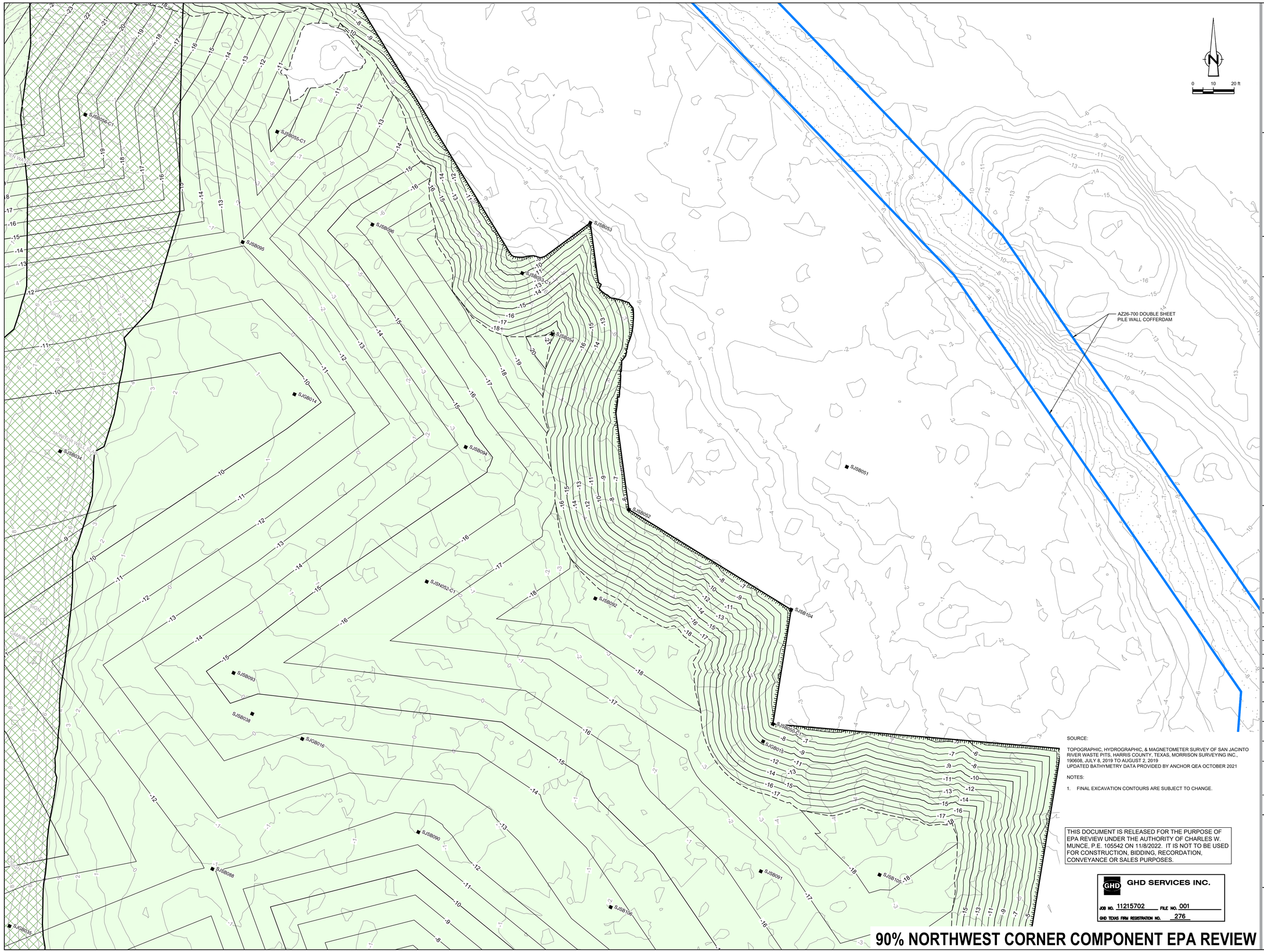
Project No. 11215702

Title
EXCAVATION PLAN NORTHWEST

Sheet No.
C-09

Sheet - of -

Plot Date: 8 November 2022 - 8:45 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-008.dwg



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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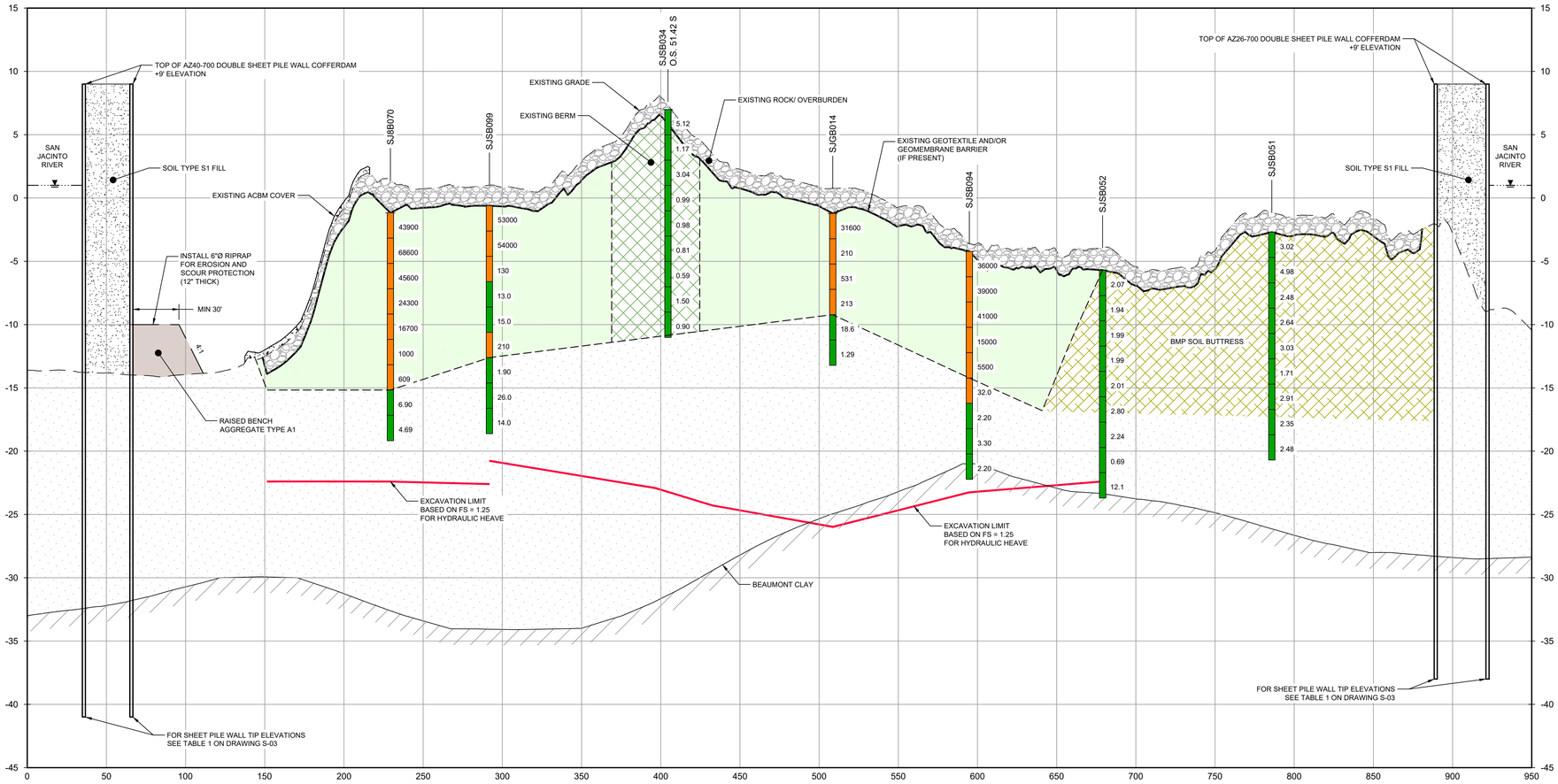
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
EXCAVATION PLAN
NORTHEAST

Sheet No.
C-10
Sheet - of -



SECTION A WEST/EAST
C-08
HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.
2. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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CHARLES W. MUNCE
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11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

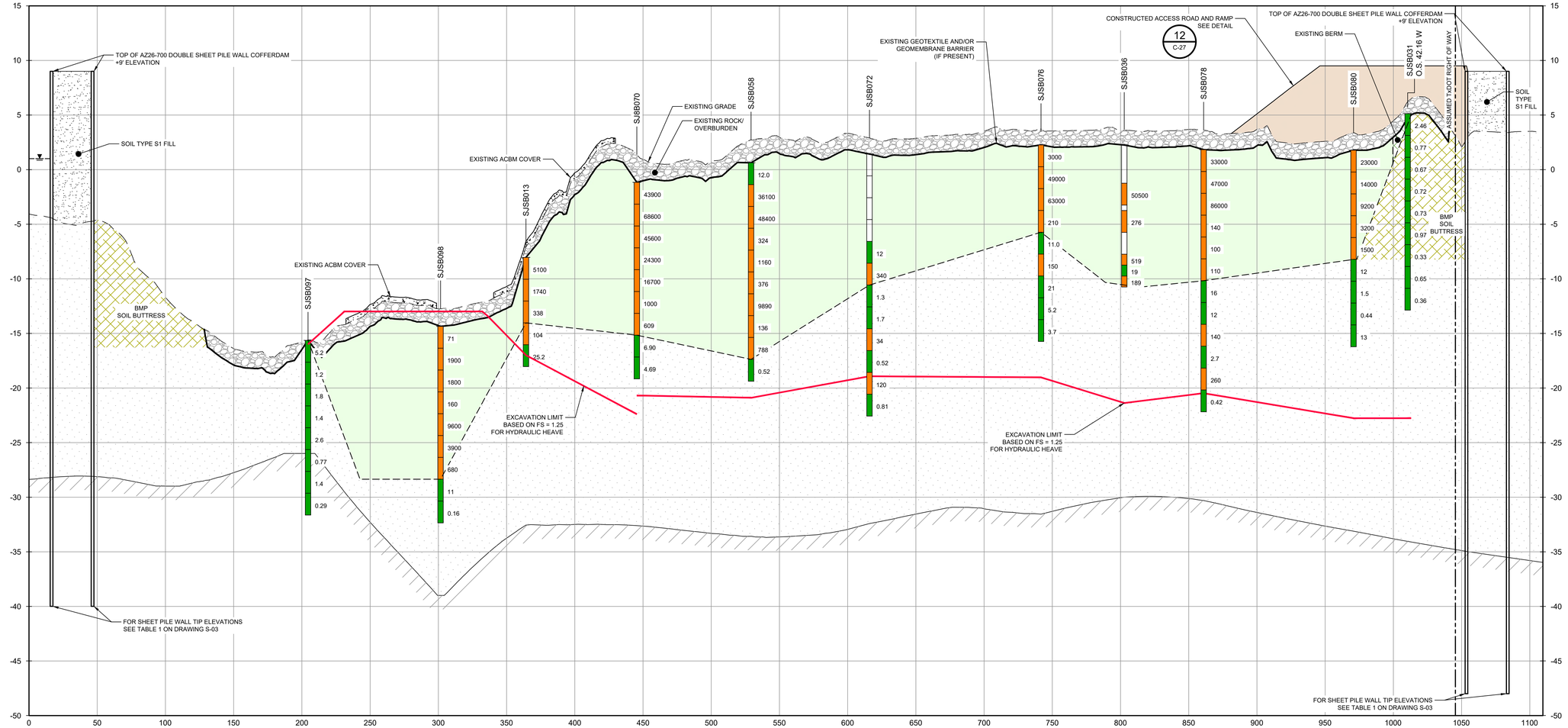
No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
EXCAVATION SECTION 1 OF 6

Sheet No.
C-13
Sheet - of -



SECTION D NORTH/SOUTH
C-08

HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.
3. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
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PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

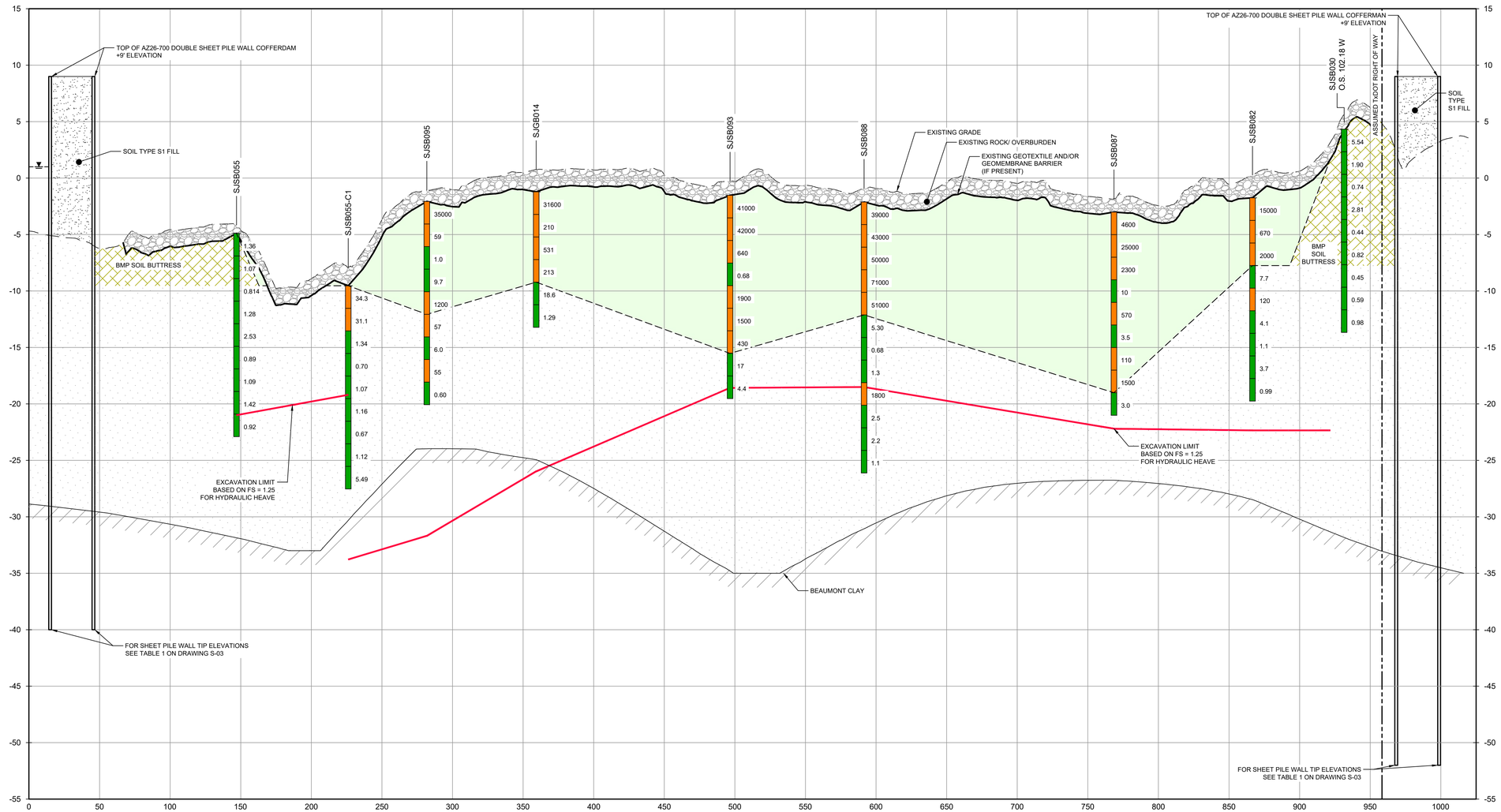
No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale AS SHOWN
Original Size Arch D	Bar is one inch on original size drawing (0 — 1")

Project No. 11215702

Title
EXCAVATION SECTION 4 OF 6

Sheet No.
C-16
Sheet - of -



SECTION E NORTH/SOUTH
C-08
HORIZ: 1"=40'
VERT: 1"=5'

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
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3. DISCONTINUITY BETWEEN EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE IS DUE TO PREVIOUS HYDRAULIC HEAVE ANALYSIS AND THE REVISED NORTHWEST CORNER SPECIFIC HYDRAULIC HEAVE ANALYSIS BEING REFLECTED IN THE SAME SECTION.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO BE EXCAVATED
- BMP SOIL BUTTRESS
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

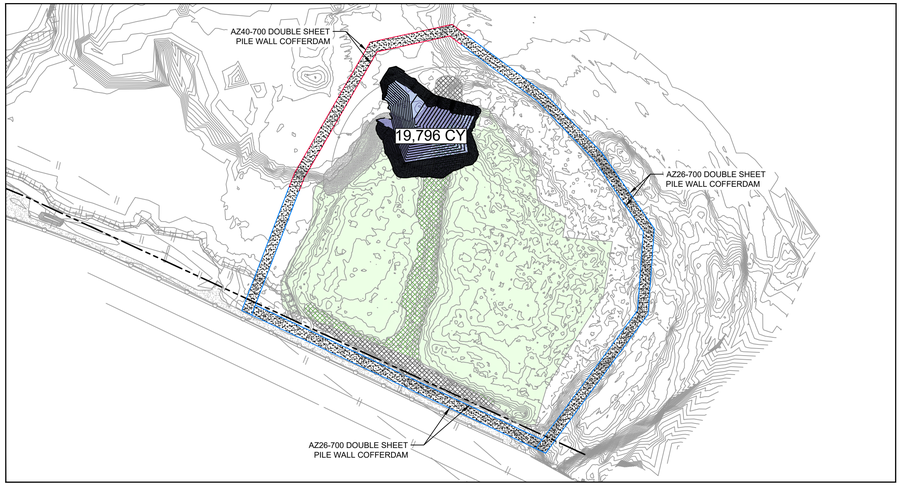
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing	0 — 1"

Project No. 11215702

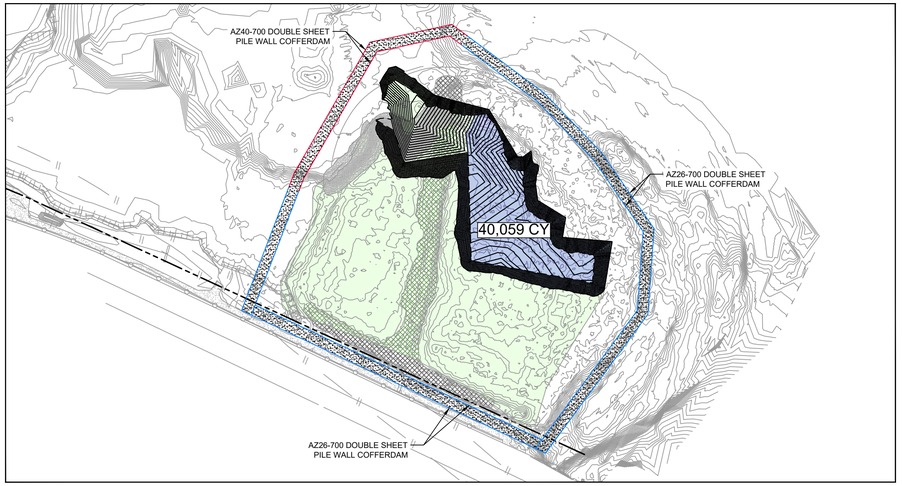
Title
EXCAVATION SECTION 5 OF 6

Sheet No.
C-17
Sheet - of -

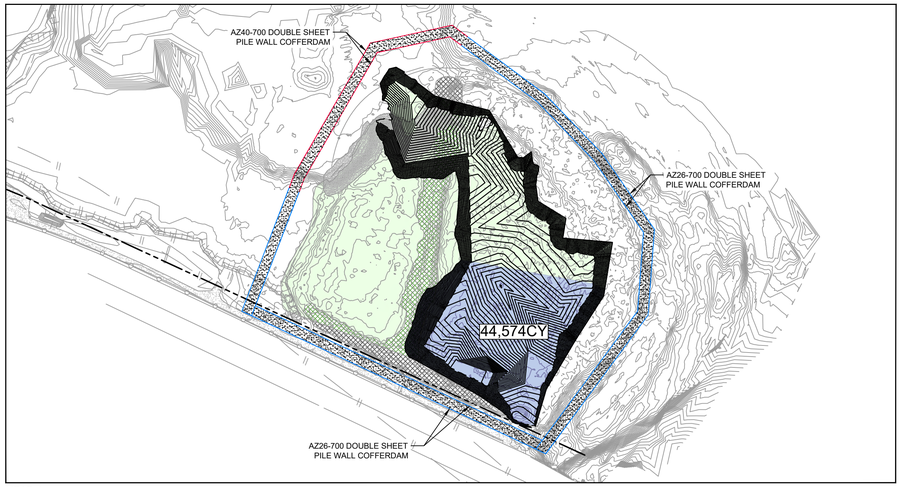
Plot Date: 8 November 2022 - 8:20 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-013.dwg



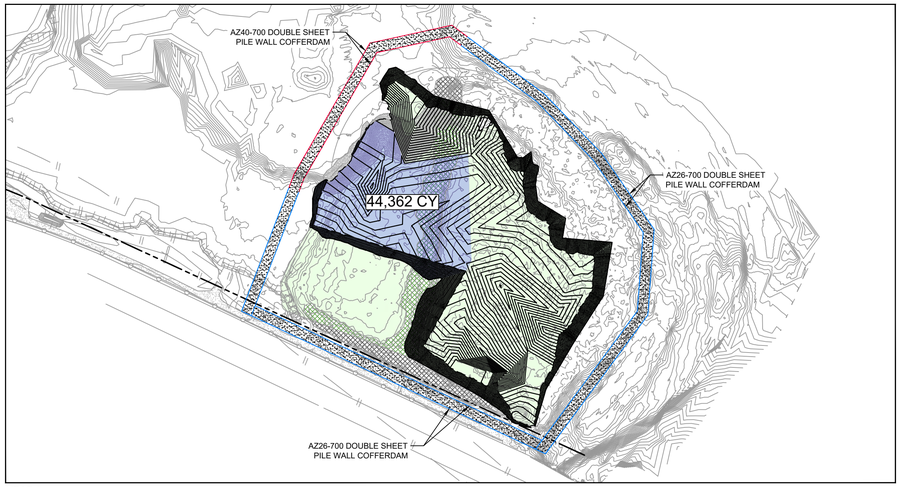
YEAR 2



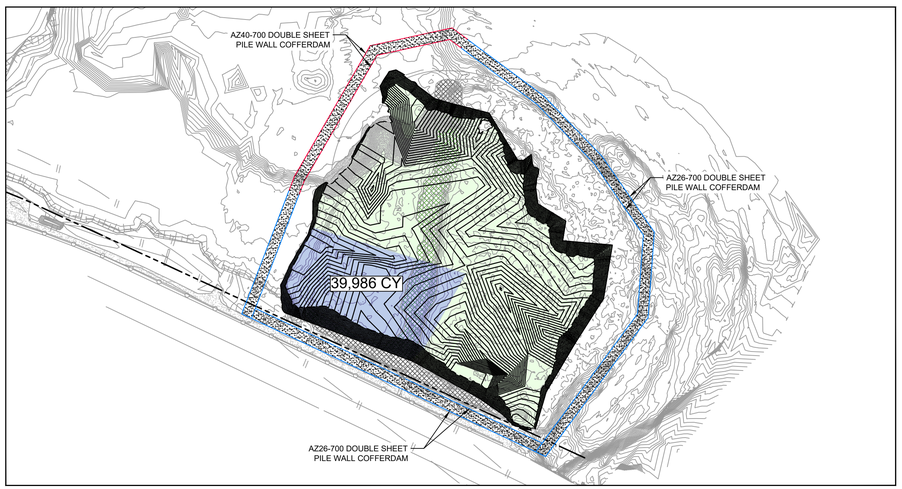
YEAR 3



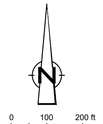
YEAR 4



YEAR 5



YEAR 6



SOURCE:

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UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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2. TYPICAL EXCAVATION SEQUENCING ASSUMES BMP INSTALLATION AND SITE PREPARATION WILL BE COMPLETED IN YEAR 1, REMEDIATION OF THE NORTHWEST CORNER IN YEAR 2, AND BMP REMOVAL AND SITE RESTORATION WILL BE COMPLETED IN YEAR 7.
3. SEASONAL EXCAVATION AREAS, VOLUMES, AND SEQUENCING ARE APPROXIMATE AND SUBJECT TO CHANGE.

