11451 Katy Freeway, Suite 400
Houston, Texas 77079
United States
www.GHD.com

Our Ref.: 11215702-Appelt-24

November 25, 2024

Mr. Robert Appelt
Environmental Protection Agency Remedial Project Manager
1201 Elm Street, Suite 500
Dallas, Texas 75270

Revised Final (100%) Remedial Design - Northern Impoundment Deliverables Submittal

Dear Mr. Appelt:

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 Revised Final (Revised 100%) Remedial Design - Northern Impoundment (Northern Impoundment Revised 100% RD) for the Northern Impoundment of the San Jacinto River Waste Pits Superfund Site, located in Harris County, Texas.

On October 25, 2024, EPA provided a response to the Final (100%) Remedial Design - Northern Impoundment (Northern Impoundment 100% RD) in a letter to the Respondents titled Comments on Final 100% Remedial Design – Northern Impoundment San Jacinto River Waste Pits Site (October 25 Letter). The complete Northern Impoundment Revised 100% RD, in accordance with the October 25 Letter, is hereby being submitted. As part of this submittal, a Response to Comments is provided as Table 1-1. Should you have any questions or require additional information regarding this submittal, please don’t hesitate to contact GHD at (832) 380-7655.

Regards,

GHD

Charles W. Munce, P.E.
(832) 380-7655
Charles.Munce@GHD.com

Leander J. Lavergne, III
(225) 292-9007
Lee.Lavergne@GHD.com

LJL/kdn/24

Encl.: Revised Final 100% Remedial Design (Revised 100% RD) – Northern Impoundment

Copy to: Katie Delbecq, Texas Commission on Environmental Quality (TCEQ)
Brent Sasser, IPC
Judy Armour, MIMC

100032256

Revised Final 100% Remedial Design - Northern Impoundment

San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company &
McGinnes Industrial Maintenance Corporation

November 25, 2024

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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
FHWA		Federal Highway Administration
FRP		Fiberglass Reinforced Polymer
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
HWPP	-	High-Water Preparedness Plan
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
NI		Northern Impoundment
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
PPV		Peak Particle Velocity
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
RML		Residual Management Layer
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
WEAP		Wave Equation Analysis of Pile Driving
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

1. Introduction

GHD Services Inc. (GHD), on behalf of International Paper Company (IPC) and McGinnes Industrial Maintenance Corporation (MIMC; collectively referred to herein as the Respondents), submits to the United States Environmental Protection Agency (EPA) this *Revised Final 100% Remedial Design - Northern Impoundment* (Revised 100% RD) for the Northern Impoundment (NI) of the San Jacinto River Waste Pits Site in Harris County, Texas (Site). References in this Revised 100% RD to the "work site" are to the Northern Impoundment, the Texas Department of Transportation (TxDOT) right of way (ROW) that provides the only means of land access to the Northern Impoundment, and the associated locations to be used for staging, office trailers and activities such as wastewater treatment. This Revised 100% 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 (EPA, 2018a). The AOC includes a Statement of Work (SOW) that provides for a 100% RD for the Northern Impoundment to be submitted to the EPA. The *Preliminary 90% Remedial Design - Northern Impoundment* (GHD, 2022f), the *Preliminary 90% Remedial Design - Northern Impoundment (Northwest Corner Component)* (NW Corner Addendum) (GHD, 2022g) (collectively, the 90% RD) were submitted on June 27, 2022 and November 8, 2022, and the *Final 100% Remedial Design - Northern Impoundment (100% RD)* was submitted on July 17, 2024 (GHD, 2024b). Comments on the 100% RD (Comments) were received in a letter dated October 25, 2024 (October 25 Letter; EPA, 2024c), and have been addressed in this Revised 100% RD and in accordance with the schedule contained in the Comments.

In a January 5, 2024 letter (January 5 Letter; EPA 2024a) titled Notification of Serious Deficiency, the EPA notified Respondents that it deemed there to be deficiencies in the 90% RD and requested that they submit a plan within 20 days to address such deficiencies. The Respondents, while disputing EPA's claims of deficiencies in the 90% RD, submitted a plan in response to the January 5 Letter in a letter dated January 25, 2024 (January 25 Letter; IPC and MIMC 2024a), which they supplemented with additional submissions dated March 28, 2024, and April 3, 2024.

The EPA then provided comments on the 90% RD in a letter dated April 18, 2024, (April 18 Letter; EPA, 2024c). The comments included EPA's comments on the 90% RD and comments from all relevant stakeholders and agencies. In the April 18 Letter, the EPA established a deliverable schedule of 30-days, 60-days, and 90-days for the Respondents' submissions to the EPA of a 100% RD. The Respondents subsequently made the 30-day, 60-day, and 90-day submissions to EPA, as required by the April 18 Letter.

The EPA then provided the Comments to the 100% RD in the October 25 Letter. The Comments included EPA's comments on the 100% RD and the comments from all relevant stakeholders and agencies. In the October 25 Letter, the EPA provided a 30-day deadline for submission of the Revised 100% RD.

The Respondents are submitting this Revised 100% RD in response to the Comments in the October 25 Letter. Further revisions of the Revised 100% RD are anticipated based on, among other things, resolution of issues related to use of the TxDOT ROW for purposes of the RA.

1.1 Background

The Site is located in Harris County, Texas, east of the City of Houston, between two unincorporated areas known as Channelview and Highlands. The vicinity of the Site is shown on Figure 1-1. In 1965 and 1966, pulp and paper mill waste was reportedly transported by barge from the Champion Paper, Inc. paper mill in Pasadena, Texas, and deposited in the Northern Impoundment. The Preliminary Site Perimeter established by EPA for the remedial investigation (RI) encompasses this impoundment and the surrounding in-water and upland areas of the San Jacinto River and is depicted on Figure 1-1. The Northern Impoundment is located immediately north of the I-10 Bridge over the San Jacinto River. An area referred to in the AOC as the Sand Separation Area (SSA; Figure 1-2) is located to the northwest of the Northern Impoundment.

The Northern Impoundment is shown on Figure 1-2. Beginning in 2010, a Time Critical Removal Action (TCRA) was implemented by the Respondents under an Administrative Order on Consent with EPA (Docket No. 06-12-10, April 2010; EPA, 2010). Construction elements of the TCRA included placement of a stabilizing geotextile barrier over the eastern side of the Northern Impoundment, construction of a low-permeability geomembrane and geotextile barrier on the western side of the Northern Impoundment, and placement of armored cap material over the entire Northern Impoundment. Additional background information regarding the Northern Impoundment is contained in the *Remedial Investigation Report* (RI Report; Integral and Anchor QEA, 2013b). In June 2019, approximately 40,000 square feet of articulated concrete block mat (ACBM) were installed along the northwestern submerged slope of the armored cap, as described in the *Northwest Slope Enhancement Completion Report*, submitted to the EPA on August 13, 2019 (Integral and Anchor QEA, 2019).

The remedy selected by the EPA for the Northern Impoundment described in the ROD (EPA, 2017) includes the following:

– Removal of a portion of the existing armored cap material installed as part of the TCRA armored cap.
– Removal of approximately 162,000 cubic yards (CY) of waste material exceeding the clean-up level of 30 nanograms per kilogram (ng/kg) 2,3,7,8-tetrachlorinated dibenzo-*p*-dioxin (TCDD) toxicity equivalent ($TEQ_{DF,M}$) that is located beneath the armored cap and its stabilization, as necessary to meet the appropriate requirements for acceptance at a permitted disposal facility.

The ROD also specifies that Institutional Controls (ICs) will be used to prevent disturbance (dredging and anchoring) in the SSA and that monitored natural recovery (MNR) will be the remedy used for the SSA.

The Remedial Action Objectives (RAOs) for the Site, as identified in the ROD, include:

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 potential exposure of a future young recreational fisher to dioxin and dioxin-like compounds in sediment, as detailed in the *Baseline Human Health Risk Assessment* (BHHRA; Integral and Anchor QEA, 2013a), was considered in selecting a risk-based clean-up level for the Northern Impoundment. The BHHRA assumed that the young recreational fisher could be exposed through chronic (39 days per year for 6 years) incidental ingestion and dermal contact of impacted sediment and through ingestion of fish collected in areas with impacted sediment. The risk-based clean-up level for the Northern Impoundment was calculated to be 30 ng/kg $TEQ_{DF,M}$.

1.2 Remedial Design Approach

As an introductory note, the EPA has required Respondents to develop a RD based on the remedy selected in the 2017 ROD for the Northern Impoundment. Prior to and during the RD process, the Respondents have raised with the EPA the magnitude of the risks associated with the selected remedy, including the fact that the remedy requires excavation on a “no release” basis to more than 28 feet below the river surface in a complex riverine environment subject to extreme high-water events during which overtopping of the BMP wall might occur. In light of that risk, the Respondents, after discussions with the EPA, proposed in their 30% RD and 90% RD submissions that work be limited to a six-month season that did not include the hurricane season. The 90% RD comments asked that the Respondents commit to extend the excavation season well into the hurricane season. The Respondents are prepared to extend the excavation season on the basis set forth below in Section 5.3.2, if directed by the EPA to do so.

In accordance with the AOC, the remedial design (RD) process includes the use of a Technical Working Group (TWG) to provide technical expertise in the development and evaluation of the RD plans. The TWG has considered the pre-design investigation (PDI), Supplemental Design Investigation (SDI), Treatability Study results, and Northern Impoundment RD elements presented in this document. The TWG consists of representatives from the EPA, Texas Commission on Environmental Quality (TCEQ), the United States Army Corps of Engineers (USACE), GHD, and other technical subject matter experts, as needed. TWG Meetings have been conducted a total of 25 times since the RD was initiated, including on April 30, 2018, May 14 to 15, 2018, May 30, 2018, June 13, 2018, May 3, 2019, December 17, 2019, January 27 to 28, 2020, February 19, 2020, March 25, 2020, April 22, 2020, July 29, 2020, November 12, 2020, December 15, 2020, February 4, 2021, March 10, 2021, April 19, 2021, June 4, 2021, August 5, 2021, August 30, 2021, October 19, 2021, November 16, 2021, December 14, 2021, March 10, 2022, March 25, 2022, and April 14, 2022.

In addition, during certain portions of the RD process, representatives from GHD and EPA conducted weekly meetings to discuss the ongoing design progress, key technical items, and decisions associated with these items.

With the exception of Monthly Progress Reports, a summary of the deliverables associated with the RD to-date are listed below:

– On June 8, 2018, the *Draft First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018a) was submitted to the EPA. The EPA provided comments and the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b) was submitted to the EPA on August 24, 2018. It was approved by the EPA on September 12, 2018 (EPA, 2018b). An Addendum to the First Phase Pre-Design Investigation Work Plan (Integral and Anchor QEA, 2018d) was submitted on October 18, 2018.
– On September 10, 2018, the *Draft Remedial Design Work Plan* (RDWP, Integral and Anchor QEA, 2018c) was submitted to the EPA and outlined plans for implementing the RD activities identified in the SOW. The EPA provided comments on the Draft RDWP on October 24, 2018. The *Remedial Design Work Plan* (Integral and Anchor QEA, 2018e) was submitted to the EPA on December 24, 2018.
– On December 7, 2018, a letter was submitted to the EPA (GHD, 2018) requesting a 48-day extension of the deadline for submittal of the *Draft Second Phase Pre-Design Investigation Work Plan* to allow time for the results from the First Phase Pre-Design Investigation (PDI-1) to be evaluated and incorporated. This extension request was approved by the EPA on December 18, 2018 (EPA, 2018c), effectively extending the date for all subsequent RD submittals.
– On February 11, 2019, the *Draft Second Phase Pre-Design Investigation Work Plan* (GHD, 2019a) was submitted to the EPA. The EPA provided comments to the work plan on April 18, 2019 (EPA, 2019a). On June 3, 2019, the *Final Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d) was submitted to the EPA and approved by the EPA in written correspondence dated August 8, 2019 (EPA, 2019c).
– On February 11, 2019, the *Draft Treatability Study Work Plan* (GHD, 2019b) was submitted to the EPA. The EPA provided comments to the work plan on April 18, 2019 (EPA, 2019b). On May 20, 2019, the *Final Treatability Study Work Plan,* (GHD, 2019c) was submitted to the EPA and approved in written correspondence dated August 27, 2019 (EPA, 2019d).
– On September 27, 2019, a letter was submitted to the EPA (GHD, 2019e) requesting an extension to the deadline for both the 30% RD for the Northern and Southern Impoundments in response to a *force majeure* event caused by Tropical Storm Imelda, which caused significant flooding at the Northern Impoundment and the surrounding area beginning on September 17, 2019, and delayed the completion of field work related to the Second Phase PDI (PDI-2) from September 17 to October 7, 2019. In a letter dated October 30, 2019 (EPA, 2019f), the EPA approved a 24-day delay due to the *force majeure* event and an extension to the deadlines for submittal of the 30% RD for both the Northern Impoundment and the Southern Impoundment.
– On May 28, 2020, the 30% RD was submitted to the EPA. The EPA provided Comments on July 16, 2020 (EPA, 2020f).
– On August 21, 2020, a letter was submitted to the EPA (GHD, 2020e) requesting a 160-day extension of the November 13, 2020, deadline for submitting the 90% RD to April 22, 2021, to allow time to determine if significant constructability concerns raised in the 30% RD could be resolved and to obtain additional information about plans

being developed by other agencies. The extension was approved by the EPA in a letter dated September 10, 2020 (EPA, 2020g).

- On February 3, 2021, a letter was submitted to the EPA (GHD, 2021a) requesting a 270-day extension of the deadline for the 90% RD to January 17, 2022, to allow time to conduct the SDI to better delineate the extent of the impacted material for removal and to better understand geotechnical conditions to support the design. The extension was approved by the EPA in a letter dated March 29, 2021 (EPA, 2021a).
- On February 19, 2021, the *Supplemental Design Investigation Sampling Plan* (SDI Work Plan) (GHD, 2021b) was submitted to the EPA. EPA provided comments on the SDI Work Plan on March 29, 2021 (EPA, 2021b). On May 21, 2021, the *Supplemental Design Investigation Sampling Plan - Rev. 1* (Revised SDI Work Plan) (GHD, 2021c) was submitted to the EPA and approved by the EPA in written correspondence dated June 4, 2021 (EPA, 2021c).
- On October 1, 2021, a letter was submitted to the EPA (GHD, 2021f) requesting a 160-day extension of the deadline for the 90% RD to June 26, 2022, to allow for receipt, evaluation, and incorporation of the analytical, geotechnical, and supporting data from the SDI. As requested in an e-mail from the EPA dated October 28, 2021, a Request for Northern Impoundment Schedule Extension - Addendum (GHD, 2021h) was submitted on November 9, 2021, that included a revised schedule that provided for the staged submittal of all RD components required by the SOW to be included in the 90% RD. This extension request was approved by the EPA in a letter dated January 12, 2022 (EPA, 2022a). A further extension request specifically with respect to the northwest corner was submitted to the EPA on June 21, 2022 (IPC and MIMC, 2022b).
- On June 27, 2022, the 90% RD was submitted to the EPA (GHD, 2022f), to which the EPA provided comments in the April 18 Letter (EPA, 2024b).
- On November 8, 2022, the 90% RD - Northwest Corner Addendum was submitted to the EPA (GHD, 2022g), to which the EPA provided comments in the April 18 Letter (EPA, 2024b).
- On January 25, 2024, the Respondents submitted in the January 25 Letter (IPC and MIMC, 2024a) a plan in response to the EPA's January 5 Letter and subsequently supplemented that plan in submissions dated March 28, 2024 and April 3, 2024. EPA collectively provided comments from other stakeholders on these submissions as part of the 90% RD comments (EPA, 2024b).
- On May 20, June 17, and July 17, 2024, the Final 100% RD was submitted to the EPA (GHD, 2024b), to which the EPA provided Comments on October 25, 2024 (EPA, 2024c). Responses to these Comments are summarized in Table 1-1 and these Comments have been addressed throughout this Revised 100% RD.

1.3 Objective

The objective of this Revised 100% RD is to present a summary, consistent with the SOW, of the RD for the Northern Impoundment.

This Revised 100% RD includes a summary of the results from the PDI-1, PDI-2, SDI, and Treatability Studies. This Revised 100% RD also includes a description of the primary design elements for the remedy selected in the ROD for the Northern Impoundment, including those related to the design and installation of the BMP wall, waste material removal methodology, and water treatment. Associated design drawings, specifications, and supplemental plans are also included in this Revised 100% RD.

1.4 Document Organization and Supporting Deliverables

The remaining sections of this Revised 100% RD are organized as follows:

- ***Section 2*** includes descriptions of the phased PDI and SDI for the Northern Impoundment that were performed and a summary of the results and conclusions from these events.
- ***Section 3*** includes a description of Treatability Studies performed for the Northern Impoundment and results.

- ***Section 4*** addresses the Applicable or Relevant and Appropriate Requirements (ARARs) that may be applicable to the Northern Impoundment remedial action (RA) work.
- ***Section 5*** details the design criteria assumptions that are the basis for the current BMP wall design, waste material removal and solidification methodology, transportation and disposal, and water treatment process elements of the Northern Impoundment RD.
- ***Section 6*** includes a description of the investigation activities conducted in the SSA during PDI-2 and the implications of the results of that investigation for MNR.
- ***Section 7*** includes a description of how the RA for the Northern Impoundment may be implemented in a manner that minimizes environmental impacts in accordance with the EPA's *Principles for Greener Clean-Ups* (EPA, 2009).
- ***Section 8*** includes a list of the drawings and associated technical specifications developed to date for this Revised 100% RD.
- ***Section 9*** includes descriptions of the supporting deliverables identified in the SOW: Health and Safety Plan (HASP), Emergency Response Plan (ERP), Field Sampling Plan (FSP), Quality Assurance Project Plan (QAPP), Site-Wide Monitoring Plan (SWMP), Construction Quality Assurance/Quality Control Plan (CQA/QCP), Institutional Controls Implementation and Assurance Plan (ICIAP), Transportation and Off-Site Disposal Plan (TODP), Monitored Natural Recovery (MNR) Plan, and High-Water Preparedness Plan (HWPP).
- ***Section 10*** includes references to cited reports, correspondence and other documents.

This Revised 100% RD includes supporting figures and tables that are referenced throughout the document. This Revised 100% RD also includes the following appendices:

- **Appendix A** - PDI and SDI Supporting Documents (including aquifer test results for the PDI-1, and analytical laboratory reports, data validation reports, and a photographic log for PDI-1, PDI-2, and SDI).
- **Appendix B** - Geotechnical Engineering Report, including an SDI Geotechnical Data Report and the Updated Hydraulic Heave Analysis Report dated May 20, 2024 (GHD, 2024a; Updated Hydraulic Heave Report).
- **Appendix C** - Treatability Testing Supporting Documents (including water and waste material analytical laboratory reports, data validation reports, and a photographic log).
- **Appendix D** - ARAR Support Documents.
- **Appendix E** - SSA Supporting Documents (including analytical lab reports and data validation reports).
- **Appendix F** - Hydrodynamic Modelling Report.
- **Appendix G** - Design Drawing Package.
- **Appendix H** - Design Specifications.
- **Appendix I** - BMP Structural Design Report.
- **Appendix J** - Supporting Deliverables (including HASP, ERP, FSP, QAPP, SWMP, CQA/QCP, ICIAP, TODP, MNR Plan, and HWPP).

2. Design Investigations

In March 2011 and May 2012, the Respondents completed investigations at the Northern Impoundment as part of the RI. A summary and the results of these investigations are included in the RI Report. The RI included installation of eight borings to total depths ranging from 7.5 to 12.5 feet (ft) below ground surface (bgs) to characterize waste material chemistry, the results of which provided the basis for the remedial alternative selected in the ROD.

The main objective of the Northern Impoundment PDI and the SDI was to delineate and refine the depth and volume of materials likely requiring removal, as well as to obtain site-specific geotechnical data to inform the design of the BMP, specified in the ROD.

The PDI for the Northern Impoundment was conducted in two phases (in 2018 and 2019) and the SDI was conducted in 2021, as described below.

2.1 First Phase Pre-Design Investigation (PDI-1)

PDI-1 activities in the Northern Impoundment were completed by Integral Consulting and Anchor QEA between November 5 and December 9, 2018, in accordance with the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b), dated August 24, 2018, and approved by the EPA on September 12, 2018 (EPA, 2018b), and the *Addendum to the First Phase Pre-Design Investigation Work Plan*, dated October 18, 2018 (Integral and Anchor QEA, 2018d).

The purpose of the PDI-1 for the Northern Impoundment was to:

– Characterize the waste material in the Northern Impoundment that contains concentrations of dioxins and furans greater than 30 ng/kg $TEQ_{DF,M}$.

– Evaluate the concentrations of dioxins and furans within the historic central berm separating the eastern and western sides of the Northern Impoundment, as well as the perimeter berm located at the southern edge of the Northern Impoundment.

– Evaluate geotechnical characteristics of the material contained within the Northern Impoundment to inform RD engineering controls.

– Assess the specific yield of the waste material in the Northern Impoundment and hydraulic conductivity and specific yield of the unconsolidated riverine deposits below the Northern Impoundment and above the Beaumont Clay formation, in order to evaluate permeability of the soils and the expected infiltration/seepage of water during excavation activities.

Northern Impoundment PDI-1 field activities included waste material sampling for chemistry, waste characterization, and geotechnical analyses at 17 boring locations (Figure 2-1). Soil borings were advanced from the surface to 18 ft bgs for dioxins and furans analysis, from the surface to 10 ft bgs for waste characterization analysis, and from the surface to the Beaumont Clay (to a maximum depth of 62 ft bgs) for geotechnical sampling and testing. Four monitoring wells were also installed and an aquifer test was conducted.

Upland soil borings were installed from November 5 to 19, 2018 at 10 locations (SJSB028 to SJSB037), from which analytical, geotechnical, and waste characterization samples were collected. Four of these borings were completed as monitoring wells to utilize for aquifer testing. Six geotechnical borings (SJGB018 to SJGB023) were installed outside the perimeter of the armored cap from November 28 to December 5, 2018. Finally, on December 9, 2018, boring SJSB038 was installed for analytical, geotechnical, and waste characterization sampling.

A photographic log documenting the PDI-1 field event is included as part of Appendix A.

2.1.1 PDI-1 Drilling Methodology

PDI-1 boring locations were placed in areas that could be accessed from either a barge secured outside the extent of the armored cap or from a land-based drilling rig.

A roto-sonic drilling rig was utilized to install the 17 geotechnical borings. Six geotechnical boring locations (SJGB018, SJGB019, SJGB020, SJGB021, SJGB022, and SJGB023) were located under water, outside the extent of the armored cap. For these locations, a barge-mounted roto-sonic drilling rig was used. A track-mounted Direct Push Technology (DPT) drilling rig was utilized for the analytical borings. All analytical borings were located on the upland portions of the Northern Impoundment. Boring SJSB038 was located in an area of the Northern Impoundment that is covered with water that fluctuates from 0 to 2 ft of water, depending upon the season and the tide. To ensure that the boring at this location could be completed with the terrestrial drilling equipment, road-base aggregate was brought in and placed to establish access to the boring location.

At locations accessible by standard terrestrial equipment, armored cap material was removed, and the geotextile and/or geomembrane liner was cut prior to drilling activities. At the conclusion of drilling, the borings were grouted to the top, the geotextile and/or geomembrane liner was repaired, and the armored cap material was replaced.

2.1.2 PDI-1 Analytical Sampling

A total of 11 borings were installed at locations in the Northern Impoundment for chemical sampling to fill in data gaps from the RI, as shown on Figure 2-1. Borings were generally installed to a depth of 18 ft bgs, with three borings (SJSB036, SJSB037, and SJSB038) installed to maximum depth of 12 to 13 ft bgs.

Discrete waste material samples were collected via DPT methodology and submitted for analysis consistent with the *First Phase Pre-Design Investigation Work Plan* (Integral and Anchor QEA, 2018b), with the exception of boring location SJS038 which was sampled with the use of a 7-inch diameter sonic core method, due to low recovery with the DPT methodology. With the exception of boring locations SJSB036, SJSB037, and SJSB038, all samples were collected in two-foot intervals. Borings SJSB036, SJSB037, and SJSB038 were used to determine a potential contact point differentiating waste from underlying soil. Samples for these borings were collected above and below the identified waste contact point.

All samples were analyzed by ALS Laboratories for dioxins and furans using EPA approved Method 1613B. Sample data validation was completed by a third-party validation firm (EcoChem, Inc.).