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- X FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 200'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
TYPICAL SEASONAL EXCAVATION SEQUENCING

Sheet No.
C-19

Sheet - of -

AZ40-700 DOUBLE SHEET PILE WALL COFFERDAM
TO BE REMOVED

AZ26-700 DOUBLE SHEET PILE WALL COFFERDAM
TO BE REMOVED

EMBANKMENT CONSTRUCTED OF SOIL TYPE S2
INSTALL RIPRAP COVER FOR EROSION AND
SCOUR PROTECTION

AZ26-700 DOUBLE SHEET PILE WALL COFFERDAM
TO BE REMOVED

0 30 60 ft

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RESTORED AREA INCLUDING TOPSOIL PLACEMENT AND SEEDING TO RIVER LEVEL

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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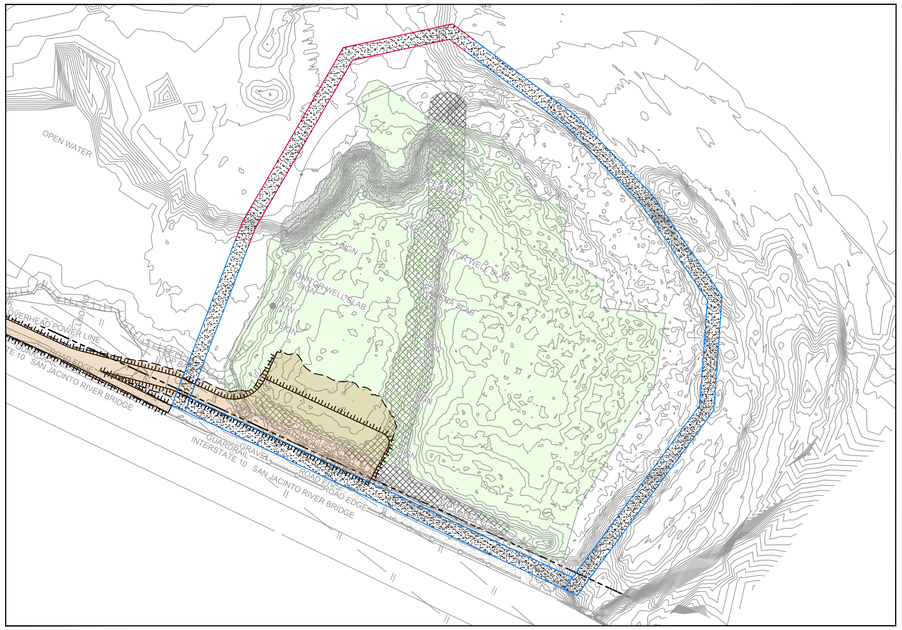
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
RESTORATION PLAN

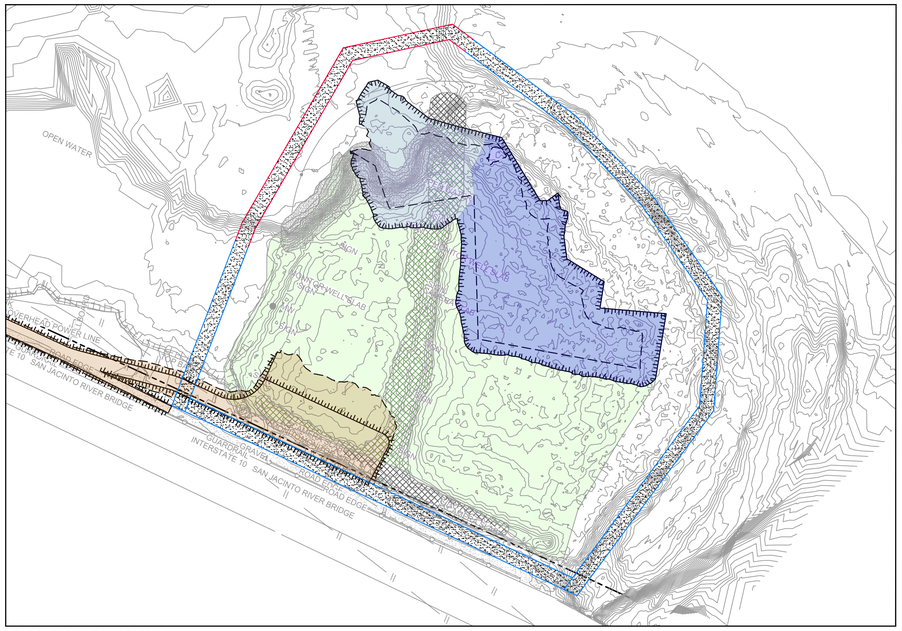
Sheet No.
C-22
Sheet - of -

Plot Date: 8 November 2022 - 8:24 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-032.dwg



YEAR 1 - BMP INSTALLATION AND SITE PREPARATION

YEAR 2 - EXCAVATION SEASON 1



YEAR 3 - EXCAVATION SEASON 2

YEAR 4 - EXCAVATION SEASON 3

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

1. ASSUMED TxDOT RIGHT OF WAY IS BASED ON INFORMATION PROVIDED BY THE HARRIS COUNTY TAX ASSESSOR'S OFFICE.
2. SEASONAL EXCAVATION AREAS, VOLUMES, AND SEQUENCING ARE APPROXIMATE AND SUBJECT TO CHANGE.

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

0 75 150 ft

GHD
5551 Corporate Boulevard Suite 200
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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- X FENCELINE
- SHORELINE
- TOP OF BANK
- OH TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale 1" = 150'
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

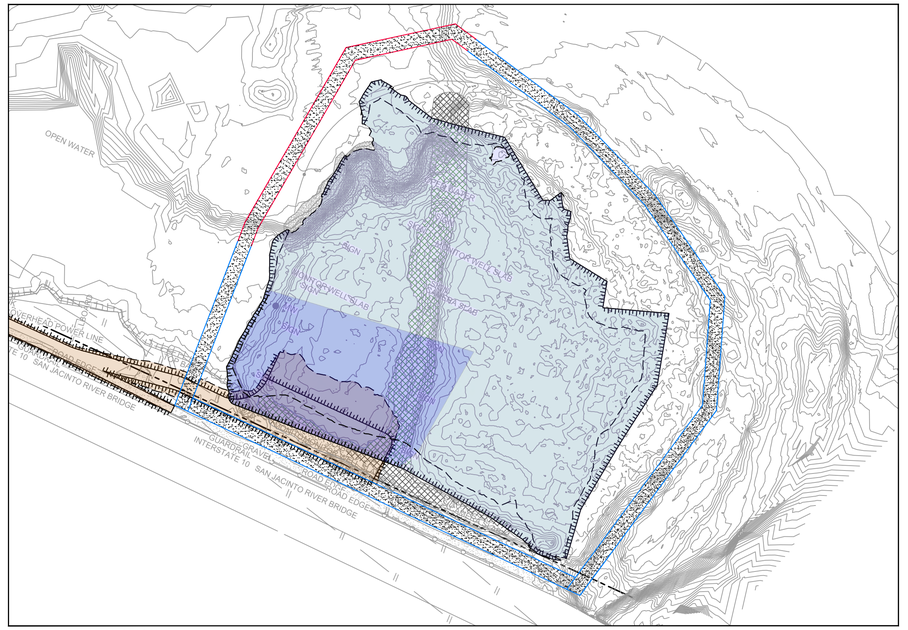
Title
TYPICAL CONSTRUCTION SEQUENCING 1 OF 2

Sheet No.
C-23

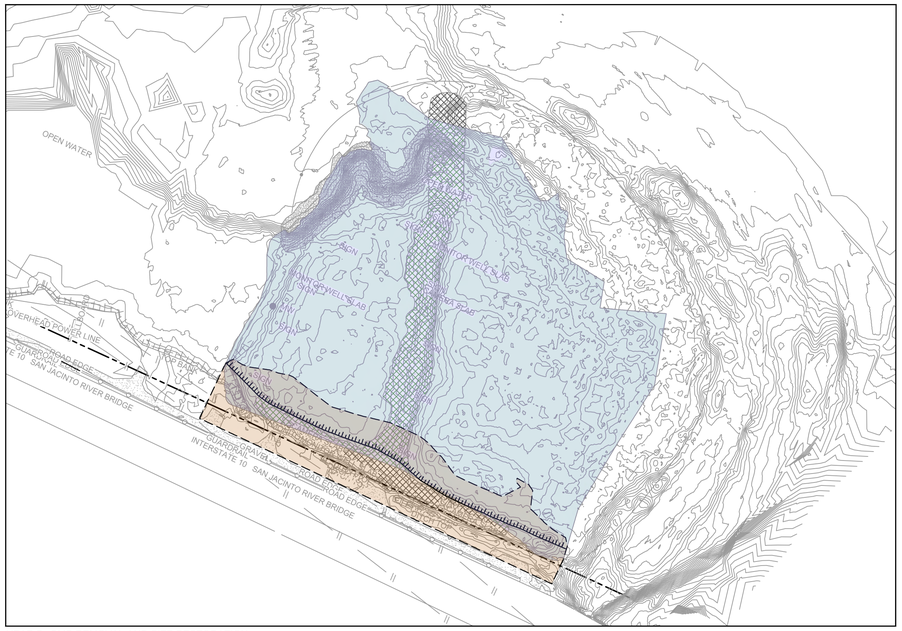
Sheet - of -

Plot Date: 8 November 2022 - 8:27 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-033.dwg

YEAR 5 - EXCAVATION SEASON 4



YEAR 6 - EXCAVATION SEASON 5



YEAR 7 - BMP REMOVAL AND SITE RESTORATION

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

0 75 150 ft

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PHASE OF EXCAVATION

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
TYPICAL CONSTRUCTION SEQUENCING 2 OF 2

Sheet No.
C-24

Sheet - of -

Plot Date: 8 November 2022 - 8:27 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-033.dwg

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- ASPHALT
- AZ26-700 PILE
- AZ40-700 PILE

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER COMPONENT EPA REVIEW	MW	CM	11/8/2022

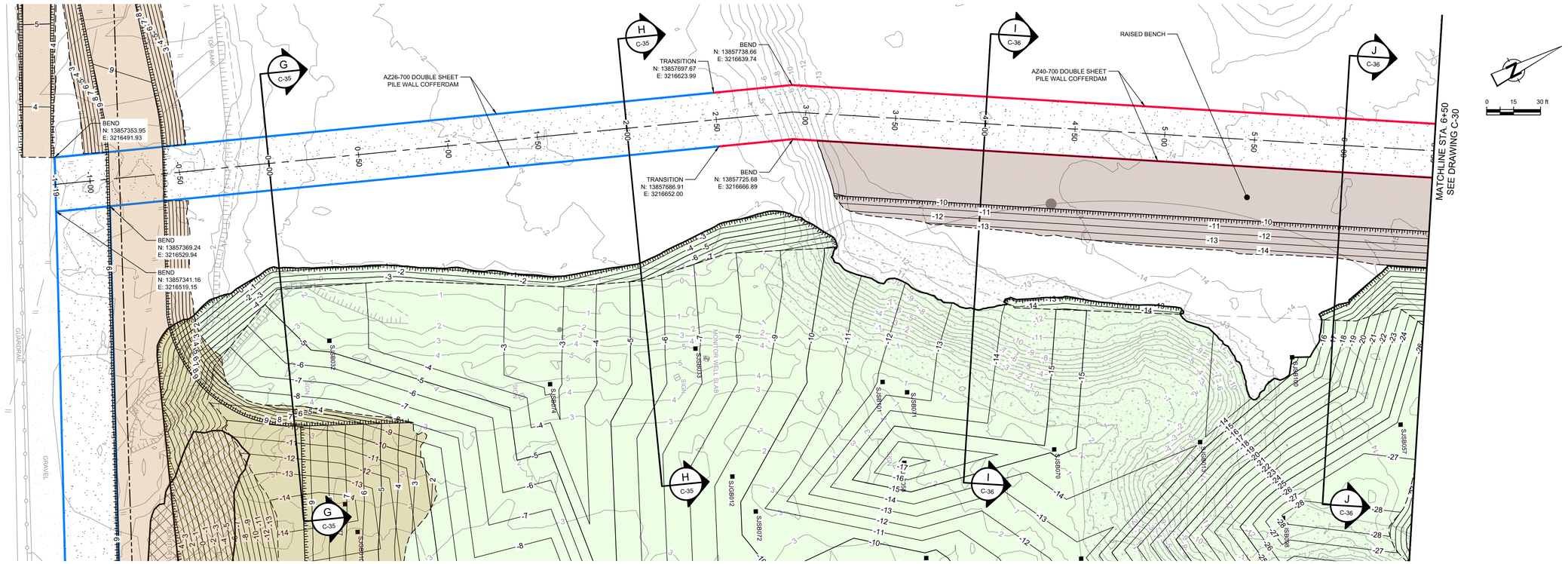
Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 100'
Original Size	Arch D	Bar is one inch on original size drawing 0 1"	

Project No. 11215702

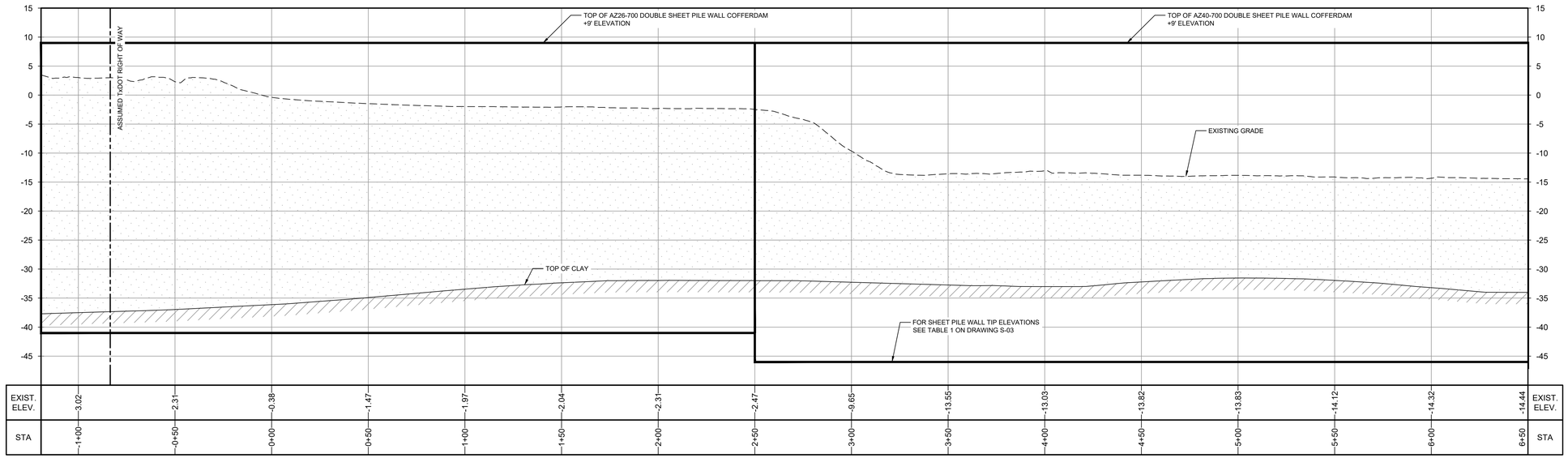
Title
PILE WALL LAYOUT PLAN

Sheet No.
C-28

Sheet - of -



PLAN
1" = 30'



PROFILE
HORIZ: 1" = 30'
VERT: 1" = 10'

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- 10 EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- PLANNED IMPROVEMENTS FOR NORTHERN IMPOUNDMENT ACCESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

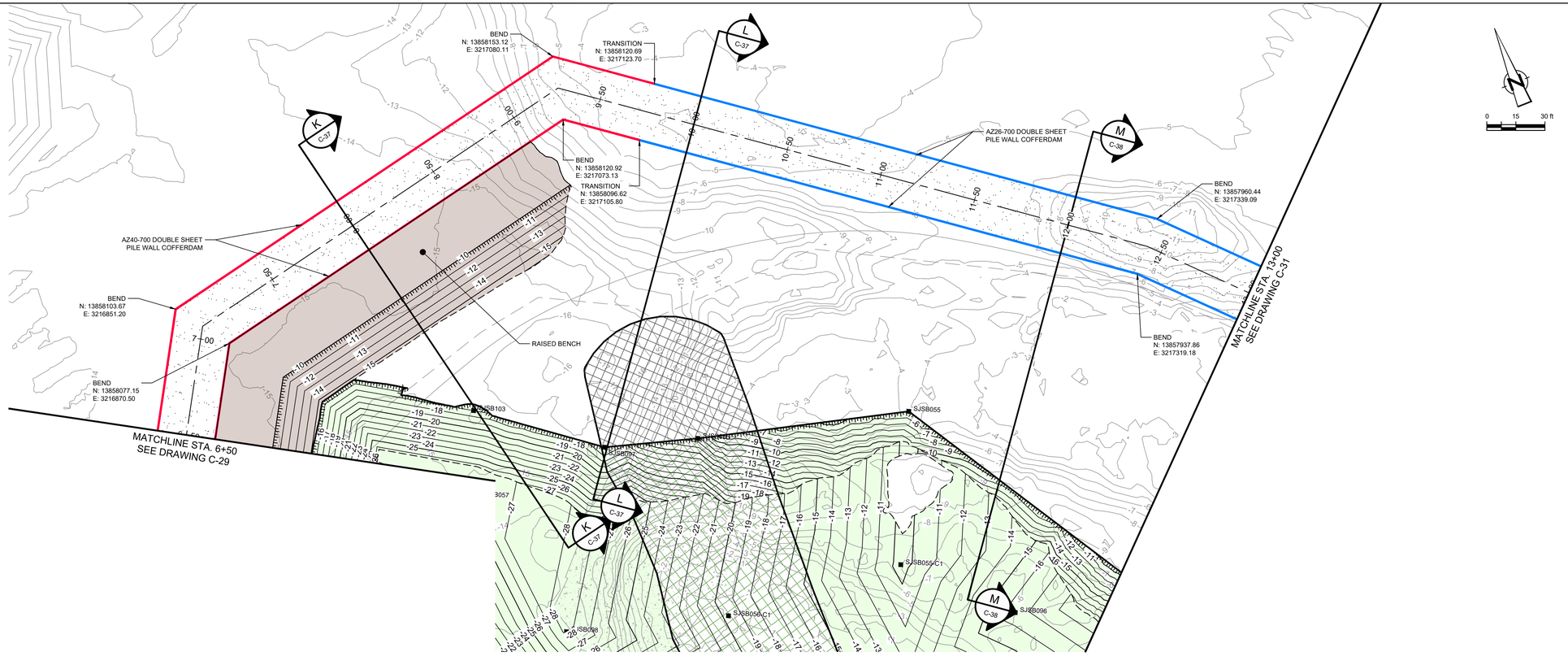
Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale AS SHOWN
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

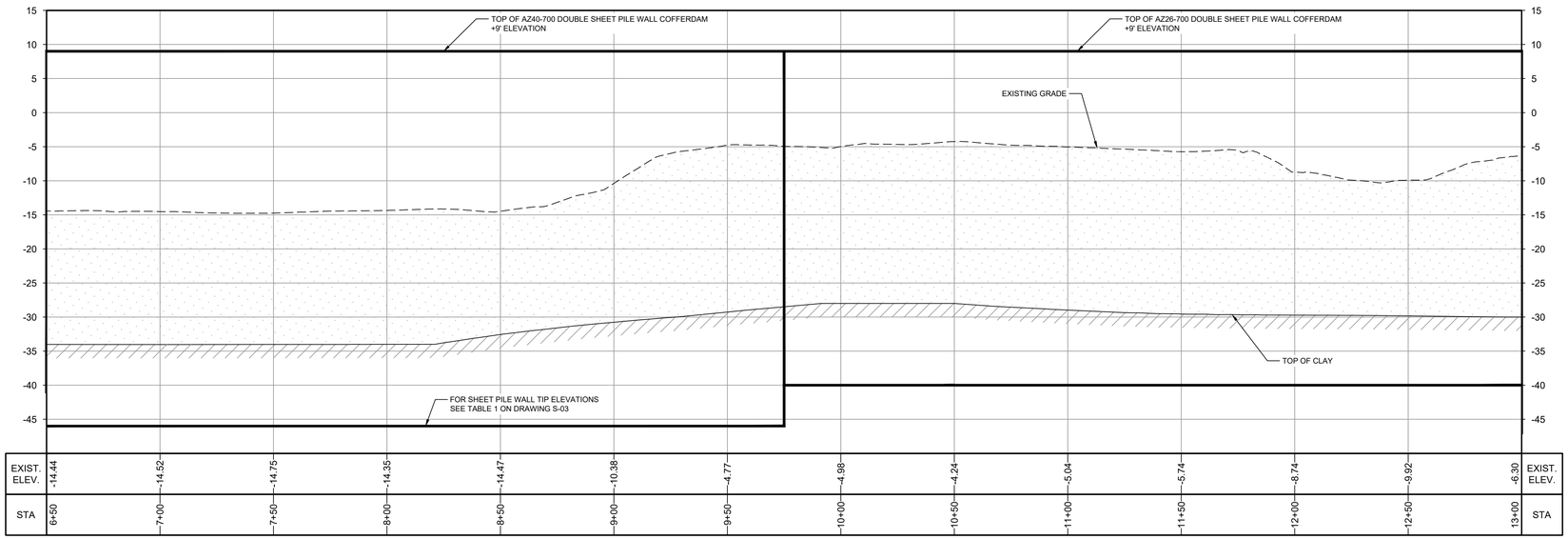
Title
DOUBLE PILE WALL
PLAN AND PROFILE
1 OF 4

Sheet No.
C-29

Sheet - of -



PLAN
1" = 30'



PROFILE
HORIZ: 1" = 30'
VERT: 1" = 10'

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190808, JULY 8, 2019 TO AUGUST 2, 2019.
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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

0 15 30 ft

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
5	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
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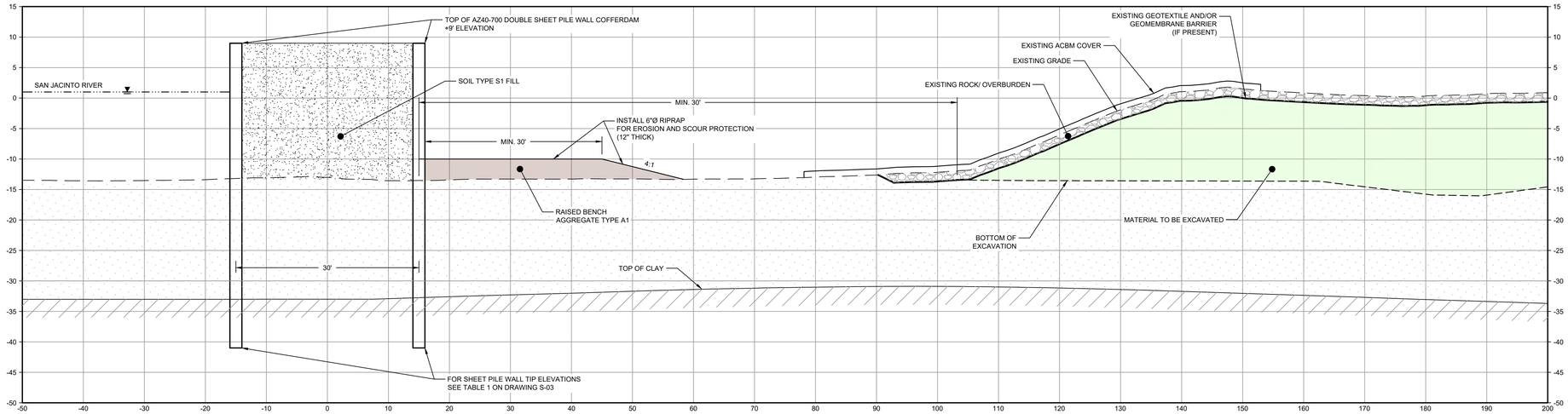
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

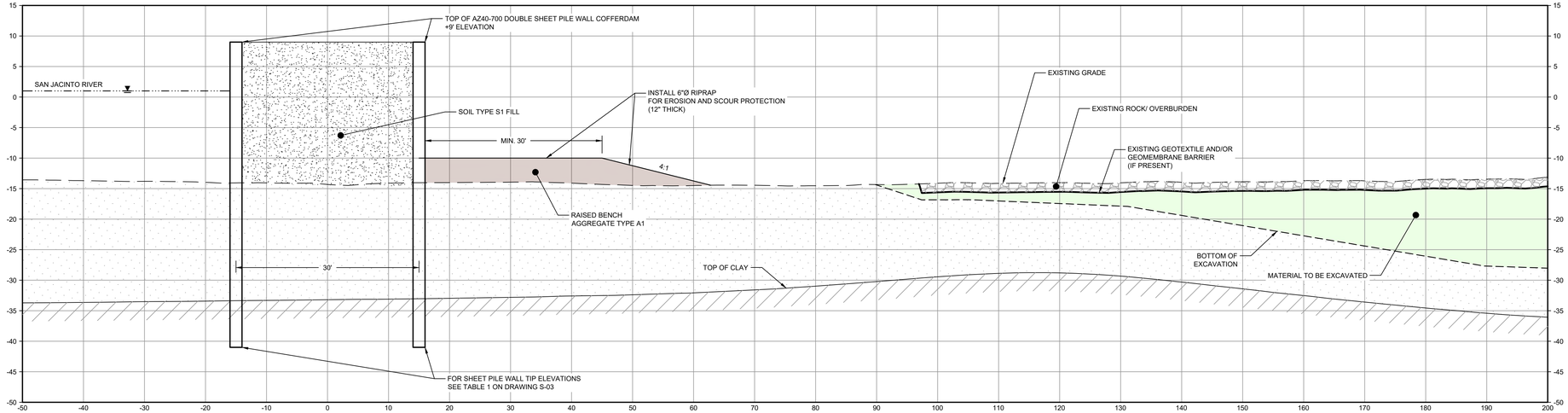
Title
DOUBLE PILE WALL PLAN AND PROFILE 2 OF 4

Sheet No.
C-30
Sheet - of -

Plot Date: 8 November 2022 - 8:53 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-026.dwg



SECTION I STA. 4+00.00
SCALE: 1"=10'
C-29



SECTION J STA. 6+00.00
SCALE: 1"=10'
C-29

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- BMP SOIL BUTTRESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check JC	Design Check LL
Project Coordinator CM	Date Nov 8, 2022
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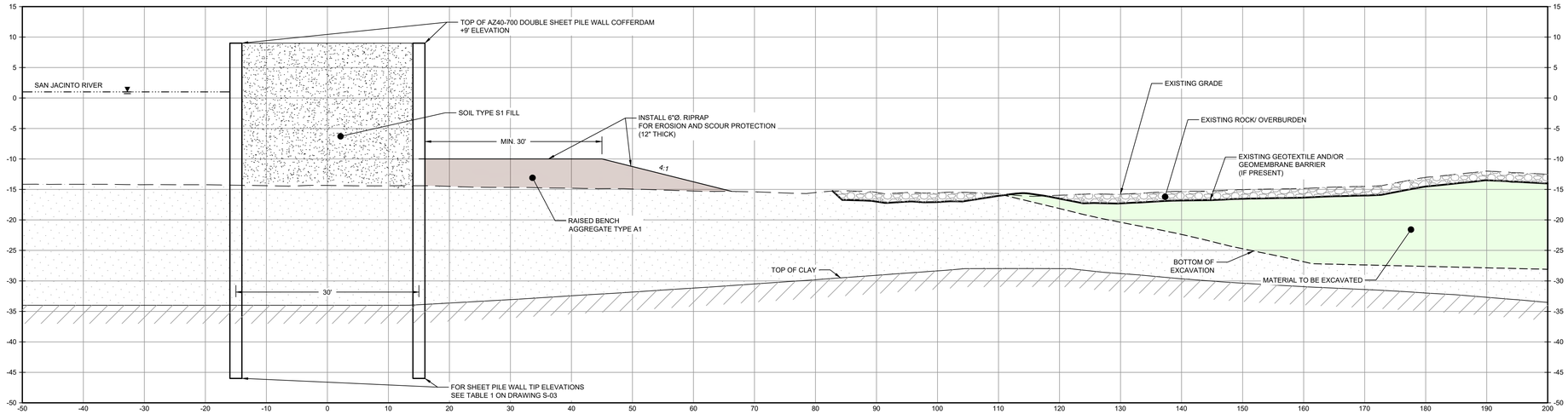
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
DOUBLE PILE WALL SECTIONS 2 OF 7

Sheet No.
C-36

Sheet - of -



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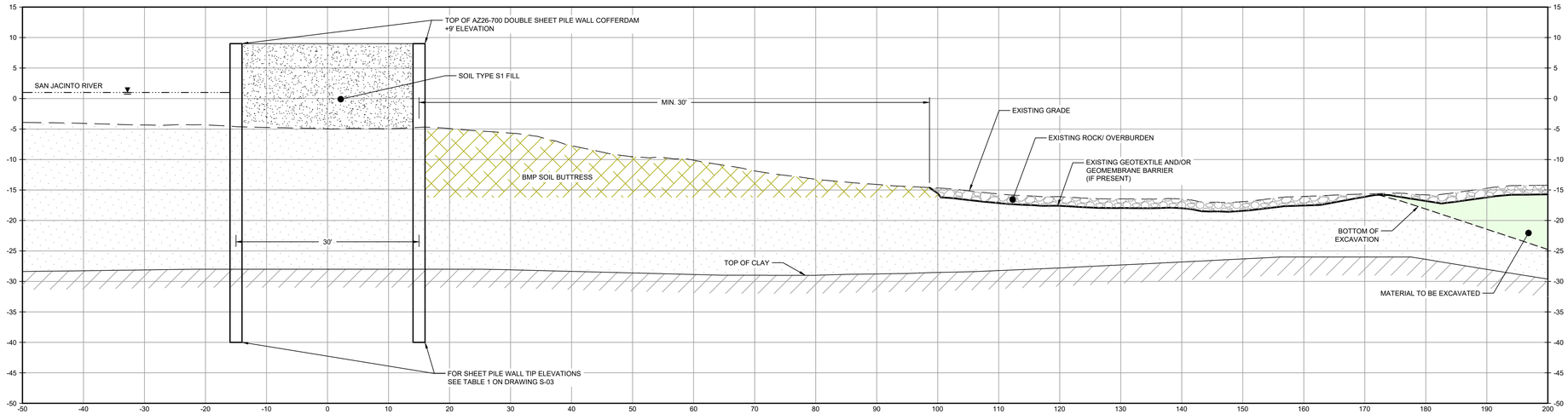
SCALE: 1"=10'
C-30



SECTION L STA.10+00.00
SCALE: 1"=10'
C-30

NOTES:

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GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
CHARLES W. MUNCE
105542
LICENSED
PROFESSIONAL ENGINEER
11/7/22

LEGEND
- MATERIAL TO BE EXCAVATED
- BMP SOIL BUTTRESS
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
3	90% NORTHWEST CORNER	MW	CM	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	JC	Design Check	LL
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

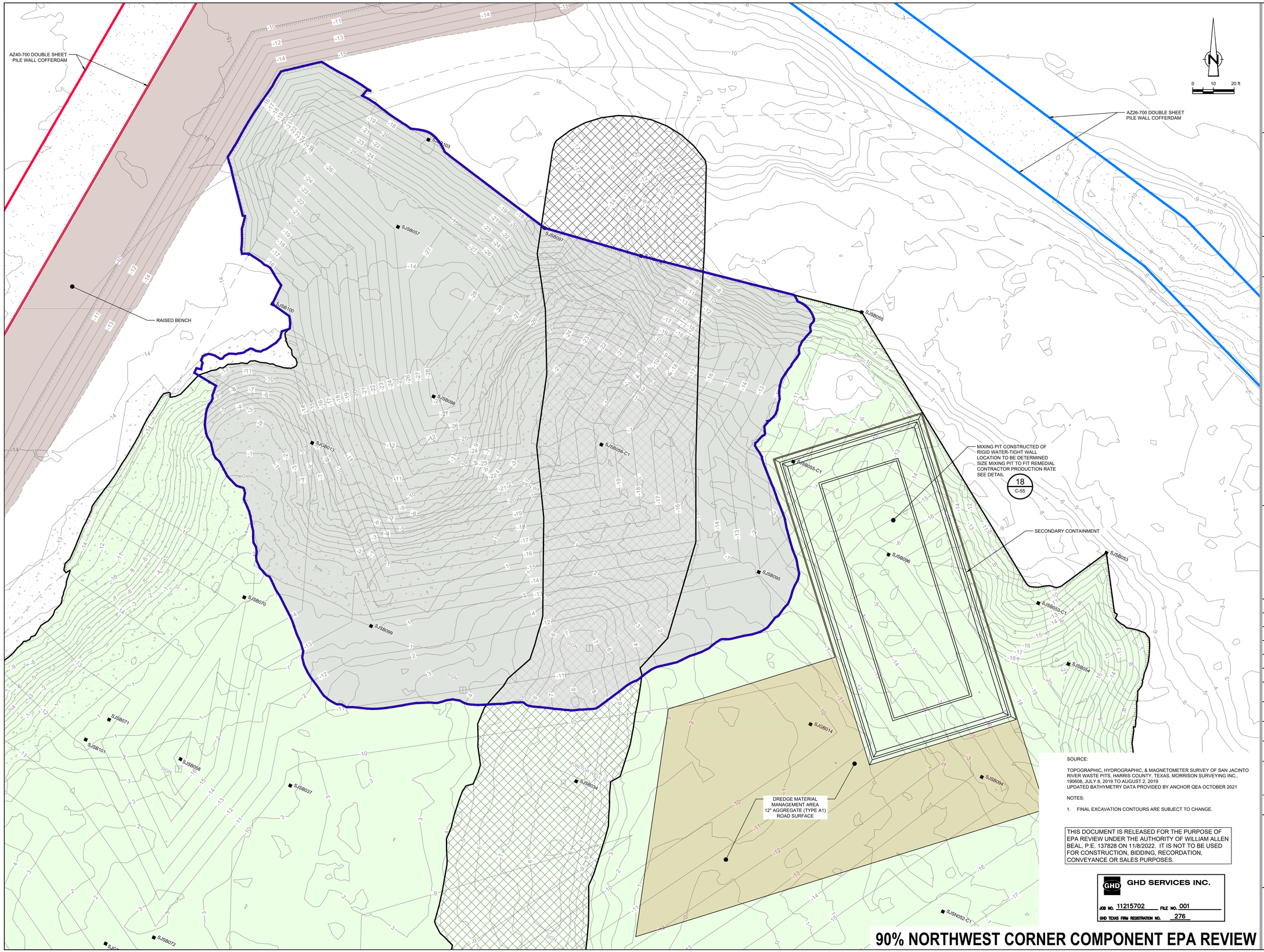
Project No. 11215702

Title
DOUBLE PILE WALL SECTIONS 3 OF 7

Sheet No.
C-37

Sheet - of -

Plot Date: 8 November 2022 - 8:21 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-024.dwg



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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THIS DOCUMENT IS RELEASED FOR THE PURPOSE OF EPA REVIEW UNDER THE AUTHORITY OF WILLIAM ALLEN BEAL, P.E. 137828 ON 11/8/2022. IT IS NOT TO BE USED FOR CONSTRUCTION, BIDDING, RECORDATION, CONVEYANCE OR SALES PURPOSES.

GHD SERVICES INC.
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90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10- EXISTING CONTOUR INTERVAL
- -X- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- ■ SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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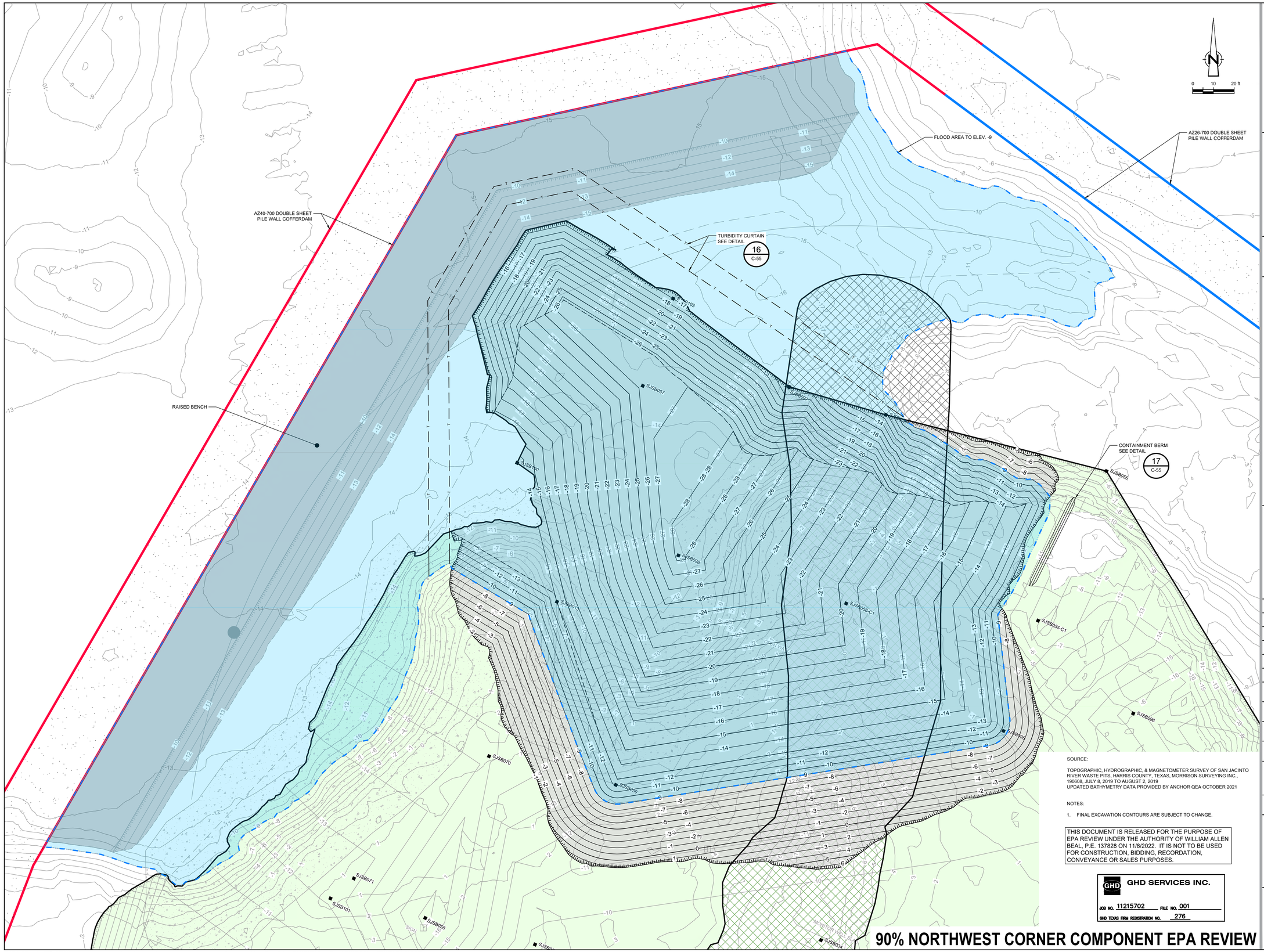
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. **11215702**

Title
DREDGING ALTERNATIVE NORTHWEST CORNER WORKS PLAN

Sheet No.
C-45

Sheet - of -



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Baton Rouge Louisiana USA
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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND
- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10 EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- OH OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
- L.P. LIGHT POLE
- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- FLOOD AREA TO ELEV. -9
- TURBIDITY CURTAIN

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	1" = 20'
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. **11215702**

Title
DREDGING ALTERNATIVE NORTHWEST CORNER DREDGING CONTROLS

Sheet No.
C-46
Sheet - of -

SOURCE:
TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:
1. FINAL EXCAVATION CONTOURS ARE SUBJECT TO CHANGE.

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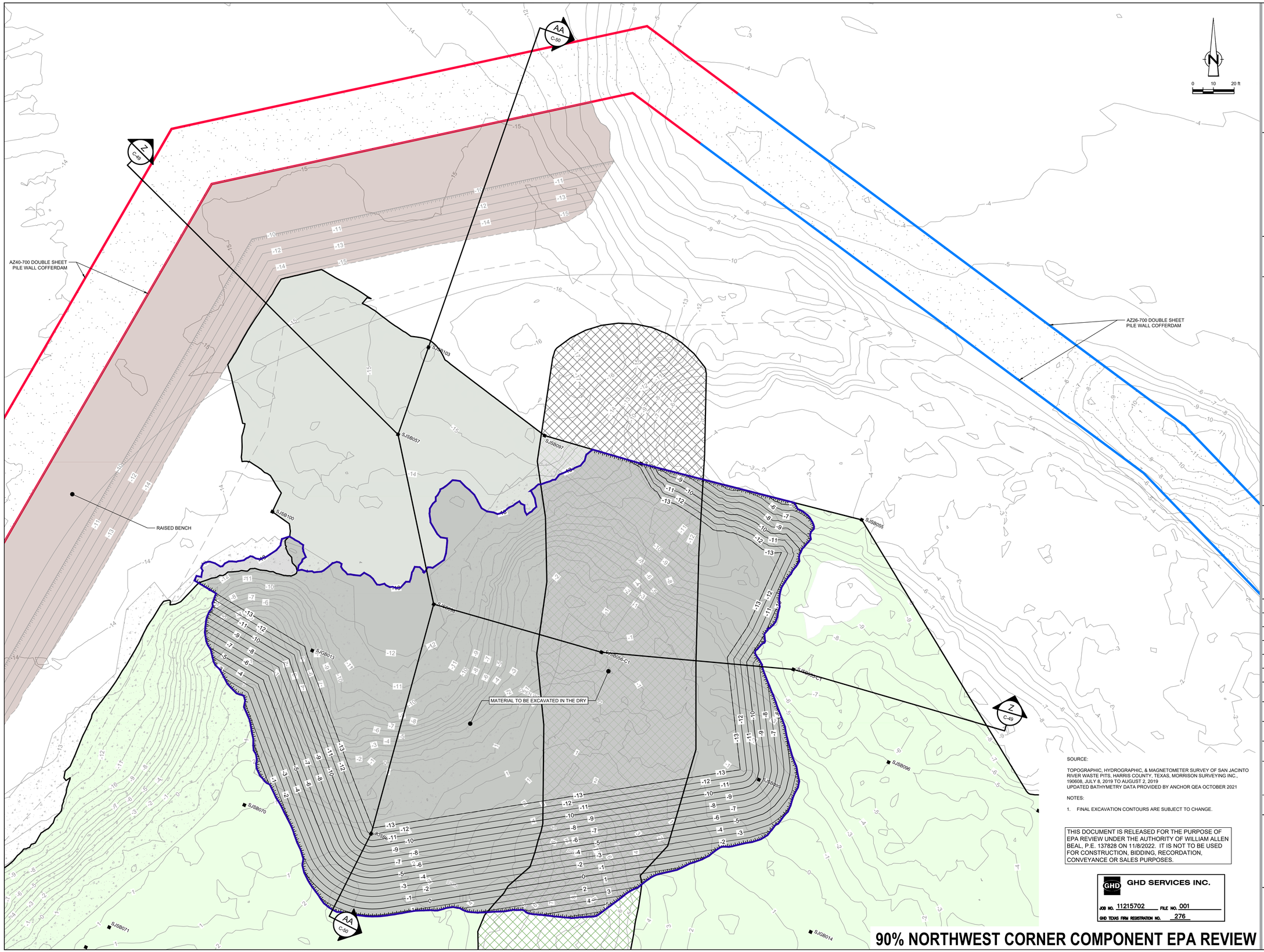
GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

Plot Date: 8 November 2022 - 7:56 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-035.dwg



90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
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STATE OF TEXAS
WILLIAM A. BEAL
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LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10- EXISTING CONTOUR INTERVAL
- -X- FENCELINE
- SHORELINE
- TOP OF BANK
- TOE OF SLOPE
- -OH- OVERHEAD ELECTRICAL
- GUARDRAIL
- PIPELINE
- ■ SJSB002 BORING LOCATION
- MW MONITORING WELL
- P.P. POWER POLE
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- WELL
- MATERIAL TO BE EXCAVATED
- EXISTING BERM TO EXCAVATED
- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- MATERIAL TO BE EXCAVATED - DRY

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
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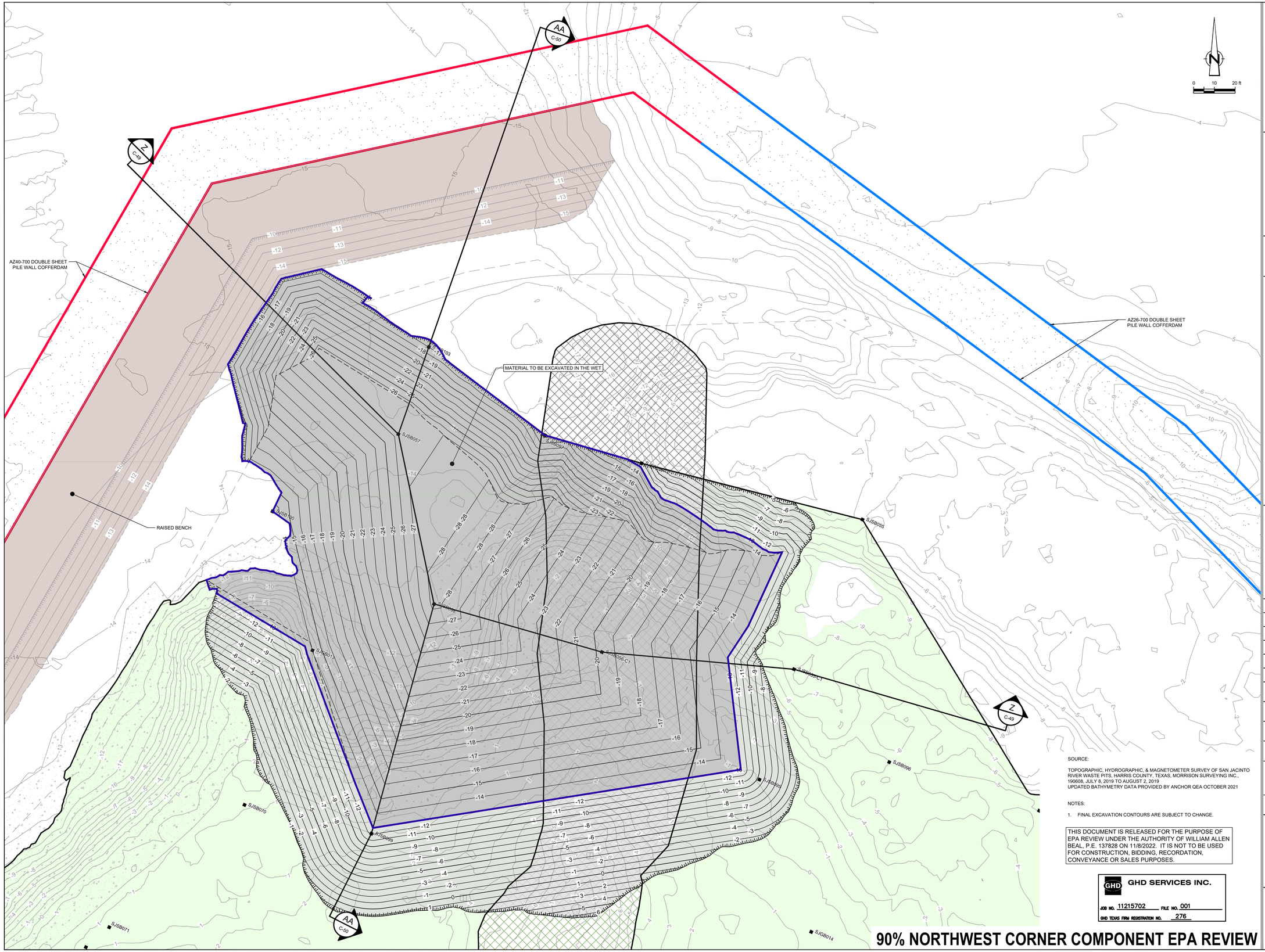
Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER DRY EXCAVATION

Sheet No.
C-47

Sheet - of -

Plot Date: 8 November 2022 - 7:59 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-036.dwg



SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

GHD
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STATE OF TEXAS
WILLIAM A. BEAL
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LICENSED
PROFESSIONAL ENGINEER

11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- EXISTING CONTOUR INTERVAL
- FENCELINE
- SHORELINE
- TOP OF BANK
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- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- MATERIAL TO BE EXCAVATED - WET

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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Original Size	Arch D	Bar is one inch on original size drawing	0 1"