2.1.3 PDI-1 Geotechnical Sampling

A total of 17 geotechnical borings were installed in the Northern Impoundment to total depths ranging from 22 to 62 ft bgs to fill data gaps from the RI and to evaluate the geotechnical properties of the soil around the perimeter of the Northern Impoundment. PDI-1 geotechnical boring locations are shown on Figure 2-1. Disturbed samples were collected from standard penetration test (SPT) split-spoon samplers and analyzed for moisture content, plasticity (Atterberg limits), specific gravity, and grain size distribution. Undisturbed samples were collected using Shelby tube samplers and analyzed for consolidated undrained (CU) triaxial shear strength, direct shear strength testing, one-dimensional consolidation testing, and bulk density. All tests were performed in a laboratory setting, with the exception of blow counts that were conducted in the field. Geotechnical samples were analyzed by GeoTesting Express.

2.1.4 PDI-1 Waste Characterization Sampling

To support waste disposal planning, three composite samples were collected for waste characterization sampling, as depicted on Figure 2-1. Samples were collected from depths of 0 to 10 ft bgs. Samples were analyzed by ALS Laboratories for toxicity characteristic leaching procedure (TCLP) parameters (EPA Method 1311 [SW-846]), ignitability (Flashpoint - SW-846 1010A), corrosivity (pH - EPA 9040), and reactivity (Reactive cyanide - SW-846 7.3.3.2 and Reactive sulfides - SW-846 9034). All waste characterization samples indicate that the waste material did not exhibit any of the four characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity) and, therefore, can be disposed of as non-hazardous waste.

2.1.5 PDI-1 Aquifer Testing

As part of PDI-1 field activities, four 4-inch diameter temporary monitoring wells (SJTW014, SJTW015, SJTW016, and SJTW017) were installed to total depths ranging from 36 to 42 ft bgs and screened from 10 to 15 ft bgs to total depth. Locations of the monitoring wells are shown on Figure 2-1. The monitoring wells were developed and utilized for an *in-situ* hydraulic aquifer test (i.e., constant rate discharge pumping tests).

Aquifer testing was conducted on each monitoring well from December 4 through December 7, 2018. Each test was run for approximately 3 hours, with a downhole transducer in the pumping well and periodic water level gauging at the other three monitoring wells being used as observation wells. Monitoring wells SJTW-015, SJTW-016, and SJTW-017 all yielded high pumping rates ranging from 16 to 26 gallons per minute (gpm). Each well had a relatively stable drawdown ranging from 7 to 11 ft from the starting water level. After each test, recovery water level readings were collected and each well displayed a relatively rapid well recovery. Only well SJTW-014, in the southeast corner, exhibited slow recovery and supported a pumping rate of 0.2 gpm.

2.1.6 Summary of PDI-1 Results

2.1.6.1 PDI-1 Analytical Results

Of the 11 borings analyzed, 5 borings (SJSB029, SJSB030, SJSB031, SJSB034, and SJSB035) had dioxin and furan concentrations below 30 ng/kg $TEQ_{DF,M}$, in all intervals as seen on Figure 2-2. These borings were located within the historic central berm separating the eastern and western sides of the Northern Impoundment, as well as the berm located at the southern edge of the Northern Impoundment. This is consistent with the understood construction of the historic impoundment whereby native soil was used to create the central and southern berms.

Six boring locations (SJSB028, SJSB032, SJSB033, SJSB036, SJSB037, and SJSB038) had concentrations greater than 30 ng/kg $TEQ_{DF,M}$ in one or more intervals. Boring location SJSB028, installed on the far eastern edge of the southern berm, had concentrations above 30 ng/kg $TEQ_{DF,M}$, at a maximum depth of 6 ft bgs. Boring locations SJSB032 and SJSB033 were installed to 18 ft bgs along the western edge of the Northern Impoundment. Results from these boring locations indicated concentrations above 30 ng/kg $TEQ_{DF,M}$, to depths of 10 and 12 ft bgs, respectively. Borings SJSB036 and SJSB037 were installed to terminal depths of approximately 13 ft bgs. Concentrations above 30 ng/kg $TEQ_{DF,M}$, at these locations near the center of the western side were identified at a maximum depth of approximately 11 ft bgs at both borings. Boring SJSB038 on the eastern side of the Northern Impoundment was installed to a depth of 12 ft bgs and showed concentrations above 30 ng/kg $TEQ_{DF,M}$ at a depth of 11 ft bgs.

PDI-1 analytical results are shown on Figure 2-2. The validated analytical data, shown in Table 2-1, provides quality assurance that the data collected are usable. The analytical laboratory reports and data validation report are included as part of Appendix A.

2.1.6.2 PDI-1 Geotechnical Results

The PDI-1 geotechnical results identified the presence of interbedded clay, silt, and sand in the areas of the Northern Impoundment in which the geotechnical samples were collected. Soils down to 6 to 10 ft bgs have a high moisture content, with moisture content decreasing as depth increases. Atterberg classification of clay soils indicated that most of the clays are high plasticity, fat clays, with a slightly fewer number of samples classified as low plasticity, lean clays. Interspersed within these clays were samples showing high gravel/sand content. The PDI-1 geotechnical results are included in Appendix B and are further discussed in Section 5.3.3, as they relate to the Northern Impoundment RD.

2.1.6.3 PDI-1 Waste Characterization Results

Waste characterization results indicate that the Northern Impoundment waste material did not exhibit any of the four characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity) and are not Listed Wastes, as defined in Title 40 of the Code of Federal Regulations (CFR) Part 261, Subpart C. As a non-hazardous waste, the waste material would meet the definition of Class I or Class II industrial waste under the regulations governing classification of non-hazardous industrial solid waste in Texas (30 Texas Administrative Code [TAC] §335.505, 335.506, and 335.508).

Validated waste characterization data, shown in Table 2-2, provides quality assurance that the data collected are usable. The analytical laboratory reports and data validation report are included as part of Appendix A.

Additional waste characterization testing of Northern Impoundment waste material was performed as part of the 2019 Treatability Study, conducted concurrently with PDI-2, and as part of the 2021 SDI activities. See Section 3.3 for a summary of the Treatability Study waste characterization results. See Section 2.3.7.2 for a summary of the SDI waste characterization results.

2.1.6.4 PDI-1 Aquifer Testing Results

Analysis of the transducer and gauging data from the PDI-1 aquifer tests indicated that there was no meaningful connectivity between the observation wells and the temporary monitoring wells (SJTW014, SJTW015, SJTW016, and SJTW017) and that there is no influence on the water levels of nearby wells that is not also matched by the tidal fluctuations of the river. Results indicated that there is a strong hydrological connection between the river and the shallow sand/silt layer underlying the Northern Impoundment. The data show that the shallow groundwater system is controlled by the hydrological influence of the river. The BMP included in the design will cut off the interconnection between the shallow groundwater and the river within the areas of removal. The only groundwater infiltration to be considered in the design is local seepage of stored groundwater near the excavations. Aquifer test results are included as part of Appendix A.

2.2 Second Phase Pre-Design Investigation (PDI-2)

The PDI-2 fieldwork on the Northern Impoundment was conducted by GHD from September 4 through December 13, 2019, in accordance with the *Final Second Phase Pre-Design Investigation Work Plan* (PDI-2 Work Plan; GHD, 2019d), dated June 3, 2019, and approved by the EPA on August 8, 2019 (EPA, 2019c). On September 17, 2019, Tropical Storm Imelda caused significant flooding at the Northern Impoundment, forcing all field activities to be suspended from September 17 to October 7, 2019. This event resulted in a *force majeure* event that delayed the completion of PDI-2 field activities. EPA approved a 24-day schedule extension due to the *force majeure* event on October 30, 2019 (EPA, 2019f),

The purpose of the PDI-2 was to:

- Fill data gaps identified in PDI-1 by refining the horizontal and vertical extent of the waste material with a $TEQ_{DF,M}$ greater than 30 ng/kg to quantify the volume of waste material requiring removal, and to inform the alignment of the BMP during removal activities.
- Fill geotechnical data gaps identified in PDI-1 by collecting geotechnical data to support evaluation of slope stability and inform the BMP design.
- Conduct topographic, bathymetric, and utility surveys to support design of access, staging, and excavation.
- Collect hydrographic data to inform engineering of the BMP.

The Northern Impoundment PDI-2 field activities included installation of 25 analytical sample borings and 9 geotechnical borings at a total of 29 locations, as shown on Figure 2-3. Cuttings from the geotechnical borings were also collected as composite samples for treatability testing, further discussed in Section 3. Borings were advanced from the surface to a maximum depth of either 18 or 30 ft bgs for analytical borings, and to a maximum depth ranging from 20 to 100 ft bgs for geotechnical borings.

A photographic log documenting the Northern Impoundment PDI-2 field event is included in Appendix A.

2.2.1 Drilling Methodology

Due to the location of the Northern Impoundment, portions of the impoundment are heavily influenced by tides and inclement weather. The water level across the Northern Impoundment can vary several feet in the course of one day, providing unique challenges to the use of the drilling methodologies implemented during the PDI-2. Boring installation and sampling were conducted by one of the following methodologies:

- Track mounted drilling rig (DPT and hollow-stem auger).
- Airboat-mounted drilling rig (DPT).
- Barge-mounted drilling rig (hollow stem auger).

Of the 29 boring locations selected for PDI-2, all but six were located in areas that were under water. The appropriate drilling equipment and methodology was selected specifically for each boring location as required by the site conditions and water level of the San Jacinto River at the time each boring was advanced. PDI-2 boring locations are shown on Figure 2-3.

At locations accessible by standard terrestrial equipment, a mini-excavator was used to remove armored cap rock, then the geotextile and/or geomembrane liner was cut prior to drilling activities. At boring locations that were submerged under water, accessible only by airboat or barge-mounted drilling equipment, certified divers hand cleared the cap rock from each boring location, precisely cut the geotextile and/or geomembrane liner, and then installed a short surface casing (4 feet diameter High-Density Polyethylene [HDPE] pipe or 18-inch diameter steel pipe) to protect against sloughing of the surrounding surface cap materials during drilling. For underwater borings, a wider-diameter casing was first pushed through the extent of the impacted material (approximately 18 to 20 ft bgs) and then the drill rod was advanced through the casing to prevent the potential release of any impacted material to the river during drilling activities.

At the conclusion of drilling at all boring locations, the borings were grouted, the casing was pushed to the mudline (for underwater borings), the geotextile and/or geomembrane liner was repaired, and the armored cap rock was replaced.

2.2.2 PDI-2 Analytical Sampling

In accordance with the PDI-2 Work Plan (GHD, 2019d), the sampling program was designed to better define the placement of the outer BMP. To that end, 14 non-contingent, analytical borings (SJSB045 to SJSB058) were initially installed primarily along the outer perimeter of the Northern Impoundment, just inside the limits of the armored cap. Samples from these locations were analyzed and if the concentrations of dioxins and furans in a boring were found to be below 30 ng/kg $TEQ_{DF,M}$, the associated contingent boring location (located interior to the non-contingent boring) was installed and sampled. This methodology was repeated until a boring was found to have concentrations above 30 ng/kg $TEQ_{DF,M}$.

Nine contingent sample locations (SJSB046-C1, SJSB047-C1, SJSB049-C1, SJSB050-C1, SJSB052-C1, SJSB055-C1, SJSB055-C2, SJSB056-C1, and SJSB057-C1) were originally planned, as seen on Figure 2-3, but based upon the results of the 14 non-contingent analytical borings, only six out of the nine contingent borings (SJSB046-C1, SJSB047-C1, SJSB050-C1, SJSB052-C1, SJSB055-C1, SJSB056-C1) were installed and sampled. All borings were installed using DPT methodology to a depth of 18 ft bgs and samples were collected on two-foot intervals.

Several modifications were made to the original PDI-2 scope of work based upon field conditions and analytical data results. A *Work Plan Refinement Notice* (GHD, 2019f) was submitted to the EPA on October 11, 2019, and approved on October 22, 2019 (EPA, 2019e). Per this notice, sample location SJSB050-C1 was relocated approximately 100 ft to the east to better delineate the horizontal and vertical extent of the waste material on the eastern boundary of the Northern Impoundment. Also, per this notice, sample location SJSB058 was moved approximately 60 ft to the southeast to allow the boring to be completed as a land-based boring.

There were several instances where one of the perimeter non-contingent borings had results below the clean-up level, and the next interior boring location from that clean boring had results that exceeded the clean-up level at, or almost at, total depth. To better delineate the horizontal and vertical extent of waste material, borings were added between the clean boring and the impacted boring. An *Additional Work Plan Refinement Notice* (GHD, 2019g) was submitted to the EPA on November 1, 2019, and was approved on November 8, 2019 (EPA, 2019g*).* Per this notice, three borings (SJSB045-C1, SJSB048-C1, and SJSB053-C1) were added between clean and impacted borings as described above. In addition, two samples were taken at locations SJSB070 and SJSB071 along the southern boundary of the ACBM panels on the western side of the Northern Impoundment (see Figure 2-3). The five additional borings were sampled and analyzed at two-foot intervals from zero to 18 ft bgs.

A *Fourth Work Plan Refinement Notice* (GHD, 2019h) was submitted to the EPA on December 4, 2019, requesting to relocate boring location SJSB046-C1 approximately 45 ft to the north to better delineate the horizontal and vertical extent of waste material on the eastern side of the Northern Impoundment. The request was approved by the EPA on December 9, 2019 (EPA, 2019h).

Analytical results obtained during the initial PDI-2 sample data analysis indicated concentrations of dioxins and furans greater than 30 ng/kg $TEQ_{DF,M}$, at the terminal depth of 18 ft bgs at 3 locations (SJSB046, SJSB058, and SJSB048-C1). To fully delineate the vertical extent of impacted material, duplicate borings were installed directly adjacent to the original borings at these locations, as outlined in the *Additional Work Plan Refinement Notice* (GHD, 2019f) and the *Fourth Work Plan Refinement Notice* (GHD, 2019h). Each duplicate boring was installed directly adjacent to the original borings to a depth of 30 ft bgs. Discrete samples were collected for every two-foot interval between 18 and 30 ft bgs, for a total of six samples per boring. The 18 to 20 ft bgs interval at each duplicate boring was analyzed, while the remaining five samples were held by the lab pending results of the first depth interval. Analytical results indicated that concentrations of dioxins and furans were below 30 ng/kg $TEQ_{DF,M}$ at the 18 to 20 ft bgs depth interval for all three locations; thus, the remaining samples for subsequent depth intervals were not analyzed.

In summary, 25 analytical borings were completed. Three were completed as land-based borings and 22 were completed as water-based borings. Three of the 25 borings were drilled to 30 ft bgs. All others were drilled to 18 ft bgs.

All analytical samples were analyzed by Eurofins TestAmerica Laboratory for dioxins and furans using EPA Method 1613B and percent moisture using Standard Method (SM) 2540G. Data validation was completed by GHD.

2.2.3 PDI-2 Geotechnical Sampling

Upon review of the geotechnical data obtained during the PDI-1, data gaps were identified and documented in the PDI-2 Work Plan (GHD, 2019d). Additional geotechnical data was needed on the interior of the Northern Impoundment boundary on the eastern side of the central berm to inform the design of possible internal BMPs (being considered at the time) for a multi-cell remediation approach. The geotechnical analyses performed during the RI and PDI-1 were determined to be insufficient to inform BMP design. Specifically, there was no unconsolidated-undrained (UU) triaxial compression data to evaluate shear strength. As such, a total of nine geotechnical borings (SJGB024 through SJGB027, SJSB047, SJSB050, SJSB053, SJSB057, and SJSB058) were installed during the PDI-2. The geotechnical boring locations are shown on Figure 2-3.

Geotechnical borings were installed using a Central Mine Equipment (CME) mud-rotary drilling rig. Samples were collected and analyzed for moisture content (per American Society for Testing and Materials [ASTM] D2216), grain size with hydrometer (per ASTM D6913 and ASTM D7928), plasticity (Atterberg limits; per ASTM D4318), torvane shear (per ASTM D2537), and UU triaxial shear strength (per ASTM D2850) to depths ranging from 20 to 100 ft bgs. Geotechnical samples were sent to Tolunay-Wong Engineers, Inc. for analysis.

2.2.4 Sand Separation Area Sampling

Samples were collected during the PDI-2 sampling event to establish current conditions in the SSA. The samples were collected from nine locations shown on Figure 2-4 using Vibracore sampling devices and a dive team. At each location, samples were collected at depth intervals of 0 to 1 ft, 1 to 2 ft, 2 to 4 ft, and 4 to 6 ft below the sediment/surface water interface and analyzed for dioxins and furans. Eurofins TestAmerica analyzed the samples by EPA Method 8290 and percent solids. Samples were also collected at depth intervals of 2.5 centimeters (cm) (0.98 inches) from the sediment/surface water interface to a depth of 82.5 cm (32.5 inches) and analyzed for cesium-137 (^{137}Cs) and lead-210 (^{210}Pb) using EPA Method 901.1 by Teledyne Brown Engineering, Inc.

A detailed summary of sampling activities and results is included in Section 6.

2.2.5 Transducer Installation

On July 22, 2019, two transducers were installed on the west side of the Northern Impoundment to evaluate the hydrological conductivity of the shallow sand and silt zone beneath the Northern Impoundment and the river. One transducer was installed in monitoring well SJTW-016 and the other was installed in a piezometer that was manually driven into the river sediment just off the shore to the west of SJTW-016. Each was fitted with a telemetry device and transmits data that can be remotely accessed. The locations of the transducers are shown on Figure 2-3.

2.2.6 PDI-2 Topographic, Bathymetric, and Utility Survey

To support design elements related to access, staging, and excavation, a topographic and bathymetric survey was completed on the Northern Impoundment from July 8 through August 2, 2019. The survey was conducted by a surveyor (Morrison Surveying, Inc.) licensed in the state of Texas. Field data were collected using conventional surveying equipment, including a Trimble R8 GNSS, Trimble R10 global positioning system (GPS), and Geometrics 882 marine magnetometer using Hypack software to collect geophysical data, CEE Scope Fathometer using Hypack software to collect bathymetric data, and a Trimble SX10 scan station to collect topographic data. Surveying was completed on a 50-feet grid over the Northern Impoundment boundaries. Above-ground utilities were also noted during survey activities. Survey data was utilized to develop a topographical digital elevation map of the Northern Impoundment. This surface and all identified above and below-ground utilities have been incorporated into the design drawings.

2.2.7 Summary of PDI-2 Results

2.2.7.1 PDI-2 Analytical Results

A total of 25 analytical borings were sampled and analyzed for dioxins and furans during the PDI-2 activities. Of the 25 borings, 12 had concentrations above 30 ng/kg $TEQ_{DF,M}$ to depths ranging from 4 to 18 ft bgs and the remaining borings were all below 30 ng/kg $TEQ_{DF,M}$ down to 18 ft bgs, as shown on Figure 2-5. Consistent with the objectives of the PDI-2 investigation, borings along the northeastern and eastern sides of the Northern Impoundment exhibiting $TEQ_{DF,M}$ concentrations below 30 ng/kg are to be used in the RD to define the extent of the excavation and the alignment of the outer BMP. This is further discussed in Section 5.2.

All subsurface analytical results from the RI, PDI-1, and PDI-2 are shown in Table 2-6 and on Figure 2-9. The data bars on Figure 2-9 show the interval results as elevations, adjusted to account for the depth of surface water atop each boring location, giving an indication of the total depth of waste material to be excavated during the RA.
Two borings locations (SJSB046-12 and SJSB071) had samples above 30 ng/kg $TEQ_{DF,M}$ in the deepest sample interval collected. These locations were further investigated in the 2021 SDI event.

The validated analytical PDI-2 data, shown in Table 2-3, provides quality assurance that the data collected are usable. The PDI-2 analytical laboratory reports and data validation reports are included as part of Appendix A.

2.2.7.2 PDI-2 Geotechnical Results

During the RI and PDI-1, the Northern Impoundment soil lithology was characterized as interbedded Recent Alluvial Sediments (silts, sands, and clays) to an approximate depth of -30 ft North American Vertical Datum of 1988 (NAVD88), which was confirmed during the PDI-2. The previous investigations also indicated that the Beaumont Clay formation extended below this reference elevation (-30 ft NAVD88) to a minimum elevation of -60 ft NAVD88 on the western side of the Northern Impoundment and to approximately -50 ft NAVD88 on the eastern side of the Northern Impoundment. Additional geotechnical borings installed during PDI-2 (specifically boring SJSB057) encountered the Beaumont Clay formation at approximately -80 ft NAVD88 (an additional 20 ft of thickness) on the western side and at approximately -50 to -65 ft NAVD88 (up to an additional 15 ft of thickness) on the eastern side. Additionally, the investigations prior to PDI-2 indicated a sand formation extending below the clay formation across the Northern Impoundment to approximately -80 ft NAVD88. These sands, although encountered in the PDI-2, were not found to be consistent across the Northern Impoundment.

The PDI-2 geotechnical results are included in Appendix B. Further analysis and discussion of the geotechnical data as it relates to the RD of the BMP are included in Section 5.2.3.

2.2.7.3 Transducer Results

Consistent with the results of the PDI-1 aquifer tests, data from the transducers indicated that there is a strong hydrological connection between the river and the shallow sand/silt layer underlying the Northern Impoundment. The water levels are nearly identical in all observed data, with a slightly dampened response time observed in the monitoring well data that matches pressure changes in soils versus a free-flowing river. As part of the RD, water pressure heads from the shallow permeable layer have been correlated with fluctuations in the river water levels and accounted for, as such.

2.3 Supplemental Design Investigation (SDI)

The BMP design detailed in the 30% RD was subsequently deemed to be infeasible and following submittal of the 30% RD, a new design approach for the BMP (a double wall BMP system) was developed, the alignment of the BMP was changed, and new approach to the excavation methodology was developed. Based on the changes in BMP design and alignment and changes in excavation methodology, data gaps were identified in the available analytical delineation and geotechnical data.

As discussed during a TWG Meeting on December 15, 2020, an additional field investigation was deemed necessary to address these data gaps in the analytical and geotechnical data and better inform the RD. A proposed plan to collect additional analytical and geotechnical data was presented in a TWG Meeting on February 5, 2021, and then formalized in the SDI Work Plan, submitted to the EPA on February 19, 2021 (GHD, 2021b). A TWG Meeting was held to discuss the details of the SDI Work Plan on March 10, 2021, and the EPA provided comments on the SDI Work Plan (EPA, 2021b) on March 29, 2021. On April 15, 2021, a draft Response to Comments table and figures were sent to the EPA in response to the EPA's comments and were then discussed in detail during a TWG Meeting that took place on April 19, 2021. After further discussion with the EPA regarding the SDI scope of work and other significant modifications to it, a revised SDI Work Plan (Revised SDI Work Plan) was submitted to the EPA on May 21, 2021 (GHD, 2021c). The EPA approved the Revised SDI Work Plan on June 4, 2021 (EPA, 2021c). Between the February submittal of the SDI Work Plan and the June approval of the Revised Work Plan, the scope of the SDI event grew substantially. Most notably, seven analytical boring locations were added, with six of those additional borings being located in very challenging water-based locations. The original 10-week schedule for field work thus expanded to more than 12 weeks. The SDI fieldwork was conducted by GHD from June 28, 2021, to September 16, 2021.

The objectives of the SDI included the following:

– Further delineate the vertical extent of the waste material exceeding the ROD clean-up level around the perimeter of the excavation area to support the BMP design, elements of the anticipated excavation methodology, and other aspects of the RD.
– Address data gaps for the vertical and horizontal extent of waste material exceeding the ROD clean-up level across the area anticipated to be excavated to better refine the estimated excavation bottom elevations and the volume of material to be removed (which had already increased due to the depths of the waste material encountered during the PDI).
– Collect additional geotechnical data along the conceptual alignment of the BMP to inform the BMP design.
– Collect additional hydraulic conductivity data of the material to be excavated to better estimate the amount of seepage water that will require management during the RA.
– Collect additional hydraulic conductivity and pore pressure data to evaluate the risk of hydraulic heave during the RA.

The SDI field activities included installation of 35 analytical sample borings and 17 geotechnical soundings (13 Cone Penetrometer Test [CPT] soundings and 4 instrumented boreholes), as shown on Figure 2-6. Borings were advanced from the surface to a maximum depth of 24 ft bgs for analytical borings, and to a maximum depth ranging from 24 to 75 ft bgs for geotechnical soundings.

A photographic log documenting the SDI field event is included in Appendix A.

2.3.1 SDI Drilling Methodology

Similar to the PDI-2 event, several drilling methodologies were employed to account for variable water levels at the Northern Impoundment. Boring installation and sampling were conducted using the following methodologies:

- Track mounted drilling rig (DPT).
- Airboat-mounted drilling rig (DPT).
- Track-mounted drilling rig (mud rotary).
- Truck-mounted CPT drilling rig.
- Truck-mounted CPT drilling rig secured to a floating modular barge.