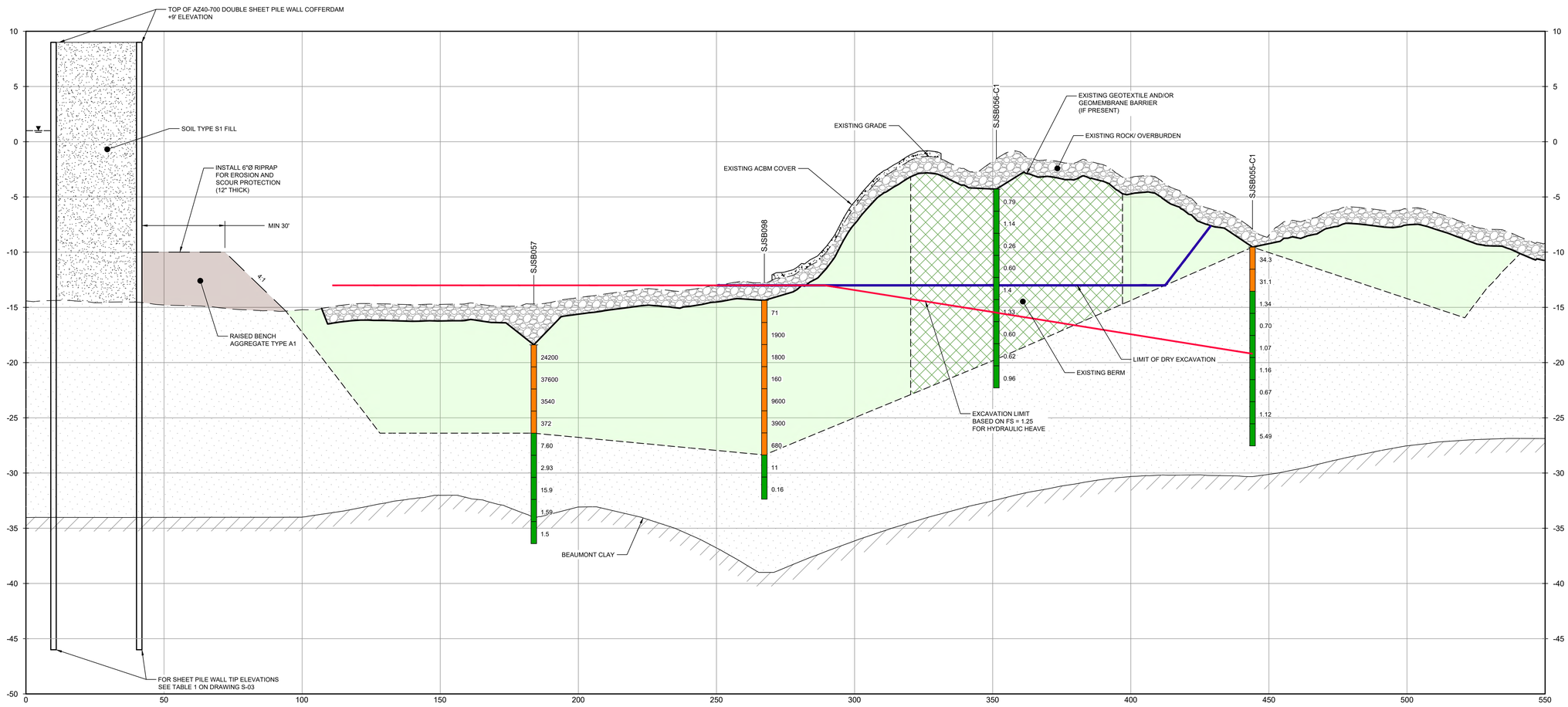
Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER WET EXCAVATION

Sheet No.
C-48

Sheet - of -

Plot Date: 8 November 2022 - 8:01 AM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-037.dwg



SECTION Z WEST/EAST
C-47,C-48
HORIZ: 1"=20'
VERT: 1"=5'

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND
MATERIAL TO BE EXCAVATED

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT
PRE-FINAL 90% REMEDIAL DESIGN
HARRIS COUNTY, TEXAS

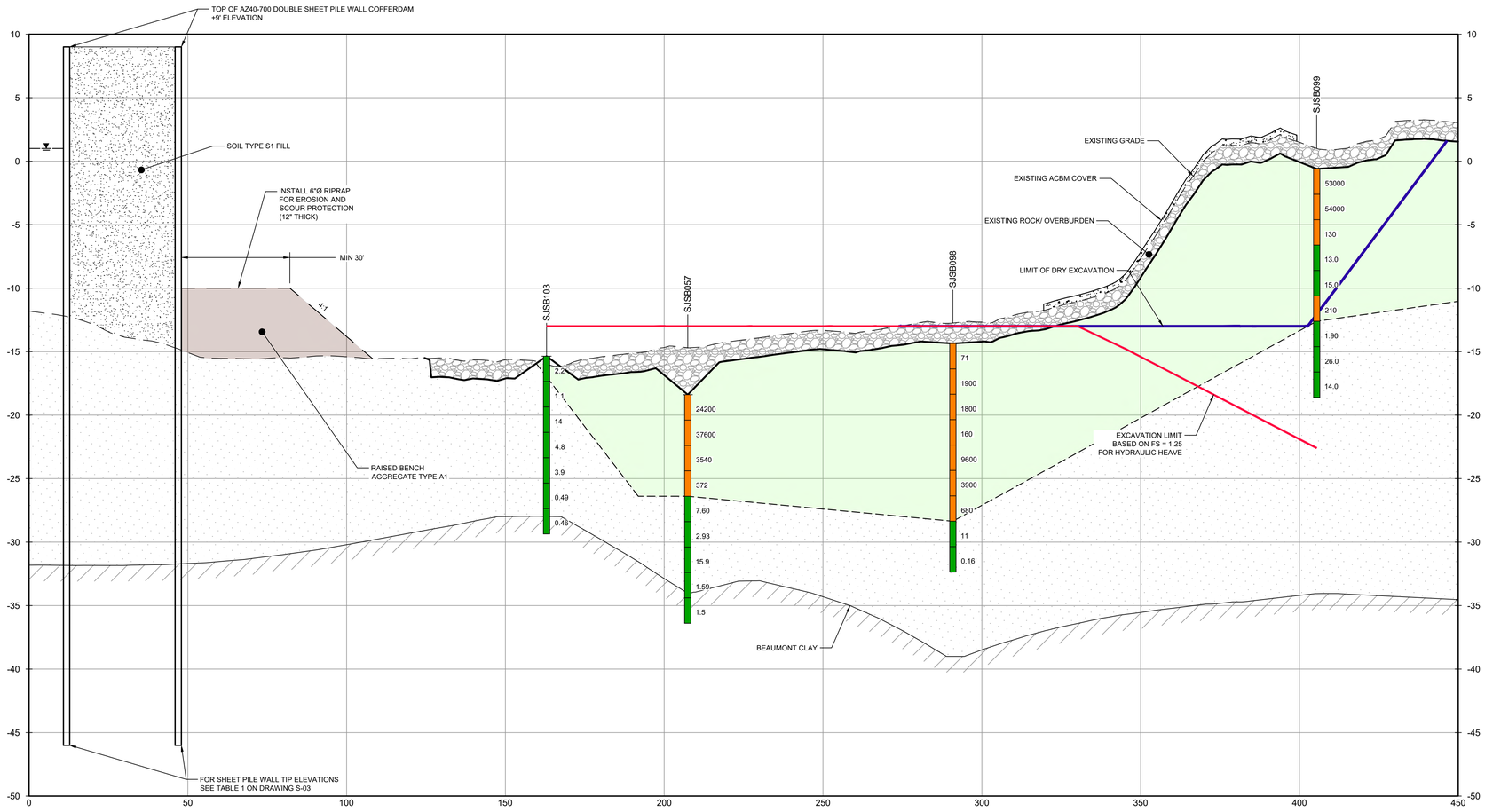
No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale AS SHOWN
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
DREDGING ALTERNATIVE
NORTHWEST CORNER
SECTIONS 1 OF 2

Sheet No.
C-49
Sheet - of -



SECTION AA NORTH/ SOUTH
HORIZ: 1"=20'
VERT: 1"=5'
C-47,C-48

NOTES:

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
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PROFESSIONAL ENGINEER
11/8/2022

LEGEND
MATERIAL TO BE EXCAVATED

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
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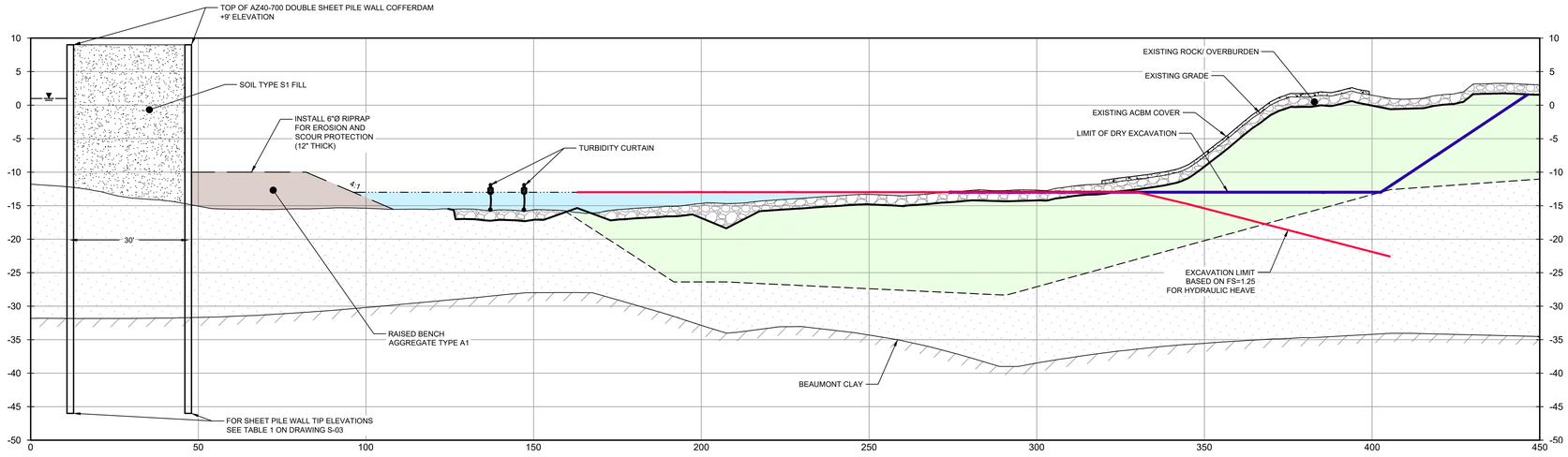
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER SECTIONS 2 OF 2

Sheet No.
C-50
Sheet - of -

Plot Date: 8 November 2022 - 2:30 PM Plotted By: Matt Wolfer Filename: N:\US\Baton Rouge\Projects\562\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-038.dwg

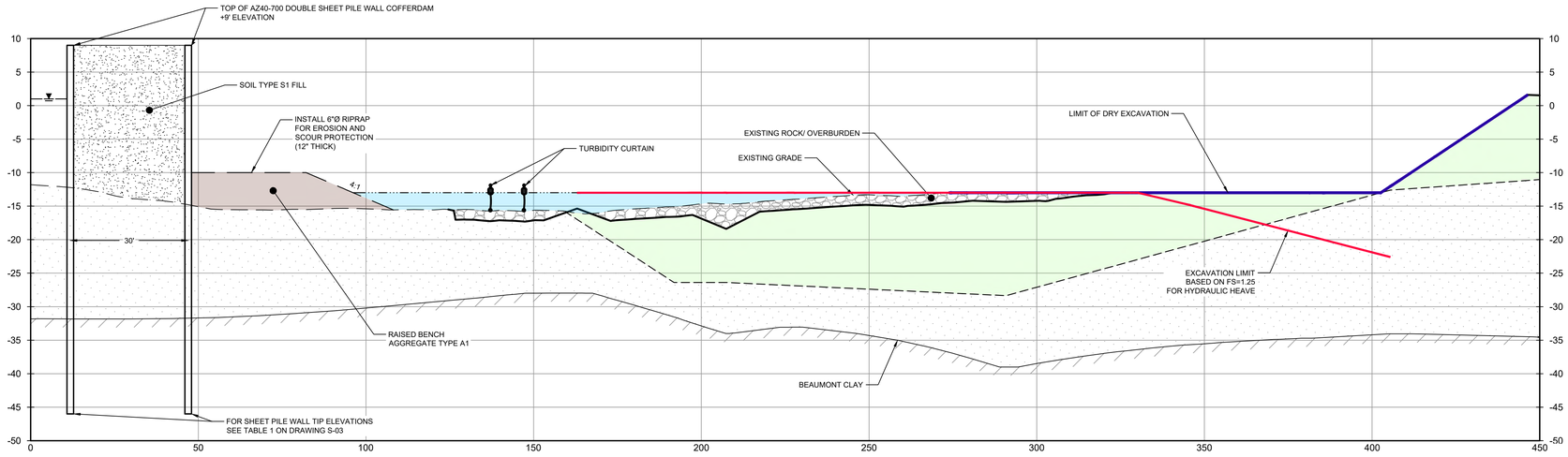


NOTES:

1. DEWATER NORTHWEST CORNER TO EXCAVATION LIMIT BASED ON FS = 1.25 FOR HYDRAULIC HEAVE.

PHASE 1

HORIZ: 1" = 20'
VERT: 1" = 10'



NOTES:

1. REMOVE ROCK LAYER TO BE STOCKPILED ON SITE. REUSED AS TEMPORARY COVER AT END OF SEASONAL EXCAVATION.
2. REMOVE GEOMEMBRANE/ GEOTEXTILE / ACBM (IF PRESENT) EXCAVATE MATERIAL ABOVE LIMIT OF DRY EXCAVATION AND DISPOSE OF OFFSITE.

PHASE 2

HORIZ: 1" = 20'
VERT: 1" = 10'

NOTES:

1. BOTTOM OF EXCAVATION IS SUBJECT TO CHANGE.

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

MATERIAL TO BE EXCAVATED

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

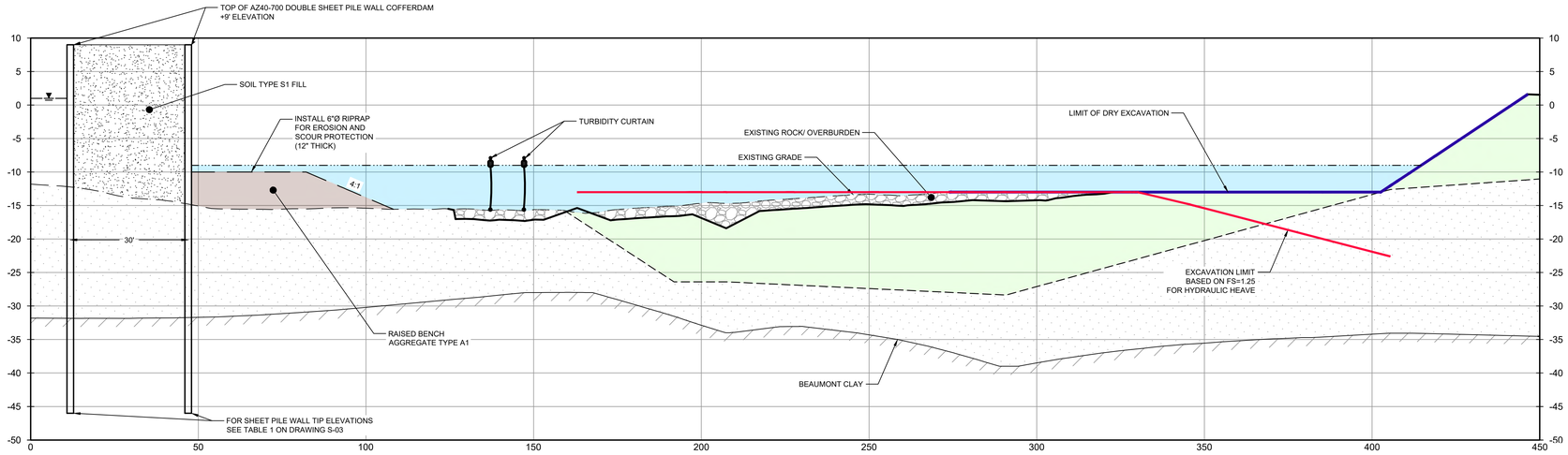
Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.	Scale AS SHOWN
Original Size Arch D	Bar is one inch on original size drawing 0 1"

Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 1 OF 3

Sheet No.
C-51

Sheet - of -

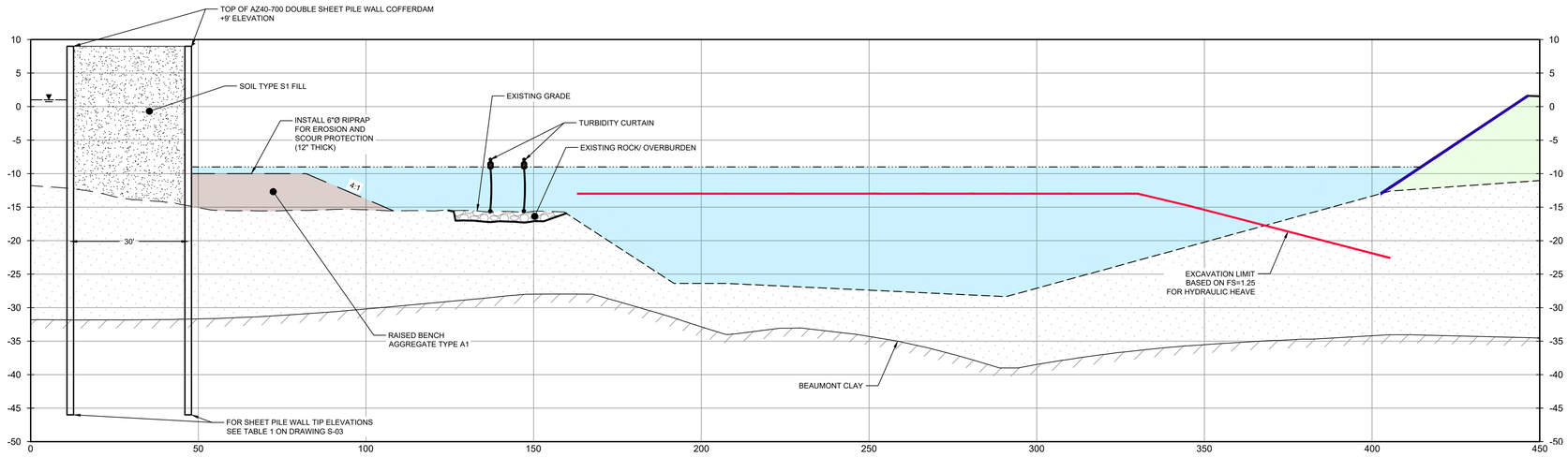


NOTES:

1. WATER ADDED TO MITIGATE HYDRAULIC HEAVE AND ALLOW DRAFT OF DREDGE VESSEL.

PHASE 3

HORIZ: 1" = 20'
VERT: 1" = 10'



NOTES:

1. REMOVE ROCK LAYER TO BE STOCKPILED ON SITE. REUSED AS TEMPORARY COVER AT END OF SEASONAL EXCAVATION.
2. REMOVE GEOTEXTILE (IF PRESENT), EXCAVATE MATERIAL THROUGH A COLUMN OF WATER, AND DISPOSE OF OFFSITE.
3. WATER LEVEL TO BE MAINTAINED ABOVE EXCAVATION LIMIT BASED ON FS=1.25 FOR HYDRAULIC HEAVE.

PHASE 4

HORIZ: 1" = 20'
VERT: 1" = 10'

NOTES:

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GHD SERVICES INC.

JOB NO. 11215702 FILE NO. 001

GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
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137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

LEGEND

MATERIAL TO BE EXCAVATED

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
Project Coordinator CM	Date Nov 8, 2022
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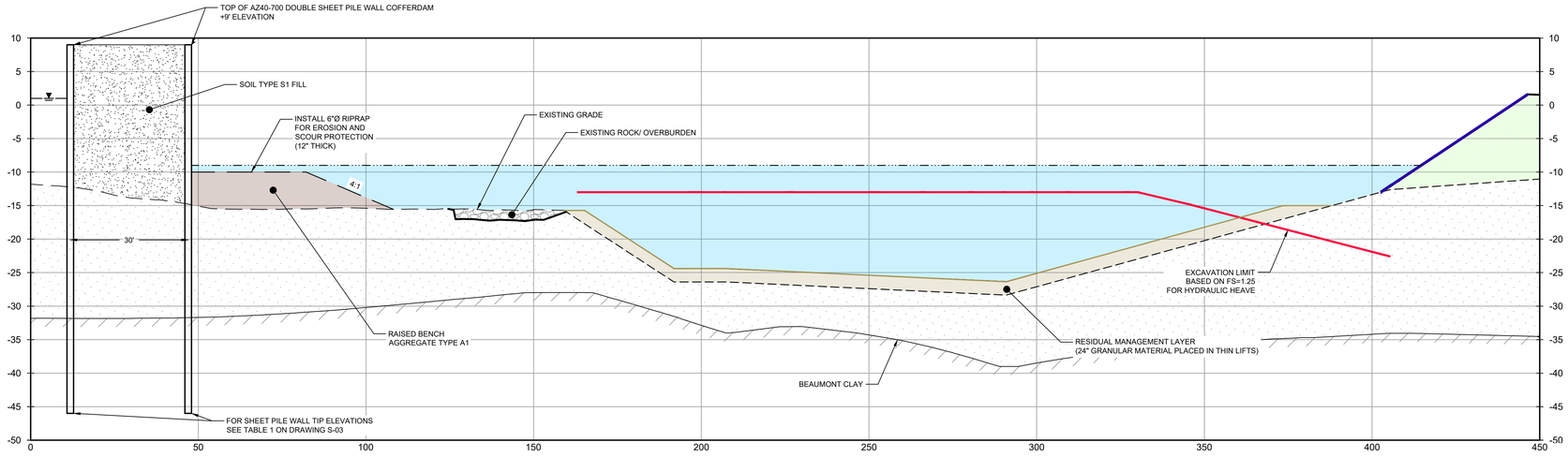
Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 2 OF 3

Sheet No.
C-52

Sheet - of -

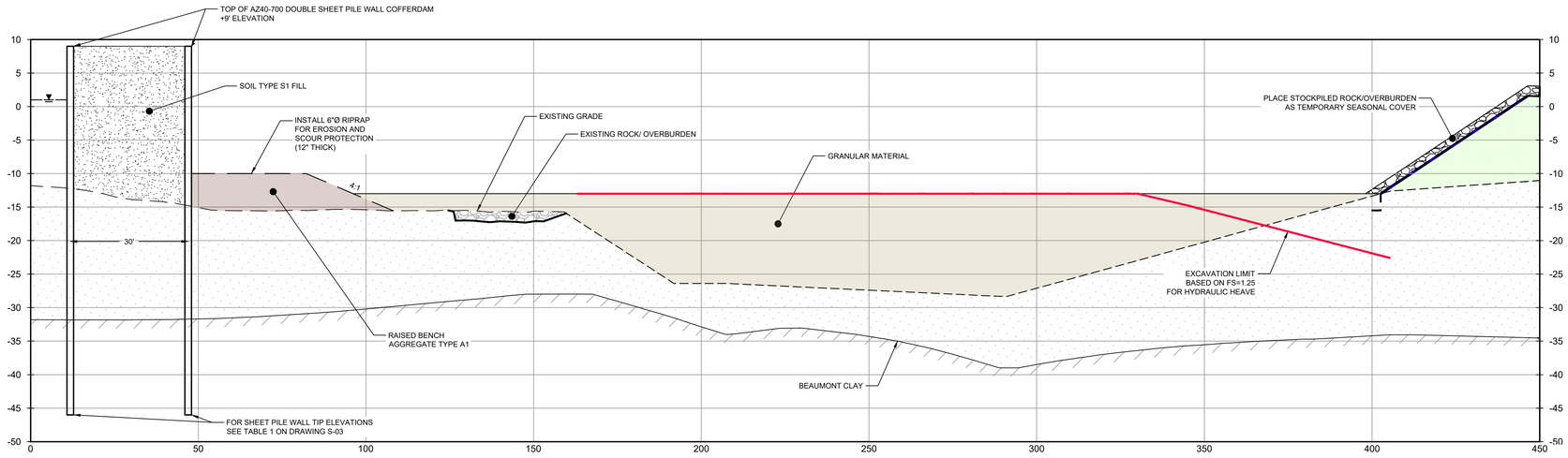


NOTES:

1. PLACE GRANULAR MATERIAL AS RESIDUAL MANAGEMENT LAYER UPON COMPLETION OF DREDGING.

PHASE 5

HORIZ: 1" = 20'
VERT: 1" = 10'



NOTES:

1. OPTIONAL REUSE OF ONSITE RIP RAP AND AGGREGATE.
2. FILL PLACEMENT TO OVERCOME HYDRAULIC HEAVE.
3. WATER TO BE PUMPED OFF AND TREATED. WATER LEVEL TO BE MAINTAINED ABOVE HYDRAULIC HEAVE LIMIT BASED ON FS=1.25.

PHASE 6

HORIZ: 1" = 20'
VERT: 1" = 10'

NOTES:

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11/8/2022

LEGEND

MATERIAL TO BE EXCAVATED

GRANULAR MATERIAL

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
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	COMPONENT EPA REVIEW			

Drawn MW	Designer RH
Drafting Check NQ	Design Check WB
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Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER SEQUENCING 3 OF 3

Sheet No.
C-53

Sheet - of -

RAISED BENCH

AZ40-700 DOUBLE SHEET PILE WALL COFFERDAM

GRANULAR MATERIAL TO ELEV. -13

AZ26-700 DOUBLE SHEET PILE WALL COFFERDAM

SJSB103
SJSB057
SJSB097
SJSB095
SJSB100
SJSB098
SJSB073
SJSB058-C1
SJSB055-C1
SJSB055
SJSB096
SJSB093
SJSB099
SJSB070
SJSB071
SJSB014

0 10 20 ft

SOURCE:

TOPOGRAPHIC, HYDROGRAPHIC, & MAGNETOMETER SURVEY OF SAN JACINTO RIVER WASTE PITS, HARRIS COUNTY, TEXAS, MORRISON SURVEYING INC., 190608, JULY 8, 2019 TO AUGUST 2, 2019
UPDATED BATHYMETRY DATA PROVIDED BY ANCHOR QEA OCTOBER 2021

NOTES:

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2. FILL PLACEMENT TO OVERCOME HYDRAULIC HEAVE

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11/8/2022

LEGEND

- ASSUMED TxDOT RIGHT OF WAY
- TCRA CAP PERIMETER
- -10 EXISTING CONTOUR INTERVAL
- FENCELINE
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- TOP OF BANK
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- EXISTING BERM
- NORTHWEST CORNER
- CONCRETE
- GRAVEL
- AZ26-700 PILE
- AZ40-700 PILE
- RAISED BENCH
- GRANULAR MATERIAL

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
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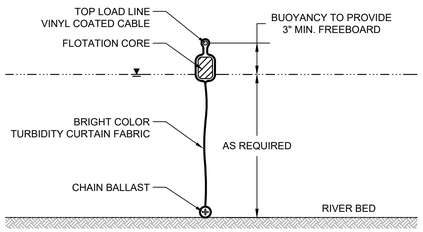
Project No. 11215702

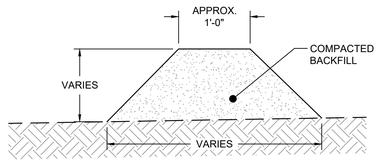
Title
DREDGING ALTERNATIVE NORTHWEST CORNER FINAL GRADE

Sheet No.
C-54
Sheet - of -

Plot Date: 8 November 2022 - 8:32 AM Plotted By: Matt Wolfer Filename: N:\IUS\Baton Rouge\Projects\662\11215702\Digital_Design\ACAD 2019\Sheets\11215702-02-DWG-C-040.dwg

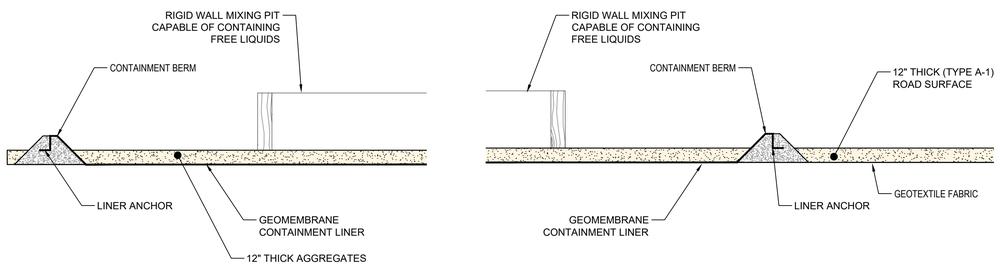


DETAIL 16 DREDGING TURBIDITY CURTAIN
N.T.S. C-46



NOTES:
1. TOP WIDTH MAY BE WIDER AND SIDE SLOPES MAY BE FLATTER IF REQUIRED TO FACILITATE CROSSING CONSTRUCTION TRAFFIC.

DETAIL 17 DREDGING CONTAINMENT BERM
N.T.S. C-46



NOTES:
1. DIMENSION TO BE DETERMINED BY CONTRACTOR

DETAIL 18 MIXING PIT
N.T.S. C-45

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GHD SERVICES INC.
JOB NO. 11215702 FILE NO. 001
GHD TEXAS FIRM REGISTRATION NO. 276

90% NORTHWEST CORNER COMPONENT EPA REVIEW

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STATE OF TEXAS
WILLIAM A. BEAL
137828
LICENSED
PROFESSIONAL ENGINEER
11/8/2022

Client
SAN JACINTO RIVER WASTE PITS

Project
NORTHERN IMPOUNDMENT PRE-FINAL 90% REMEDIAL DESIGN HARRIS COUNTY, TEXAS

No.	Issue	Drawn	Approved	Date
1	90% NORTHWEST CORNER	MW	WB	11/8/2022
	COMPONENT EPA REVIEW			

Drawn	MW	Designer	RH
Drafting Check	NQ	Design Check	WB
Project Coordinator	CM	Date	Nov 8, 2022
This document shall not be used for construction unless signed and sealed for construction.		Scale	AS SHOWN
Original Size	Arch D	Bar is one inch on original size drawing	0 1"

Project No. 11215702

Title
DREDGING ALTERNATIVE NORTHWEST CORNER DREDGING DETAILS

Sheet No.
C-55

Sheet - of -

Appendix H

Design Specifications

Appendix H-1

Design Specifications - Northwest Corner Capping

SECTION 31 35 26.50

ARTICULATING BLOCK FABRIC FORMED CONCRETE

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Furnish all materials, equipment, and labor to place granular material over the entire capping surface upon completion of dry excavation.
2. Furnish all labor, materials, equipment, and incidentals required to install articulating block fabric formed concrete cover system in accordance with the lines, grades, design, and dimensions shown on Drawings and as specified herein.
3. Install the specially woven, double-layer synthetic articulating block forms on the surface of the northwest corner of the Work Site and filling each compartment cavity with a pumpable fine aggregate concrete (structural grout) in such a manner as to form a stable lining to the required thickness, weight and configuration as described in this specification.

B. Related Requirements:
1. Section 01 10 00 – Summary.
2. Section 01 33 00 – Submittal Procedures.
3. Section 01 40 00 – Quality Requirements.
4. Section 01 50 00 – Temporary Facilities and Controls.
5. Section 01 57 19 – Temporary Environmental Controls.
6. Section 01 70 00 – Execution and Closeout Requirements.
7. Section 02 61 14 – Material Handling and Transportation.
8. Section 31 05 19.13 – Geotextiles for Earthwork.
9. Section 31 23 16 – Excavation.
10. Section 35 49 25 – Turbidity Curtain.

1.2 REFERENCES

A. Definitions:
1. Minimum Average Roll Value: Average value for a specified parameter less two standard deviations.
2. TCEQ: Texas Commission on Environmental Quality.
3. TxDOT: Texas Department of Transportation.
4. USEPA: United States Environmental Protection Agency.

B. Reference Standards:
1. Section 01 40 00 - Quality Requirements: Requirements for references.
2. ASTM International:
a. ASTM C31 – Standard Practice for Making and Curing Concrete Test Specimens in the Field
b. ASTM C33 – Standard Specification for Concrete Aggregates

c. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens
d. ASTM C150 – Standard Specification for Portland Cement
e. ASTM D4355 - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc-Type Apparatus.
f. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity.
g. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
h. ASTM D4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
i. ASTM D4632 - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
j. ASTM D4751 - Standard Test Methods for Determining Apparent Opening Size of a Geotextile.
k. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples.
l. ASTM D4884 - Standard Test Method for Strength of Sewn or Bonded Seams of Geotextiles.
m. ASTM D5199 - Standard Test Method for Measuring the Nominal Thickness of Geosynthetics.
n. ASTM D5261 - Standard Test Method for Measuring Mass Per Unit Area of Geotextiles.
o. ASTM D6241 - Standard Test Method for Static Puncture Strength of Geotextiles and Geotextile-Related Products Using a 50-mm Probe.
p. ASTM D 6449 – Standard Method for Flow of Fine Aggregate Concrete for Fabric Formed Concrete.

1.3 COORDINATION

A. Section 01 30 00 - Administrative Requirements: Requirements for coordination.

B. Coordinate installation of geotextile and fabric form panels after satisfactory surface preparation.

1.4 PRE-INSTALLATION MEETING

A. Section 01 30 00 - Administrative Requirements: Pre-installation meeting.

B. Convene minimum 1 week prior to commencing work of this Section.

C. Purpose of Meeting:
1. Define Work Site-specific quality control and monitoring procedures.
2. Discuss pre-installation submittals.
3. Identify daily schedule.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Water Quality Monitoring and Control Plan describing the methods and procedures for controlling water quality within and beyond the capping area (i.e., northwest) during cap placement activities. Include monitoring procedures to demonstrate that the controls are effective.

C. Fine aggregate concrete supplier’s certificates of compliance, mix design, fine aggregate gradation and fineness modulus for the fine aggregate concrete.

D. Geotextile and fabric form panel manufacturer’s certificates of compliance. CONTRACTOR shall also furnish the manufacturer’s specifications, literature, and any recommendations, if applicable, that are specifically related to the project, including shop drawings for the layout of the fabric form panels. Provide no later than 14 days prior to installation.

E. Samples of the geotextile and fabric form panel material proposed.
   1. Submit a representative sample of sufficient size for the geotextile and fabric form panel material no later than 10 days prior to ordering.

F. Manufacturer's Instructions: Submit at least 14 days prior to installation. Include installation, handling, storage, and repair instructions.

G. Manufacturer's Certificates:
   1. Deliver each roll of material to the Work Site accompanied by manufacturer's certificate.
   2. Identify each roll by unique manufacturing number.
   3. Include results of the tests specified for each respective product specified in PART 2 PRODUCTS.
   4. Provide manufacturer's records for storage, handling, and shipping of materials.
   5. Quality control certificates signed by manufacturer.

H. Daily Field Installation Report. Submit no later than 1 day following date covered by report. Include:
   1. Total amount and location of material placed.
   2. Identifiers of rolls.
   3. Changes in layout drawings.
   4. Record of defects caused during transportation and handling.
   5. Observations of weather conditions, and results.
   6. Observations of anchor trench excavation, backfilling, and compaction.
   7. Observations of repairs, including locations and name of repairer.

I. Qualification Statements:
   1. Installer: Submit copy of manufacturer's approval letter or license no later than 14 days prior to installation.
   2. Manufacturer: Submit no later than 14 days prior to ordering, list of previous projects meeting the qualifications requirement including name of project, description of project, area, client's name and address, contacts, and telephone numbers; engineer's name, address, contact, and telephone number; installer's name, address, contact, and telephone number; and date installed.

1.6 CLOSEOUT SUBMITTALS

A. Section 01 70 00 - Execution and Closeout Requirements: Requirements for closeout submittals.

B. Project Record Documents: Record actual locations of all placed material that is to remain in place at the completion of the project.

C. Warranties: Completed original warranty forms filled out in OWNER's name and registered with manufacturer in accordance with Section 01 70 00.

1.7 QUALITY ASSURANCE

A. Perform work of this Section according to, and in conformance with, applicable codes and standards of TCEQ, USEPA, and TxDOT.

B. Certifications: Obtain certificate of compliance from authority having jurisdiction.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum 10 projects, 5 million sq ft of manufacturing, and 3 years of documented experience.

B. Installer: Company specializing in performing work of this Section and approved by the manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Deliver geotextile and fabric form panels bearing manufacturer's seals and labels intact. Clearly label each roll to show the product identification, date of manufacture, lot number, analysis of contents, and special instructions.

C. Store and handle geotextile according to manufacturer's recommendations and ASTM D4873, in manufacturer's original covers. Protect from moisture, dust, light, and heat.

D. Keep the fabric forms panels dry and wrapped such that they are protected from the elements during shipping and storage. If stored outdoors, they shall be elevated and protected with a waterproof cover that is opaque to ultraviolet light. The fabric form panels shall be labeled as per ASTM D4873.

E. Notify ENGINEER 3 days in advance of delivery to the Work Site. Perform joint inspection with ENGINEER upon delivery. Defects or damage from shipping and handling will be grounds for rejection of the entire shipment at ENGINEER's discretion. Remove rejected material from the Work Site and replace with new material.

1.10 AMBIENT CONDITIONS

A. Install geotextile and fabric form panels according to manufacturer's instructions.

B. Suspend installation operations whenever climatic conditions, as determined by ENGINEER, are unsatisfactory for placing the material to the requirements of this Section.

PART 2 PRODUCTS

2.1 GEOTEXTILE FILTER FABRIC

A. Non-woven, needle-punched geotextile made of polypropylene that meets or exceeds the following values:

Test	Unit	Test Method	Minimum Average Roll Value
Unit Weight	ounce/yd^2	ASTM D5261	8
Tensile Strength	pound	ASTM D4632	220
Elongation at Break	percent	ASTM D4632	50
Static CBR Puncture	pound	ASTM D6241	575
Trapezoid Tear Strength	pound	ASTM D4533	90
Apparent Opening Size (AOS)	US Sieve	ASTM D4751	80
Permittivity	sec^{-1}	ASTM D4491	1.26
Water Flow Rate	gpm/ft^2	ASTM D4491	95
Ultra Violet Resistance	percent retained/ 500 hours	ASTM D4355	70

2.2 FABRIC FORMED CONCRETE MAT

A. Fabric formed concrete mat shall have a finished nominal block dimensions of 20 inches by 20 inches, a finished average thickness of 6 inches, and a nominal mass per unit area of 68 lb/ft^2.

B. Spacer cords shall be used to control the block thickness and shall have minimum tensile strength of at least 600 pounds at each control section.

C. The fabric form panels shall be composed of synthetic yarns formed into a woven fabric. Yarns used in the manufacture of the fabric shall be composed of nylon or polyester.

D. The fabric form panels shall also meet or exceed the material properties listed below:
   1. Mass per unit area, 13 ounce per square yard, ASTM D5261.
   2. Thickness, 30 mils, ASTM D5199.
   3. Wide width strip tensile strength, 300 pound per inch (lb/in) machine direction and 275 lb/in cross direction, ASTM D4595.
   4. Elongation at break, 15 percent machine direction and 15 percent cross direction, ASTM D4595.
   5. Trapezoidal tear strength, 150 pounds machine direction and 170 pounds cross direction, ASTM D4533.

6. Flow rate, 55 gallon per minute per square foot, ASTM D4491.
7. AOS, between No. 30 and No. 55 U.S. Standard Sieve, ASTM D4751.

E. Mill widths of fabric form panels shall be a minimum of 72 inches. Each selvage edge of the top and bottom layers of the fabric shall be reinforced for a width of not less than 1.25 inches.

F. The double-layer fabric shall be separately joined, bottom layer to bottom layer and top layer to top layer, by means of sewing thread, to form multiple mill width panels with sewn seams on approximately 72 inches centers.

G. All seams sewn in the factory shall have a minimum strength of 90 pound per inch (psi) when tested in accordance with ASTM D 4884. All sewn seams and zipper attachments shall be made using a double line of U.S. Federal Standard Type 401 stitch. All stitches shall be sewn simultaneously and be parallel to each other, spaced between 0.25 inches to 0.75 inches apart. Each row of stitching shall consist of 4 to 7 stitches per inch. Thread used for seaming shall be nylon and/or polyester.

H. Fabric form compartments shall have sufficient ducts to allow passage of the fine aggregate concrete between adjacent compartments. The cross-sectional area of each duct shall be no more than 10 percent of the maximum filled cross-sectional area of the block lateral to the duct.

I. Each compartment shall be interconnected with embedded longitudinal revetment cables in such a manner as to provide longitudinal and lateral binding of the finished articulating block mattress.

J. Revetment cables shall be rated to have a breaking strength of not less than 7,200 pounds. They shall be installed between the two layers of fabric. Two longitudinal cables shall be on approximately 12-inch centers and pass through each compartment to provide longitudinal and lateral binding of the finished articulating block mattress. The cables shall enter and exit the compartments through opposing ducts. All longitudinal cables within each filled concrete compartment shall be completely embedded in the fine aggregate concrete.

K. Baffles shall be installed to regulate the distance of lateral flow of fine aggregate concrete. The baffle material shall be non-woven filter fabric with a grab tensile strength of at least 90 pounds when tested in accordance with ASTM D 4632.

2.3 FINE AGGREGATE CONCRETE

A. A mixture of Portland cement, fine aggregate (sand) and water, so proportioned and mixed as to provide a pumpable fine aggregate concrete.
   1. Sand shall conform to ASTM C33. Grading for the sand shall be reasonably consistent and shall not exceed the maximum size which can be conveniently handled with concrete pumping equipment.
   2. Portland cement should conform to ASTM C150, Type I, II or V.
   3. Admixtures and/or pozzolan may be used when conforming to ASTM C618, Class C, F or N and with the approval of the ENGINEER.
   4. The water/cement ratio of the fine aggregate concrete shall be determined by the ready-mix supplier, but generally should be on the order of 0.65 to 0.70 to allow for excess water to be filtered out through the permeable fabric. The consistency of the

fine aggregate concrete delivered to the concrete pump should be proportioned and mixed as to have a flow time of 9-15 seconds when passed through the ¾-inch orifice of the standard flow cone that is described in ASTM C6449-99.

5. The sand/cement ratio should be determined by the ready-mix supplier and should be on the order of 2.4:1.
6. The hardened fine aggregate concrete shall exhibit a compressive strength of 2,500 pound per square inch (psi) at 28 days when specimens are made and tested according to ASTM C-31 and ASTM C-39.
7. The average compressive strength of fabric cast test cylinders, shall be at least 20% higher at 7 days than that of companion test cylinders made without fabric in accordance with ASTM C31, and not less than 3,000 psi at 28 days.

2.4 TURBIDITY CURTAIN

A. Impermeable Turbidity Curtains. Two parallel turbidity curtains shall be installed to contain any suspended soils generated during dry excavation activities and installation of the articulating block fabric formed concrete cover system.

B. Describe curtain material type and deployment procedures in Water Quality Control and Monitoring Plan.

2.5 GRANULAR MATERIAL

A. Supply granular material with the following mixture:
   1. 70 to 80 percent sand between No. 30 and No. 200 sieve sizes.
   2. 20 to 30 percent fines (passing No. 200 sieve).

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 70 00 - Execution Requirements: Verification of existing conditions before starting work.

B. Verify that surfaces and Work Site conditions are ready to receive work.

3.2 PREPARATION

A. Prior to material placement, provide necessary equipment and personnel to maintain an acceptable supporting surface during installation.

B. Examine the material for defects including rips, holes, flaws, deterioration, or damage incurred during manufacture, transportation, or handling.

C. Remove defective or damaged material from the Work Site.

3.3 TURBIDITY CONTROL

A. Work in the capping area shall be done to minimize disturbance of existing material within and beyond (i.e., northwest) the active work area.

B. Deploy turbidity curtain along the boundary of the capping area where the land elevation is below elevation -13 feet NAVD88 prior to commencement of capping operations as shown on Drawings. The bottom of the turbidity curtain shall be installed at the mud line and anchored or weighted in place adjacent to the capping area such that the disturbed material will be contained inside the work area during capping operations.

C. Follow the approved Water Quality Monitoring and Control Plan to maintain and monitor the water quality outside the work area.

3.4 GEOTEXTILE FABRIC PLACEMENT

A. Prior to geotextile placement, place a minimum 1 foot of granular material to a constant elevation -12 ft NAVD88 over the area requiring capping.

B. Place granular material to elevation -13 ft NAVD88 in area north of the cap boundary where existing elevation is below -13 ft NAVD88.

C. Notify ENGINEER at least 24 hours in advance of intention to commence geotextile fabric placement.

D. Geotextile filter fabric shall be placed directly on the prepared graded surface and be free of folds or wrinkles as an underlayment for the fabric form panel placement in accordance with the installation procedures specified in Section 31 05 19.13.

3.5 FABRIC FORM PLACEMENT

A. Factory assembled fabric form panels shall be placed over the geotextile filter fabric and within the limits shown on Drawings.

B. Perimeter termination of the fabric form panel material shall be accomplished using anchor trenches, as shown on Drawings.

C. Allow approximately 10% contraction of the form in each direction which will occur as a result of fine aggregate concrete filling. CONTRACTOR shall gather and fold additional fabric form in the anchor trench to be secured in such a manner as to be gradually released as fabric form panel material contracts during filling.

D. Adjacent fabric form panels shall be joined in the field by means of sewing or zippering closures. Adjacent panels shall be joined top layers to top layer and bottom layer to bottom. All field seams shall be made using two lines of U.S. Federal Standard Type 101 stitches. All sewn seams shall be downward facing.

E. When conventional joining of fabric form panels is impractical, adjacent fabric form panels may be overlapped a minimum of 3 ft to form a lap joint, pending approval by ENGINEER. In no case shall a simple butt joint between forms be permitted.

F. Expansion joints shall be provided or as specified by ENGINEER.

G. Immediately prior to filling with fine aggregate concrete, the assembled fabric form panels shall be inspected and approved by ENGINEER. At no time shall the unfilled fabric form panels be exposed to ultraviolet light (including direct sunlight) for a period exceeding five (5) days.

3.6 FINE AGGREGATE CONCRETE PLACEMENT

A. Fine aggregate concrete shall be pumped between the top and bottom layers of the fabric form panels through small slits cut in the top layer of the fabric form or through manufacturer supplied valves. The slits shall be sufficient to allow proper insertion of a filling pipe inserted at the end of a 2-inch I.D. concrete pump hose. Fine aggregate concrete shall be pumped to fill the forms to the recommended thickness and configuration.

B. Holes in the fabric forms left by the removal of the filling pipe shall be temporarily closed by inserting a piece of fabric. The fabric shall be removed when the concrete is no longer fluid and the concrete surface at the hole shall be cleaned and smoothed by hand.

C. Each cubic yard of fine aggregate concrete shall cover, at a maximum, 50 ft^2 of fabric form material.

D. Ensure complete filling of the fabric formed panels to the thickness specified by the ENGINEER. Avoid excessive pressure on the fabric form panels during fine aggregate concrete pumping and avoid using cold joints during filling.

E. Measure the thickness of the current section using a stiff wire at several locations prior to removing the filling pipe and proceed to the adjacent lining section. The average of all thickness measurements shall be not less than the specified average thickness of the concrete lining. Should the measurements not meet the specified average thickness, pumping shall continue until the specified average thickness has been attained.

F. Do not use high-pressure water hose to remove spilled fine aggregate concrete from the surface of the freshly pumped fabric formed material.

G. Provide boards if foot traffic on the freshly pumped concrete lining is necessary.

H. Backfill and compact anchor trenches after the fine aggregate concrete has set. Backfilling and compaction of trenches shall be completed in a timely fashion to protect the completed fabric formed material.

3.7 FIELD QUALITY CONTROL

A. Section 01 40 00 - Quality Requirements: Field inspecting and testing.

B. ENGINEER will inspect geotextile and fabric form panels in-place for tears, overlaps, and consistency after product installation. Damaged sections, as judged by ENGINEER, will be marked and their removal from the work area recorded. Repair minor damage and minor defects as specified in manufacturer's procedures, when approved by ENGINEER, to ENGINEER's satisfaction.

C. ENGINEER will verify that weather conditions (appropriate air temperature, non-excessive wind, and lack of precipitation) are acceptable for panel placement.

D. Conformance Testing:
   1. Samples of the materials may be removed by ENGINEER and sent to laboratory for testing to ensure conformance with the requirements of this Section.
   2. This testing will be carried out prior to field placement.
   3. ENGINEER may collect additional samples if initial test results do not comply with requirements of PART 2. The additional testing will be performed at CONTRACTOR's expense.
   4. As a minimum, the following conformance tests will be performed on the material sample:
      a. Mass per unit area.
      b. Grab tensile strength.
      c. Tear strength.
      d. Apparent Opening Size (AOS).
      e. Permittivity test.

END OF SECTION

Appendix H-2

Design Specifications - Northwest Corner Mechanical Dredging

SECTION 35 24 00

DREDGING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Furnish all material, equipment and labor to complete the mechanical dredging of subsurface material to the target limits and the transport, handling, and placement of the dredged material at a designated on-site area for material solidification.
2. Furnish all materials, equipment and labor to apply and mix chemical additives in the water column to increase the settling rate after dredging.
3. Furnish all materials, equipment and labor to place a residual management layer and final cover material over the entire surface of removed material (and beyond, where required) upon completion of dredging.

1.2 MATERIALS TO BE REMOVED

A. Materials include subsurface soil within the defined northwest corner of the Work Site, as shown on Drawings. The subsurface soil is described as heterogeneous comprised of highly interbedded alluvial deposits consisting of silty sands, sands, silts, lean clays, fat clays, and sandy clays down to an elevation of approximately -30 feet NAVD88.

B. Soil boring logs, geotechnical properties and analytical results of the subsurface material at the dredge site can be found in the Final 100% Remedial Design Report, Northern Impoundment, San Jacinto River Waste Pits Site.

1.3 PHYSICAL DATA

A. Vertical datum shown in Drawings is referenced to the North American Vertical Datum of 1988 (NAVD88), measured in feet.