Of the 35 analytical boring locations selected for SDI, all but 11 of them were located in areas that were under water. All water-based analytical borings were installed utilizing an airboat-mounted DPT rig and all land-based analytical borings were installed utilizing a track-mounted DPT rig. The three land-based piezometers were installed using a track-mounted mud-rotary rig and the land-based CPT soundings were performed using a truck-mounted CPT drilling rig. The water-based CPT soundings were taken using a truck-mounted CPT drilling rig secured to a floating modular barge. SDI boring and CPT locations are shown on Figure 2-6.

At locations accessible by standard terrestrial equipment, a mini-excavator was used to remove armored cap rock, then the geotextile and/or geomembrane was cut prior to drilling activities. At boring locations that were submerged but were accessible by airboat-mounted drilling equipment, certified divers hand cleared the cap rock from each boring location, precisely cut the geotextile liner, and marked the location with a buoy. The drilling rig then installed a short surface casing (4 ft diameter HDPE pipe or 18-inch diameter steel pipe) to protect against sloughing of the surrounding surface cap materials during drilling. For underwater borings, a wider-diameter casing was first pushed until refusal was encountered (approximately 5 to 7 ft bgs on the shallower locations and approximately 5 to 10 ft bgs on the deeper locations) and then the drill rod was advanced through the casing to prevent the potential release of any impacted material to the river during drilling activities. At the conclusion of drilling at all boring locations, the borings were grouted, the casing was pushed to the mudline (for underwater borings), the geotextile and/or geomembrane was repaired, and the armored cap rock was replaced.

As required by the Revised SDI Work Plan (GHD, 2021c), turbidity curtains were deployed around the northwest corner of the Northern Impoundment during the installation of the four soil borings in that area. The initial plan utilized curtains that spanned the full extent of the water column, but due to higher-than-expected water velocities in that area, it was not possible to maintain that configuration and the curtains were realigned to allow for shorter curtains across the deeper areas. The timeline of activities and the significant challenges encountered were detailed in a letter to the EPA dated September 28, 2021 (GHD, 2021e).

2.3.2 SDI Analytical Sampling

In accordance with the Revised SDI Work Plan (GHD, 2021c), the sampling program was designed to further delineate the vertical and horizontal extent of material exceeding the ROD clean-up level. To that end, a total of 373 discrete samples (including 61 field and lab duplicate samples) were collected from 35 locations across the Northern Impoundment. Discrete samples were collected from two-foot intervals to a total depth of 24 ft bgs. The sample intervals from 0 to 18 ft bgs were analyzed by the analytical laboratory, and the sample intervals from 18 to 24 ft bgs were archived by the laboratory pending the results of the 16 to 18 ft bgs sample interval. Analysis of the 16 to 18 ft bgs interval from each location was prioritized to expedite the determination as to whether the samples from the deeper sample intervals should be analyzed. If the 16 to 18 ft interval yielded an analytical result with $TEQ_{DF,M}$ levels above 30 ng/kg, one or more of the three deeper intervals from 18 to 24 ft were also analyzed.

There were five boring locations (SJSB072, SJSB075, SJSB077, SJSB083, and SJSB101) that were co-located with historical boring locations in which a sample interval below the clean-up standard was not observed at the bottom of the boring (SJGB010, SJGB012, SJSB036, SJSB046-C1, and SJSB071). Three of the five locations were in upland areas (SJSB072, SJSB075, SJSB077), and the other two locations (SJSB083 and SJSB101) were in areas that are normally covered in water.

For the co-located borings adjacent to historical borings with $TEQ_{DF,M}$ levels above 30 ng/kg, with the exception of SJSB083 and SJSB101 which were analyzed for waste characterization purposes, only sample intervals in the co-located borings that were deeper than the terminal depth of each historical boring with $TEQ_{DF,M}$ levels above 30 ng/kg were analyzed. For example, at proposed boring location SJSB072, the first sample interval analyzed was 8 to 10 ft bgs, because co-located historical boring SJGB012 had a $TEQ_{DF,M}$ level above 30 ng/kg at its terminal depth of 8 ft bgs.

All analytical samples were analyzed by Eurofins TestAmerica Laboratory for dioxins and furans using EPA Method 1613B and percent moisture using SM 2540G. Data validation was completed by GHD.

2.3.3 SDI Geotechnical Sampling

To delineate the subsurface stratigraphy along or in reasonable proximity to the conceptual BMP alignment, thirteen CPT soundings were taken.

Twelve of these CPT soundings (SJCPT-001 through SJCPT-010, SJCPT-002A, and SJCPT-006A) were taken along or in reasonable proximity to the conceptual BMP alignment. The initial contractor engaged to complete the water-based CPT borings was unable to successfully reach terminal depth due to the insufficient capacity through resistive force of its CPT drill rig and associated vessel. After multiple attempts by the initial contractor to successfully anchor and reach terminal depth, the initial CPT contractor and CPT drill rig demobilized and a second contractor with a larger capacity truck-mounted CPT drilling rig secured to a floating modular barge was retained to complete the CPT soundings.

A thirteenth CPT sounding (SJCPT-011) was taken adjacent to piezometer location, SJMW-016, as a “calibration sounding” to provide both CPT data and geotechnical laboratory test data for comparison with the newly-collected CPT data from the other 12 CPT soundings.

To provide the corresponding laboratory test data for comparison, geotechnical samples were collected at different locations (depths) during borehole SJMW-16 advancement and sent to Thompson Engineering Geotechnical Laboratory for laboratory analysis. The samples were collected along the entire length of this deep boring, including from the surficial alluvium, Beaumont Clay and Beaumont Sand layers (historical investigations gathered limited data from these lower geological strata).

In addition, nine vane shear tests were performed near CPT locations SJCPT-01 to SJCPT-03, and SJCPT-05 to SJCPT-10 using manual equipment. Vane shear tests were conducted in approximately 1.5 ft increments and progressed up to 24 ft bgs or until refusal, in order to define shear strength values within the surficial alluvions and calibrate the CPT results. The locations of the CPT soundings are shown on Figure 2-6.

Using the common set of information and well-defined relationships for various parameters available, the CPT results obtained from the 12 soundings along the current conceptual BMP alignment were calibrated against data from SJMW-016 and correlated to vane shear tests and existing geotechnical laboratory test data from past investigations. Physical geotechnical samples were collected and analyzed from SJMW-017 as supplemental geotechnical data.

2.3.4 Waste Characterization Sampling

Six waste characterization samples were collected from three analytical borings (SJSB083, SJSB101, and SJSB102). The original plan, as detailed in the Revised SDI Work Plan (GHD, 2021c), had been to collect duplicate samples from each planned 2-ft interval from 0 to 24 ft bgs in soil borings SJSB083 and SJSB101 and to archive the duplicates for potential waste characterization, pending dioxins analytical results. Upon receipt of the dioxins analytical results, the two samples in each boring with the highest dioxins concentration would have been identified and the duplicate samples from each of those intervals would have been analyzed for Resource Conservation and Recovery Act (RCRA) hazardous waste characteristics per EPA-required test methodology in 40 CFR Part 261. As detailed in SDI Sampling Plan Refinement Notice - 1, submitted to the EPA on July 26, 2021 (GHD, 2021d) and approved by the EPA on August 4, 2021 (EPA, 2021d), due to short analytical hold times for some of the RCRA hazardous waste characteristics parameters, the plan was revised to pre-select the intervals for analysis based upon historic dioxins data from nearby soil borings. Based upon data from historic soil boring SJSB046-C1, the 8 to 10 ft bgs and 10 to 12 ft bgs intervals were selected for waste characterization analysis from SJSB083. Based upon historic soil boring SJSB071, the 0 to 2 ft bgs and 2 to 4 ft bgs intervals were selected for waste characterization analysis from SJSB101.

Due to shipping delays, the waste characterization samples for SJSB083 were delivered to the analytical laboratory outside of the approved temperature range. The samples were analyzed, but in order to bolster the dataset for waste characterization, a third location was selected to collect waste characterization samples. Duplicate samples from two, 2-ft intervals (8 to 10 ft bgs and 10 to 12 ft bgs) were collected from SJSB102 to analyze for waste characterization parameters. Waste characterization data is included in Table 2-5 and Appendix A.

All waste characterization samples indicate that the waste material did not exhibit any of the four characteristics of hazardous waste (ignitability, corrosivity, reactivity, or toxicity) and, therefore, can be disposed of as non-hazardous waste.

2.3.5 Supplemental Data Collection

In addition to the sampling described above, supplemental data was collected to support the design of turbidity control measures for use during installation and removal of the BMP during the RA. These data collection activities focused on thicknesses of surface materials, geotechnical characteristics of surficial sediment, and velocity measurements in locations outside the proposed BMP alignment. Each of these data collection activities is described below.

2.3.5.1 Sediment and Rock Thickness

The extent and thickness of armored rock cap along the conceptual alignment of the BMP was investigated, together with the thickness of any sediment deposited on top of the armored rock cap. The information was collected by diver-assisted probing at specific intervals and further verified by examining past quarterly bathymetry surveys. The sediment and rock thicknesses varied across the Site with an average rock thickness of approximately 1.5 ft.

2.3.5.2 Surficial Sediments Geotechnical Properties

Ten samples of river sediment that had deposited on top of the armored rock cap were collected in Lexan® tubes that were hand driven into the sediment to collect a minimum 6-inch thick sample. The sediment within each tube was composited to form a single sample for geotechnical analyses. Samples were collected in proximity to corresponding CPT locations (SJCPT001 through SJCPT010, not including SJCPT-002A and SJCPT-006A) as shown on Figure 2-6.

Divers were required to clear surficial rock at six locations (SJCPT005 through SJCPT010) prior to driving each of the performed CPTs. At the time of clearing the CPT locations, the nearby six surficial sediment samples were collected at these six locations. An additional four locations (SJCPT001 through SJCPT004) were also sampled in a similar manner though the removal of rock at these locations was not necessary. Some boring locations were adjusted based on field conditions.

Both sets of samples were shipped under chain of custody procedures to a geotechnical laboratory for testing. Each sample was tested for water content (ASTM D2216), dry density (ASTM D2937), Atterberg limits (ASTM D4318), specific gravity (ASTM D854), particle size distribution (ASTM D422) and organic carbon content (ASTM D2974). The samples were also tested for consistency/stickiness using the Natural Resources Conservation Service method. The results are presented in the geotechnical report included as Appendix B.

2.3.5.3 Water Velocity and Turbidity Measurements

During the week of November 8, 2021, two velocity meters (e.g., acoustic doppler current profiler) were deployed in locations outside of the conceptual BMP alignment, in accordance with the Revised SDI Work Plan (GHD, 2021c). Four turbidity monitors were deployed at the same time in accordance with the *Revised Ambient Turbidity*

Measurements Plan, submitted to the EPA on October 6, 2021 (GHD, 2021g) and approved by the EPA on October 15, 2021 (EPA, 2021e). The four turbidity monitors and one of the two velocity monitors (Velocity Monitor A to the northwest) were removed from the river during the week of June 7, 2022. Velocity Monitor B is currently still deployed. The locations of the meters are shown on Figure 2-8. Data from the velocity and turbidity monitors will be used to inform the turbidity monitoring and controls plan to be implemented during installation and removal of the BMP during the RA. Data from December 2021 through June 2022 is summarized in the SWMP (Appendix J).

2.3.6 Piezometer Installation

Four piezometers were installed using mud-rotary drilling equipment during the SDI to better understand the hydraulic conductivity and subsurface hydrostatic pressure of the groundwater bearing units below the Northern Impoundment. The locations of the piezometers are shown on Figure 2-6.

A shallow piezometer was installed and screened from the ground surface to -8 ft NAVD88 at boring SJMW-014 to get a better understanding of the hydraulic conductivity of the waste material itself. An intermediate piezometer was installed and screened from approximately -15 to -25 ft NAVD88 at boring SJMW-015 to obtain a better understanding of the hydraulic conductivity of the zone directly below the waste material. Deep piezometers were installed at borings SJMW-016 and SJMW-017 to better evaluate the potential for hydraulic heave during excavation activities. These piezometers extend into the sand layer below the Beaumont Clay Formation. SJMW-016 was screened from approximately -60 to -70 ft NAVD88, and SJMW-017 was screened from approximately -65 to -75 ft NAVD88, each representing the top ten feet of the lower sand layer below the Beaumont Clay.

During the installation of deep piezometers (SJMW-016 and SJMW-017), split spoon and Shelby Tube samples were collected as explained in Section 2.3.3. The samples were shipped under chain of custody procedures to the Thompson Engineering geotechnical laboratory for testing. Selected samples were analyzed for Unconsolidated Undrained Compression Test (ASTM D2850), Atterberg limits (ASTM D4318), moisture content (ASTM D2216), grain size (ASTM D6913/D7928), and #200 wash (ASTM D1140).

All four piezometers were constructed of 2-inch diameter Schedule 40 polyvinyl chloride (PVC) threaded casing. After development, a transducer was installed in each, and a slug test was performed to evaluate the lateral hydraulic conductivity of the strata through which each piezometer was screened. The locations of piezometers SJMW-014 and SJMW-015 were selected from adjacent boring log data to capture the highest representative conductivity values to inform choices on peak excavation seepage rates and water volumes. The hydraulic head in the lower sand was measured after development of the two deep piezometers (piezometer locations SJMW-016 and SJMW-017) to determine the confined hydrostatic pressure.

Pressuremeter Tests (PMT) were also performed by Braun Intertec at multiple intervals in the two deep piezometer boreholes using Texam Pressuremeter equipment. The tests were performed to evaluate the pressuremeter modulus, the limit pressure, and the at-rest horizontal pressures of the surficial alluvium and Beaumont Clay Formation.

2.3.7 Summary of SDI Results

2.3.7.1 SDI Analytical Results

A total of 35 analytical borings were sampled and analyzed for dioxins and furans during the SDI activities. Of the 35 borings, 30 borings had concentrations above 30 ng/kg $TEQ_{DF,M}$ to depths ranging from 0 to 22 ft bgs and the remaining borings were all below 30 ng/kg $TEQ_{DF,M}$ at a depth of 18 ft bgs, as shown on Figure 2-7. Consistent with the objectives of the SDI, an interval below 30 ng/kg $TEQ_{DF,M}$ was encountered at the terminal depth of every soil boring, establishing vertical delineation of the waste material. Data from the SDI also identified waste material exceeding 30 ng/kg $TEQ_{DF,M}$ at elevations deeper than previously encountered (-28.36 ft NAVD88 at SJSB098).

Due to the apparent variability of the SDI results in some borings (which often include an interval with results above 30 ng/kg $TEQ_{DF,M}$ below several feet of material with results below 30 ng/kg $TEQ_{DF,M}$), a subset of data consisting of 36 selected sample intervals from the full SDI dataset was selected to be re-extracted and reanalyzed by the analytical laboratory. These re-extractions are identified in Table 2-4 as Laboratory Duplicates and the results from these samples are in addition to the 19 field duplicates that were collected and analyzed as a part of project quality assurance procedures. To evaluate the data, the relative percent difference (RPD) was calculated for each set of duplicates. Consistent with the criteria listed in the QAPP for sediment field duplicate samples, the RPD was compared to an acceptance criteria of 100% or less. Using this criteria, analysis of the duplicate data found there to be 8 of the 36 sets of data in the lab duplicate set that were above the 100% RPD threshold and four of the 19 sets above the threshold for the field duplicate sets. Given the small sample extraction amount required for the analysis and the notoriously high variability of sediment samples, this amount of variation in the duplicate datasets was deemed realistic and within normal ranges of variability for sediments. The data presented on Figures 2-7 and 2-9 and in Table 2-6 represents the highest value obtained from either the parent, field duplicate, or laboratory duplicate samples for each sample interval.

All subsurface analytical results from the RI, PDI-1, PDI-2, and SDI are shown on Figure 2-9. The data bars in this figure show the interval results as elevations, adjusted to account for the depth of water atop each boring location. Table 2-6 also presents all subsurface analytical results as elevations.

The validated analytical SDI data, shown in Tables 2-4 and 2-6, provides quality assurance that the data collected are usable. The SDI analytical laboratory reports and data validation reports are included as part of Appendix A.

2.3.7.2 SDI Waste Characterization Sampling

Consistent with the results from waste characterization sampling performed as part of the PDI-1 and PDI-2 Treatability Testing, all six samples collected during the SDI for analysis of waste characterization parameters were below the thresholds to be classified as RCRA hazardous waste. Notably, the dioxins results from three of the six samples were significantly elevated (4,400 ng/kg $TEQ_{DF,M}$ at SJSB083 [8 to 10 ft bgs], 52,000 ng/kg $TEQ_{DF,M}$ at SJSB101 [0 to 2 ft bgs], and 47,000 ng/kg $TEQ_{DF,M}$ at SJSB101 [2 to 4 ft bgs]) indicating that these samples targeted locations with high dioxins concentrations. Waste characterization results are included in Table 2-5. Analytical laboratory reports and data validation reports are included as part of Appendix A. Conclusions of the waste characterization testing are further discussed in Section 3.3.

2.3.7.3 SDI Geotechnical and Hydrogeological Sampling

Additional geotechnical sampling was conducted during the SDI, including Shelby tube and SPT testing at SJMW-016 and SJMW-017. PMT was also completed at these locations. Results were within expected ranges, with alluvium being underlain by the Beaumont Clay, which was underlain by the deep Beaumont Sand. The CPT soundings indicated that the compressible clay strata consisted predominantly of one layer on the west side of the Northern Impoundment but on the east side, this layer may be interlayered by thin occasional granular lenses. The CPTs also provided a continuous profile of the undrained shear strength of the Beaumont Clay to the termination depth of the tests. The SDI geotechnical results are included in Appendix B. Further analysis and discussion of the geotechnical data as it relates to the RD of the BMP are included in Section 5.3.3.

Single well response aquifer tests (slug tests) were conducted at the newly installed piezometers at SJMW-014, SJMW-015, SJMW-016, and SJMW-017 on August 13, 2021. The test results were evaluated with the aquifer testing software AQTESOLV version 4.50 and can be viewed in Appendix A.

The shallow alluvium piezometer SJMW-014, which was screened through the waste material, yielded a hydraulic conductivity value of 0.000127 centimeters per second (cm/s), which is appropriate for a silty material. The deeper alluvium piezometer SJSMW-015 screened in the more permeable zone directly below the waste material, yielded a hydraulic conductivity value of 0.001175 cm/s, which is within expectations for a fine-grained sand.

The deep Beaumont Sand piezometers SJMW-016 and SJMW-017 were installed and screened in the ten-foot interval below the Beaumont Clay. The confined Beaumont Sand was found to have a relatively gradual hydraulic gradient sloping to the east. The two measurement points obtained from SJMW-016 and SJMW-017 were compared to each other and available historical well measurements to confirm the gradual hydraulic gradient. This low gradient allowed the water levels taken at SJMW-016 and SJMW-017 to be extrapolated to approximate water levels across the entire excavation area. The two deep piezometers yielded hydraulic conductivity values of 0.000170 cm/s and 0.000313 cm/s, which are appropriate for a silty sand.

Hydraulic conductivity data was used to verify and refine assumptions for water storage and treatment during the RA, as further described in Section 5.2.

2.3.7.4 SDI Surficial Sediments Geotechnical Properties Sampling

Surficial sediments/alluvium deposits consisting of clay, silt and sand with organic matter contents ranging from 0.7 percent to 9.7 percent were encountered at the surface at all boreholes and CPT locations. The alluvium deposit is black to grey in color with specific gravity ranging from 2.58 to 2.79 and dry bulk density ranging from 45.3 pounds per cubic foot (PCF) to 95.0 PCF. Further details regarding geotechnical conditions are included in Appendix B.

2.4 PDI and SDI Conclusions and Recommendations

When the ROD was issued, only eight subsurface borings had been installed in the Northern Impoundment. As part of PDI and SDI activities, an additional 71 subsurface borings were installed, providing additional horizontal and vertical (to as deep as -36 ft NAVD88) characterization. Analytical results from these samples indicate that the vertical impact of material with $TEQ_{DF,M}$ exceeding 30 ng/kg extends much deeper than initially determined. As shown in Table 2-6 and on Figure 2-9, data from the PDI and SDI indicate that the excavation elevations during the RA range up to an elevation of -28.36 ft NAVD88 with an average elevation of -12.8 ft NAVD88. The average depth of waste referenced in the ROD was -8 ft NAVD88. The corresponding volume of waste material was found to be approximately 50 percent greater than what was known at the time of the ROD. The horizontal and vertical waste extents were used as part of this RD to determine the type of BMP necessary to implement the selected remedy and the appropriate removal methodology. The data from the PDI and SDI was also used to determine the area of the Northern Impoundment that will require remediation and the alignment of the BMP. Data analysis, civil excavation contouring, and BMP design are further discussed in Section 5.

Understanding the geotechnical characteristics of the soils beneath the Northern Impoundment is a critical component of the RD. Given the significantly deep elevations of waste material encountered during the SDI, a detailed evaluation was conducted to examine the potential for hydraulic heave during excavation activities. The evaluation examined the thicknesses of the underlying strata beneath the Northern Impoundment including the alluvium and underlying Beaumont Clay and the interface between the Beaumont Clay and Beaumont Sand. The evaluation also examined the pore pressures of the Beaumont Sand, as measured by the deep piezometers to determine the hydraulic head level. Finally, the evaluation examined the properties of the soils including the unit weight of the clay and overlying alluvium and the presence of sand lenses in some parts of the clay layer. This evaluation was intended to assess whether the pore pressures within the Beaumont Sand and/or sand layers within the clay would be sufficient to overcome the weight of the overburden considering the planned excavation depths and water drawdown.

Based on this evaluation, it was determined that there are several areas across the Northern Impoundment (primarily in and throughout the northwest corner) in which there would be significant risk of hydraulic heave if material is removed in the dry to the currently known elevations presented in this document (See Table 5-1). The evaluation indicated a total stress analysis safety factor (SF) below 1.25 for removal of material to the depths of deepest impact in these areas. A total stress analysis SF of 1.25 is considered protective of hydraulic heave and is in accordance with USACE guidance. Based upon the results of this evaluation, it was determined that it would be unsafe to excavate the material in the northwest corner to the currently known depths in the manner required by the ROD. The results of this evaluation were detailed in a Hydraulic Heave Analysis Report submitted to the EPA on December 9, 2021, (GHD, 2021i) and in a follow-up letter submitted to the EPA on December 22, 2021 (GHD, 2021j). Based upon this evaluation, excavation of the northwest corner is technically impracticable as prescribed by the ROD (i.e., “in the dry”) and that area will be addressed with mechanical dredging to mitigate the hydraulic heave risk and based on the Updated Hydraulic Heave Analysis Report submitted as part of this Revised 100% RD.

A detailed analysis of the geotechnical conditions at the Northern Impoundment, as they relate to the RD, are included in Appendix B and are discussed in Section 5. The Updated Hydraulic Heave Analysis Report is also included as an attachment to the Geotechnical Engineering Report included in Appendix B.

3. Treatability Studies

3.1 2019 Treatability Study Overview

As part of the PDI-2 field activities in October 2019, waste material, porewater, and armored cap material samples were collected and contact water was generated from the Northern Impoundment for treatability testing, as specified in the *Treatability Study Work Plan* (TSWP) (GHD, 2019c) submitted to the EPA on May 20, 2019, and approved on August 27, 2019 (EPA, 2019d). Treatability testing was conducted in the GHD Treatability Laboratory in Niagara Falls, New York (GHD Treatability Lab). Analytical testing was completed by Eurofins TestAmerica Laboratories.

Four composite waste material samples were collected from the four quadrants of the Northern Impoundment for additional waste characterization sampling to determine eligibility for Texas Class I and/or Class II non-hazardous industrial waste disposal and evaluation of solidification mix design, as necessary. Three composite samples of armored cap material were collected for characterization and evaluation for reuse.

As described in the TSWP, two water management approaches were evaluated, as part of the Treatability Study: traditional treatment through clarification and filtration, and thermal evaporation.

To assess the traditional treatment approach, contact water was generated in an excavation on the southwest quadrant of the Northern Impoundment and a field pilot test which involved on-site clarification and filtration was performed. Effluent from the on-site treatment was also utilized in bench-scale treatability testing at the GHD Treatability Lab, to evaluate particle size and the effectiveness of filtration to remove Constituents of Potential Concern (COPCs) for water discharge criteria.

Concurrently, a pilot study was conducted to evaluate the proposed thermal evaporation treatment approach using the clarified contact water. The fate of dioxins and furans was evaluated at different steps of the evaporation treatment process.