B. Horizontal coordinates shown in Drawings is referenced to the Texas State Plane Zone 4, TX-South Central.

1.4 REFERENCES

A. Related Sections:
1. Section 01 10 00 – Summary
2. Section 01 33 00 – Submittal Procedures
3. Section 01 40 00 – Quality Requirements.
4. Section 01 50 00 – Temporary Facilities and Controls
5. Section 01 57 19 – Temporary Environmental Controls
6. Section 02 61 14 – Material Handling and Transportation
7. Section 35 49 25 – Turbidity Curtain

1.5 QUALIFICATIONS

A. CONTRACTOR shall have completed at least three (3) dredging projects of similar size and scope using mechanical methods.

B. The dredging supervisor shall have a minimum of five (5) years of experience with dredging projects in the role of dredging supervisor or superintendent.

C. CONTRACTOR's equipment operators, supervisory engineering staff, and technical staff shall have a minimum of two (2) years of experience with dredging by mechanical methods.

1.6 PRE-MOBILIZATION AND PRE-DREDGE MEETINGS

A. Section 01 30 00 - Administrative Requirements: Pre-mobilization and pre-dredge meetings.

B. Convene 1 week prior to installation of turbidity curtains.

C. Mandatory attendance includes ENGINEER, CONTRACTOR and Subcontractor.

D. Purpose of Meeting:
   1. Review the Work Site-specific quality assurance/quality control and monitoring procedures.
   2. Review time schedules.
   3. Review applicable personal protective equipment and regulations.
   4. Review safety plan and procedures.

1.7 SEQUENCE OF WORK

A. Mobilize to the Work Site and construct staging area and Solidification Containment Area.

B. Install turbidity curtains outside the active dredge site, as shown on Drawings.

C. Perform bathymetric survey to confirm pre-dredge surface and develop dredge prisms.

D. Conduct mechanical dredging for Production Dredging pass to remove the subsurface material to the lines and grades shown on Drawings and as described in this specification.

E. Apply chemical additives (e.g., polymers, coagulants) with the specified dosage to facilitate settling of suspended solids. Sufficiently mix within the water column to provide maximum effectiveness of chemical additives.

F. Perform bathymetric survey after settling of suspended solids. Develop dredge prisms based on surveyed surface and target elevations provided by ENGINEER for final pass.

G. Conduct mechanical dredging for Final Dredging pass to remove settled material and/or additional subsurface material to limits determined by ENGINEER.

H. Place granular material within dredge limits while pumping excess water to the Water Treatment System (WTS).

I. Place granular material in area beyond the dredge site (i.e., northwest) as indicated on Drawings.

1.8 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Requirements for submittals.

B. Plan for installation of turbidity curtains including equipment to be used and deployment procedures.

C. Manufacture Data (chemical additives): Include material properties and safety data sheets (SDS) and manufacturer's certified report of test.

D. Dredge Operation Plan for Approval: Include as a minimum the followings:
1. Description of mobilization/demobilization activities.
2. Schedule of dredging and ancillary works.
3. Method and equipment to accomplish the dredging operation, including ancillary equipment.
4. Description and Shop Drawing of environmental dredging bucket that will be used.
5. Description of dredging procedures to minimize resuspension.
6. Method of verification of pre-dredge and post-dredge site conditions.
7. Site access procedures, including location of staging areas and access to dredging equipment before each shift.
8. Proposed dredging plan and method of verification of dredge positioning and dredging depth.
9. Procedures and equipment layout for solidification procedures.
10. Information to be included in the daily records of operation.

E. Water Quality Monitoring and Control Plan describing the methods and procedures for controlling water quality outside the work area during dredging operations. Include monitoring procedures to demonstrate that the controls are effective.

F. Chemical Additives Dosing Plan: include as a minimum the following:
1. Proposed chemical additives - Include plan for treatability testing using site water and sediments to determine appropriate additives and dosage.
2. Dosage to be used based on the treatability testing.
3. Plan for placing residual management layer including equipment to be used and placement procedures.

G. Daily records of operation.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 01 60 00 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Package and label chemical additives bearing manufacturer's markings to clearly identify it with applicable safety data sheet (SDS) submitted to ENGINEER.

C. When transported to the Work Site, handle chemical additives by appropriate means as recommended by manufacturer.

D. Store chemical additives as recommended by manufacturer to prevent degradation, theft, and vandalism.

1.10 AMBIENT CONDITIONS

A. Suspend operations whenever climatic or water conditions, or equipment proposed for the operation, as determined by ENGINEER, are unsatisfactory for performing the tasks in accordance with the requirements of this Section.

PART 2 PRODUCTS

2.1 CHEMICAL ADDITIVES

A. CONTRACTOR is required to use chemical additives in the water column after the completion of the Production Dredging pass to settle out the suspended solids.

B. Chemical additives may also be used to settle suspended solids after the Final Dredging pass at the direction of the ENGINEER.

2.2 TURBIDITY CURTAIN

A. Impermeable Turbidity Curtains. Two parallel turbidity curtains shall be installed to contain the suspended soils from dredging operation within the dredge site.

B. Describe curtain material type and deployment procedures in Dredging Operation Plan.

2.3 GRANULAR MATERIAL

A. Supply granular material with the following mixture:
   1. 70 to 80 percent sand between No. 30 and No. 200 sieve sizes
   2. 20 to 30 percent fines (passing No. 200 sieve)

PART 3 EXECUTION

3.1 EQUIPMENT

A. Provide dredging equipment as described in CONTRACTOR’s Dredging Operation Plan. Equipment must provide sufficient capacity to satisfactorily complete the Work scope within the scheduled time and in accordance with this specification. Equipment should be selected for implementation that is the most protective of the environment for this project.

B. Provide environmental bucket that is specifically designed to reduce the release of sediments during closure and retrieval to minimize resuspension.

C. Provide equipment for transportation of the dredge material to the shore (dry land outside of dredging limits) and offloading to facilitate efficient management and transportation of material.

D. Material barges must be sealed to prevent leakage.

E. Provide Solidification Containment Area at location shown on Drawings to meet the following requirements:
   1. Sufficient size and capacity to manage a minimum of two days of production.
   2. Capable of containing material for off-loading, solidification and loading of dredge spoils.
   3. Provide secondary containment to prevent potential spillage from operation.
   4. Follow layout and details shown on Drawings.

3.2 TURBIDITY CONTROL

A. Work in the dredge site shall be done to minimize resuspension of material outside of the active work area. Take all precautions to minimize and contain suspended solids from the dredging operation.

B. Deploy turbidity curtain along the boundary of the dredge site where the land elevation is below -9 feet NAVD88 prior to dredging as shown on Drawings. The bottom of the turbidity curtain shall be installed at the mud line and anchored in place adjacent to the dredge site such that the resuspended sediment will be contained inside the work area during the dredging operation.

C. Follow the approved Water Quality Monitoring and Control Plan to maintain and monitor the water quality outside the work area.

3.3 DREDGING

A. Perform Dredging Production pass to the target limits shown on Drawings, or as directed by ENGINEER.
   1. Begin dredging in the direction and sequence as proposed in the approved Dredging Operation Plan. Attain full grade at each transect prior to moving to the next transect location.

B. Maintain water level during dredging so that it does not go below -10.9 ft NAVD88.

C. Dredging tolerances are +0 foot and -0.5 feet from the required final elevation to cover the inaccuracies of the dredging process.

D. The side slopes shall not be steeper than shown on Drawings. Side slopes shall be dug from top to bottom and to the grades shown on Drawings.

E. Begin dredging at the highest elevation of material to be removed and work toward the lowest elevation to minimize sloughing of material.

F. Do not overfill dredge bucket.

G. Monitor dredge operation throughout the course of work for depth, slopes, location, and tolerances.

H. CONTRACTOR shall be responsible for damages due to dredging beyond the specified depth or horizontal limits.

I. Use real-time kinematic (RTK) GPS to accurately position dredge and remove material in dredge prism. Use Hypack, Inc. Dredgepack® software or similar product to monitor and process the data.

J. Track progress with bathymetric surveys.

K. Dredge to minimize resuspension of sediments.

L. Set and sequence production cuts to reduce concentrations in residuals.
   1. Place bucket accurately to avoid missing sediments between bucket placements.
   2. Control bucket overpenetration and overfilling.

M. Dredge entire limit to remove all material within the allowable tolerance.

N. Notify the ENGINEER when all dredging operations are completed. A post-dredge bathymetric survey of the dredge site and confirmation sampling will be completed by the ENGINEER. Assist ENGINEER by providing equipment and labor support.

O. Apply chemical additives to promote settling of the resuspended sediments after ENGINEER approval the Production Dredging pass.
   1. Evaluate the GHD treatability data and perform additional testing as necessary to develop a plan for application and mixing of polymers, coagulants and/or other additives.
   2. Sufficiently mix within the water column to provide maximum effectiveness of chemical additives.

P. ENGINEER to develop requirements for Final Dredging pass to be performed by CONTRACTOR.

Q. Follow ENGINEER’s requirements for Final Dredging pass.

3.4 TRANSPORT OF DREDGE MATERIAL

A. Place dredged material in sealed hopper and transport onshore to the on-site material processing area.

B. Transfer the dredged material from the hopper barge to the Solidification Containment Area for waste solidification.

C. Keep material barges in good working condition to prevent spillage or overflow of dredged material.

3.5 FIELD QUALITY CONTROL

A. Lay out work area using benchmarks and baselines established by the surveyor. Be responsible for accuracy of work relative to established benchmarks and baseline.

B. Maintain buoys and markers required to define transects in dredge site.

C. Use real time kinematics (RTK) positioning GPS to accurately position dredge and remove material in dredge prism. Use Hypack, Inc. Dredgepack® software or similar product to process the data.

D. Track progress with bathymetric surveys referenced to survey benchmarks.

E. Provide a daily quality control report to ENGINEER as specified in the approved Dredging Operation Plan.

F. Provide a final post-dredge survey of the project dredging limits to ENGINEER for final acceptance of dredging work prior to site restoration.

3.6 SITE RESTORATION

A. After completion and approval of Final Dredging pass by ENGINEER, place chemical additives to promote settling of the resuspended sediments, as directed by ENGINEER.
   1. Develop the procedures for the final round of settling of resuspended sediments based on the condition of the water and of the water and the effectiveness of the additives during the first application.
   2. Sufficiently mix within the water column to provide maximum effectiveness of chemical additives.

B. Upon acceptance and approval of the dredging operation by ENGINEER, backfill the entire dredge site with granular material.

C. Initially place minimum of 2 feet of granular material as residual management layer in thin lifts to minimize disturbance of the settled solids

D. Subsequently place remainder of granular material to elevation -13 ft NAVD88.

E. Remove water while placing granular material. Maintain water level between elevation -9 ft NAVD88 and -13 ft NAVD88 during granular material placement. Treat water in WTS.

F. Place granular material to elevation -13 ft NAVD88. As an alternative, there may be a potential to reuse the removed riprap or aggregate material that comprised the existing rock layer that was removed to facilitate dredging

G. After completion of granular material placement, pump water to elevation between -13 ft NAVD88 to -13.5 ft NAVD88.

H. Place granular material to lines and grade shown on Drawings to the northwest of the dredging area.

I. Demobilize Equipment.

J. Remove rock and liner from Solidification Containment Area and transport off site for disposal at direction of ENGINEER.

END OF SECTION

Appendix J

Supporting Deliverables

Appendix J-1

Supporting Deliverables - Northwest Corner Capping

Attachment 6-A - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Northwest Corner (Capping)

Provided As Part of Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)
San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company
McGinnes Industrial Maintenance Corporation

November 8, 2022

Contents

Table index

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
A. Temporary Traffic Control				
• Traffic Control	• Has a Temporary Traffic Control Plan been provided as specified?	• Check Section 01 35 00	• Continuous	• Temporary Traffic Control Plan
• Traffic Control Devices	• Have signs been inspected for legibility, damage, suitability, and location? • Are signs clean, repaired, or replaced to maintain clarity and reflectiveness?	• Check Section 01 35 00	• Continuous	• None
B. Health and Safety				
• Health and Safety Planning	• Are health and safety procedures in place, including equipment, work area and excavation inspections?	• Check Section 1 35 29	• Continuous	• Health and Safety Plan
C. Temporary Facilities and Controls				
• Utilities	• Have utilities been provided as specified and coordinated with local utility providers?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Construction Facilities	• Have temporary construction facilities been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Vehicular Access and Parking	• Has vehicular access and parking been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Barriers and Enclosures	• Have barriers and enclosures been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Temporary Controls	• Have temporary controls been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
D. Temporary Soil Erosion and Sediment Control				
• Erosion Control Items	• Is depth of silt fence embedment in accordance with drawings?	• Visual & check drawings	• Continuous	• Soil Erosion & Sediment Control Plan
	• Are tears or holes present in silt fence fabric?	• Visual	• Continuous	• Product Data
	• Is erosion around and under silt fence present?	• Visual	• Continuous	• None
	• Is sagging or collapse evident?	• Visual	• Continuous	• None
	• Has a Soil Erosion and Sediment Control Plan been provided as specified?	• Check permit	• Continuous	• Soil Erosion and Sediment Control Plan
E. Waste Material Solidification				
• Waste Material Solidification	• Has waste material been dewatered and solidified as specified?	• Check Section 02 55 13	• Continuous	• Solidification Plan • Daily Field Installation Reports • Quality Assurance/Quality Control Plan

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
G. Material Handling and Transportation				
• Material Handling and On-Site Transportation	• Has a Material Handling and On-Site Transportation Plan been provided as specified?	• Check Section 02 61 14	• Continuous	• Material Handling and On-Site Transportation Plan
G. Transportation and Disposal				
• Disposal Equipment	• Is equipment provided as specified?	• Check Section 02 61 16	• Upon delivery	• Operating licenses and permits
	• Is equipment being decontaminated properly?	• Check Section 02 61 16	• Prior to leaving Site and changing to lower impacted waste type	• Transportation and Disposal Plan
	• Are vehicles maintained properly in accordance with 49 CFR 393?	• Visual	• Daily (Periodically)	• Transportation and Disposal Plan
	• Do motor vehicle operator(s) perform a safety inspection of each motor vehicle before it is used and at least once a day?	• Visual	• Continuous	• None
• Disposal of Materials	• Has a Transportation and Disposal Plan been provided as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Plan
	• Has a Transportation Emergency Response Plan been provided as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Plan
	• Are materials transported and disposed of to satisfy requirements as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Proposal • Shipping and Disposal Documents • TSDF Weigh Scale documents
	• Are trucks inspected prior to leaving the Site to transport for disposal at approved TSDFs?	• Visual	• Continuous	• Shipping and Disposal Documents
H. Excavation				
• Excavation Equipment	• Is equipment inspected daily by a qualified person?	• Visual	• Continuous	• Excavation Plan
• Sediment/Soil	• Are excavations being conducted as specified?	• Check Section 31 23 16 and Drawings • Visual	• Periodic during excavation	• Excavation Plan
• Material Handling and Stockpiling	• Is material being handled and stockpiled as specified?	• Check Section 31 23 16 • Visual	• During excavation and stockpiling	• Material Handling and On-Site Transportation Plan
	• Is load packaged, labelled etc. as specified?	• Check Section 31 23 16	• After loading and before leaving Site	• Material Handling and On-Site Transportation
I. Dewatering				
• Dewatering Equipment	• Does equipment meet specifications?	• Check Section 31 23 19 • Visual	• Upon delivery	• Dewatering Plan
	• Has system been installed as specified?	• Check Section 31 23 19 and Drawings	• Periodic during installation	• Dewatering Plan
	• Has equipment and surplus raw materials been removed?	• Visual	• Daily as required	• Dewatering Plan

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
I. Dewatering (cont'd)				
• Sediment/Soil Dewatering	• Is dewatering procedure adequate to contain impacted groundwater?	• Check Section 31 23 19 • Visual	• Periodic during operation	• Dewatering Plan
	• Is material being dewatered as specified?	• Check Section 31 23 19 • Visual	• During staging	• Dewatering Plan
• Sediment/Soil Dewatering (cont'd)	• Is settlement being detected where critical structures or facilities exist immediately adjacent to areas of proposed dewatering.	• Check Section 31 23 19 • Visual	• Periodic during operation	• None
J. Fill				
• Existing Berm Material	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Fill for Between Sheet Pile Walls	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Structural Fill	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results • Analytical data • Product data
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Common Fill	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results • Analytical data • Product data
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Sand	• Does sand meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of sand	• Geotechnical testing results • Analytical data • Product data
	• Has sand been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Topsoil	• Does topsoil meet specifications?	• Check Section 31 23 23 • Visual	• Each source of topsoil	• Geotechnical testing results • Analytical data • Product data
• Coarse Aggregate	• Does aggregate meet specifications?	• Check Section 21 23 23	• Each source of aggregate	• Source of aggregate • Geotechnical data • Samples • Suppliers' Certificates
	• Has aggregate been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
J. Fill (cont'd)				
• Clearstone	• Does clearstone meet specifications?	• Check Section 31 23 23 • Visual	• Each source of clearstone	• Geotechnical testing results • Analytical data • Product data
• Backfilling Excavations	• Are excavations being backfilled as specified?	• Check Section 31 23 23 and Drawings	• During backfilling	• Geotechnical data • Survey
	• Has horizontal and vertical control been maintained?	• Check Section 31 23 23 • Visual	• After placement	• Analytical results • Test reports
K. Synthetic Materials				
• Materials	• Do materials provided meet specifications?	• Check Section 31 35 26.16	• Each source of geotextile and geomembrane (liner)	• Product data • Manufacture's instructions • Samples
	• Are materials being stored properly?	• Visual	• Upon delivery to Site	• Manufacturer's instructions
• Installation	• Have materials been placed as specified?	• Visual • Survey	• Periodic during installation	• Manufacturer's instructions
	• Are there any visible defects with materials?	• Visual	• After installation is completed	• None
L. Riprap				
• Materials	• Do materials provided meet specifications?	• Check Section 31 37 00	• prior to delivery	• Source Quality Control testing
• Installation	• Have materials been placed to the proper location and depth	• Survey	• Continuous during work	• None
M. Articulating Block Fabric Formed Concrete				
• Submittals	• Has Water Quality Monitoring and Control Plan been provided as specified?	• Check Section 31 35 26.50	• Continuous	• Water Quality Monitoring and Control Plan
• Materials	• Do materials provided meet specifications?	• Check Section 31 35 26.50	• Each source of fine aggregate • Each source of geotextile and fabric form fabric	• Product data • Manufacture's instructions • Samples
	• Are materials being stored properly?	• Visual	• Upon delivery to Site	• Manufacturer's instructions
	• Has Manufacturer's Certificates been provided as specified?	• Check Section 31 35 26.50	• Continuous	• Product data
	• Have Qualification Statements for manufactuer and installer been provided as specified?	• Check Section 31 35 26.50	• Continuous	• Product data
	• Have Daily Field Installation Reports been provided?	• Check Section 31 35 26.50	• Daily	• Field Installation Reports
• Placement	• Has articulating block fabric fomed concrete been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of placement and thickness measurements

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
N. Sheet Piles				
• Materials	• Do materials provided meet specifications?	• Check Section 31 41 16	• Upon delivery	• Product data • Mix Design • Test samples in accordance with AI MS-2 • Records
• Installation	• Have sheet piles been inspected prior to and after installation?	• Check Section 31 41 16 and Drawings	• After installation	• Records
	• Have sheet piles been installed as specified?	• Check Section 31 41 16 and Drawings	• After installation	• Certifications
O. Chain Link Fences and Gates				
• Materials	• Do materials provided meet specifications?	• Check Section 32 31 13	• Upon delivery	• Product data • Manufacture's instructions
• Installation	• Have chain link fences and gates been installed as specified?	• Check Section 32 31 13 and s Drawings	• After installation	• Certifications
	• Has a final inspection taken place?	• Check Section 32 31 13 and Drawings	• Upon Substantial Performance	• Records
P. Seeding				
• Topsoil Placement	• Has topsoil been placed as specified?	• Check Section 31 23 23 • Visual	• Periodic during placement	• None
	• Has topsoil been lightly surface compacted following seeding?	• Visual	• Periodic following seeding	• None
	• Horizontal and vertical control	• Visual • Survey	• Following placement	• Survey
• Seeding	• Are materials stored properly?	• Visual	• Periodic during storage	• Manufacturer's instructions
	• Does seed, lime, fertilizer, and mulch meet specifications?	• Check Section 32 92 19	• Prior to application	• Source of materials • Product data
	• Has hydroseed, fertilizer, and mulch been applied as specified?	• Check Section 32 93 00 • Visual	• Periodic during application	• Seeding and Erosion Control Plan
	• Have correct quantities of hydroseed, fertilizer, and mulch been placed?	• Check Section 32 93 00 • Visual	• Periodic during placement	• Seed certificates • Fertilizer certificates
	• Have bare spots been rehydroseeded?	• Visual	• Periodic during installation	• None
	• Is height of grass as specified?	• Check Section 32 93 00	• Periodically during maintenance	• None

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
Q. Turbidity Curtain				
• Material	• Have materials been joint inspected upon delivery?	• Visual	• Upon delivery to Work Site	• None
	• Are materials being stored properly?	• Visual	• Periodic during storage	• Manufacturer's instructions
	• Do materials meet specifications?	• Check Section 31 05 19 • Check material property sheets and quality control certificates	• Each source of geotextile • Upon delivery to Work Site	• Product data • Manufacturer's certificates • Samples
• Placement	• Have materials been placed as specified?	• Visual • Survey	• Periodic during installation	• Manufacturer's instructions
	• Are there any visible defects, tears or overlaps with materials?	• Visual	• After installation is completed	• None
R. Process Equipment				
• Materials	• Do materials provided meet specifications?	• Check Division 40 Sections	• Upon delivery	• Product data • Shop drawings • Certifications and Reports
• Installation	• Has process equipment been installed as specified?	• Check Division 40 Sections and Drawings	• After installation	• Records
	• Has a final inspection taken place?	• Check Division 40 Sections and Drawings	• Upon Substantial Performance	• Records
R. Wastewater Treatment System				
• Materials	• Do materials provided meet specifications?	• Check Section 46 07 01	• Upon delivery	• Product data • Shop drawings • Certifications and Reports
• Installation	• Has process equipment been installed as specified?	• Check Section 46 07 01 and Drawings	• After installation	• Records
	• Has a final inspection taken place?	• Check Section 46 07 01	• Upon Substantial Performance	• Records

Notes:
*Frequencies of inspections are considered minimum and will be increased or added to as determined necessary by the Engineer.
1. The quality assurance/quality control inspections included herein are suggested in accordance with the technical specifications.
2. New or updated information is indicated by black font.

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
A. Health and Safety (Section 01 00 00)									
• Reportable Quantities	• Identification of hazardous chemicals	• State accredited method	• Throughout the Works	• In accordance with State accredited criteria	• As determined by Engineer	• See Section 01 35 29	• On Site	• 50	• 50
B. Waste Material Solidification (Section 02 55 13)									
• Waste Material Solidification	• In accordance with accepted QA/QC Plan	• State accredited method	• Throughout the Works	• In accordance with State accredited criteria	• As determined by Engineer	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
C. Geotextiles for Earthwork (Section 31 05 19.13)									
• Geotextile G1									
Material	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• 220	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 50	• As above	• As above	• As above	• 100	• 0
	• Static CBR Puncture	• ASTM D6241	• See standard	• 575	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 90	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 80	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 1.26	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.30	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 95	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Geotextile G2									
Material	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• 320	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 50	• As above	• As above	• As above	• 100	• 0
	• Static CBR Puncture	• ASTM D4632/D4632M	• See standard	• 900	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 125	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 100	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 0.80	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.29	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 60	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Geotextile G3									
Material	• Tensile Strength @ 2% strain (MD)	• ASTM D4595	• See standard	• 720 (typical) 600 MARV	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Tensile Strength @ 2% strain (CD)	• ASTM D4595	• See standard	• 1200 (typical) 1020 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Tensile Strength @ 5% strain (MD)	• ASTM D4595	• See standard	• 2100 (typical) 1800 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Tensile Strength @ 5% strain (CD)	• ASTM D4595	• See standard	• 2580 (typical) 2256 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 50 (typical) 40 (MARV)	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 1.2 (typical) 0.9 (MARV)	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 85 (typical) 75 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
	• Pore Size	• ASTM D6767	• See standard	• 85 (typical) 75 (MARV)	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Interaction Coefficient	• ASTM D6706	• See standard	• 0.89	• As above	• As above	• As above	• 100	• 0
	• Factory Sewn Seam	• ASTM D4884.D4884M	• See standard	• 2700	• As above	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
D. Fill (Section 31 23 23)									
• Existing Berm Material	• Particle Size	• ASTM D6913/D6913M and D7928	• Minimum 1 test per 2,500 cu yd (clay)	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
Material	• Soil Classification	• ASTM D2487	• Minimum 1 test per 2,500 cu yd (clay)	• Any except poorly graded and except CH, MH, OL, and OH	• As above	• As above	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List.	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
		Parameter / *Methods*							
		TAL[3] Metals / SW-846 6020A/7471A							
		Hexavalent Chromium / SW-846 7196A							
		Cyanide / SW-846 9010/9012							
		TCL[2] Volatiles / SW-846 8260B							
		TCL Semi-Volatiles / SW-846 8270D							
		TCL Pesticides / SW-846 8081B							
		Polychlorinated Biphenyls / SW-846 8082A							
		Herbicides / SW-846 8151A							

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
D. Fill (Section 31 23 23) cont'd									
• Aggregate Types A1 and A2 (Course Aggregate and Clear Stone) *Material*	• Grain Size	• ASTM C117, C136/C136M, and D6913/D6913M	• Minimum 1 test per 1,000 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Soil Type S1 and S2 (Fill Between Sheet Pile Walls and Structural Fill) *Material*	• Particle Size	• ASTM D6913/D6913M and D7928	• Minimum 1 test per 2,500 cu yd (clay)	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Soil Classification	• ASTM D2487	• Minimum 1 test per 2,500 cu yd (clay)	• Any except poorly graded and except CH, MH, OL, and OH	• As above	• As above	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Soil Type S3 (Common Fill) and Sand	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Imported Topsoil *Material*	• Particle Size	• ASTM D422	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• pH	• ASTM D4972	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard	• Sample size per ASTM	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Organic Content	• ASTM D2974	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard					
	• Phosphorus, potassium, calcium, and magnesium	• In accordance with State accredited criteria	• Minimum 1 test per 2,500 cu yd						
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Imported Common Fill, Topsoil and Aggregate *Placement*	• Particle Size Analysis	• ASTM DD6913/D6913M and ASTM D7928 or ASTM C117 and ASTM C136	• Minimum 1 test per source	• Per ASTM standard	• Sample size per ASTM	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
E. Geomembranes (Section 31 05 20)									
• LLDPE Liner *Material*	• Thickness	• ASTM D5199	• As above	• nominal 60 mil • lowest individual of 10 values (-10% or 54 mil)	• As per GRI GM 17	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 0	• 0
	• Formulated Density	• ASTM D1505/D792	• As above	• 0.939 g/cu cm MARV *	• As above	• As above	• As above	• 0	• 0
	• Break Strength	• ASTM D6693, Type IV	• As above	• 152 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• Break Elongation	• ASTM D6693, Type IV	• As above	• 800 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• 2% Modulus (max.)	• ASTM D1004	• As above	• 2400 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• Tear resistance	• ASTM D1004	• As above	• 22 pounds	• As above	• As above	• As above	• 0	• 0
	• Puncturing resistance	• ASTM D4833/D4833M	• As above	• 56 pounds	• As above	• As above	• As above	• 0	• 0
	• Carbon Black Content	• ASTM D5596	• As above	• 2 to 3 percent	• As above	• As above	• As above	• 0	• 0
	• Oxidation Induction Time Standard High Pressure	• ASTM D8117 • ASTM D5885/D5885M	• As above • As above	• 100 minutes • 400 minutes	• As above • As above	• As above • As above	• As above • As above	• 0 • 0	• 0 • 0
	• Oven Aging at 85 degrees Celsius Standard High Pressure	• ASTM D5721 and ASTM D8117 • ASTM D5885/D5885M	• As above • As above	• 35 percent • 60 percent	• As above • As above	• As above • As above	• As above • As above	• 0 • 0	• 0 • 0
	• UV Resistance	• ASTM D7238 and D5885/D5885M	• As above	• 2 to 3 percent	• As above	• As above	• As above	• 0	• 0
Installation	• Seam shear test on test seam	• Field tensiometer	• Minimum 2 times per day for each seaming equipment. Minimum once per day per seamer.	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample coupons to be 1 inch wide, collected from test seam	• See Section 31 05 20, Article 3.7	• On Site	• 100	• Engineer will observe Contractor QC Tests
	• Seam peel test on test seam	• Field tensiometer	• Minimum 2 times per day for each seaming equipment. Minimum once per day per seamer.	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• On Site	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam shear test	• Field tensiometer	• Minimum 1 test per approximately 500 L.F. of production seam or at least one per seam	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• As above	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam peel test	• Field tensiometer	• Minimum 1 test per approximately 500 L.F. of production seam or at least one per seam	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• As above	• 100	• Engineer will observe Contractor QC Tests
	• Non-destructive pressure test	• Pressure test GRI Test Method GM6	• 100% of production seams	• Pressurize air channel to between a min. 20 psi and max. 30psi • Maintain pressure for a 2 minute stabilization period • Maximum allowable pressure drop is 4 psi over 2 minutes	• 100% of production seams	• See Section 31 05 20	• In-place	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam shear test (if field test acceptable)	• ASTM D4437 (Mod.) per NSF Std. 54	• Minimum one test per approximately 500 L.F. of production seam or at least one per seam	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample size per ASTM. Sample locations on fixed 500-foot increments; possible intermediate locations	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
	• Destructive seam peel test (if field test acceptable)	• ASTM D4437 (Mod.) per NSF Std. 54	• Minimum one test per approximately 500 L.F. of production seam or at least one per seam	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample size per ASTM. Sample locations on fixed 500-foot increments; possible	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
F. Articulating Block Fabric Formed Concrete (Section 31 35 26.50)									
• Granular Material *Material*	• Grain Size	• 70 to 80 percent sand between No. 30 and No. 200 sieve sizes • 20 to 30 percent fines (passing No. 200 sieve)	• Minimum 1 test per 1,000 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Geotextile G1 *Material*	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• 220	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 50	• As above	• As above	• As above	• 100	• 0
	• Static CBR Puncture	• ASTM D6241	• See standard	• 575	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 90	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 80	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 1.26	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 95	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
F. Articulating Block Fabric Formed Concrete (Section 31 35 26.50) cont'd									
• Geotextile G1 (cont'd)									
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Fabric Formed Concrete Mat									
Material	• Mass per Unit Area	• ASTM D5161	• See standard	• 13	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Thickness	• ASTM D5199	• See standard	• 30	• As above	• As above	• As above	• 100	• 0
	• Wide Width Strip Strength	• ASTM D4595	• See standard	• 300 (machine direction) • 275 (cross direction)	• As above	• As above	• As above	• 100	• 0
	• Elongation at Break	• ASTM D4595	• See standard	• 15 (machine direction) • 15 (cross direction)	• As above	• As above	• As above	• 100	• 0
	• Trapezoidal Tear Strength	• ASTM D4533	• See standard	• 150 (machine direction) • 170 (cross direction)	• As above	• As above	• As above	• 100	• 0
	• Flow Rate	• ASTM D4491	• See standard	• 55	• Minimum once every month	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 30 to 55	• As above	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Fine Aggregate Concrete									
Material	• Sand Grain Size	• ASTM C33	• See standard	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Portland Cement	• ASTM C150, Type I, II, or V	• See standard	• Per ASTM standard	• As above	• As above	• As above	• 100	• 0
G. Riprap (Section 31 37 00)									
Riprap (Section 31 37 00)									
Material	• Gradation Testing	• per spec & OPSS.PROV 1004	• As per specification	• Per ASTM standard	• 1 sample per stone type	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
	• Bulk Specific Gravity	• ASTM C127	• As per specification	• Per ASTM standard	• 1 sample per stone type	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
H. Sheet Piles (Section 31 41 16)									
• Sheet Piles									
Material	• Material Testing	• ASTM A6/A6M	• See standard	• Per ASTM standard	• Sample size per ASTM	• Per ASTM standard	• Per ASTM standard	• 100	• 0
I. Seeding (Section 32 92 19)									
• Seed									
Material	• Nitrogen	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Phosphorus	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Potash	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Soluble Salt Content	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Organic Matter Content	• ASTM D2974	• As per specification	• Per ASTM standard	• 1 sample per source	• 2% to 10%	• Per ASTM standard	• 100	• 0
	• Acidity Range (pH)	• ASTM D4972	• As per specification	• Per ASTM standard	• 1 sample per source	• 5.5 to 7.5	• Per ASTM standard	• 100	• 0
	• Clay	• ASTM D2487	• As per specification	• Per ASTM standard	• 1 sample per source	• 10% to 15%	• Per ASTM standard	• 100	• 0
	• Lime	• ASTM DC602	• As per specification	• Per ASTM standard	• 1 sample per source	• 80% calcium carbonate (min.)	• Per ASTM standard	• 100	• 0
J. Turbidity Curtain (Section 35 49 25)									
• Geosynthetics									
Material	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• (Wrap) 350, (Fill) 250	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 34	• As above	• As above	• As above	• 100	• 0
	• Mullen Burst Strength	• ASTM D3786/D3786M	• See standard	• 510	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 65	• As above	• As above	• As above	• 100	• 0
	• Puncture Strength	• ASTM D4833/D4833M	• See standard	• 140	• As above	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 0.04	• As above	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.01	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 5	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 80/500	• As above	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• Minimum once every 100,000 sq ft	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50

Notes:
* Minimum criteria, unless identified otherwise.
1. The quality assurance/quality control tests included herein are suggested in accordance with the technical specifications.
2. New or updated information is indicated by black font.
MARV = Minimum Average Roll Value
AI = Asphalt Institute
ASTM = ASTM International


GHD

Appendix J-2

Supporting Deliverables - Northwest Corner Mechanical Dredging

Attachment 3-A - Field Sampling Plan - Northern Impoundment (Northwest Corner Component) - Dredging

Provided As Part of Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)
San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company
McGinnes Industrial Maintenance Corporation

November 8, 2022

Contents

Contents

Table index

Figure index

1. Introduction

1.1 Relationship to Supporting Plans

2. Post-Excavation Confirmation Soil Sampling

2.1 Establishing Decision Units

2.1.1 Sampling Locations within a DU

2.2 Sampling Procedures

2.2.1 Sample Collection and Compositing Procedures

2.2.2 Sample Analysis

2.3 Data Analysis

2.4 Areas Sensitive to Hydraulic Heave

2.5 Northwest Corner Post-Dredging Confirmation Sampling

As detailed in the Pre-Final (90%) Remedial Design - Northern Impoundment - Northwest Corner Component (90% RD - Northwest Corner Component), under a mechanical dredging approach, the impacted material in the northwest corner will be removed to the target elevations exceeding the cleanup standard, based upon the data from past sampling events and utilizing barge-mounted mechanical dredging equipment. Prior to conducting a final pass to remove remaining settled residuals, confirmation sampling will be conducted to demonstrate compliance with the cleanup standard. The sampling will also serve to inform the target depth of the final dredge pass to a depth limit of 2 feet (ft) beyond the target removal elevations (further explained in Section 2.6.2).

Prior to confirmation sample collection, and to maximize residuals removal, chemical additives will be mixed with the water in the northwest corner to promote settling of resuspended sediments from the water column.

This section describes the use of composite sampling across decision units (DU) within the northwest corner to demonstrate compliance with the clean-up level under a mechanical dredging approach. This process is consistent with the confirmation sampling approach for the remainder of the Northern Impoundment, as described in Sections 2.1 to 2.4. This section includes procedures for collection of samples and preparation of composites. It also describes the analysis of the data and course of action based upon the results.

2.6 Sampling in Decision Units

As detailed in Section 2.1, the confirmation sampling plan for the other portions of the Northern Impoundment includes dividing the seasonal excavation cell into approximately ½ DUs for post-excavation confirmation sampling. Due to the

specialized remediation planned for the northwest corner, this area will be addressed in the first excavation season of the Northern Impoundment RA. The area to be addressed in the northwest corner is approximately 1 acre. In keeping with the previously established confirmation sampling methodology, following removal of the waste material in the area to the target elevations, the northwest corner will be divided into two DUs, approximately ½ acre in size.

Within each ½-acre DU, six to eight (6 to 8) discrete 2-ft core samples will be collected from sample locations evenly spaced across the DU. Prior to sampling, the locations may be located using Global Positioning System (GPS) and marked using a polyvinyl chloride (PVC) marker. One discrete sample will be collected from each sample location, as further described in Section 2.6.1. The top approximately 6 inches of each core may be comprised of excavated sediment residuals that have settled out of suspension following dredging. This layer will be addressed during the subsequent clean pass, so it will not be sampled during the confirmation sampling process. The remainder of the cores will be divided into two samples (6 to 12 inches and 12 to 24 inches) and composite samples will be prepared for each layer composed of the sample from that depth layer from each of the six to eight discrete samples to form one composite sample from 6 to 12 inches for each DU and one composite sample from 12 to 24 inches for each DU. The samples will be homogenized, composited, packed, and labeled in the field and then sent to the approved analytical laboratory (Approved Laboratory) for analysis. Figure 2.5, below, illustrates a conceptual approach for collection of six discrete samples across each ½-acre DU in the northwest corner. This figure is purely conceptual, as the boundaries of the DUs and/or confirmation sampling locations will not be predefined.

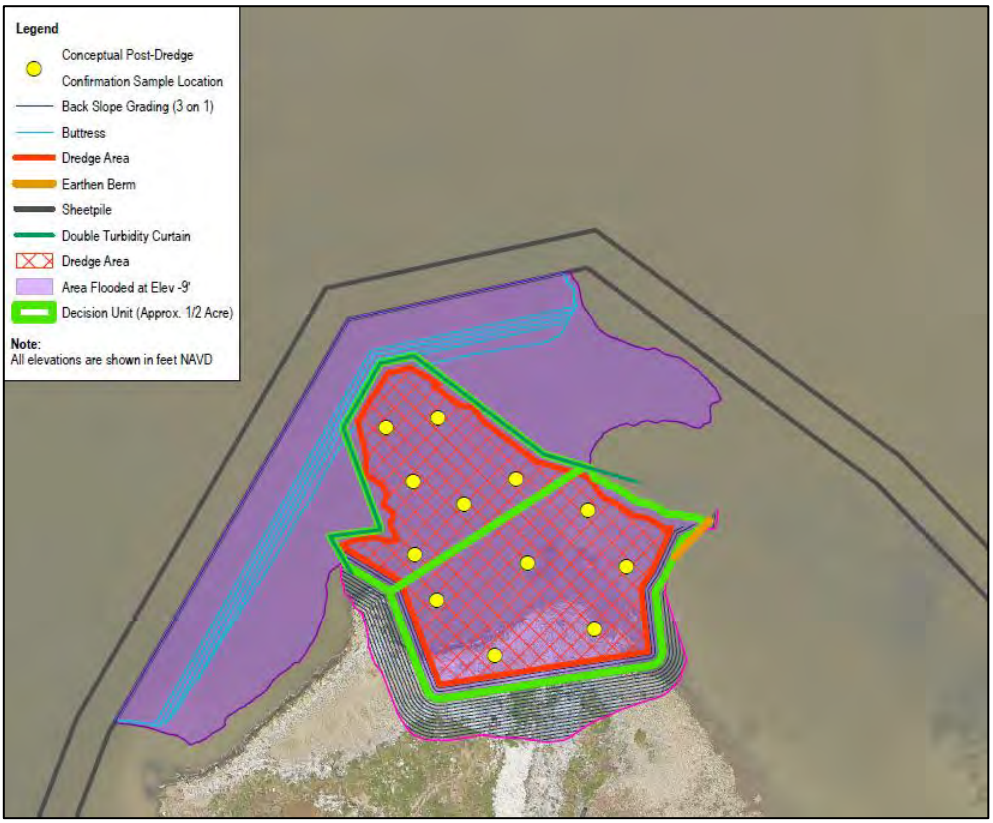

Figure 2.5 Conceptual Northwest Corner Post-Dredging Confirmation Sampling Locations

2.6.1 Sampling Procedures

2.6.1.1 Sample Collection and Compositing Procedures

At the completion of dredging activities to the target removal elevations across the northwest corner, the bottom 2 ft of the dredged area would be sampled.

To initiate the sampling, the sampling craft would be navigated to the approximate sampling location using GPS technology. The remedial contractor (RC) may decide to pre-mark the sampling locations with PVC markers. The sampling would likely be conducted from a standard support boat or airboat. Once positioned in the general area, the craft would be anchored or stabilized with spuds at the sample location, and samples would be collected. After sampling, the craft would be navigated using GPS technology to the next location. Sample location coordinates (longitude and latitude) would be recorded along with other pertinent information including water depth and time.

A 3-inch diameter aluminium or PVC sample sleeve would be used for collection of samples. The sample craft would be positioned over the sampling location and the sample core would then be pushed by hand through the sediment/soil to a depth of 24 inches or until refusal is met. The core sample would then be hoisted to the surface and the sediment/soil samples would be collected for analyses. An alternate collection method may be implemented for collection of soil samples depending on-site conditions at the time of sample collection. Any modification of field sample collection methods would be documented in the field logbook. The sampling cores would be transported to the shore where RC samplers would open the sample cores and identify the depth intervals within the core. The top 0 to 6 inches of each sample core would be excluded (as the settled residuals in this layer would be removed as part of the final pass). An approximately 6-ounce sample from the 6 to 12-inch interval from each discrete core sample would be placed into its own decontaminated stainless-steel bowl. Each 6-ounce discrete sample would then be thoroughly homogenized in that bowl using a clean trowel. Following homogenization, approximately 2 ounces from each of the six to eight discrete samples would then all be combined into one clean bowl for preparation of the composite sample. The combined soil would be thoroughly homogenized using a clean trowel. Following homogenization, approximately 4-ounce of the homogenized mixture would be placed into a laboratory-supplied sampling container, sealed, and labeled. Alternately, the RC may opt to have the Approved Laboratory (as defined in the Quality Assurance Project Plan [QAPP]) prepare the composite samples in the laboratory. In that case, all 6 ounces of the material from each discrete sample would be homogenized in the field and sent to the Approved Laboratory where a portion will be utilized for the composite sample. This process would be repeated to prepare a composite sample from the 12 to 24-inch depth interval in each DU. The sampling event would result in four composite samples - one composite sample from 6 to 12 inches and one composite sample from 12 to 24 inches from DU-1, and one composite sample from 6 to 12 inches and one composite sample from 12 to 24 inches from DU-2. Sample equipment would be decontaminated between samples, per Section 7.1.

Any remaining material not placed in sample containers would be added to the excavated material for off-site disposal. Samples are to be labeled, packed, and shipped as outlined in the procedures in Section 7.

2.6.1.2 Sample Analysis

Once at the Approved Laboratory, the composite samples would be tested iteratively. The Approved Laboratory would first analyze the 6 to 12-inch composite samples, and pending the results of that analysis, the Approved Laboratory may analyze the 12 to 24-inch sample, as described in Section 2.6.2, below. The samples would be analyzed for the analytical parameters listed in Table 2.2, pursuant to the United States Environmental Protection Agency (EPA) Test Methods for Evaluating Solid Waste: Physical/Chemical Methods (SW-846). Analytical test methods and quality assurance/quality control procedures (QA/QC) are outlined in the QAPP.

Table 2.2 Analytical Testing Method for Post-Dredging Confirmation Sampling

Analytical Parameters	Analytical Method[1]
Dioxins and Furans	SW-846 1613B

Note:
[1] EPA SW-846.

2.6.2 Data Analysis

Following laboratory analysis of the 6 to 12-inch composite sample, the result would be compared to the clean-up level. Results are to be evaluated, as described below. A flow-chart below (Figure 2.3) provides a summary of the evaluation procedures.

- If the result of the 6 to 12-inch composite sample is below the clean-up level, a 6-inch overcut will be performed in that DU to serve as a final pass and remove any settled residuals.
- If the result of the 6 to 12-inch composite sample is above the clean-up level, the 12 to 24-inch composite sample that the Approved Laboratory is holding will be analyzed.
- If the result of the 12 to 24-inch composite sample is below the clean-up level, a 12-inch overcut will be performed in that DU to remove the remaining inventory and any settled residuals.
- If the result of the 12 to 24-inch composite sample is above the clean-up level, a 24-inch overcut will be performed in that DU to remove the remaining inventory and any settled residuals.

As the result of three pre-design investigations, there is an extensive dataset to give confidence in the horizontal and vertical delineation of impacted area in the Northern Impoundment. Even still, as is the case in the remainder of the impoundment, the BMP around the northwest corner has been designed to allow for the removal of up to an additional 2-ft of material. In addition, in the northwest corner, as waste material is removed, makeup water must be added to offset the weight of the removed material. A water elevation of -9 feet North American Vertical Datum of 1988 (ft NAVD88) is sufficient to compensate for removal of waste material to the identified target excavation elevations based on the existing dataset that include a maximum excavation of -28 ft NAVD88 plus an additional 2-ft overcut if necessary. If additional dredging passes are required to remove deeper material, the water level would have to be raised proportionately to offset the deeper removal. If more than 2 ft of additional removal were to be required, a larger area of the Northern Impoundment would become flooded, increasing the potential spread of impacted residuals and/or contact water. Further, due to a very tight schedule for the seasonal dredging in the northwest corner, only one round of sampling, analysis, and over-excavation would likely be possible.

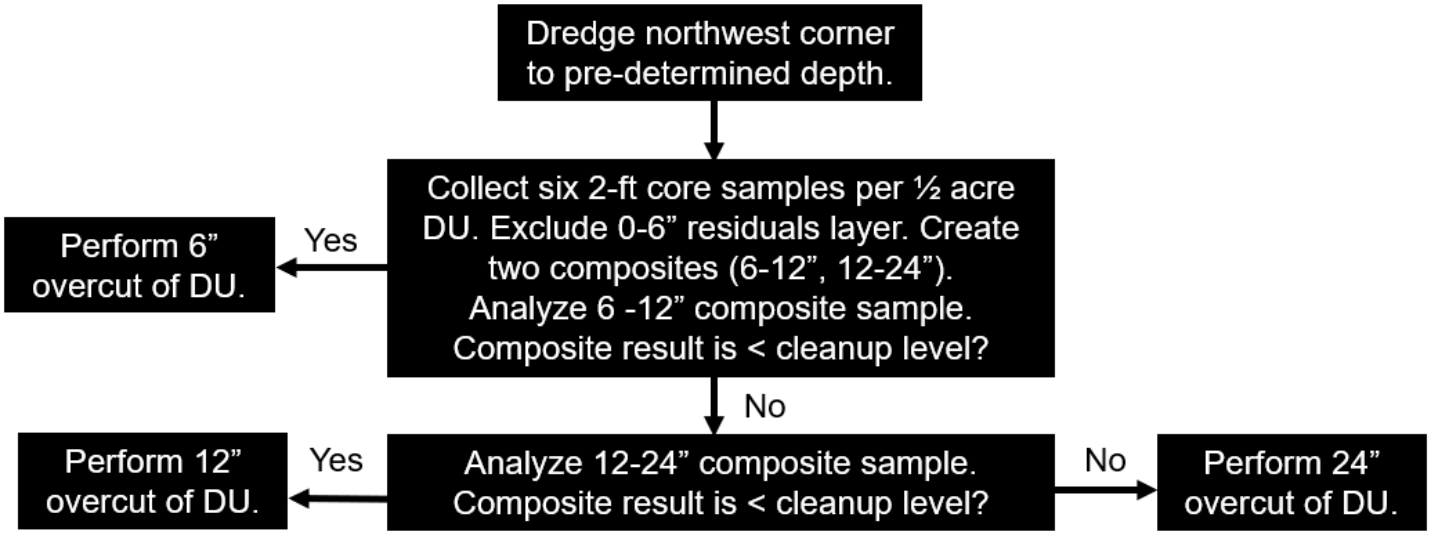

Figure 2.6 Post-Dredging Confirmation Sampling Decision Flow Chart

6. Investigation Derived Wastes

7. Equipment, Decontamination, Sample Labeling, Packing, and Shipping

7.1 List of Equipment Needed

7.1.1 Confirmatory and Source Material Sampling Equipment

7.1.2 Water Sampling Equipment

7.2 Decontamination of Sampling Equipment

7.3 Sample Labeling

7.4 Sample Packing and Shipping

8. References

– GHD, 2021. *Hydraulic Heave Analysis*, San Jacinto River Waste Pits Superfund Site. Prepared for McGinnes Industrial Maintenance Corporation, International Paper Company, and U.S. Environmental Protection Agency, Region 6. December 10, 2021


GHD

Attachment 6-B - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Northwest Corner (Dredging)

Provided As Part of Pre-Final 90% Remedial Design - Northern Impoundment (Northwest Corner Component)
San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company
McGinnes Industrial Maintenance Corporation