3.2 2019 Treatability Study Objectives

As outlined in the TSWP, the objectives of the Northern Impoundment treatability testing included:

– Evaluation of optimum solidification mix designs to solidify the waste material for off-site transportation and disposal.
– Evaluation of optimum solidification mix designs to meet requirements for Texas Class I and/or Class II non-hazardous industrial waste disposal, in accordance with 30 TAC 335.505-506 and 335.508.
– Evaluation of evaporation technology, including processing capacities, fuel consumption, evaluation of the characteristics of the brine produced by the evaporation process, and air emissions.
– Evaluation of traditional water treatment technology.
– Determination of optimum treatment alternatives for contact water to comply with ARARs.
– Evaluation of the armored cap materials at the Northern Impoundment to determine whether such materials can be reused on-site during or post-remedy implementation.

3.3 2019 Waste Material Treatability Testing

Based on the origin of waste material in the Northern Impoundment, the waste material is not listed as hazardous under 40 CFR Part 261, Subpart D. Further, waste characterization samples collected during the PDI-1 were analyzed for ignitability, corrosivity, reactivity, and toxicity, as defined in Title 40 of CFR Part 261, Subpart C, to determine if the material is characteristically hazardous. The results indicate that the material is not a characteristic hazardous waste under RCRA or EPA or TCEQ regulations. Validated PDI-1 waste characterization data are included in Table 2-2.

Additional testing was conducted during the Treatability Study to further classify the non-hazardous waste under applicable Title 30 of the TAC, (Industrial Solid Waste and Municipal Hazardous Waste) (30 TAC 335). The material was also tested in accordance with EPA Method SW-846 Test Method 9095B (i.e., paint filter test), to determine whether free liquids were present which would prevent the material from being disposed of without solidification. Solidification tests were also performed on the waste material to determine the level of solidification necessary to achieve a target unconfined compressive strength (UCS) that may be required for off-site disposal.

Additional waste characterization testing was also performed on six samples collected during the 2021 SDI to supplement the previous dataset.

3.3.1 Treatability Testing Sample Collection

As part of the Northern Impoundment PDI-2 activities conducted from September to December 2019, four approximately 30-gallon composite samples of waste material were collected from the southwest, northwest, northeast, and southeast quadrants of the Northern Impoundment to utilize for treatability testing, as shown on Figure 3-1. Composite Sample 1 in the southwest quadrant was composited from waste material removed from the excavation to create contact water for water treatability testing. The samples were containerized in 5-gallon buckets, sealed, and transported via freight to the GHD Treatability Lab on September 19, 2019. The remaining three samples were composited from cuttings in the first 20 feet from the geotechnical borings in each quadrant (Composite Sample 2 from the northwest quadrant, Composite Sample 3 from the northeast quadrant, and Composite Sample 4 from the southeast quadrant). The samples were containerized in 5-gallon buckets and transported via freight to the GHD Treatability Lab on December 17, 2019.

3.3.2 Baseline Characterization

An initial baseline characterization was performed to determine if there was significant variation of the chemical and physical properties between the four quadrant waste material samples collected within the Northern Impoundment and to provide data for further waste characterization.

Each waste material sample was analyzed for the following parameters to determine whether it met TCEQ Class I or Class II non-hazardous waste landfill disposal requirements:

- Percent Solids - SM for the Examination of Water and Wastewater 2540G.
- TCLP Dioxins and Furans - EPA 1613B.
- TCLP Volatile Organic Compounds (VOCs) - EPA 8260C.
- TCLP Semi-volatile Organic Compounds (SVOCs) - EPA 8270D.
- TCLP Organochlorine Pesticides - EPA 8081B.
- TCLP Polychlorinated Biphenyls (PCBs) - EPA 8082A.
- TCLP Herbicides - EPA 8151A.
- TCLP Glycols - EPA 8015D Direct Injection.
- TCLP Metals - EPA 6010C.
- TCLP Mercury - EPA 7470A.
- TCLP Methomyl - EPA 8321A.
- Total Cyanide - EPA 9014.
- Sulfide - EPA 9034.
- Ignitability - EPA 1020B.
- pH - EPA 9045D.

– Paint Filter - EPA 9095B.

3.3.3 Waste Material Treatability Results and Conclusions

Consistent with the results obtained during PDI-1 and PDI-2, results from the SDI testing characterization indicated that all waste material samples are expected to meet disposal criteria for a Class II landfill and that the material is a non-hazardous waste under RCRA. The basis for this classification is discussed in the sections below.

The results from the PDI-1 waste characterization testing are shown in Table 2-2, the results of the SDI waste characterization testing are shown in Table 2-5, and the results from the PDI-2 Treatability waste characterization testing are shown in Table 3-1. Analytical laboratory reports for the PDI-1 and SDI testing are included as part of Appendix A and analytical laboratory reports for the PDI-2 Treatability Testing are included as part of Appendix C.

3.3.4 Waste Characterization Conclusions

The EPA's guidance regarding the management of remediation waste states that "contaminated environmental media, of itself, is not hazardous waste and, generally, is not subject to regulation under RCRA." (*Management of Remediation Waste under RCRA*, EPA, 1998). The material to be excavated during the Northern Impoundment RA for disposal off-site is the environmental media to be evaluated, and it is subject to regulation under RCRA as hazardous waste only if one of the following two conditions exists:

1. The media is impacted with a listed hazardous waste at concentrations that are above the health-based risk levels.
2. Any constituent in the media exhibits one of the characteristics of hazardous waste.

GHD submitted a waste characterization evaluation for the Northern Impoundment to the EPA on October 20, 2020 (Waste Characterization Letter; GHD, 2020g). The purpose of the evaluation was to describe how pulp and paper mill waste, proposed to be excavated as part of the Northern Impoundment RA, has been characterized and classified in accordance with the RCRA regulations as non-hazardous waste. EPA subsequently concurred with the conclusions contained in the Waste Characterization Letter in a letter to GHD dated November 19, 2020 (EPA, 2020h).

As part of this evaluation, the following sections of Title 40 of the CFR Part 261 - *Identification and Listing of Hazardous Waste*, were evaluated:

– Subpart A - Definition of Solid Waste, Hazardous Waste & Exclusions (261.1-.9).
– Subpart B - Criteria for Identifying the Characteristics and Listing of Hazardous Wastes (261.10-.11).
– Subpart C - Characteristics of Hazardous Waste (261.20-.24).
– Subpart D - Lists of Hazardous Wastes (261.30-.33).

3.3.4.1 Listed Waste Evaluation

The listed waste evaluation involved determining whether the material contains a "listed" hazardous waste at concentrations above regulatory thresholds. The categories of listed hazardous wastes, using the codes assigned to each category, are:

– "F" codes = Non-Specific Sources.
– "K" codes = Specific Sources.
– "P" codes = Commercial Chemical Products (acutely hazardous).
– "U" codes = Commercial Chemical Products (non-acutely hazardous).

According to EPA guidance, information about the source of the waste is to be used in making the determination. Information about the waste material was summarized in the Waste Characterization Letter. The evaluation concluded that the material did not meet any of the listed descriptions.

3.3.4.2 Characteristic Waste Evaluation

Under RCRA, a solid waste is a hazardous waste if it exhibits any of the following characteristics:

– Ignitability (D001).
– Corrosivity (D002).
– Reactivity (D003).
– Toxicity (D004 - D043).

The evaluation involved a review of available waste characterization data from PDI-1 and PDI-2 and information from the RI about the material deposited in the Northern Impoundment. It concluded that the excavated material at the point of generation (when it is excavated) would not exhibit the characteristics of a RCRA hazardous waste (i.e., ignitability, corrosivity, reactivity, or toxicity).

In its letter to GHD dated November 19, 2020, the EPA stated that "based upon information provided in the October 20, 2020 evaluation, EPA agrees with GHD's determination that the initially generated waste would not be a listed hazardous waste meeting the current definitions of an F, K, P or U waste. From review of the analytical testing results, the samples are all non-hazardous" (EPA, 2020h). Additional waste characterization sampling was conducted during the 2021 SDI, the results of which further support the conclusions summarized in GHD's October 2020 letter. Additional sampling may be required to further characterize excavated material to determine whether it meets the definition of Class 1 or Class 2 non-hazardous waste under the regulations governing classification of non-hazardous industrial solid waste in Texas. If additional characterization is conducted it will be done so in accordance with the guidance provided in Chapter Nine "Sampling Plan" of the *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (EPA, 1986) and in *RCRA Waste Sampling Draft Technical Guidance* (EPA, 2002). If at any time a hazardous waste, as defined in 40 CFR Part 261, is identified, it will be managed and disposed of in accordance with RCRA regulations.

3.3.5 Solidification Testing

Solidification testing was conducted to determine the appropriate reagent dosages to solidify the waste material for transportation to an off-site disposal facility. Off-site disposal facilities typically require incoming waste to pass paint filter testing (an indicator of moisture content) and meet a minimum UCS criteria. A series of tests were performed on material with various levels of the following parameters:

1. Moisture content - to simulate a wide range of site conditions.
2. Reagent concentration - to develop optimal dosage percentage to address paint filter and UCS disposal requirements.
3. Reagent mix - to develop optimal reagent blend for cost analysis.

The solidification testing methodology and results are summarized in the sections to follow.

3.3.5.1 Solidification Testing Methodology

Waste material composite Sample 3 and composite Sample 4 from the Northern Impoundment were utilized for solidification testing. The testing mixtures were prepared by placing 400 grams (g) of waste material with the predetermined amount of reagent in a mechanical mixer. Waste material and reagent were mechanically mixed for five minutes and then placed into a mold for curing. Reagent doses and blends tested are summarized in Table 3-A, as follows:

Table 3.A Solidification Testing Parameter Matrix

Percent Solids Tested (%)	Reagent Type Tested	Reagent Dosage(s) Tested (%)
35 ,45, 55, 70	Portland Cement	2, 5, 10, 20
	Lime	5, 10, 20
	Portland / Lime	5/5, 10/10, 10/20, 15/20

Notes:
(1) Portland/Lime reagent blends were utilized to evaluate cost effective substitutes.
(2) "5/5" indicates percentage of Portland cement and lime used (i.e., 5% Portland + 5% lime).

Curing was monitored using a pocket penetrometer and samples were monitored for the presence of free water which would be a leading indicator of not passing a Paint Filter Test. Pocket penetrometer testing was conducted on molds starting from two days after mixing up to 14 days. Results of solidification testing is summarized in Section 3.3.5.2.

3.3.5.2 Solidification Results and Conclusions

The results of the solidification testing indicated that free water (Paint Filter testing) and UCS requirements of an off-site disposal facility can be met across a range of waste material percent solid scenarios (35 to 70 percent) utilizing Portland cement and/or lime. In general, Portland cement was more effective at achieving both disposal requirements. Lime dosages did not result in significant strength (UCS) or free water reduction. In addition, combining lime with Portland cement did not result in the ability to lower the percentage of Portland cement utilized.

Based on these solidification tests, the required dose of Portland cement increases with decreasing percent solids and ranges from a dose of two percent for waste material with 70 percent solids to 10 to 20 percent (depending on potential landfill strength requirements) for material with 35 percent solids. Material with 45 percent solids or less has the potential to fail the Paint Filter test without adequate treatment. The selected Remedial Contractor (RC) may perform their own testing at the time of the RA. The specifics of the off-site disposal facility requirements will be worked out between the RC and the selected off-site disposal facility at the time of the RA. The results for these solidification treatability tests are presented in Appendix C.

3.4 2019 Water Treatability Testing

During the RA, as specified in the ROD, as sections of the armored cap are removed, water will come into contact with the waste material through seepage or stormwater and will require management. Additionally, water generated from equipment decontamination and the water treatment system (WTS) containment area will need to be managed. Water treatability testing was performed to evaluate two water management options: (1) traditional treatment and (2) discharge using clarification and filtration and thermal evaporation.

To generate a sufficient quantity of representative contact water for all necessary testing, an open excavation area was constructed in the waste material in the southwestern quadrant, as shown on Figure 3-1, and filled with potable water to simulate potential stormwater or seepage that may come into contact with the impacted waste material. A sample of the raw contact water was collected and sent to the GHD Treatability Lab for baseline characterization and filtration testing.

The remaining generated contact water was processed on-site through a modular filtration treatment system, including polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration. Samples were collected at each step of the treatment process to evaluate the concentration of dioxins and furans. Additional focused filtration testing was performed on a sample of the final clarified and filtered effluent to further evaluate dioxin and furan concentrations using different filter sizes. Treatability testing was also conducted on the clarifier underflow (solids that settle out during the clarification process) to evaluate the level of settling and solidification necessary to prepare the waste stream for off-site disposal.

A batch of clarified water, prior to filtration, was sent to the Purestream pilot test facility in Logan, Utah for a thermal evaporation pilot test to evaluate air emissions.

All water testing results were evaluated against calculated water discharge criteria, as discussed below.

3.4.1 Water Discharge Concentrations

So that discharge of treated water during the RA meets water quality standards, COPC discharge concentrations were developed by conducting a water quality-based effluent limitation (WQBEL) assessment. The Texas Surface Water Quality Standards (TSWQS) are specific to water bodies, not to discharges, so WQBELs take into account the load that the site-specific discharge would add to the water body as a whole to determine the necessary limits to maintain protection of human health and aquatic life.

The TCEQ utilizes the Texas Toxicity Screening (TexTox) Menus to determine WQBELs. TexTox Menus include all relevant formulas and inputs found in the *Procedures to Implement the Texas Surface Water Quality Standards* (Implementation Procedures), June 2010 (TCEQ, 2010). Depending on the type of receiving water body, different TexTox Menus would be assigned. During the RA, treated water from the Northern Impoundment will discharge to either Segment 1005 (Houston Ship Channel/San Jacinto River Tidal, south of I-10) or Segment 1001 (San Jacinto River Tidal, north of I-10) of the San Jacinto River, which is classified as a bay/wide tidal river.

For discharges into Segments 1005 or 1001, TCEQ would assign the TexTox Menu #5 to calculate WQBELs. This TexTox Menu requires inputs for Total Suspended Solids (TSS), effluent flow, and effluent fractions for chronic and acute aquatic life and human health. Based on the planned location of the outfall and the type of water body, the following default dilution fractions were used, per TCEQ guidance: 30 percent for Zone of Initial Dilution (Acute), eight percent for Aquatic Life Mixing Zone (Chronic), and four percent for Human Health Mixing Zone. Since Segments 1005 and 1001 are tidal water bodies, they are dominated by the ebb and flow of tides rather than from upstream flow. These effluent fractions, along with an estimated effluent flow, serve as main inputs for the discharge information required by the TexTox Menu to calculate WQBELs. The estimated discharge flow rate for the RA ranges from 300 to 1,000 gpm (0.432 to 1.44 million gallons per day [gpd]). The default dilution factors are recommended for any discharge into a bay/tidal river greater than 400 ft wide with a flow rate less than 10 million gpd.

Using default dilution factors, river segment specific inputs, and expected TSS and discharge flow rates from the Northern Impoundment WTS discharge, preliminary discharge concentrations were determined. These preliminary calculated discharge concentrations were used to evaluate water treatability testing results and can be found in Table 3-2.

3.4.1.1 Compliance with the Texas Surface Water Quality Standard - Dioxins and Furans

The EPA has made a determination regarding compliance with the TSWQS for dioxins and furans as an ARAR, based on the substantive requirements of the TCEQ's regulation for surface water discharge, as detailed in e-mail correspondence dated February 18, 2020 (EPA, 2020b; included in Appendix D).

EPA has determined that compliance with the TSWQS ARAR will be attained as follows:

- *The state surface water quality standard for Dioxins/Furans is 7.97 x 10^{-8} micrograms per liter (µg/L)[1] (0.0797 picograms per liter [pg/L][2]) (as TCDD equivalents).*
- *Compliance with the TSWQS will be determined using the minimum level of the EPA approved method (1613B), cited in 40 CFR Part 136 (Guidelines Establishing Test Procedures for the Analysis of Pollutants), in sampling of surface water discharges during the site remedial action.*
- *If an effluent sample analyzed for dioxin is below the Minimum Level (ML) using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR.*
- *The ML for each analyte is defined as the level at which the entire analytical system must give a recognizable signal and acceptable calibration point. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and clean-up procedures have been employed.*
- *This approach is consistent with the state's guidance and other permits issued by the TCEQ. EPA's determination is contingent on the water treatment facility using a 1-micron final filtration step in the water treatment process*.

3.4.2 Contact Water Pilot Testing

3.4.2.1 Contact Water Creation

Contact water for pilot testing was generated from the Northern Impoundment by creating an open excavation in the southwestern portion of the Northern Impoundment, with approximate dimensions of 20 ft by 20 ft and a depth of 10 ft. The excavated material was temporarily stored in roll-off containers. The excavation remained open overnight, and water that seeped into the excavation was collected and submitted for analysis. Approximately 20,000 gallons of potable water was then transferred into the excavation and mixed using an excavator bucket to generate a worst-case sediment and water mixture that may be encountered during the RA. This simulated contact water was then pumped into two storage tanks and the contents of the two tanks were homogenized prior to treatment.

3.4.2.2 Pilot Test Overview

Once the contact water was created and removed for treatment testing, as described above, the excavation was backfilled with the stockpiled waste material, the geomembrane cover was replaced and sealed, and the armored cap material was replaced. A sample of contact water created from the on-site excavation was shipped to Evoqua Water Technologies LLC (Evoqua), to determine the optimum polymers for addition during the on-site field filtration pilot testing. The modular filtration treatment system included polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration, as depicted on Process Flow Diagram (PFD) shown on Figure 3-2. During the treatment system operations, the storage tanks were continuously mixed, while the water was recirculated between the two tanks to homogenize the feed to the treatment system.

One batch of contact water was treated through clarification only, and one batch was treated through both clarification and sand filtration. The batch of clarification-only water was sent to the Purestream pilot test facility in Logan, Utah, and used to evaluate thermal evaporation technology for water management. The batch of clarified and filtered water was sampled and used to evaluate traditional pump-and-treat technology through on-site field and bench-scale testing, as described in the subsequent sections.

The pilot test treatment system was operated at a flow rate of approximately 30 gpm. The system was initially flooded with contact water, which was directed to an off-specification wastewater storage tank. Clarifier effluent turbidity was monitored as the polymer dosage rates were adjusted. Once the clarifier effluent turbidity dropped below 10 Nephelometric Turbidity Units (NTUs), the clarified water was directed to a separate holding tank. After 7,500 gallons were collected, the clarified effluent was directed to the sand and bag filters, and the effluent to the off-specification tank. Once turbidity levels remained at a consistent value of 10 NTUs in the effluent out of the clarifier, and at approximately one NTU in the filtrate from the filters, the filtered effluent water was discharged to a separate holding tank. Clarifier underflow solids were discharged to a holding tank and allowed to further settle. Photographs from the water treatment pilot test activities are included in the photographic log included in Appendix C.

3.4.2.3 Filtration Pilot Test Water Samples

As discussed previously, contact water was generated in the southwestern part of the Northern Impoundment by placing potable water in an open excavation. This simulated contact water was then processed through an on-site pilot treatment system which included polymer addition with inline mixing followed by clarification, sand filtration, and bag filtration. Water samples were collected and analyzed at different steps in the process, as depicted in the PFD included as Figure 3-2.

A contact water sample taken from the storage tank prior to homogenization was sent to the GHD Treatability Lab for bench-scale testing. This sample and the excavation seepage water were analyzed for the following parameters:

- Total and Dissolved Dioxins and Furans - EPA Method 1613B.
- VOCs - EPA Method 8260C.
- SVOCs - EPA Method 8270D.
- Organochlorine Pesticides - EPA Method 8081B.
- Herbicides - EPA Method 8151A.
- PCBs - EPA Method 8082A.
- Anions - EPA Method 300.0R2.1.
- Total Metals - EPA Method 6010C.
- Total Mercury - EPA Method 7470A.
- Alkalinity - SM 2320B.

- Ammonia Nitrogen - EPA Method 350.1.
- Biochemical Oxygen Demand - SM 5210B.
- Chemical Oxygen Demand (COD) - EPA Method 410.4.
- Cyanide - EPA Method 9012B.
- Ferrous iron - SM 3500.
- Hydrogen sulfide - EPA Method 15.
- pH - EPA Method 9040C.
- Phosphorus - EPA Method 6010C.
- Sulfide - EPA Method 9034.
- Total Dissolved Solids (TDS) - SM 2540C.
- Total Organic Carbon (TOC) - SM 5310C.
- TSS - SM 2540D.

The two homogenized contact water samples, the clarified effluent sample, and the filtered effluent sample were analyzed for any COPC that had a detection in the results of the previous non-homogenized contact water sample. Based on those results, these samples were analyzed for all of the same constituents listed above, except the following which were found to be non-detect: VOCs, SVOCs, Organochlorine Pesticides, Herbicides, and PCBs.

In addition, samples were collected from the clarifier underflow and settling tank for treatability testing and TSS analysis.

3.4.2.3.1 Filtration Pilot Test Results

Results of the water samples from each step of the on-site pilot testing are summarized in Table 3-2 and were compared to the estimated discharge criteria established by the EPA (ML), as described in Section 3.4.1. Analytical laboratory reports are included as part of Appendix C.

The homogenized contact water initially exhibited levels of dioxins and furans, TSS, and some metals (including copper, lead, and zinc) above the estimated discharge criteria. Following clarification, the metal concentrations in the clarified effluent sample were below the estimated discharge criteria. Following filtration, dioxins and furans concentrations were also below the ML. The table on Figure 3-2 shows the stepwise decrease in dioxins, metals, and TSS levels at each step in the treatment process. This treatment process is being used as the basis for the RD with additional proposed unit processes, as discussed in Section 5.9.

Turbidity was monitored online at both the clarifier effluent and the filtered effluent. Turbidity results are presented on Figure 3-3. Clarifier turbidity was typically at 10 NTUs or less, while filtered effluent turbidity was typically at one NTU or below. The clarifier effluent TSS concentration was 10 milligrams per liter (mg/L), while the filtered/clarified effluent TSS was 2 mg/L. Based on the observed relationship between turbidity and TSS (see Figure 3-A), turbidity levels can be used as an indication of the TSS concentration. One dioxin congener was above the ML in the clarified effluent, but below the ML in the filtered effluent. For the RA, due to the strong correlation between TSS and dioxan and furan concentrations, TSS and turbidity levels could potentially be used to indicate if the dioxin and furan level is below the ML based on these pilot testing results, as well as the bench-scale filtration results. However, further field testing will be required during the operations of the treatment system. The strong correlation between TSS and dioxin and furan concentrations was noted during bench scale and pilot testing where a direct linear concentration between TSS and concentration of dioxins and furans was observed and filtration testing showed that dioxins and furan concentrations in filtered water decreased with the size of filter used. Water treatment is discussed further in the document in Section 5.9.

A turbidity spike occurred at the 19:30 hour mark during the filtration pilot test as a result of the loss of polymer feed. Once this issue was observed, the polymer feed was changed from automatic to manual then restarted, and turbidity dropped to the pre-spike levels. This result supports the benefit of polymer, as well as the ability to monitor performance using turbidity as an indicator.

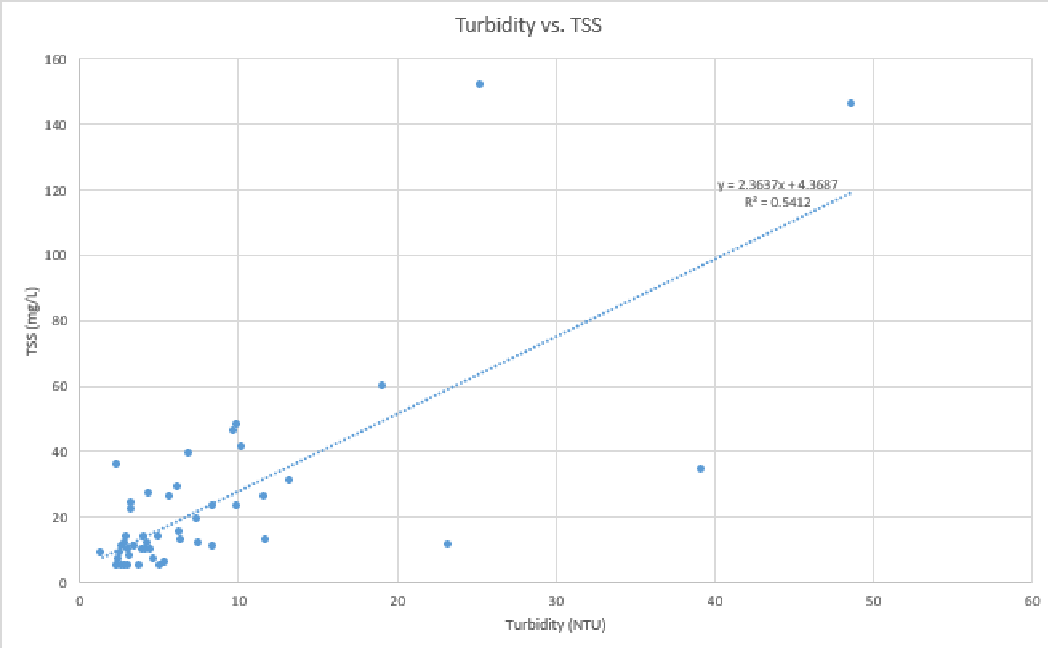

Figure 3-A Turbidity vs. TSS

3.4.2.4 Thermal Evaporation Pilot Test

For the thermal evaporation evaluation, approximately 5,000 gallons of clarified contact water were transported to the Purestream pilot test facility in Logan, Utah, for a three-day pilot test. The pilot test facility utilized a 1/10 scale replica pilot test model of a Flash thermal evaporation unit, which utilizes a direct flame to evaporate influent water to the atmosphere, creating a brine byproduct only (that would need to be disposed) with no effluent water stream for river discharge. The pilot test included three days of stack testing to evaluate emissions of COPCs. Results of the stack testing indicated that none of the COPC emissions were above the levels of the applicable air emissions ARAR (the Permit by Rule [PBR] 30 TAC §106.261(a)(3)). This indicates that most of the COPCs remain in the brine byproduct generated by thermal evaporation.

As part of the RD evaluation, water treatment rates and storage requirements were evaluated for both water management alternatives. The treatment flowrate for the traditional pump-and-treat option is 300 gpm. In order to achieve a 300-gpm flowrate using the thermal evaporation option, 25 thermal evaporation units would be needed. It was determined that it would not be feasible to stage and operate this large a number of units at the Northern Impoundment during the RA. As a result, contact water would need to be stored and evaporated at a lower flow rate, resulting in storage of larger volumes of water over a longer duration as compared to the treat-and-discharge option. As a result, traditional treatment through clarification and filtration was selected for use in the 90% RD and thermal evaporation was not further evaluated. Thus, results of the thermal evaporation evaluation are not included in this Revised 100% RD.

3.4.3 GHD Treatability Bench-Scale Testing

The bench-scale testing of the non-homogenized contact water is described in Section 3.4.2.3. In addition to the initial analysis and characterization of the contact water, bench-scale filtration tests were performed on the generated contact water (Section 3.4.3.1, below). Bench-scale testing was also performed on the clarified and filtered effluent from the pilot test (Section 3.4.3.2, below) to evaluate additional filtration steps.

As part of the clarification process, solids settle out of the water into a sludge. This clarifier underflow sludge will be disposed off-site as a separate waste stream. Because the sludge will have a very high moisture content, it may need to be solidified prior to off-site transport. Treatability testing was performed to evaluate options for solidification of the sludge. To optimize the amount of reagent necessary for solidification, additional settling treatability testing was performed to evaluate the effectiveness prior to solidification (Section 3.4.3.3, below).

3.4.3.1 Contact Water Filtration Testing

A serial filtration test was performed on the non-homogenized contact water during the bench-scale testing in order to determine the size distribution of the particles present in the contact water and any relationship between particle size and the concentration of dioxins and furans in the sample.

The test was performed on a 7-liter sample of non-homogenized contact water. The entire sample was filtered through a pre-weighed 100-micron (µm) filter paper. A one-liter sample of the filtrate was then collected for analysis of dioxins and furans. This process was repeated using the remaining filtrate water and pre-weighed 10, 1, 0.45 and 0.1 µm filter papers, with collection of a filtrate sample after each filtration. After the filtration test was complete, each filter paper was dried and then weighed to determine the amount of particulate captured on the filter, and the filtrate samples were analyzed for dioxins and furans.

Testing of other water treatment technologies identified in the TSWP, such as those for metals and ammonia removal, were not required as these compounds did not exceed discharge criteria in the baseline characterization.

Contact Water Filtration Test Results

The results of the filtration test showed more than 90 percent of the particulates were larger than 10 µm in size. Concentrations of dioxins and furans that exceeded the MLs were observed in the filtrate that had passed through the 100 µm and 10 µm filters; however, after filtration with a 1 µm filter, concentrations of all dioxins and furans were below their MLs. These results are summarized in Table 3-3 and shown graphically on Figure 3-4. Analytical laboratory reports are included as part of Appendix C.

3.4.3.2 Focused Filtration Testing

The on-site filtration pilot test water treatment included clarification, followed by sand filtration and nominal bag filtration. In order to determine the effect of additional filtration on the already filtered effluent from the pilot study, the pilot study filtrate water was filtered through 1 µm, 0.45 µm, 0.1 µm, 0.05 µm and 0.025 µm filters. The filtrate from each filter was collected and analyzed for dioxins and furans.

Further testing on the effluent included coagulation/flocculation testing and testing of granular activated carbon (GAC) for polishing.

Focused Filtration Testing Results

The filtrate from the 1 µm, 0.45 µm, 0.1 µm, 0.05 µm and 0.025 µm filters was analyzed for dioxins and furans. These results are summarized in Table 3-4 and shown graphically on Figure 3-4. Analytical laboratory reports are included as part of Appendix C. Consistent with the results obtained from the initial effluent bench-scale filtration testing, none of the filtrate samples contained dioxins and furans above the MLs. This confirms that a 1 µm filter is sufficient for removal of the dioxins and furans from the water. This and the contact water filtration testing data (Section 3.4.3.1) were presented and discussed with members of the TWG on January 27, 2020. Based upon the results and the TWG discussion, the EPA sent correspondence to the Respondents on February 18, 2020 (EPA, 2020b), stating that “compliance with the TSWQS will be determined using the minimum level of the EPA approved method (1613B).” The correspondence further specified that this determination would be “contingent on the water treatment facility using a 1 µm final filtration step in the water treatment process.”

Coagulation/flocculation jar testing was performed on the non-homogenized contact water by Evoqua, and the results were used to inform the polymer dose utilized during the pilot test discussed in Section 3.4.2.

Further testing of the effluent included polishing with GAC. As dioxins and furans were not present above their MLs prior to GAC treatment, removal of dioxins and furans by GAC could not be quantified. However, GAC treatment will be included in the RD to provide a final polishing step to the effluent discharge.

3.4.3.3 Clarifier Underflow Solids Testing

As previously discussed, bench-scale treatability testing was performed to evaluate the effectiveness of additional settling of the clarifier underflow prior to solidification for off-site disposal. As part of the settling test, a sample of the clarifier underflow was agitated to resuspend solids and an initial sample was analyzed for TSS. A subsample of the material was poured into a 500 mL graduated cylinder and allowed to settle. The height of the sediment/water interface was recorded every five minutes and a sample of the supernatant was analyzed for turbidity every ten minutes. After settling was complete (i.e., no change in the sediment/water interface was observed), a sample of the supernatant was analyzed for TSS.

Solidification tests were also performed on both the raw clarifier underflow and the clarifier settled solid samples that were generated, as described above. The solidification tests were conducted by placing 400 grams of waste material with the amounts of solidification agent, stated below, and water in a mechanical mixer. The waste, water, and solidification agent were mixed for five minutes and then placed in a plastic mold. The samples were allowed to cure for two weeks. During curing, the hardness of the sample was evaluated using a pocket penetrometer three times per week. After curing, the samples were analyzed for UCS.

For the raw clarifier underflow sample, solidification was tested using the sample alone and the sample mixed in a 1:1 ratio with a sample of waste material composite. Cement doses between 15 percent and 85 percent were tested with and without the addition of lime at doses between 20 percent and 70 percent.

For the settled solids sample, solidification was tested using the sample alone and the sample mixed in a 1:1 ratio with a sample of waste material composite. Cement doses between 10 percent and 30 percent were tested with and without the addition of lime at doses between 20 percent and 30 percent.

Similar solidification testing was performed with the brine from the evaporation pilot test. Since evaporation is no longer being considered as an option for water treatment, these results will not be discussed in this Revised 100% RD.

Clarifier Underflow Solids Test Results

Settling of the clarifier underflow solids occurred quickly; the bulk of the solids settled within four minutes and the supernatant gradually cleared to produce a low turbidity, low TSS liquid within two hours. These results indicate that settling is useful in removing suspended solids. Photographs of the settling tests are shown in the photographic log included in Appendix C.

For the raw clarifier underflow solidification tests in which lower Portland cement and lime doses were used, even though good solidification of the solids was achieved, standing water remained on top of the solidified mass. This showed that the water had not been incorporated into the solidified material.

To eliminate standing water in the samples, a dose of 35 percent Portland cement and 60 percent lime was required for the raw clarifier underflow sample and a dose of 70 percent Portland cement was required for the clarifier underflow sample mixed at a 1:1 ratio. A pocket penetrometer hardness of >64 pounds per square inch (psi) was achieved for these samples.

These data show that a large dose of Portland cement and lime would be required to solidify the clarifier underflow on its own and that mixing with the waste material at a ratio of less than one part underflow per part of waste material would be recommended in order to minimize the reagent dose for solidification.

For the solidification test using the settled solids, standing water was observed initially in some tests with lower doses of cement and lime. However, after two days, the standing water had been absorbed by the solidified solids. The minimum reagent doses to achieve a pocket penetrometer hardness of >64 psi and a UCS of >50 psi were 25 percent Portland cement with 30 percent lime or 20 percent Portland cement with a 1:1 mixture of waste material and settled solids.

These data show that the settled solids can be solidified on their own but that mixing with waste material at a 1:1 ratio can reduce the required reagent dose. The selected RC may perform its own testing at the time of the RA. The specifics of the off-site disposal facility requirements will be worked out between the RC and the selected off-site disposal facility at the time of the RA. More detailed data for these solidification treatability tests can be made available upon request.

3.5 2019 Armored Cap Material Treatability Testing

The TSWP scope of work included generation and testing of an elutriate to characterize the armored cap material and evaluate the potential for reuse as part of the RA. During the December 17, 2019 TWG Meeting, the EPA requested that the scope be revised to include additional analyses of the sediment that is generated from the rinsing of the armored cap material, as well as analysis of the crushed rock itself. The revised scope was documented in a *Treatability Study Work Plan Refinement Notice*, submitted January 10, 2020, (GHD, 2020a) and approved by the EPA on January 17, 2020 (EPA, 2020a).

Composite samples of the armored cap material were collected from three different locations in the Northern Impoundment (the west side of the impoundment, the east side of the impoundment and the bermed areas). The sample locations included submerged and non-submerged areas, and the samples were collected only from areas in which a geotextile and/or geosynthetic liner separates the rock from the waste material. Two five-gallon buckets of armored cap material were collected per composite sample area. All treatability activities were performed at the GHD Treatability Lab. Approximate locations of the armored cap material samples are shown on Figure 3-5.

The elutriate was generated by mixing the armor rock with deionized (DI) water at a ratio of 1:5, agitating the mix for 30 minutes before removal of rock, settling the solids in the supernatant water for one hour, and finally, centrifugation of the supernatant water. The resulting elutriate water was then analyzed for dioxins and furans using EPA Method 1613B.

The settled solids from the containers comprising the same armored cap material sample, as well as any solids that resulted from centrifugation of the respective rock water, were combined and sent to the laboratory for analysis of dioxins and furans.

The armored cap material that was washed during the elutriate testing was crushed using a rock crusher and the crushed material from the three separate armored cap locations was analyzed for dioxins and furans.

Armored Cap Treatability Testing Results

No dioxins or furans were detected in any of the elutriate samples above their MLs. Similarly, all $TEQ_{DF, M}$ results from the solids that were washed from the rocks and of the crushed rocks, themselves were below the 30 ng/kg clean-up level. These data are shown in Table 3-5. Analytical laboratory reports are included as part of Appendix C.

3.6 Additional Treatability Testing

Treatability activities performed prior to the submittal of the 30% RD and summarized in the previous sections of this Revised 100% RD, were designed to evaluate the water treatment process for the pump-and-treat approach where water generated from the RA would be stored in aboveground tank(s) and then treated. The 30% RD described an alternate remediation approach (Approach B) that was being considered for the Northern Impoundment. Water treatment under this approach would have included water treatment technology similar to that of the pump-and-treat approach except that water would be treated in-situ in a flooded excavation cell via a recirculation and filtration process. The feasibility of the Approach B excavation methodology hinged on the success of the Approach B water treatment methodology. As described in the 30% RD, additional treatability testing was proposed to evaluate the effectiveness of the Approach B water treatment methodology. In addition, a field filtration test was proposed to evaluate operation of an absolute filter for the reduction of dioxin and furan concentrations in the clarified and sand-filtered contact water that remained on-site following the 2019 field pilot testing.

The planned treatability testing was summarized in an *Additional Treatability Testing Notice* submitted to the EPA on April 16, 2020 (GHD, 2020b). Comments were received from the EPA on May 5, 2020 (EPA, 2020c). The EPA's comments were addressed in the *Revised Additional Treatability Testing Notice* (Revised Notice; GHD, 2020c), submitted to the EPA on June 4, 2020. The Revised Notice was approved by the EPA on June 11, 2020

(EPA, 2020d). In response to revisions that were requested by the EPA during a call on October 9, 2020, a *Refinement Notice - Revised Additional Treatability Testing Notice* was submitted to the EPA on October 15, 2020 (GHD, 2020f)

The two treatability testing scopes included in the Revised Notice were conducted in 2020. In addition, some supplemental filtration confirmation testing was performed in October 2021. The results of these three treatability scopes are presented in the following sections.

3.6.1 Field Filtration Testing

As described in the Revised Notice, a field filtration testing was conducted on May 28, 2020, at the Northern Impoundment to further refine the filtration design requirements (specifically the use of nominal versus absolute filters) evaluated in the initial October 2019 field pilot testing. Absolute filters provide a higher removal efficiency than nominal filters at the same pore size. Therefore, the use of absolute filters was expected to provide more efficient removal of dioxins and furans than the nominal filters.

The May 2020 field filtration testing consisted of filtration of contact water that had previously been clarified and sand filtered during the October 2019 field pilot testing through absolute filters.

The primary objectives of the field filtration testing were to:

- Evaluate water quality using 1 μm and 0.5 μm absolute filters.
- Evaluate the operating costs of 1 μm and 0.5 μm absolute filters.
- Evaluate which pore size filter is more appropriate for the application, based on operational efficiency.

3.6.1.1 Field Filtration Testing Process

The field filtration tests were conducted in May 2020.

ProAct, a subsidiary to Evoqua, provided a modular filtration system containing both 1 μm and 0.5 μm absolute filters with a design flow of 80 to 100 gpm. Filtration tests were conducted in one day over the course of ten hours. Prior to filtration, turbidity was measured in the filter feed tank while mixing until readings stabilized, indicating that tank contents were sufficiently mixed and solids were adequately suspended. Flow was then passed through the filter housing with no bag filters so that influent samples could be collected.

The 0.5 μm absolute bag filter was placed inside the housing and then flow was passed through the filter, during which time flow and differential pressure across the filter were continuously monitored. After approximately 35 minutes, flow through the 0.5 μm filter was stopped, and the test was repeated with the 1 μm absolute filter. Again flow and differential pressure were continuously monitoring across the filter. The 1 μm filter test ran for approximately 25 minutes before the volume of water available was expended.

Samples of influent (i.e., the previously sand filtered and clarified contact water), filtrate through 0.5 μm filter, and filtrate through 1.0 μm filter were analyzed for water quality parameters. Parameters of interest were total dioxins and furans, TSS, total metals, and dissolved metals (field filtered).

3.6.1.2 Field Filtration Test Results

Flow and differential pressure measurements for the 0.5 μm and 1 μm absolute filters were plotted versus time and then extrapolated over a longer duration as shown on Figure 3-6.

Figure 3-6 shows that flow decreased rapidly, especially through the 0.5 μm filter, which dropped to nearly 0 gpm after 40 minutes of operation. Flow through the 1 μm filter was projected to drop by almost 20 percent after operating for 50 minutes, although this is based on limited data (due to only a limited volume of water being available to use in the testing). Differential pressure variations appear to correlate with flow variations, increasing significantly even after short operational durations. Differential pressures through the 0.5 μm filter were projected to increase to almost 30 psi after only 40 minutes of operation. Differential pressures through the 1 µm filter show a more gradual increase, but projections are based on fewer data points.

Analytical results from the influent, 1 µm filtrate, and 0.5 µm filtrate samples for parameters of interest are presented in Table 3-6.

Results show that concentrations of TSS and dioxins and furans were low in the influent water, with TCDD levels already below the MLs. As expected, filtration further reduced TSS and dioxins and furans to levels below the MLs after the 1 µm filter, with additional reduction after the 0.5 µm filter. Both filters achieved dioxins and furans concentrations below MLs. Finally, results for both total and dissolved metals showed no concentrations above the discharge criteria.

3.6.1.3 Field Filtration Testing Conclusions

Analytical results indicate that the 0.5 µm and 1 µm absolute filters achieve concentrations of dioxins and furans below the MLs however, the data shown on Figure 3.6 indicate that operations using absolute filters at the small pore sizes evaluated (0.5 µm and 1 µm) may cause operational difficulties, such as rapid increase in differential pressures due to filter fouling, that would require frequent filter changeout. These difficulties are addressed in the WTS design by providing a two-step filtration process after the media filters using a 10-µm filter system before the 1 µm filter system. In addition, the WTS design includes redundant 10 µm and 1 µm filtration systems in parallel, which will allow rapid change over from the duty to the standby system to reduce downtime. Subsequent filtration tests (summarized in Section 3.6.3) indicate that filters provide effective removal of dioxins and furans to below the MLs; therefore, the WTS described in this Revised 100% RD prescribes the use of 95% efficient 10 µm and 1 µm filter cartridges or bags. Actual filtration during treatment may improve based on refining chemical addition and filter feed rates during operation.

3.6.2 Approach B Water Filtration Testing

Approach B excavation methodology considered in the 30% RD included removal of soils through a water column. Approach B in-situ water treatment would have involved adding chemicals to the water column within the barrier wall and then sending the water through a recirculating filtration system (with filter pore sizes down to 1 µm) to reduce TSS concentrations which is also expected to remove dioxins and furans.

The primary objectives of the Approach B water filtration testing were to:

- Quantify volume of soil particles that become suspended in the water after excavation.
- Determine particle size distribution and dioxin load of the suspended soil particles.
- Determine settling properties of the suspended soil particles.
- Determine time needed for the filtration system to reduce TSS of the water column to acceptable levels.
- Evaluate effects of adding polymer to the water column containing suspended soil particles.
- Evaluate polymer/coagulant mix required to condition soil for filtration and the design parameters for this filtration.

3.6.2.1 Approach B Water Filtration Testing Process

The Approach B water filtration tests were conducted in the GHD Treatability Lab in Niagara Falls, New York from October 2020 through January 2021. Test activities included the following steps:

- Two (2) tanks with sampling ports were constructed to simulate the water column in the excavation cell. The two tanks were used to run parallel tests as follows:
  - Tank #1 tests evaluated treatment effectiveness with the addition of coagulant and polymer.
  - Tank #2 tests evaluated treatment effectiveness without any chemical addition.
- A slurry was prepared with simulated river water and waste materials collected from the Site.
- The slurry was added to each tank and then solids were allowed to settle to mimic an in-situ water column.

- Excavation was simulated in the tanks to reagitate the solids.
- Chemicals, including coagulant and polymer, were added to facilitate setting and filtration.
- After chemical addition, solids were allowed to settle in the tank. Supernatant was sampled for TSS.
- Solids were resuspended then recirculated through a series of filters with decreasing pore sizes down to 1 µm. For this test, Geotube® fabric was used for initial filtration to remove larger particles of TSS and mitigate clogging of the subsequent finer filters.
- Filtrate was then collected for analysis of general chemistry parameters, specifically dioxins and furans.

3.6.2.2 Approach B Water Filtration Testing Results

After simulating the excavation within the water column in the tanks, settling tests showed that the chemical addition increased the rate of solids settling, reaching low levels of TSS and turbidity within three hours of settling as compared to more than 24 hours of settling that was required without chemical addition. However, results from both tests produced supernatant with dioxins and furans still above the MLs.

Geotube filtration tests showed that chemical addition improved TSS removal, reducing TSS in settled supernatant by 90 percent as compared to 50 percent without chemical addition. Recirculation filtration of Geotube filtrate did not remove TSS as much as expected based on calculations using Geotube filtrate particle size distribution. Figure 3-7 shows the actual versus expected TSS values over the time of the recirculation filtration.

After recirculation tests were completed, the solids were mixed to simulate the full-scale operation excavation that would be conducted while recirculating the water column through filters. Particle size distribution was evaluated on samples from both tanks after completion of the recirculation tests and after simulating excavation.

Results showed that there was some decrease in solids particle sizes after excavation simulation, suggesting that excavation activities along with recirculation breaks down particles to sizes that may pass through filtration, even after chemical addition. Additionally, larger particle sizes were observed in the tank where chemicals were added, indicating that chemical addition effectively increases particle sizes of the solids.

Water in the tanks after recirculation testing was analyzed for dioxins and furans. Data show that a series of recirculating filters did not reduce dioxins and furans as expected/calculated. Analysis of dioxins and furans in the filtrate water from each filter size showed significant reduction in dioxin/furan concentrations. However, filtrate through even the smallest 0.1 µm filter did not achieve dioxins and furans below the MLs, compared with previous tests on the pump-and-treat methodology that achieved dioxins and furans below the MLs after a 1 µm filter (Section 3.4.3.). Analytical results from these tests are shown in Table 3-7.

Further review of the particle size distribution test results showed that the majority of particulates containing dioxins and furans are between the sizes of 10 and 41 µm; therefore, it was expected that the filtration through the 10 µm should have produced filtrate with dioxins and furans close to or below the MLs. Inadequate removal of dioxins and furans observed during recirculation testing suggests that the mixing energy imparted from recirculation may break down solids into smaller sizes that can pass through a 0.1 µm filter and allow breakthrough of dioxins and furans in the filtrate.

3.6.2.3 Approach B Water Filtration Testing Conclusions

Treatability testing showed that the Approach B in-situ water treatment approach is not effective. This is due to challenges in mixing in order to keep solids in suspension to allow for effective removal via filtration.

Based on these results, this approach was eliminated as an option for the WTS and was not carried forward in this Revised 100% RD.

3.6.3 Additional WTS Treatability Testing

Following the Approach B water filtration testing which demonstrated that in-situ filtration methodology was not effective, the design shifted to focus on a dry excavation and pump-and-treat aboveground WTS.

The WTS design included herein includes pumping contact water from the excavation area to a separate aboveground WTS utilizing chemical treatment (i.e., coagulation/flocculation) followed by filtration and activated carbon treatment to reduce the TSS, which would be expected to also remove dioxins and furans. Previous filtration testing of contact water from the site showed that filtration through a 1 µm filter reduced solids to achieve dioxins and furans concentrations below MLs (Section 3.4.3).

Certain tests that had been conducted in previous testing (including polymer addition and settling) were not applicable to the design of the WTS process, as they had been conducted to evaluate the Approach B methodology. As such, to verify the effectiveness of the treatment process included in this Revised 100% RD and to evaluate its operational feasibility, additional WTS treatability testing was conducted.

The primary objectives of the additional WTS treatability testing were:

- Determine particle size distribution and dioxin load of the suspended soil particles.
- Determine settling properties of the suspended soil particles.
- Evaluate polymer/coagulant dosages required for effective setting and filtration.
- Develop design parameters for the chemical addition and filtration processes.

3.6.3.1 Additional WTS Treatability Testing Process

The additional WTS treatability testing was conducted at the GHD Treatability Lab in Niagara Falls, New York in October 2021. Test activities included the following steps:

- Contact water was prepared using simulated precipitation water and waste material collected from the site during the SDI activities.
- The contact water was added to a tank and then solids were allowed to settle.
- Chemicals were added to facilitate setting and filtration.
- After chemical addition, solids were allowed to settle in the tank. Supernatant was pumped to a separate tank and sampled for TSS.
- Supernatant was then sent through a series of filters with decreasing pore sizes to simulate the filtration included in the design of the WTS.
- Filtrate was then collected for analysis of general chemistry parameters, specifically dioxins and furans.

3.6.3.2 Additional WTS Treatability Testing Results

Supernatant from initial one-hour settling tests had high TSS and concentrations of dioxins and furans well above the MLs. Chemicals were added to facilitate solids settling; 100 mg/L of polyaluminum chloride coagulant and 25 mg/L of polymer were added. After chemical addition, settling times decreased, with the majority of solids settling after five minutes. Supernatant from settling after chemical addition was then filtered through 5 µm and 1 µm filters. TSS and dioxins and furans were analyzed after each treatment step with results shown in Table 3-8.

Results showed that filtration achieves very low concentrations of dioxins and furans, with concentrations of all congeners below the MLs, using a 5 µm filter with chemical addition.

Because dioxins and furans are organic compounds, GAC is being included in the treatment process downstream of the 1 µm filter to remove residual dioxins and furans prior to discharge. TOC concentrations were measured in the 5 µm and 1 µm filtrates at 21 mg/L and 19 mg/L, respectively. These are relatively low concentrations that maintain the ability of the GAC to adsorb residual dioxins and furans prior to discharge.