November 8, 2022

Contents

Table index

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
A. Temporary Traffic Control				
• Traffic Control	• Has a Temporary Traffic Control Plan been provided as specified?	• Check Section 01 35 00	• Continuous	• Temporary Traffic Control Plan
• Traffic Control Devices	• Have signs been inspected for legibility, damage, suitability, and location? • Are signs clean, repaired, or replaced to maintain clarity and reflectiveness?	• Check Section 01 35 00	• Continuous	• None
B. Health and Safety				
• Health and Safety Planning	• Are health and safety procedures in place, including equipment, work area and excavation inspections?	• Check Section 1 35 29	• Continuous	• Health and Safety Plan
C. Temporary Facilities and Controls				
• Utilities	• Have utilities been provided as specified and coordinated with local utility providers?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Construction Facilities	• Have temporary construction facilities been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Vehicular Access and Parking	• Has vehicular access and parking been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Barriers and Enclosures	• Have barriers and enclosures been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
• Temporary Controls	• Have temporary controls been provided as specified?	• Check Section 01 50 00 • Visual	• Periodic during installation	• None
D. Temporary Soil Erosion and Sediment Control				
• Erosion Control Items	• Is depth of silt fence embedment in accordance with drawings?	• Visual & check drawings	• Continuous	• Soil Erosion & Sediment Control Plan
	• Are tears or holes present in silt fence fabric?	• Visual	• Continuous	• Product Data
	• Is erosion around and under silt fence present?	• Visual	• Continuous	• None
	• Is sagging or collapse evident?	• Visual	• Continuous	• None
	• Has a Soil Erosion and Sediment Control Plan been provided as specified?	• Check permit	• Continuous	• Soil Erosion and Sediment Control Plan
E. Waste Material Solidification				
• Waste Material Solidification	• Has waste material been dewatered and solidified as specified?	• Check Section 02 55 13	• Continuous	• Solidification Plan • Daily Field Installation Reports • Quality Assurance/Quality Control Plan

Table 1

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

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
G. Material Handling and Transportation				
• Material Handling and On-Site Transportation	• Has a Material Handling and On-Site Transportation Plan been provided as specified?	• Check Section 02 61 14	• Continuous	• Material Handling and On-Site Transportation Plan
G. Transportation and Disposal				
• Disposal Equipment	• Is equipment provided as specified?	• Check Section 02 61 16	• Upon delivery	• Operating licenses and permits
	• Is equipment being decontaminated properly?	• Check Section 02 61 16	• Prior to leaving Site and changing to lower impacted waste type	• Transportation and Disposal Plan
	• Are vehicles maintained properly in accordance with 49 CFR 393?	• Visual	• Daily (Periodically)	• Transportation and Disposal Plan
	• Do motor vehicle operator(s) perform a safety inspection of each motor vehicle before it is used and at least once a day?	• Visual	• Continuous	• None
• Disposal of Materials	• Has a Transportation and Disposal Plan been provided as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Plan
	• Has a Transportation Emergency Response Plan been provided as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Plan
	• Are materials transported and disposed of to satisfy requirements as specified?	• Check Section 02 61 16	• Continuous	• Transportation and Disposal Proposal • Shipping and Disposal Documents • TSDF Weigh Scale documents
	• Are trucks inspected prior to leaving the Site to transport for disposal at approved TSDFs?	• Visual	• Continuous	• Shipping and Disposal Documents
H. Excavation				
• Excavation Equipment	• Is equipment inspected daily by a qualified person?	• Visual	• Continuous	• Excavation Plan
• Sediment/Soil	• Are excavations being conducted as specified?	• Check Section 31 23 16 and Drawings • Visual	• Periodic during excavation	• Excavation Plan
• Material Handling and Stockpiling	• Is material being handled and stockpiled as specified?	• Check Section 31 23 16 • Visual	• During excavation and stockpiling	• Material Handling and On-Site Transportation Plan
	• Is load packaged, labelled etc. as specified?	• Check Section 31 23 16	• After loading and before leaving Site	• Material Handling and On-Site Transportation
I. Dewatering				
• Dewatering Equipment	• Does equipment meet specifications?	• Check Section 31 23 19 • Visual	• Upon delivery	• Dewatering Plan
	• Has system been installed as specified?	• Check Section 31 23 19 and Drawings	• Periodic during installation	• Dewatering Plan
	• Has equipment and surplus raw materials been removed?	• Visual	• Daily as required	• Dewatering Plan

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
I. Dewatering (cont'd)				
• Sediment/Soil Dewatering	• Is dewatering procedure adequate to contain impacted groundwater?	• Check Section 31 23 19 • Visual	• Periodic during operation	• Dewatering Plan
	• Is material being dewatered as specified?	• Check Section 31 23 19 • Visual	• During staging	• Dewatering Plan
• Sediment/Soil Dewatering (cont'd)	• Is settlement being detected where critical structures or facilities exist immediately adjacent to areas of proposed dewatering.	• Check Section 31 23 19 • Visual	• Periodic during operation	• None
J. Fill				
• Existing Berm Material	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Fill for Between Sheet Pile Walls	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Structural Fill	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results • Analytical data • Product data
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Common Fill	• Does fill meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results • Analytical data • Product data
	• Has fill been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Sand	• Does sand meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of sand	• Geotechnical testing results • Analytical data • Product data
	• Has sand been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Topsoil	• Does topsoil meet specifications?	• Check Section 31 23 23 • Visual	• Each source of topsoil	• Geotechnical testing results • Analytical data • Product data

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
J. Fill (cont'd)				
• Coarse Aggregate	• Does aggregate meet specifications?	• Check Section 21 23 23	• Each source of aggregate	• Source of aggregate • Geotechnical data • Samples • Suppliers' Certificates
	• Has aggregate been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of excavation and thickness measurements
• Clearstone	• Does clearstone meet specifications?	• Check Section 31 23 23 • Visual	• Each source of clearstone	• Geotechnical testing results • Analytical data • Product data
• Backfilling Excavations	• Are excavations being backfilled as specified?	• Check Section 31 23 23 and Drawings	• During backfilling	• Geotechnical data • Survey
	• Has horizontal and vertical control been maintained?	• Check Section 31 23 23 • Visual	• After placement	• Analytical results • Test reports
K. Synthetic Materials				
• Materials	• Do materials provided meet specifications?	• Check Section 31 35 26.16	• Each source of geotextile and geomembrane (liner)	• Product data • Manufacture's instructions • Samples
	• Are materials being stored properly?	• Visual	• Upon delivery to Site	• Manufacturer's instructions
• Installation	• Have materials been placed as specified?	• Visual • Survey	• Periodic during installation	• Manufacturer's instructions
	• Are there any visible defects with materials?	• Visual	• After installation is completed	• None
L. Riprap				
• Materials	• Do materials provided meet specifications?	• Check Section 31 37 00	• prior to delivery	• Source Quality Control testing
• Installation	• Have materials been placed to the proper location and depth	• Survey	• Continuous during work	• None
M. Sheet Piles				
• Materials	• Do materials provided meet specifications?	• Check Section 31 41 16	• Upon delivery	• Product data • Mix Design • Test samples in accordance with AI MS-2 • Records
• Installation	• Have sheet piles been inspected prior to and after installation?	• Check Section 31 41 16 and Drawings	• After installation	• Records
	• Have sheet piles been installed as specified?	• Check Section 31 41 16 and Drawings	• After installation	• Certifications

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
N. Chain Link Fences and Gates				
• Materials	• Do materials provided meet specifications?	• Check Section 32 31 13	• Upon delivery	• Product data • Manufacture's instructions
• Installation	• Have chain link fences and gates been installed as specified?	• Check Section 32 31 13 and s Drawings	• After installation	• Certifications
	• Has a final inspection taken place?	• Check Section 32 31 13 and Drawings	• Upon Substantial Performance	• Records
O. Seeding				
• Topsoil Placement	• Has topsoil been placed as specified?	• Check Section 31 23 23 • Visual	• Periodic during placement	• None
	• Has topsoil been lightly surface compacted following seeding?	• Visual	• Periodic following seeding	• None
	• Horizontal and vertical control	• Visual • Survey	• Following placement	• Survey
• Seeding	• Are materials stored properly?	• Visual	• Periodic during storage	• Manufacturer's instructions
	• Does seed, lime, fertilizer, and mulch meet specifications?	• Check Section 32 92 19	• Prior to application	• Source of materials • Product data
	• Has hydroseed, fertilizer, and mulch been applied as specified?	• Check Section 32 93 00 • Visual	• Periodic during application	• Seeding and Erosion Control Plan
	• Have correct quantities of hydroseed, fertilizer, and mulch been placed?	• Check Section 32 93 00 • Visual	• Periodic during placement	• Seed certificates • Fertilizer certificates
	• Have bare spots been rehydroseeded?	• Visual	• Periodic during installation	• None
	• Is height of grass as specified?	• Check Section 32 93 00	• Periodically during maintenance	• None
P. Dredging				
• Submittals	• Has Dredge Operation Plan been provided as specified?	• Check Section 35 25 00	• Continuous	• Dredge Operation Plan
	• Has Water Quality Monitoring and Control Plan been provided as specified?	• Check Section 35 25 00	• Continuous	• Water Quality Monitoring and Control Plan
	• Has Chemical Additives Dosing Plan been provided as specified?	• Check Section 35 25 00	• Continuous	• Chemical Additives Dosing Plan
• Granular Material	• Does granular material meet specifications?	• Check Section 31 23 23 and Drawings	• Each source of fill	• Geotechnical testing results
• Placement	• Has granular material been placed as specified?	• Visual • Survey	• Periodic during installation	• Limits of placement and thickness measurements

Table 1

Summary of Construction Quality Assurance and Quality Control Inspections
Northern Impoundment Remediation
San Jacinto River Waste Pits Site
Harris County, Texas

Key Work Task Component to be Inspected	Key Items to be Checked During Inspection	Type of Inspection	*Frequency of Inspection	Contractor Submittals to Resident Engineer
Q. Turbidity Curtain				
• Material	• Have materials been joint inspected upon delivery?	• Visual	• Upon delivery to Work Site	• None
	• Are materials being stored properly?	• Visual	• Periodic during storage	• Manufacturer's instructions
	• Do materials meet specifications?	• Check Section 31 05 19 • Check material property sheets and quality control certificates	• Each source of geotextile • Upon delivery to Work Site	• Product data • Manufacturer's certificates • Samples
• Placement	• Have materials been placed as specified?	• Visual • Survey	• Periodic during installation	• Manufacturer's instructions
	• Are there any visible defects, tears or overlaps with materials?	• Visual	• After installation is completed	• None
R. Process Equipment				
• Materials	• Do materials provided meet specifications?	• Check Division 40 Sections	• Upon delivery	• Product data • Shop drawings • Certifications and Reports
• Installation	• Has process equipment been installed as specified?	• Check Division 40 Sections and Drawings	• After installation	• Records
	• Has a final inspection taken place?	• Check Division 40 Sections and Drawings	• Upon Substantial Performance	• Records
R. Wastewater Treatment System				
• Materials	• Do materials provided meet specifications?	• Check Section 46 07 01	• Upon delivery	• Product data • Shop drawings • Certifications and Reports
• Installation	• Has process equipment been installed as specified?	• Check Section 46 07 01 and Drawings	• After installation	• Records
	• Has a final inspection taken place?	• Check Section 46 07 01	• Upon Substantial Performance	• Records

Notes:
*Frequencies of inspections are considered minimum and will be increased or added to as determined necessary by the Engineer.
1. The quality assurance/quality control inspections included herein are suggested in accordance with the technical specifications.
2. New or updated information is indicated by black font.

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
A. Health and Safety (Section 01 00 00)									
• Reportable Quantities	• Identification of hazardous chemicals	• State accredited method	• Throughout the Works	• In accordance with State accredited criteria	• As determined by Engineer	• See Section 01 35 29	• On Site	• 50	• 50
B. Waste Material Sonification (Section 02 55 13)									
• Waste Material Solidification	• In accordance with accepted QA/QC Plan	• State accredited method	• Throughout the Works	• In accordance with State accredited criteria	• As determined by Engineer	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
C. Geotextiles for Earthwork (Section 31 05 19.13)									
• Geotextile G1									
Material	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• 220	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 50	• As above	• As above	• As above	• 100	• 0
	• Static CBR Puncture	• ASTM D4632/D4632M	• See standard	• 575	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 90	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 80	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 1.26	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.30	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 95	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Geotextile G2									
Material	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• 320	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 50	• As above	• As above	• As above	• 100	• 0
	• Static CBR Puncture	• ASTM D4632/D4632M	• See standard	• 900	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 125	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 100	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 0.80	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.29	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 60	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
• Geotextile G3									
Material	• Tensile Strength @ 2% strain (MD)	• ASTM D4595	• See standard	• 720 (typical) 600 MARV	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Tensile Strength @ 2% strain (CD)	• ASTM D4595	• See standard	• 1200 (typical) 1020 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Tensile Strength @ 5% strain (MD)	• ASTM D4595	• See standard	• 2100 (typical) 1800 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Tensile Strength @ 5% strain (CD)	• ASTM D4595	• See standard	• 2580 (typical) 2256 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 50 (typical) 40 (MARV)	• Minimum once every month	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 1.2 (typical) 0.9 (MARV)	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 85 (typical) 75 (MARV)	• As above	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
	• Pore Size	• ASTM D6767	• See standard	• 85 (typical) 75 (MARV)	• Minimum once every 100,000 sq ft	• As above	• As above	• 100	• 0
	• Interaction Coefficient	• ASTM D6706	• See standard	• 0.89	• As above	• As above	• As above	• 100	• 0
	• Factory Sewn Seam	• ASTM D4884.D4884M	• See standard	• 2700	• As above	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
D. Fill (Section 31 23 23)									
• Existing Berm Material	• Particle Size	• ASTM D6913/D6913M and D7928	• Minimum 1 test per 2,500 cu yd (clay)	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
Material	• Soil Classification	• ASTM D2487	• Minimum 1 test per 2,500 cu yd (clay)	• Any except poorly graded and except CH, MH, OL, and OH	• As above	• As above	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List.	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
	Parameter	*Methods*							
	TAL[3] Metals	SW-846 6020A/7471A							
	Hexavalent Chromium	SW-846 7196A							
	Cyanide	SW-846 9010/9012							
	TCL[2] Volatiles	SW-846 8260B							
	TCL Semi-Volatiles	SW-846 8270D							
	TCL Pesticides	SW-846 8081B							
	Polychlorinated Biphenyls	SW-846 8082A							
	Herbicides	SW-846 8151A							

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
0. Fill (Section 31 23 23) cont'd									
• Aggregate Types A1 and A2 (Course Aggregate and Clear Stone) *Material*	• Grain Size	• ASTM C117, C136/C136M, and D6913/D6913M	• Minimum 1 test per 1,000 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Soil Type S1 and S2 (Fill Between Sheet Pile Walls and Structural Fill) *Material*	• Particle Size	• ASTM D6913/D6913M and D7928	• Minimum 1 test per 2,500 cu yd (clay)	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Soil Classification	• ASTM D2487	• Minimum 1 test per 2,500 cu yd (clay)	• Any except poorly graded and except CH, MH, OL, and OH	• As above	• As above	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Soil Type S3 (Common Fill) and Sand	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
• Imported Topsoil *Material*	• Particle Size	• ASTM D422	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• pH	• ASTM D4972	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard	• Sample size per ASTM	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Organic Content	• ASTM D2974	• Minimum 1 test per 2,500 cu yd	• Per ASTM standard					
	• Phosphorus, potassium, calcium, and magnesium	• In accordance with State accredited criteria	• Minimum 1 test per 2,500 cu yd						
	• Chemical Analysis *Parameter* TAL[3] Metals Hexavalent Chromium Cyanide TCL[2] Volatiles TCL Semi-Volatiles TCL Pesticides Polychlorinated Biphenyls Herbicides	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List. *Methods* SW-846 6020A/7471A SW-846 7196A SW-846 9010/9012 SW-846 8260B SW-846 8270D SW-846 8081B SW-846 8082A SW-846 8151A	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0

Table 2

Summary of Construction Quality Assurance and Quality Control Tests
Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
5. Fill (Section 31 23 23) cont'd									
• Imported Common Fill, Topsoil and Aggregate *Placement*	• Particle Size Analysis	• ASTM DD6913/D6913M and ASTM D7928 or ASTM C117 and ASTM C136	• Minimum 1 test per source	• Per ASTM standard	• Sample size per ASTM	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
8. Geomembranes (Section 31 05 20)									
• LLDPE Liner *Material*	• Thickness	• ASTM D5199	• As above	• nominal 60 mil • lowest individual of 10 values (-10% or 54 mil)	• As per GRI GM 17	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 0	• 0
	• Formulated Density	• ASTM D1505/D792	• As above	• 0.939 g/cu cm MARV *	• As above	• As above	• As above	• 0	• 0
	• Break Strength	• ASTM D6693, Type IV	• As above	• 152 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• Break Elongation	• ASTM D6693, Type IV	• As above	• 800 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• 2% Modulus (max.)	• ASTM D1004	• As above	• 2400 pounds per inch	• As above	• As above	• As above	• 0	• 0
	• Tear resistance	• ASTM D1004	• As above	• 22 pounds	• As above	• As above	• As above	• 0	• 0
	• Puncturing resistance	• ASTM D4833/D4833M	• As above	• 56 pounds	• As above	• As above	• As above	• 0	• 0
	• Carbon Black Content	• ASTM D5596	• As above	• 2 to 3 percent	• As above	• As above	• As above	• 0	• 0
	• Oxidation Induction Time Standard High Pressure	• ASTM D8117 • ASTM D5885/D5885M	• As above • As above	• 100 minutes • 400 minutes	• As above • As above	• As above • As above	• As above • As above	• 0 • 0	• 0 • 0
	• Oven Aging at 85 degrees Celsius Standard High Pressure	• ASTM D5721 and ASTM D8117 • ASTM D5885/D5885M	• As above • As above	• 35 percent • 60 percent	• As above • As above	• As above • As above	• As above • As above	• 0 • 0	• 0 • 0
	• UV Resistance	• ASTM D7238 and D5885/D5885M	• As above	• 2 to 3 percent	• As above	• As above	• As above	• 0	• 0
Installation	• Seam shear test on test seam	• Field tensiometer	• Minimum 2 times per day for each seaming equipment. Minimum once per day per seamer.	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample coupons to be 1 inch wide, collected from test seam	• See Section 31 05 20, Article 3.7	• On Site	• 100	• Engineer will observe Contractor QC Tests
	• Seam peel test on test seam	• Field tensiometer	• Minimum 2 times per day for each seaming equipment. Minimum once per day per seamer.	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• On Site	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam shear test	• Field tensiometer	• Minimum 1 test per approximately 500 L.F. of production seam or at least one per seam	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• As above	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam peel test	• Field tensiometer	• Minimum 1 test per approximately 500 L.F. of production seam or at least one per seam	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• As above.	• See Section 31 05 20	• As above	• 100	• Engineer will observe Contractor QC Tests
	• Non-destructive pressure test	• Pressure test GRI Test Method GM6	• 100% of production seams	• Pressurize air channel to between a min. 20 psi and max. 30psi • Maintain pressure for a 2 minute stabilization period • Maximum allowable pressure drop is 4 psi over 2 minutes	• 100% of production seams	• See Section 31 05 20	• In-place	• 100	• Engineer will observe Contractor QC Tests
	• Destructive seam shear test (if field test acceptable)	• ASTM D4437 (Mod.) per NSF Std. 54	• Minimum one test per approximately 500 L.F. of production seam or at least one per seam	• 1,200 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample size per ASTM. Sample locations on fixed 500-foot increments; possible intermediate locations	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
	• Destructive seam peel test (if field test acceptable)	• ASTM D4437 (Mod.) per NSF Std. 54	• Minimum one test per approximately 500 L.F. of production seam or at least one per seam	• 1,000 psi minimum strength and seam must not delaminate. Four of 5 replicate samples must pass. *	• Sample size per ASTM. Sample locations on fixed 500-foot increments; possible	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
9. Riprap (Section 31 37 00)									
6. Riprap (Section 31 37 00) *Material*									
	• Gradation Testing	• per spec & OPSS.PROV 1004	• As per specification	• Per ASTM standard	• 1 sample per stone type	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
	• Bulk Specific Gravity	• ASTM C127	• As per specification	• Per ASTM standard	• 1 sample per stone type	• See Section 31 05 20	• Geosynthetic laboratory	• 0	• 100
3. Sheet Piles (Section 31 41 16)									
• Sheet Piles *Material*	• Material Testing	• ASTM A6/A6M	• See standard	• Per ASTM standard	• Sample size per ASTM	• Per ASTM standard	• Per ASTM standard	• 100	• 0

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Harris County, Texas

Work Task Component to be Tested	Type of Test	Standard	Frequency of Tests per Construction Specifications	Key Acceptance Criteria	Sample Size/Location	Potential Corrective Measures	Test Location	Percentage of Test Frequency by Contractor	Percentage of Test Frequency by Engineer
I. Seeding (Section 32 92 19)									
• Seed									
Material									
	• Nitrogen	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Phosphorus	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Potash	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Soluble Salt Content	• per spec	• As per specification	• Per ASTM standard	• 1 sample per source	• As per specification	• Per ASTM standard	• 100	• 0
	• Organic Matter Content	• ASTM D2974	• As per specification	• Per ASTM standard	• 1 sample per source	• 2% to 10%	• Per ASTM standard	• 100	• 0
	• Acidity Range (pH)	• ASTM D4972	• As per specification	• Per ASTM standard	• 1 sample per source	• 5.5 to 7.5	• Per ASTM standard	• 100	• 0
	• Clay	• ASTM D2487	• As per specification	• Per ASTM standard	• 1 sample per source	• 10% to 15%	• Per ASTM standard	• 100	• 0
	• Lime	• ASTM DC602	• As per specification	• Per ASTM standard	• 1 sample per source	• 80% calcium carbonate (min.)	• Per ASTM standard	• 100	• 0
I. Turbidity Curtain (Section 35 49 25)									
• Geosynthetics									
Material									
	• Tensile Strength	• ASTM D4632/D4632M	• See standard	• (Wrap) 350, (Fill) 250	• Minimum once every 100,000 sq ft	• Removal, reinstallation and re-testing	• Analytical Laboratory	• 100	• 0
	• Elongation at Break	• ASTM D4632/D4632M	• See standard	• 34	• As above	• As above	• As above	• 100	• 0
	• Mullen Burst Strength	• ASTM D3786/D3786M	• See standard	• 510	• As above	• As above	• As above	• 100	• 0
	• Trapezoid Tear Strength	• ASTM D4533	• See standard	• 65	• As above	• As above	• As above	• 100	• 0
	• Puncture Strength	• ASTM D4833/D4833M	• See standard	• 140	• As above	• As above	• As above	• 100	• 0
	• Permittivity	• ASTM D4491	• See standard	• 0.04	• As above	• As above	• As above	• 100	• 0
	• Permeability	• ASTM D4491	• See standard	• 0.01	• As above	• As above	• As above	• 100	• 0
	• Water Flow Rate	• ASTM D4491	• See standard	• 5	• As above	• As above	• As above	• 100	• 0
	• Apparent Opening Size (AOS)	• ASTM D4751	• Once per month minimum	• 70	• Minimum once every month	• As above	• As above	• 100	• 0
	• Ultra Violet Resistance	• ASTM D4355	• Once per month minimum	• 80/500	• As above	• As above	• As above	• 100	• 0
Installation	• Conformance Testing	• ASTM D4354	• See standard	• In accordance with State accredited criteria	• Minimum once every 100,000 sq ft	• As above	• As above	• 50	• 50
	• Acceptance Testing	• ASTM D4759	• See standard	• In accordance with State accredited criteria	• As above	• As above	• As above	• 50	• 50
J. Dredging (Section 35 25 00)									
• Residual Management Layer (Granular Material)									
Material	• Grain Size	• 70 to 80 percent sand between No. 30 and No. 200 sieve sizes • 20 to 30 percent fines (passing No. 200 sieve)	• Minimum 1 test per 1,000 cu yd	• Per ASTM standard	• Sample size per ASTM collected at source	• Locate suitable material and re-test	• Analytical Laboratory	• 100	• 0
	• Chemical Analysis	• (1) EPA SW 846. (2) TCL: Target Compound List. (3) TAL: Target Analyte List.	• Minimum 1 test per source	• In accordance with State accredited criteria	• Sample collected from stockpile at source	• As above	• Analytical Laboratory	• 100	• 0
	Parameter	*Methods*							
	TAL[3] Metals	SW-846 6020A/7471A							
	Hexavalent Chromium	SW-846 7196A							
	Cyanide	SW-846 9010/9012							
	TCL[2] Volatiles	SW-846 8260B							
	TCL Semi-Volatiles	SW-846 8270D							
	TCL Pesticides	SW-846 8081B							
	Polychlorinated Biphenyls	SW-846 8082A							
	Herbicides	SW-846 8151A							

Notes:
* Minimum criteria, unless identified otherwise.
1. The quality assurance/quality control tests included herein are suggested in accordance with the technical specifications.
2. New or updated information is indicated by black font.
MARV = Minimum Average Roll Value
AI = Asphalt Institute
ASTM = ASTM International


GHD


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