3.6.3.3 Additional WTS Treatability Testing Conclusions

The additional WTS treatability testing confirmed that the pump-and-treat WTS process included in the RD will successfully remove dioxins and furans to levels below MLs and will meet all TSWQS for discharge. This testing also indicated that chemical addition followed by the use of a 5 µm filter is effective in removing an adequate amount of solids to achieve the target dioxin and furan concentrations, with 1 µm filtration and GAC provided as an additional SF for water treatment prior to discharge. Settling tests indicated that the addition of 100 mg/L of coagulant followed by 25 mg/L of polymer was the most effective at achieving solids settlement prior to filtration.

Based on these results, the design of the optimized WTS is further outlined in Section 5.9.

3.7 Treatability Study Conclusions

Waste Material

– Characterization results for the Northern Impoundment waste material samples collected during PDI-1, PDI-2, and SDI indicate that the waste material is non-hazardous and is not subject to regulation under RCRA. This position was detailed in a Waste Characterization Letter, submitted to the EPA on October 20, 2020 (GHD, 2020g) and approved by the EPA in a letter dated November 19, 2020 (EPA, 2020h). In addition, the characterization results from the SDI suggest that the waste material should meet criteria for disposal in a Texas Class II landfill.
– Solidification testing on waste material samples indicates that an addition of a low dose (2 to 10 percent) of Portland cement will allow the removed waste material to meet landfill paint filter and compressive strength requirements.

Water

– Results of the particle size analysis and filtration testing of both simulated contact water and filtered effluent indicate that dioxins and furans in water are primarily associated with the TSS in the water. TSS and turbidity demonstrated potential to serve as an indicator parameter for dioxins and furans.
– The results of the 2019 bench-scale testing show that filtration with a 1 µm filter can reduce concentrations of dioxins and furans in the contact water to below the ML. Further testing in the 2021 Additional WTS Treatability Testing suggest that filtration with a 5 µm filter with chemical addition can reduce concentrations of dioxins and furans to levels below the ML. Further evaluation of the use of a 5 µm filter in lieu of a 1 µm filter may be warranted depending upon the long-term operational performance of the 1 µm filter.
– Treatment of simulated contact water by clarification and filtration resulted in an effluent that meets the discharge criteria established by the EPA. The success of the treatment process and methodology was corroborated through the implementation of parallel bench-scale tests conducted in 2019 and 2021. This technology has been selected to be advanced in the RD for water treatment. The treatment process will be designed in accordance with EPA correspondence to Respondents dated February 18, 2020, (EPA, 2020b) which stated that "if an effluent sample analyzed for dioxin is below the ML using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR."
– In-situ recirculation water treatment methodology (Approach B) was unsuccessful at achieving an effluent that met the TSWQS. This methodology has not been carried forward in the RD.
– Solids in the clarifier underflow will likely require further settlement to produce a concentrated stream for solidification. The settled solids from the clarifier can be solidified with doses as low as 20 percent Portland cement if mixed with waste material in a 1:1 waste material to settled solids ratio.

Armored Cap Material

– No dioxins or furans were detected in any of the armored cap elutriate samples above their MLs. Similarly, all $TEQ_{DF,M}$ results from the sediment that was washed from the rocks and the crushed rock samples themselves were below the 30 ng/kg $TEQ_{DF,M}$ clean-up level. These results support the proposed reuse of the existing armored cap material during or after execution of the Northern Impoundment RA.

4. Applicable or Relevant and Appropriate Requirements (ARARs)

Compliance with ARARs does not include formal submission of permit applications to the agencies for permits or approvals. Instead, information sufficient to demonstrate compliance at the work site with the relevant ARARs will be presented to the EPA and coordinated with other agencies.

The EPA recognizes the following three types of ARARs:

– ***Chemical-Specific ARARs***: Chemical-specific ARARs include health- or risk-based numeric limits or methods that establish the acceptable amount or concentration of a chemical that may be found in or discharged to the environment.
– ***Location-Specific ARARs***: Location-specific ARARs include limits on allowable concentrations or on activities associated with hazardous substances solely because they occur in special locations.
– ***Action-Specific ARARs***: Action-specific ARARs include technology- or activity-based requirements or limitations on actions involving the management of hazardous substance.

As part of the RD, and since the submittal of the 30% RD, 90% RD, and 100% RD, focused efforts have been made to engage with the relevant regulatory stakeholders that may have interest in the Northern Impoundment RA to make them aware of the anticipated scope of the RD and to ensure that all substantive permit requirements are identified for purposes of this Revised 100% RD. These efforts at engagement included meetings between the Respondents and the EPA with the following agencies: TCEQ, USACE, United States Coast Guard (USCG), TxDOT, Port of Houston Authority (POHA), Harris County Flood Control District (HCFCD), Harris County Pollution Control, and the Coastal Water Authority (CWA). Applicable regulatory requirements along with project-specific comments that explain how these regulations apply to the project, and how the RD and RA will comply with the regulations are summarized in Table 4-1. Table 4-1 addresses each of the ARARs identified in the ROD and certain additional ARARs applicable to the Northern Impoundment RD. In addition, several supporting documents are included in Appendix D, as referenced in Table 4-1.

5. Remedial Design

This Section provides an overview of the remedial approach for the Northern Impoundment to implement the remedy selected in the ROD and outlines the corresponding RD components, including the following:

– Excavation (traditional dry excavation and mechanical dredging).
– Engineered Barrier BMP.
– Water Management.
– Transportation and Disposal.
– Monitoring and Controls.

5.1 Remedial Design Background

The remedy selected for the Northern Impoundment, as outlined in the ROD, includes the excavation and off-site disposal of waste material located beneath the TCRA armored cap such that the resulting bottom surface is below the prescribed clean-up concentration of 30 ng/kg $TEQ_{DF,M}$. As described in the ROD, the selected remedy is to utilize a BMP, such as a cofferdam, to isolate the excavation area from the river.

At the time that the remedial alternative was selected, the only subsurface data available had been collected during the RI in 2011 and 2012. At the time the ROD was issued, eight soil borings had been installed from elevations ranging from -7.6 ft to -22.7 ft NAVD88. As part of the RD process, 71 additional subsurface soil borings were installed in the Northern Impoundment at deeper elevations up to -35 ft NAVD88. Analytical results from these borings have further defined the vertical and horizontal extent of material located beneath the TCRA armored cap and have significantly increased the volume of waste material to be excavated from the volume and depth estimates that was the basis for the ROD.

The selected remedial alternative in the ROD was based on an expected excavation with an average depth of approximately -8 ft NAVD88 and a maximum depth of -20 ft NAVD88. However, results from the PDI and SDI indicate that the actual excavations necessary to remove materials exceeding 30 ng/kg $TEQ_{DF,M}$ are significantly deeper, with an average depth of approximately -13 ft NAVD88 and a maximum depth of -28 ft NAVD88. Furthermore, based on geological and geotechnical data collected during the SDI and not available at the time the ROD was selected, some of the deeper excavation elevations pose a significant risk of hydraulic heave if the remedy is conducted as stated in the ROD (i.e., in the dry).

The following summary provides context to the transition in the RD from the 30% RD submitted in May 2020 (GHD, 2020d) to the RD included in the 90% RD (GHD, 2022f), prior to the northwest corner being addressed in a subsequent submission.

Approach B Water Treatability Testing

During a TWG Meeting in February 2020, newly obtained PDI-2 data was discussed which showed that material exceeding the ROD clean-up level extended to depths that were significantly deeper than were previously understood. It was further explained that utilizing traditional excavation methodology in dry conditions (referred to as “Approach A” in the 30% RD) would pose significant risk and technical challenges for the deeper areas within the Northern Impoundment, as excavating within the confines of a BMP, to the required depth could undermine the structural integrity of the BMP. Therefore, when the 30% RD was submitted, it included an alternative for excavation (referred to as “Approach B”) in areas of deeper waste depths. This approach included installing the BMP and then removing material exceeding the clean-up level through a column of water using barge-mounted excavation equipment. As described in the 30% RD, this approach would require that prior to the end of an excavation season, the water within the BMP would be recirculated through a treatment system until it achieved the TSWQS (as demonstrated through compliance with the ML). In order to evaluate the practicality and effectiveness of this conceptual approach, additional treatability testing was proposed. This additional treatability testing was summarized in the *Revised Additional Treatability Testing Notice*, submitted to the EPA on June 4, 2020 (GHD, 2020c), and approved by the EPA on June 11, 2020 (EPA, 2020d).

The additional treatability testing, as described in the approved notice, included a bench-scale simulation of the recirculation process through a bench-scale filtration system to determine if the ML could be met. The recirculation testing was conducted by the GHD Treatability Laboratory in Niagara Falls, New York from November 2020 to January 2021. As summarized in Section 3.6.2, treatability data indicated that after 16 days of recirculation the TSS reduction had plateaued at around 500 mg/L and the resulting dioxin and furan concentrations remained above the ML.

As presented during a TWG Meeting in December 2020, based on the results of the recirculation testing, Approach B water treatment was deemed technically infeasible for full-scale application during the RA. This treatability testing was strictly limited to an approach where material would be excavated through a water column and the water would be treated through recirculation and filtration in the excavation. Since the water treatment for Approach B was shown to be technically infeasible, Approach B excavation methodology was also deemed technically infeasible. As a result, the design process was again significantly altered to focus on performing all excavation work “in the dry.” As such, additional data, including full vertical delineation and geotechnical data along the revised BMP alignment, was required to evaluate the feasibility of excavating the deeper areas “in the dry.” Other methods to excavate through the water column and manage the water in compliance with the ROD were later evaluated and are included in the RD.

Supplemental Design Investigation

A major uncertainty identified in the 30% RD was the constructability of the BMP wall. Even with the assumption that the majority of the Northern Impoundment would be excavated through a column of water, the required BMP design included in the 30% RD was extremely robust and was arguably technically infeasible. The pile types necessary would have been 5.5-ft diameter tubular pipe piles and double I-beam piles, driven to tip depths as deep as -93 ft NAVD88 into Beaumont Sand layer. Significant concerns were identified in the Northern Impoundment 30% RD about the ability to successfully drive and/or remove the piles. Given these concerns and the poor performance of the Approach B water treatability testing, following the submittal of the 30% RD, the design team began evaluating other BMP types and excavation methodologies that could overcome these limitations. An optimized BMP design was identified. The optimized BMP design includes a double wall system that allows for shallower embedment depths than the single cantilever wall proposed in the 30% RD. The double wall in this optimized design is further offset, except in limited circumstances, by a minimum of 30-ft from the area of excavation than the BMP described in the 30% RD to increase the structural stability of the BMP system.

Previous investigations had not included collection of data regarding soil properties and stratigraphy in the areas of the new BMP wall. Given the modified alignment of the BMP, the Respondents and EPA agreed that it was necessary to collect additional analytical data to more fully delineate the waste material and geotechnical data to better understand the soil properties and thickness of the shallow stratigraphy in locations in and near the proposed conceptual BMP alignment. With the change in excavation methodology, an additional risk that needed to be evaluated was the potential for hydraulic heave.

The SDI was performed in the summer of 2021 to supplement the delineation of the vertical extent of material requiring excavation and to provide information to aid in designing a structurally robust BMP, potentially capable of withstanding forces associated with excavation in the deeper areas of the Northern Impoundment.

Risk of Hydraulic Heave

The SDI was conducted from June through September 2021 in accordance with the Revised SDI Work Plan, submitted to the EPA on May 21, 2021 (GHD, 2021c) and approved by the EPA on June 4, 2021 (EPA, 2021c). The investigation included the installation of 35 analytical soil borings and 17 geotechnical borings (13 CPT soundings and four instrumented boreholes). Data from the SDI indicated that impacted material above the clean-up level was at deeper elevations than previously understood, with impacts as deep as -28 ft NAVD88 in the northwest corner. Based on these deeper impacts, a focused evaluation was conducted to assess the potential for hydraulic heave while excavating to target depths of known impact. The technical evaluation regarding hydraulic heave was discussed with the EPA, USACE, and TCEQ in detail during the October 19, 2021; November 16, 2021; and December 14, 2021, TWG Meetings. It was documented in the Hydraulic Heave Analysis Report submitted to the EPA on December 9, 2021, (GHD, 2021i) and written correspondence to EPA dated December 22, 2021 (GHD, 2021j). It also was updated as part of this Revised 100% RD submission in Updated Hydraulic Heave Analysis Report, which is included as part of Appendix B.

Based upon the results of this evaluation, it was determined that it is not technically feasible to excavate the material in the northwest corner to the currently known depths in the dry. An alternative approach using mechanical dredging to mitigate the potential for hydraulic heave in the northwest corner has been incorporated in the Revised 100% RD in Section 5.7.

5.2 Remedial Approach

An overall remedial approach has been developed, in coordination with members of the TWG, and includes several fundamental elements that are described below.

BMP Alignment and Lateral Excavation Extent

The lateral extent of the excavation for purposes of the RD is defined by the lateral extent of waste material above the 30 ng/kg $TEQ_{DF,M}$ dioxin clean-up level underneath the armored cap. The lateral extent of the planned removal is shown in green shading on Figure 5-A, below.

Figure 5-A ***BMP Alignment and Excavation Extent***

The lateral limits of the planned removal area also define the corresponding outer alignment of the BMP. The optimized double wall BMP system includes two parallel single cantilever walls spaced approximately 30-ft apart, connected with tie-rods and walers, and filled with aggregate.

In the Revised 100% BMP wall design, the existing riverbed between the BMP (interior wall) and the excavation area is referred to as the “Soil Buttress.” This Soil Buttress is essential to the stability of the wall and the ability to excavate to the target elevations “in the dry.” In some instances, additional fill material is added to the Soil Buttress to raise the riverbed elevation and reduce the exposed height of the BMP above riverbed elevation. That additional fill is referred to as a “Raised Bench.”

Along the west, north, and east sides of the BMP, the system includes at least a 30-ft wide Soil Buttress between the inner wall and the top edge of any excavation inside the BMP to support the wall system and in one section on the west side, a Raised Bench. Along the south side of the BMP, the Soil Buttress in some locations is less than 30-ft wide, due to space constraints.

This optimized wall system pushed the alignment of the BMP further out from the excavation area than the alignment considered in the 30% RD. The alignment of the BMP is shown on Figure 5-A, above. A conceptual depiction of the BMP and a conceptual cross-section of the BMP system are shown below on Figure 5-B.

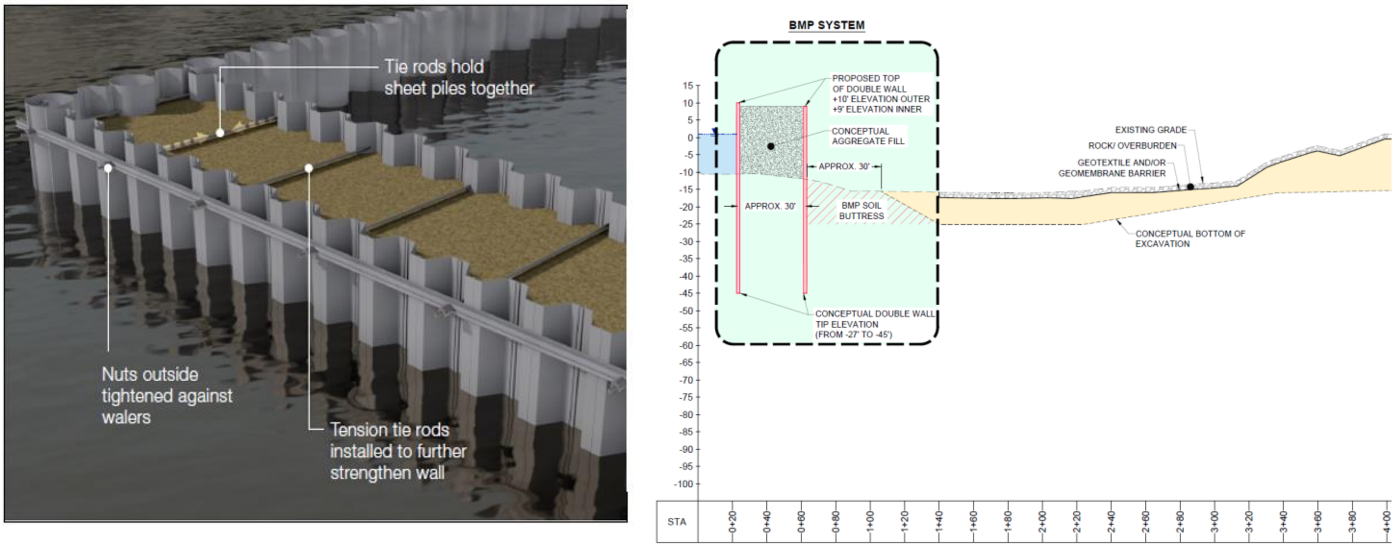

Figure 5-B** BMP Alignment and Excavation **Extent

Seasonal Excavation and Top of Wall Elevation

The ROD states that performing the removal of the waste material using a BMP would reduce short-term impacts, prevent any material release to the San Jacinto River during removal, and ensure compliance with ARARs. As such, to design the BMP, historical San Jacinto River water surface elevation data, dating back to 1994, was obtained and evaluated. Based upon an evaluation of that historical data, the San Jacinto River seasonally has experienced high water levels between May and October. Therefore, as a risk management measure, an excavation period of November to April was selected for use in the RD and approved by the EPA and members of the TWG during the February 19, 2020 TWG Meeting. This same excavation season had been used as the basis for the 30% RD.

During the non-excavation season and during the first and last year of construction, the RC will perform necessary work activities that do not involve managing impacted material. This work will include, but not be limited to: installing and removing the BMP, developing infrastructure for the project along the TxDOT ROW, constructing and then demobilizing or partially demobilizing the WTS at the end of each excavation season, re-installing the portions of the WTS that were demobilized prior to the next excavation season, dewatering excess water within the BMP and treating and discharging the remaining water in the BMP, water sampling, protecting office trailers and truck laydown equipment from flooding, visual inspections of the BMP and work site properties, importing and staging clean fill material, mobilizing and demobilizing trucks scales and washes, and mobilizing and demobilizing heavy equipment. As discussed in Section 5.3.2, if directed by the EPA, the length of excavation season will be evaluated on a case-by-case basis, as directed by EPA, and potentially extended into the months of May, June, and July, while following the requirements of a High-Water Preparedness Plan prepared for the work site, which is included in Appendix J.

The historical San Jacinto River elevation data were also used to identify a top elevation for the BMP assuming that any high-water events during the planned excavation months of November to April would not exceed historical levels. Based upon the hindcasted data in the vicinity of the Northern Impoundment, since 1994 there were no highwater events that exceeded an elevation of +10 ft NAVD88, the top elevation of the exterior wall of the BMP, with the exception of Hurricane Harvey in August 2017, which took place outside of the excavation season of November to April. This information is contained on Figures 5-2 and 5-3. Therefore, for design purposes, the top of pile elevation for the BMP was established as +10 ft NAVD88 for the exterior wall. As further detailed in Section 5.12, the use of this design top elevation will not eliminate the risk of overtopping during any of the excavation seasons, and the protectiveness of this design top elevation will need to be confirmed following receipt of modelled flow data from the CWA in relation to its planned improvement project for the Lake Houston Flood Control structure located upriver of the Northern Impoundment. Additional information is provided in the HWPP (Attachment 10) of Appendix J.

The excavation of the Northern Impoundment will be approached as seasonal cells - with a single cell being excavated each excavation season. The exact shape and size of the seasonal cells will not be pre-defined but will be based upon production efficiency each season. This is different than the plan proposed in the 30% RD which included pre-defined seasonal cells divided by interior barrier walls. Instead, during an excavation season, only the portion of the TCRA armored cap covering the area targeted for excavation during that season will be removed, with the rest of the TCRA armored cap remaining intact. At the end of each excavation season, the exposed slope between that seasonal cell and the remaining TCRA armored cap will be covered with a cap, consistent with the design used during the TCRA. At the start of the next excavation season, the water inside the Northern Impoundment BMP will be handled as “non-contact water” as described in Section 5.9.2 and returned to the river and the process will start again.

A conceptual visualization of the overall project sequencing, including a potential seasonal cell layout is included on Figure 5-C, below. This Revised 100% RD has been prepared to be “implementable” as designed. The northwest corner will be completed in the first excavation season 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 will also be appropriate due to the deep bathymetry in that area and the implications of that deep bathymetry on water management.

It is anticipated that the RA excavation activities can be completed in 5 seasons. The planned number, size, and configuration of the cells are flexible and may change based upon the following factors:

– ***Volume and Removal Rates*** -The tentative cell sizes ensure that the volume of planned removal from within each cell could be achieved within the excavation period of November through April (potentially extending to July).
– ***Excavation Depth*** - Depending upon the results of confirmation sampling, the depths of the seasonal excavations could increase, which may, in turn, limit the area effectively excavated in that season.
– ***Access and Implementability*** - The tentative seasonal cells assume sustained access to each area for necessary excavation equipment and trucks.
– ***Transportation and Disposal*** - The target seasonal production rate used to define the tentative cell sizes is dependent on the ability to efficiently and consistently load out waste material and transport it to an offsite landfill, an activity which, as addressed above, requires full access to the TxDOT ROW and I-10.

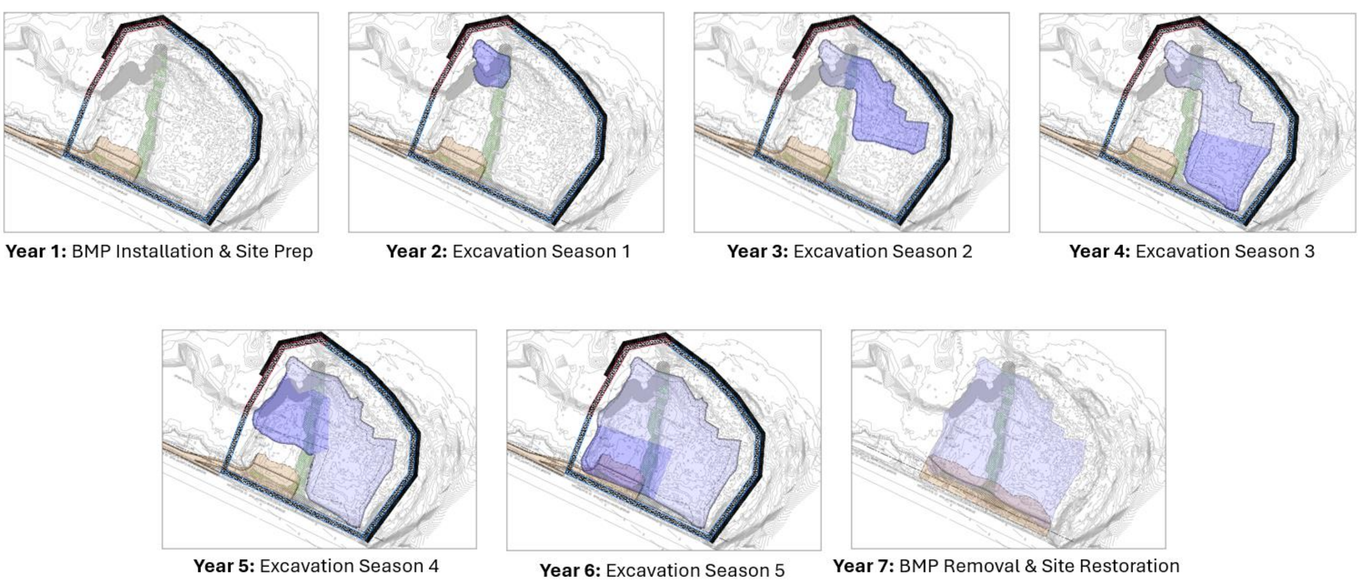

Figure 5-C Conceptual Project Sequencing

Excavation Approach

An excavation approach was developed across the Northern Impoundment that is implementable, mitigates hydraulic heave risk, is protective of human health and the environment, is consistent with the methodology used to develop the clean-up standard outlined in the ROD, and would result in an exposed surface that is below the clean-up level. Figure 5-D, below illustrates the benefits of this excavation approach relative to the risk of hydraulic heave. When the design excavation surface is compared to the hydraulic heave risk elevations, the "hot spots" of hydraulic heave sensitivity are identified and will require local mitigation measures to excavate and offset the hydraulic heave.

The water will be pumped down to allow material in the northwest corner that is above elevation -15 ft NAVD88 to be excavated in the dry. The submerged material below elevation -15 ft NAVD88 will then be excavated by mechanical dredging to mitigate the hydraulic heave risk.

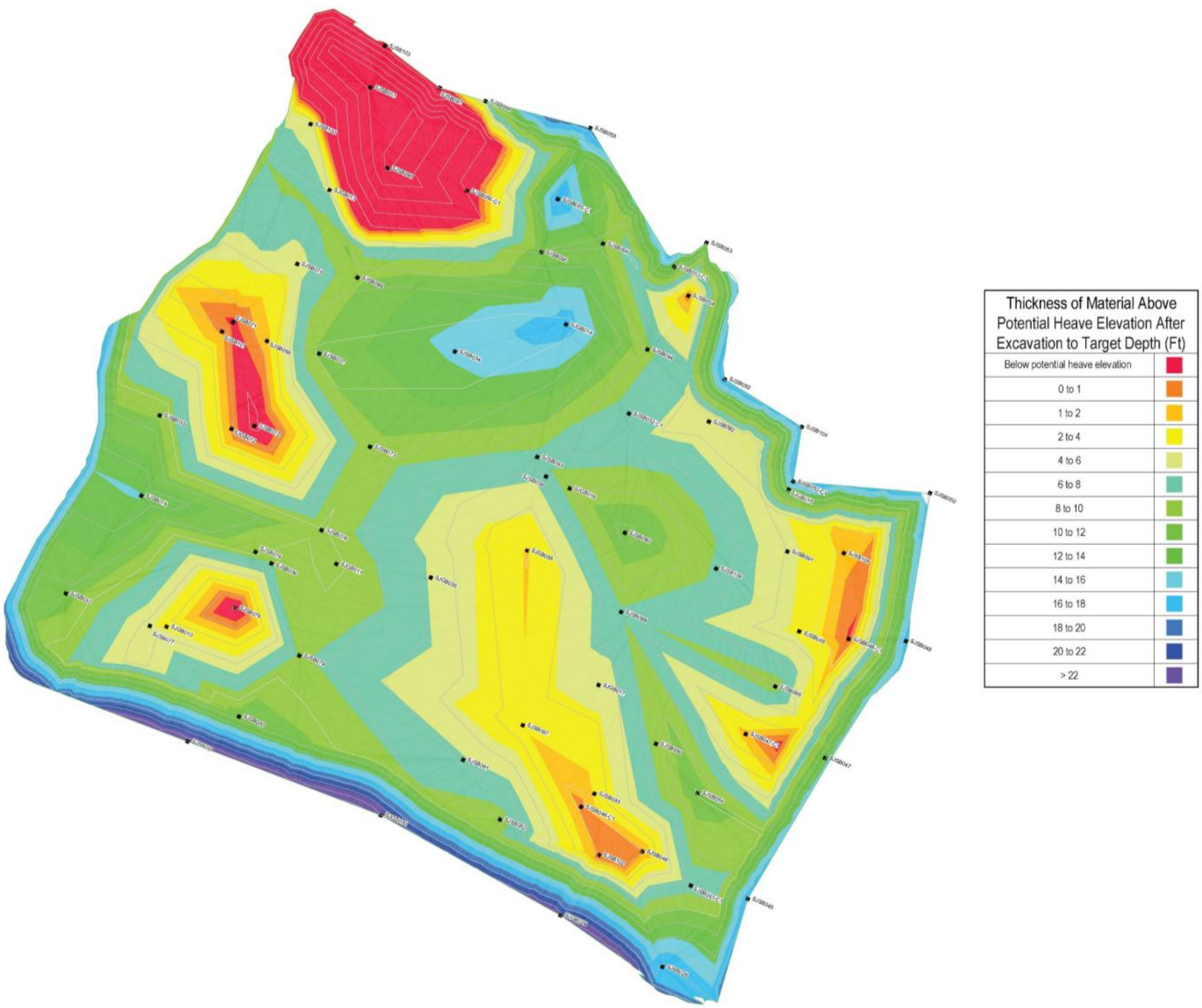

Figure 5-D Hydraulic Heave Sensitivity

Table 5-1 presents the design excavation elevations at all the borings. This excavation surface results in approximately 230,000 CY of total volume removed. This excavation surface is intended to provide an indication of where the initial excavation ends (i.e., design elevations); the data collected during the PDI and SDI has been used to inform this. The excavation surface will be refined based on confirmation sampling, which would be used to determine whether the clean-up level has been achieved, as detailed in the FSP (Appendix J, Attachment 3) and in Section 5.6.4.

Excavation Methodology

The approach would include (1) installation of a physical BMP around the perimeter of the Northern Impoundment, (2) processing of river water prior to removal of the TCRA armored cap, (3) removal of the waste material with land-based excavation equipment working within a seasonal cell, removing the TCRA armored cap as work progresses (while leaving in place the portions of the TCRA armored cap not being excavated), and (4) placing an engineered cap over the exposed slope of the seasonal cell excavation at the end of each excavation season. A conceptual illustration of the excavation methodology is shown on Figure 5-E.

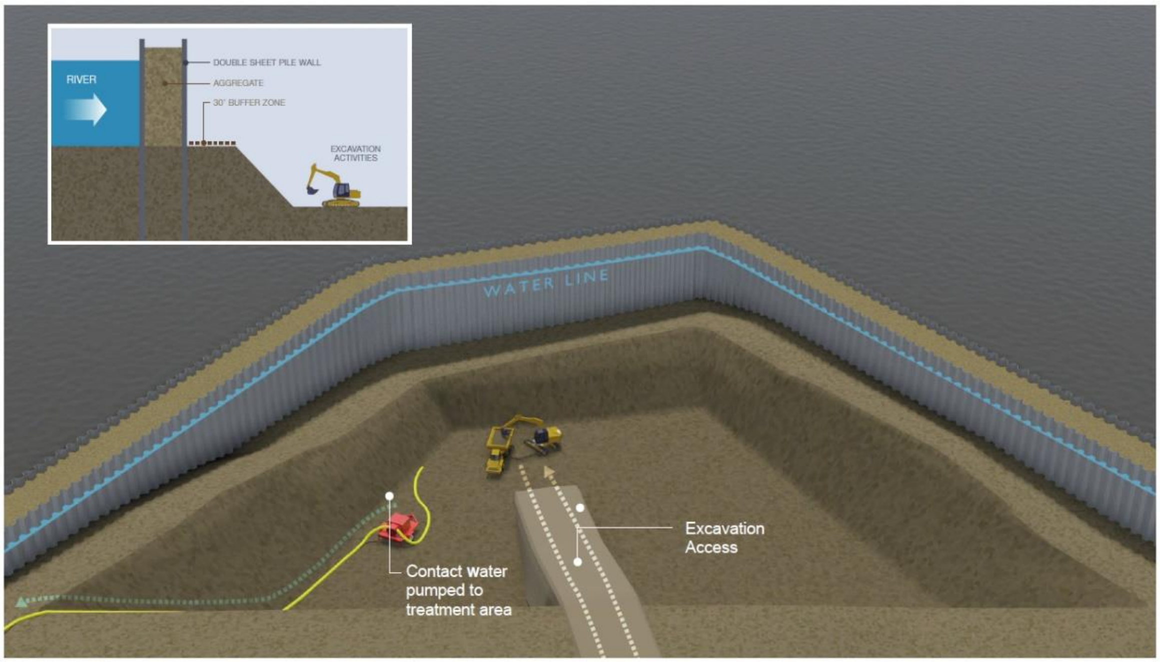

Figure 5-E Conceptual Excavation Methodology

Water Management

Following installation of the BMP, and at the beginning of each excavation season, non-contact water trapped behind the BMP wall will be pumped from the excavation to the non-contact portion of the water treatment system (non-contact water treatment system) where it will be treated to remove solids and then discharged back to the river. Non-contact water is water within the BMP that has not contacted impacted material and occurs 2 ft or more above the lowest elevation at the time of the dewatering activity. Impacted material is material that is not covered by the TCRA cap and has not been excavated to the defined clean excavation limits. When removing the non-contact water, the RC will be required to maintain the pump intake a minimum height of 2 feet above the bottom floor to minimize solids in the water pumped to the non-contact water treatment system. Sampling is not required for the non-contact water.

The remaining 2 feet of water, and any water that has come in contact with impacted material, will be managed as contact water. In addition, any non-contact water that somehow mixes with contact water will also be managed as contact water. The contact water will be pumped from the excavation to the contact water treatment system (contact water treatment system), treated through clarification and filtration, and discharged to the river. The contact water will be sampled and tested for compliance with WTS effluent discharge concentration criteria.

Re-Use of TCRA Armored Cap and Historic Berm Material

The Northern Impoundment is currently covered by an armored cap comprised of 6- to12-inch diameter rock on top of a low-permeability geomembrane and/or geotextile barrier, and/or ACBM, as shown on Design Drawing C-02 in Appendix G. As described in Section 3.5, treatability testing was performed on the TCRA armored cap material and results demonstrated that the rock, its elutriate, and sediment generated from its elutriate did not exhibit dioxin concentrations above the ML (as defined in Section 3.4.1) or the clean-up level of 30 ng/kg $TEQ_{DF,M}$.

Prior to removal of the waste material, the TCRA armored cap rock will be removed. The TCRA armored cap rock will be stockpiled at or near the Northern Impoundment for potential reuse or disposal during or after execution of the Northern Impoundment RA. The northwest portion of the TCRA cap, including the ACBM, will not be sampled for re-use and will be removed and sent off-site for disposal.

It is anticipated that during the RA approximately 30,700 CY of unimpacted material from the historic central and southern berms at the Northern Impoundment will be excavated. Based upon characterization data from the PDI (see Figure 2-9), the berm material does not contain dioxin concentrations above the clean-up level. During the RA, this unimpacted material will be considered for reuse for various site activities, construction of site features, cover material, etc. The material will be segregated from the waste material during excavation activities, stockpiled, and sampled prior to reuse, as detailed in the FSP (Appendix J, Attachment 3). Any material not reused will be sent off-site for disposal.

The locations of the historic berm and the TCRA armored cap rock planned for re-use are shown on Figure 3-5.

Preliminary RA Schedule

Based on the current remedial approach, it is anticipated that the implementation of the Northern Impoundment remedy following EPA final approval of the RD will require a period of at least 7 years to complete. This 7-year period will be preceded by an initial period in which parties undertaking the RA will select an RC and engage in steps to procure necessary materials and other resources needed to begin construction of the BMP. Following that initial period, it will then take a minimum of one year to construct the BMP and then to conduct confirmation sampling, followed by an estimated 5 years of waste removal (one cell per excavation season), and concluding with an additional and final year for BMP removal, site restoration, and project demobilization. The estimated five years of waste removal is based on the assumptions described above. This schedule assumes coordinated access to the TxDOT ROW during the implementation period, both to construct the BMP wall and also for purposes of ingress and egress. Limitations on the use of the ROW, which is needed for the approximately 4,600 truck trips required each excavation season to transport the excavated material off-site and reduced production due to traffic and access issues related to an I-10 Bridge replacement project, could extend the overall project schedule.

5.3 Basis of Design

5.3.1 Historic River Level Evaluation

To design the BMP and plan for the RA, all available historical San Jacinto River elevation data dating back to 1994 was evaluated. Data evaluated included continuous monitoring data from the Sheldon gage (described below) and a United States Geological Survey (USGS) Fact Sheet which reported a major flood event in October 1994. The Northern Impoundment is subject to both tidal fluctuations, as well as increases in river level from rainfall and tropical storm events. As such, installation of BMPs requires an understanding of both the vertical range of typical water surface elevations, as well as the temporal variation in water surface elevations, based on available historical data, that would be encountered during the RA.

To evaluate these influences, GHD developed a model to create a history of water surface elevations at the Northern Impoundment by hindcasting historical water level data from an upriver USGS gage in the San Jacinto River near Sheldon, Texas (i.e., Sheldon gage). This was required as historical routine water level readings had not been collected at the Northern Impoundment, whereas the Sheldon gage has a historical record dating back to 1996. This gage is upstream of the Northern Impoundment and is subject to large increases in surface elevation due to major rainfall events in the area. Although the Sheldon gage data are indicative of trends at the Northern Impoundment, the data are not appropriate for understanding the full pattern of water surface elevations at the Northern Impoundment. Historical water surface elevations for the USGS Sheldon gage are shown on Figure 5-1.

To understand the pattern of local variation in water surface elevations, a transducer gage was installed at the Northern Impoundment during the PDI-2 (see Section 2.2.5). Data collected from the transducer provided a direct understanding of water levels at the Northern Impoundment, which could be correlated with the Sheldon gage data thereby allowing for the hindcasting of the long history of data at the Sheldon gage to the Northern Impoundment.

The current 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 a dataset of calculated site-specific historical river levels dating back to 1996. Northern Impoundment transducer data and Sheldon gage data continue to be collected. As new data become available, the model can then be periodically re-hindcasted to reflect the additional data and provide increased confidence in the outputs.

The original hindcasted data provided in the May 2020 30% RD and the June 2022 90% RD was based on approximately 6 months of site-specific transducer data (July 2019 through December 2019) available at the time of the 30% RD. In connection with the November 2022 NWC, the hindcasted model was updated and rerun with a larger, more recent dataset from both the Sheldon gage and the onsite transducer (July 2019 through December 2021). For purposes of this Revised 100% RD, the hindcasted model has been updated and rerun using available data from February 2023 through February 2024.

To hindcast the Sheldon gage data to the Northern Impoundment, synchronous observations from the Sheldon gage and the Northern Impoundment were subjected to a machine learning model, Multivariate Adaptive Regression Splines (MARS). MARS is an advanced form of linear regression that allows varying relationships between dependent and independent variables across the range of the independent variable. For example, in this case the model has the flexibility to predict different correlations between the Northern Impoundment and Sheldon gage depending on the water surface elevation at the Sheldon gage.

The model selects relationship terms using a generalized cross validation (GCV) method which takes the form of:

$$GCV = RSS/(N \times (1 Ne)/N2)$$

Where RSS is the residual sum of squares of the model, N is the number of observations, and Ne is the effective number of parameters. Thus, the GCV algorithm balances minimization of RSS (which may result in an overfitted model) with parameter number (which allows more flexibility in the model).

The form of the hindcasting model for the Northern Impoundment is:

$$WSESJ,t = WSESH,t \times LSH,t$$

Where, WSESJ,t is the water surface elevation at the Northern Impoundment at time t, WSESH,t is the water surface elevation at the Sheldon gage at time t, and LSH,t is the either rising or falling limb of the hydrograph at the Sheldon gage at time t.

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 hindcast model data was provided in the 90% RD and since that time the model has been updated and rerun with a larger, more recent dataset from both the Sheldon gage and the on-site transducer (July 2019 through December 2021 and February 2023 through February 2024). The updated model data was submitted as a technical memo to the EPA in March 2024. On-site data was collected between December 2021 and February 2023; however, there was an issue with the transducer and data cable that ultimately corrupted the entire dataset recorded during this period. During this period the transducer's telemetry was damaged and stopped transmitting data while the transducer continued to log data. The corrupted data was not immediately discovered until months later when the data was retrieved by manually downloading and evaluating the data. Exploration of the time series alignments has revealed how better pre-processing of the time series results in a dataset that more accurately enables comparison between them. Further analysis has also been conducted on how to present extreme events based on the predicted San Jacinto water levels during different months of the year. One way of visualizing these events is by projecting values as boxplots with overlays of different heights, and conducting a flood frequency analysis. In evaluating the hindcasted predictions back to 1996, a maximum level of +8.72 ft NAVD88 was predicted in November 1998 for the planned excavation season (November through April).

The updated river level hindcasted predictions for the full year and the planned excavation season, November through April, are shown on the attached Figures 5-2 and 5-3, respectively. The boxplot in the attached Figure 5-4 also highlights the predicted month-wise river levels at the Northern Impoundment. Figure 5-4 demonstrates that all of the predicted outliers or rare events where water levels exceeded +9 ft NAVD88 occurred outside the planned excavation season.

As stated above, the hindcasted model was updated and rerun with additional river stage data collected since the last modelling run in connection with the modelling report submitted in November 2022. This rerun of the model is based on a dataset that is nearly double the size of the dataset available for purposes of the previous hindcasted modelling report submitted in November 2022. Because of this larger dataset, the hindcasted model has more information to draw on when building and predicting the correlation and relationship between the river stages for the Sheldon gage and on-site.

The hindcasting model was then used to hindcast water surface elevations at the Northern Impoundment using the Sheldon gage record. Figure 5-2 shows the 24-year hydrograph for the Sheldon gage and the 24-year hindcasted water surface elevations for the Northern Impoundment.

Results of the model and surface water elevations were evaluated and discussed during the December 2019, January 2020, and February 2020 TWG Meetings. Based on the evaluations and discussions, the TWG agreed on the need to complete removal activities during a specified “excavation season,” and also agreed on the proposed design elevation of +9 ft NAVD88 for the top of the BMP. The hindcast model data was provided in the 90% RD and since that time the model has been updated to incorporate recent river levels. Based on the latest update to the hindcast model and as a risk mitigation measure, the BMP elevation has been adjusted from +9 ft NAVD88 to +10 ft NAVD88 for the outer wall. These topics as they relate to the Revised 100% RD for the Northern Impoundment are further discussed below.

5.3.2 Excavation Season and BMP Height

Based on the historic river elevations, the San Jacinto River seasonally experiences high water levels between May and October due to rainfall and tropical storm events. Therefore, an excavation season of November to April was selected for the 90% RD. If directed by the EPA, and to increase production and shorten the overall project schedule, the excavation season will be evaluated on a year-by-year basis and possibly extend into the months of May, June, and July based on the conditions and progress of the work. To allow for the removal of waste material during the excavation season, the Northern Impoundment RA work will likely be divided into five cells with a single cell being remediated each excavation season. During the non-excavation season, based on the Respondents’ ability to perform such activities with regards to weather, and during the first and last year of construction, the RC will perform necessary work activities that do not involve managing impacted material. This work will include, but not be limited to: installing and removing the BMP, developing infrastructure for the project along the TxDOT ROW, constructing and then demobilizing or partially demobilizing the WTS at the end of each excavation season, reinstalling the portions of the WTS that were demobilized prior to the next excavation season, dewatering excess water within the BMP and treating and discharging the remaining water in the BMP, water sampling, protecting office trailers and truck laydown equipment from flooding, visual inspections of the BMP and work site properties, importing and staging clean fill material, mobilizing and demobilizing trucks scales and washes, and mobilizing and demobilizing heavy equipment.

The historical San Jacinto River elevation data was also used to determine a top elevation for the BMP that would be protective of high-water events (based on the available historical data) during the planned excavation season (but also during the months of May, June, and July). High-water extreme events that would have overtopped the BMP have historically occurred during the non-excavation season, as shown on Figures 5-1 and 5-2. For example, in

August 2017, Hurricane Harvey made landfall in the Galveston Bay area. During this event, water surface elevation peaked at 14.28 ft NAVD88 at the Northern Impoundment. More recently, Tropical Storm Imelda caused significant flooding in September 2019, with water surface elevation peaking at 8.9 ft NAVD88 at the Northern Impoundment. For reference, the typical river stage for September at the Northern Impoundment fluctuates between 1 to 3 ft NAVD88.

Comparison of the Sheldon gage and Northern Impoundment hydrographs for both the full year (shown on Figure 5-2) and for the excavation season (shown on Figure 5-3) show that excluding the months of May to October would substantially reduce the number of high-water events that could be expected, based on the available historical data. These data were reviewed with the members of the TWG during the February 19, 2020 TWG Meeting and it was agreed that excavation activities should only take place between November and April.

A comparison of the Sheldon gage and Northern Impoundment hydrographs from 1996 through 2024 show that there were no high-water events that exceeded an elevation of +9 ft NAVD88 during the proposed excavation season. The members of the TWG agreed that an excavation season of November through April each year and a top of BMP elevation of +9 ft NAVD88 would reduce the risks of water overtopping and should be protective of all events in the hydrographic record dating back to 1996 and the October 1994 flood event. After further evaluation of the hindcast data and as an additional protective measure, the outer wall of the BMP has been raised to +10 ft NAVD88. In addition, the excavation season will be evaluated on a year-by-year basis and may be extended into the months of May, June, and July. As further detailed in Section 5.12, the protectiveness of this design top elevation will need to be confirmed following receipt of modelled flow data from the CWA in relation to the CWA’s planned improvement project involving the Lake Houston Flood Control structure located upriver of the work site.

The WTS is sized to treat, in the case of an overtopping event, both contact and non-contact water generated.

5.3.3 Geotechnical Conditions

A primary objective of the SDI was to collect additional geotechnical data to provide a better understanding of the geotechnical properties of the underlying substrata to support the design of the double wall BMP system. A Geotechnical Engineering Report was prepared by Ardaman & Associates Inc. and GHD, and is included as Appendix B. A brief summary of the geotechnical subsoil conditions and the BMP design is presented, below.

The results of the SDI CPT investigation confirmed PDI-2 results and showed that the subsoils in the Northern impoundment, and particularly along the BMP footprint, are principally composed of the three following stratigraphic units:

1. Fairly heterogenous alluvium sediments consisting of a mixture of sand, silt, and clay in varying proportions, present from the riverbed to elevations ranging from -20 to -35 ft NAVD88.
2. Stiff-to-very-stiff high plasticity clay formation (Beaumont Clay) encountered starting at elevations ranging between -20 to -35 ft NAVD88.
3. Compact-to-dense sandy formation (Beaumont Sand) encountered beneath the Beaumont Clay deposit at elevations ranging between -50 to -70 ft NAVD88.

Continuous profiles of different geotechnical parameters were defined from the CPT results using robust published correlations (undrained shear strength, the pre-consolidation pressure, undrained modulus, hydraulic conductivity, friction angles etc.). All CPT defined parameters were compared and validated with those measured in previous investigations.

The Northern Impoundment characteristics vary across the impoundment and necessitate evaluation of multiple sections using soil-structure interaction. The presence of the thick cohesive formation that behaves in a drained or undrained state, requires consideration of both quick and slow loading cases (Q and S cases respectively).

The soft heterogeneous alluvium deposit on the riverbed may temporarily develop pore pressure upon backfilling between the sheet piles and will increase the loads against these sheet piles. The design of the BMP wall includes the full extent of the wall encircling the Northern Impoundment, including the portions of the wall surrounding the northwest corner. Due to deeper mudline depth in the northwest corner, dewatering within the BMP causes a large load differential between the interior and exterior sides of the BMP. In order to mitigate these challenges, design features such as additional buttressing on the interior and staged construction of the BMP such as installing fill in multiple layers with intentional delay between layers and selecting appropriate fill height before installing tie-rods, will be required.

Since the BMP will be driven in the alluvium and Beaumont Clay with tip depths at elevations of approximately -40 ft NAVD88, no excessive vibrations and no detrimental impact on the stability of the existing slope on the riverbed are anticipated during installation.

5.3.4 Excavation Extent and BMP Alignment

Analytical data obtained from the RI, the PDI, and the SDI were used to inform the RD and determine excavation extents and volumes and the alignment of the BMP.

Lateral Extent

As described in the EPA-approved PDI-2 Work Plan (GHD, 2019d), the lateral extent of excavation is based on analytical data. Areas with $TEQ_{DF,M}$ levels below the clean-up level of 30 ng/kg will not require excavation, as depicted on Figure 2-9. The historic central and southern berms depicted on Figure 2-9 have been shown to have levels of dioxins and furans below the clean-up level. To allow for efficient waste removal, the berm material may be excavated in conjunction with the waste material. The unimpacted berm material may be disposed of with the waste or segregated and reused on-site, pending analysis, as described in the FSP (Appendix J, Attachment 3).

The double wall BMP design requires a significant lateral footprint, in addition to the 30-ft width of the wall itself. A Soil Buttress with a minimum width of 30 ft is also necessary between the inner wall and the top of the excavation slope to support the wall. To accommodate the footprint of the BMP wall and to avoid installation of the BMP wall through the TCRA armored cap, the alignment of the BMP was moved outward to fully encircle the Northern Impoundment area.

On the south side of the Northern Impoundment, SDI results indicated that waste material was much deeper than previously understood (as deep as -20 ft NAVD88 while the ROD had assumed that area was -5 ft NAVD88). As the south side of the Northern Impoundment abuts the TxDOT ROW property, there is not sufficient space to accommodate a double wall system (including a slope out of the excavation, 30-ft Soil Buttress, and double wall) without encroaching on the TxDOT ROW property. As further detailed in Section 5.5.6, several different wall types and alignments were evaluated as part of an effort to identify a structurally sound wall with a thinner profile than the double wall system. Ultimately, the only wall-type that proved to be structurally sound for installation on the south side of the Northern Impoundment was the double-wall system, the majority of which will need to be placed on the TxDOT ROW property. Figure 5-A shows the alignment of the BMP and the extent of the excavation area.

TxDOT submitted comments on the 100% RD related to the BMPs wall design and the placement on the TxDOT ROW. Respondents, EPA, and TxDOT are engaged in continued technical discussions regarding the southern wall alignment and the double wall system.

Vertical Extent

Analytical data from the RI, PDI, and SDI were also utilized to determine the vertical extent of the waste material requiring removal. As previously mentioned, results from the PDI and SDI indicated that waste material is present at elevations significantly deeper than was known at the time the ROD was issued. During the SDI, the elevation of waste material in the Northern Impoundment was found to be as deep as -28.3 ft NAVD88 with an average depth of -12.8 ft NAVD88. The excavation surface was developed by targeting excavation depths/elevations that were identified across the Northern Impoundment such that the resulting surface will meet the clean-up level of 30 ng/kg $TEQ_{DF,M}$. Due to the deeper elevations of waste material and the goal to design a remedy that includes excavation “in the dry,” a detailed hydraulic heave evaluation was conducted. This evaluation indicated that there are hydraulic heave risks in certain areas, with the most significant risk in the northwest corner.

Table 5-1 presents the analytical data at all borings based on elevations (rounded to the nearest foot), with concentrations greater than 30 ng/kg $TEQ_{DF,M}$ indicated by bold text. The red line on Table 5-1 identifies the elevation at each boring at which there is a calculated risk of hydraulic heave, with a SF of 1.25. The green line indicates the design excavation elevation at each boring based on the 30 ng/kg $TEQ_{DF,M}$ criterion. Five boring locations (SJGB010, SJGB012, SJSB036, SJSB046-C1, and SJSB071) had results above 30 ng/kg $TEQ_{DF,M}$ in the deepest sample interval collected, as seen on Figure 2-9. At these locations, the design considered the adjacent co-located borings to determine the appropriate excavation elevations to complete the excavation bottom contours. All borings located within the northwest corner, where there is a significant hydraulic heave concern, are marked with a dark grey tone. Based on this evaluation, it was determined that the northwest corner is technically impracticable to excavate in the dry and will be addressed with mechanical dredging to mitigate the hydraulic heave risk.

The design excavation contours can be seen in Design Drawings C-08 through C-12 in Appendix G. As noted in Section 5.2, these design excavation elevations are the initial excavation depths and will be verified through confirmation sampling.

The approximate volume of material to be excavated in the Northern Impoundment is estimated at 230,000 CY. To facilitate a seasonal excavation approach, the total volume of material will be divided into multiple cells, with a single cell excavated each excavation season.

5.4 Pre-RA Activities

5.4.1 Property Access

To implement the RA, it will be necessary to have access to approximately 15 to 20 acres of dry land to utilize for lay-down storage of equipment, water storage and treatment, office trailers and parking. It is preferred that the property(ies) be located as close as possible to the Northern Impoundment to minimize the distance over which water requiring treatment needs to be conveyed. Property access will also need to be secured for the duration of the RA, which is expected to require at least 7 years and additional time to procure and mobilize equipment and personnel. Currently, several properties located in the vicinity of the Northern Impoundment are being evaluated. The general layout of the WTS is depicted in Drawings P-04 and P-08 (Appendix G). These layouts will need to be updated with site-specific detail in future design submittals once access to a property for laydown/staging has been secured.

Implementation of the Northern Impoundment RA will also require access to and utilization of the TxDOT ROW that runs parallel to I-10, as well as properties owned by POHA and Houston Fleeting Services, LLC between the TxDOT ROW and the bank of the San Jacinto River. As previously mentioned, in addition to providing the only land access route to the Northern Impoundment, the southern extent of the BMP will need to be installed on the TxDOT property. Executing the Northern Impoundment RA will require that an agreement be reached with TxDOT to allow for use of the TxDOT ROW both for access and purposes of construction of the BMP. In addition, as is discussed in more detail in Section 5.11.3, TxDOT plans to replace the I-10 Bridge beginning in the next 2 to 3 years. It is currently unknown as to how TxDOT's plans may impact its ability to allow access to its ROW for purposes of the Northern Impoundment RA, but it is expected that significant coordination between the two large construction projects will be required to minimize delays.

As part of RD efforts, the Respondents have engaged with the POHA, USCG, TxDOT, and the HCFCD to inform these stakeholders about the planned alignment and design of the BMP wall that will be present in the San Jacinto River for at least 7 years. As requested by the HCFCD, a Floodplain Drainage Impact Analysis was conducted to evaluate the effect that the BMP could have on the surrounding floodplain. Water levels in the vicinity of the Northern Impoundment were evaluated with and without the BMP present under 2-year, 10-year,100-year, and 500-year flood scenarios. Modelling results indicated that the effects of the BMP on the surrounding floodplain would not be significant under any of the four scenarios. The evaluation was submitted to the HCFCD in a letter dated March 30, 2022 (GHD, 2022a). Comments were received from the HCFCD via e-mail on April 8, 2022 (HCFCD, 2022) and a revised letter was submitted on May 6, 2022 (GHD, 2022b). This letter is included in Appendix D. The hydrodynamic modelling data was also provided to TxDOT on April 4, 2022, to allow TxDOT to begin evaluating the effects of the BMP on its bridge structures.

Additional comments were received as part of the EPA Review of the 90% RD (EPA, 2024b) and 100% RD (EPA, 2024c). The hydrodynamic model was updated to address EPA's comments and is included as Appendix F.

The RC will need to continue to engage these stakeholders and coordinate accordingly as the project progresses.

5.4.2 Northern Impoundment Preparation and Layout

In order to facilitate waste material removal, solidification, and water treatment, the RC will be required to complete several activities to prepare to implement the Northern Impoundment RA.

Assuming that access can be obtained to use the existing TxDOT ROW to implement the RA, the existing TxDOT ROW cannot accommodate two-way traffic for haul trucks; therefore, the TxDOT ROW would need to be enhanced/widened in order to make Northern Impoundment RA operations efficient and safe. Widening the ROW may necessitate installation of a bulkhead along the north side of the TxDOT ROW to bolster and protect the roadway. This access road will also need to be built up as it approaches the south side of the Northern Impoundment, such that the elevation of the access road at the entrance of the Northern Impoundment will be at or above the BMP top elevation of +10 ft NAVD88. This access ramp will be constructed to allow truck traffic to traverse in and out of the Northern Impoundment, over the BMP wall, while maintaining a protective BMP height to prevent overtopping during the excavation season. In addition, the elevated roadway would need to be constructed in a manner that will accommodate TxDOT's need for its vehicles to have access to the ROW for purposes of maintenance of the existing I-10 Bridge structure and future construction of a replacement bridge structure. The area immediately north of the TxDOT ROW is owned by a third-party landowner and access to it will be required to improve the access road.

Working and staging areas on the Northern Impoundment are limited due to the existing topography and tidal conditions. On the west side of the impoundment, the existing TCRA armored cap rock creates uneven terrain that is not suitable for truck traffic. The east side of the impoundment is consistently covered in water during high tides. Therefore, access roads to and within the Northern Impoundment may need to be constructed in different areas of the Northern Impoundment, depending on which cell is being addressed, in order to allow for truck access and turnarounds. The exact nature and extents of these access roads will be determined by the RC as part of its initial work plan submittals.

Staging and laydown pads may need to be constructed on the selected off-site property for materials staging and water storage and treatment equipment. The RC will also provide power, communications, and water utilities for the water treatment equipment, as necessary.

The RC will construct mixing areas for soil solidification as shown on the design drawings on Appendix G. These mixing areas will be constructed with berms and will be lined to contain the waste and prevent contamination of the underlying material. The exact location of the mixing areas may vary from excavation season to excavation season. For each excavation season, the RC will determine the exact nature and location of mixing areas to be used during that season. It is anticipated that these mixing areas will be constructed in areas adjacent to active cells to mitigate excessive handling and transport of wet material.

5.5 BMP Wall

The following guidelines, standards, and technical manuals are the primary sources used to develop the design of the BMP:

- American Society of Civil Engineers (ASCE) 7-16, Minimum Design Loads and Associated Criteria for Building and Other Structures.
- USACE Engineer Manual (EM) 1110-2-2504, Design of Sheet Pile Walls by USACE.
- American Institute of Steel Construction (AISC) 360-16, Steel Construction Manual 15th Edition.
- USACE Hurricane and Storm Damage Risk Reduction System Design Guidelines, updated June 2012.
- American Association of State Highway and Transportation Officials (AASHTO) LRFD Bridge Design Specifications.
- Nucor Skyline Technical Product Manual, 2021 Edition.
- Arcelor Mittal Impervious Steel Sheet Pile Walls Design & Practical Approach.

5.5.1 Structural Definitions

ASCE 7-16 categorizes structures into four Risk Categories (I through IV). During an excavation season, the BMP may be considered to be similar to structures or facilities that process, handle, or store toxic substances. ASCE 7-16 categorizes such structures or facilities as being in Risk Category IV, in which the failure of such structures or facilities may pose a significant hazard to the public.

EM 1110-2-2504 defines the following load case conditions based on severity and probability of occurrences during the design life of the structure:

– ***Usual:*** Service level loading experienced frequently such as static earth pressure, hydrostatic pressures after installation of the BMP and during excavation with normal water levels in the river.
– ***Unusual:*** Loads larger than those considered usual and experienced less frequently, such as 100-year probability storm events and flood levels in the river.
– ***Extreme:*** Worst-case scenario loads, rarely experienced during the design life of the structure, such as hurricane level winds, flood levels in the river and barge impacts.

5.5.2 Material

Material grades for the various structural components are summarized below:

– ***Sheet Piles*** ASTM A572 Grade 60 (Yield stress, F_y = 60 kilopounds per square inch [ksi])
– ***Tie rods*** ASTM A615 Grade 80 (F_y = 80 ksi)
– ***Walers*** ASTM A36 Grade 36 (F_y = 36 ksi)

For purposes of the design, the standard sections for sheet pile and tie-rods were selected from the Nucor Skyline Technical Product Manual. The manual also included the section properties used for design calculations. Alternative sections with equivalent properties are available from other manufacturers and may be used in construction.

5.5.3 Design Parameters

5.5.3.1 In-Situ Soil

The soil parameters specific to the Northern Impoundment are discussed in detail in Appendix B and Appendix I. The subsurface soils include fine grained material that is expected to behave differently in drained (long-term) and undrained (short-term) condition. Both drained and undrained loading conditions were considered. The designations for soil parameters are in accordance with the Unified Soil Classification System (USCS).

Drained and undrained clays and silts behave differently under loading and have different strengths with respect to time and duration of the applied load. Submerged clays loaded rapidly and for short duration behave the same as an undrained soil since drainage cannot occur through the clay particles in a short time, a condition which is referred to as the Q-case (EM 1110-2-2504). Over longer time frames, clay will drain, and the apparent strength will change. This condition represents the S-case loading (EM 1110-2-2504). Results of the stability analysis include strength from both cases, Q-case and S-case.

5.5.3.2 River Water Levels

The loading from the river water with a density of 62.4 pound per cubic feet (lb/ft^3) would be applied as hydrostatic pressure to the exterior and interior BMP faces.

Water elevations for various load case conditions are as follows:

– ***Usual*** +5 ft NAVD88
– ***Unusual*** +10 ft NAVD88

– ***Extreme*** +10 ft NAVD88 (used for Barge Impact loading condition)
– *Note: The river water is influenced by the tidal waters from the bay and Gulf of Mexico. The water density will be in the range of 62.4 lb/ft³ (freshwater) to 64 lb/ft³(seawater). The maximum difference of 1.6 lb/ft³ (2.5%) will not have any impact on the design.*

Tide data is available from the NOAA[1] Station 8770613 located is approximately 9 miles south of the Northern Impoundment. The mean higher high water (MHHW) elevation is 1.33 ft with respect to the mean lower low water (MLLW). The daily tide variation is significantly lower than the water levels assumed for the design of the BMP. Hence, tides will not govern the design.

5.5.3.3 Scour at BMP Exterior

The presence of the BMP can affect the natural flow state of the San Jacinto River in the vicinity of the Northern Impoundment. The scour potential of the river flow around the BMP installation was evaluated using the Hydrodynamic Model developed for the Northern Impoundment. The shear stresses determine the capability of the river flow to move the riverbed material (sediment). The analysis method and results are provided in Appendix F.

The model evaluated the changes in water circulation with and without the BMP installation for 2-year, 10-year, 100-year and 500-year flow events in the river. The analysis results show that average flow velocity increases as the river discharge increases, and it decreases with the increase in water surface elevation.

With the measured average sediment size, it is noted that shear stress exceeding 0.15 Pascals (Pa) has the potential to mobilize the sediment in the vicinity of the Northern Impoundment. The analysis results show maximum increase in shear stress of 2.65 Pa, maximum value of shear stress of 4.34 Pa and an average value of 0.24 Pa. The shear stress values are large compared to the critical shear stress value of 0.15 Pa for the sediment in the area, indicating that the soil particles are mobile and there is potential for scour and/or sediment deposition along the outside perimeter of the BMP.

The maximum shear stresses differences were observed in two locations - the southwest corner and the north side of the BMP installation. The elevated shear stresses are due to the increase in the river flow within these areas due to the presence of the BMP. However, the bathymetry in the model does not account for modifications of the access road for purposes of the RA which will elevate the area in the southwest corner, limiting the river flow and in effect, preventing increase in the shear stress reflected in the analysis model.

The relatively small value of the maximum shear stress indicates that, except for the two locations discussed above, the conditions overall remain similar to the existing conditions (without the BMP in place). The pattern is similar for all four modelled storm conditions (2-year, 10-year, 100-year and 500-year flow events) with only small differences in magnitude.

Scour protection measures such as rock or riprap will be required around the majority of the perimeter of the wall.

5.5.3.4 Scour at BMP Interior

Based on the evaluation of the historic data for the water levels and hindcast model (Section 5.3.1 and Figure 5-4), there have been five (5) instances of water level exceeding elevation +10 ft NAVD88 that occurred outside the planned excavation season. The BMP is designed for water levels ranging from normal levels (elevation +2 ft) to top of the exterior wall (elevation +10 ft NAVD88).

For the rare instances where the water level exceeds elevation +10 ft NAVD88, the plunging water may cause scour at the interior base of the BMP wall. The riverbed elevation within the Northern Impoundment varies between 0 to -5 ft NAVD88 on the interior of the BMP walls, except in the northwest corner where the riverbed elevation is approximately -15 ft NAVD88. The riverbed elevation will be raised to elevation -4 ft NAVD88 along the northwest corner by installing a 30 ft wide bench (See Section 5.5.6.1).

[1] National Oceanic and Atmospheric Administration Station at Morgans Point, Barbours Cut, Texas.

Based on the calculated flow rate over the height of the BMP, the entire BMP will fill to the top of the wall within 1 to 2 hours when the river level rises only 6 inches above the top of the BMP wall. The water levels in the river may continue to rise for several hours but as the Northern Impoundment starts filling with water, the energy of the water overtopping the structure will be dissipated before it reaches the base of the BMP wall and the potential for scour will be reduced.

Scour protection measures such as rock or riprap will be provided along the entire interior perimeter of the walls for the initial stages of river water overtopping the BMP wall, should this occur.

5.5.3.5 Wind

The 3-second gust design wind speeds and hurricane exposure are defined in ASCE 7-16 Chapter 26. The web-based hazard tool by ASCE (**https://asce7hazardtool.online**) provides site-specific information. The standard design wind speeds relate to a maximum recurrence interval (MRI) of 100-years. The wind speeds for Risk Category IV structure in hurricane exposure areas correspond to MRI of 3000-years. All wind speeds are defined at 33-ft above ground level.

- Design wind velocity, 3-second gust, MRI 100-years, V_{100} = 116 miles per hour (mph).
  - Equivalent to 77 mph wind sustained over 1 hour
- Design wind velocity, 3-second gust, MRI 3000-years, V_{3000} = 154 mph.
- Exposure Category C.
- Wind directionality, K_d = 0.85 (solid freestanding wall).
- Topographic Factor, K_{zt} = 1.0.
- Ground Elevation Factor, K_e = 1.0.
- Velocity Pressure Exposure Coefficient, K_z = 0.85.

Velocity Pressure, $q_z = 0.00256\ K_z\ K_{zt}\ K_d\ K_e\ V^2$.

Using $V = V_{100}$, qz_{100} = 24.89 pounds per square foot (lb/ft^2) (Unusual load condition).

Using $V = V_{3000}$, qz_{3000} = 43.87 lb/ft^2 (Extreme load condition).

Velocity pressure from wind (q_z) was applied as uniformly distributed load on the exposed exterior of the BMP.

5.5.3.6 Waves

Wind-waves are generated by sustained winds over unobstructed open waters (fetch). The Northern Impoundment is sheltered by land on all sides within 0.2 miles except the north and northwest directions as shown in Figure 5-F. There are barges moored on the north side within 0.3 miles interrupting the open waters and beyond that, the nearest land is 0.5 miles away. The fetch distance perpendicular to the northwest is less than 1.5 mile.

A detailed analysis of wind generated waves including the water levels and fetch distance near the Northern Impoundment is provided in Attachment 3. The analysis showed a maximum wave height of 0.86 ft is generated over the longest fetch with winds approached from North.

Since the BMP will be designed for water surface elevation at top of the wall (elevation +10 ft), the wind-waves will not govern the BMP design over the loading scenarios with the total hydrostatic pressure applied from top of the wall and barge impact as described in Section 5.5.3.7.

Figure 5-F *Fetch Distance near Northern Impoundment*

Wake-waves are generated by passing vessels in the area and approach the BMP walls at an angle as the navigation channel flows parallel to the walls. Similar to the wind-waves, wake-waves should also be combined with the normal water levels in the area (elevation +2 ft to +5 ft). Wind-waves are not combined with wake-waves since passing vessels overlapping with a storm event is unlikely. Since the BMP will be designed for water surface elevation at top of the wall (elevation +10 ft), the wake-waves will not govern the BMP design over the loading scenarios with the total hydrostatic pressure applied from top of the wall and barge impact as described in Section 5.5.3.7.

5.5.3.7 Barge Impact

Given the heavy barge traffic in the San Jacinto River, there is a potential for the BMP to be struck by a barge. An impact could be the result of a barge coming off its mooring and drifting toward the BMP during a storm or it could be the result of a towed barge veering off course. The segment of the river around the BMP actively used by barges is shown on Figure 5-G. The barges traveling in the navigational waterway, either empty or loaded, would be likely to make contact with the BMP at an angle. The barges moored directly north of the BMP would be likely to make head-on contact with the BMP. The impact energy from a barge moving at the river flow velocity will be absorbed by the combination of a barrier wall system installed outboard of the BMP and the BMP structure.

Impact Energy

The kinetic energy from impact can be determined as follows, where velocity may be either the flow velocity or the navigation speed. The energy of impact will be lower for any impact angle other than head-on collision.

Kinetic Energy of Impact = 0.5 x Mass x (Velocity x cosine (α))$^{2.}$

Where:

Mass = Mass of the vessel

Velocity = Speed of the vessel at impact cosine (α) = directional factor for impact angle relative to the velocity vector

= 1 for Head-on impact, i.e., 0 degrees relative to velocity vector

The kinetic energy will be absorbed by the structures (barrier wall and BMP) but the barge itself will absorb some energy and suffer damage. The AASHTO[2] method to determine impact force absorbed by bridge piers is being used for evaluating the BMP. This method is conservative since the BMP has a larger profile area than the typical bridge piers to absorb impact and distribute the energy.

Figure 5-G *Navigational Waterway - Northern Impoundment*

USACE developed design guidelines outlining minimum impact forces for hurricane protection structures.[3] These include structures in protected waterways not exposed to tidal surge (Zone 1A), similar to the conditions at the Northern Impoundment. The extreme load condition criterion for Zone 1A corresponds to an impact force of 400 kilopounds (kips) from a light (empty or ballast condition) barge applied at the top of the wall with hydrostatic pressure induced by the 100-year still water level and wind load applied on any exposed portion of the wall. It should be noted that heavier (loaded or laden condition) vessels did not govern the design as the velocities of these vessels were considerably less.

AASHTO requires all bridge piers located in navigable waterway crossings to be designed for ship and barge impact. The required minimum impact load corresponds to a 195-ft long, 35-ft wide and 12-ft tall empty hopper barge (displacement = 200-ton), drifting toward the structure. This barge size is representative of the barges in the area.

TxDOT's design criteria for the dolphin and fender system protecting the I-10 Bridge piers includes impact from a 30,000-barrel (BBL) barge, one of the larger barges in the area. A typical 30,000 BBL barge is 300-ft long, 54-ft wide, and 12-ft tall. In laden condition, the barge is loaded to full capacity and displaces 30,000 BBL equivalent or approximately 168,500 cubic feet (ft^3) of water. Thus, the barge weighs approximately 5,250 US-tons or 10,500 kips in

[2] AASHTO LRFD Bridge Design Specifications, Section 3.14.
[3] USACE Hurricane and Storm Damage Risk Reduction System Design Guidelines, Section 5.2.1.

laden condition. In ballasted condition, the barge carries only fuel and ballast water, and weighs approximately 910 US-tons or 1,820 kips.

The head-on impact from the 54-ft wide, 30,000 BBL barge resulted in impact energy (and force) greater than the values recommended using USACE and AASHTO vessels. Therefore, the 54-ft, 30,000 BBL barge is considered the design barge for evaluating impact. A contact width of 50-ft was assumed to account for variations in barge bow shapes.

Impact Velocity

The hydrodynamic model (Appendix F) evaluated the flow velocities for four storm conditions at 2-year, 10-year, 100-year and 500-year recurrence intervals, both with and without the BMP present. The maximum and average velocities for the river flow from the hydrodynamic analysis report are summarized in Table 5-A.

Table 5-A Velocity - Hydrodynamic Model

Velocity (ft/s)	Existing Conditions (No BMP)				With BMP in Place			
	2-Year	**10-Year**	**100-Year**	**500-Year**	**2-Year**	**10-Year**	**100-Year**	**500-Year**
Maximum	2.79	2.68	2.95	2.95	2.68	2.93	3.14	3.14
Average	0.56	0.55	0.66	0.68	0.61	0.60	0.71	0.72

The buoys installed at the Northern Impoundment have collected velocity measurements since January 1, 2022. A total of 129,593 observations were evaluated and processed to remove unrealistic spikes in the data. The methodology is described in Attachment 3. There were 11 individual instances (10-minute each) of measurements greater than 4 ft/s, with a maximum value of 5.2 ft/s. Since these 11 instances are not sustained, they are not considered in the design parameters of the barge impact analysis.

Based on the results from the hydrodynamic model and evaluation of the buoy data, the barge impact is evaluated for a velocity between 3.14 to 4 ft/s.

5.5.3.8 Earthquake

The area of the Northern Impoundment is generally considered to have low seismicity. This is also reflected by the following low seismic accelerations noted in the Geotechnical Report (Appendix B).

PGA: 0.034 g

S_S: 0.069 g

S_1: 0.040 g

Typical retaining wall structures are impacted by earthquake loads due to reduction in strength of the foundation soils, fill material and/or the backfill. Structures that are founded on saturated, cohesionless soils or lenses of such soils within the cohesive soils can lose foundation support when subject to earthquake loading.

The seismic accelerations will not affect the alluvium and Beaumont clay layers. There will be impact on Beaumont sand layers or other granular material but as the BMP walls do not extend into the sand layers, the seismic accelerations do not impact the stability of the wall.

5.5.4 Load Combinations

The following load combinations (LC) are appropriate for the structural design in accordance with Allowable Stress Design in ASCE 7-16, Section 2.4.

LC#1	D + H + F
LC#1A	D + H + F + I
LC#5	D + H + F + 0.6W

Where:

D = Dead load

F = Fluid load (hydrostatic pressure)

H = Lateral earth pressures (active and passive)

W = Wind Load on exposed surfaces (interior and/or exterior)

I = Barge Impact

LC#1 was evaluated for both Usual and Unusual load conditions. LC#1A was used to evaluate the barge impact as extreme load condition with impact near top of the wall. An impact at lower levels will cause less rotation in the structure.

LC#5 combines wind load with other loads acting on the BMP. It is noted that wind load is applicable only to the exposed height of BMP above ground or water level. At the design water level for Unusual or Extreme conditions (+10 ft NAVD88), the BMP exterior would not be exposed to wind.

A parametric evaluation was performed for the effect of wind loads on the design of BMP using LC#5. The 0.6 reduction factor for wind load was conservatively ignored for the evaluation. The net load ($F + W_{Exterior} - W_{Interior}$) on the BMP, calculated as sum of the hydrostatic load and the wind load applied to both interior (above ground) and exterior (above water level), was compared to the hydrostatic load with water level at +9 ft NAVD88 acting alone. The net load was determined to be lower. Given that D + H are common to both load cases, LC#5 did not govern over LC#1 and was not evaluated further.

ASCE 7-16 recommends reduction in the load factor for resisting (passive) lateral earth pressure to 0.6. The intent of the reduction is to design structures resistant to overturning by reducing the resistance. Since the BMP wall was designed for overturning (rotational) stability with adequate embedment as described in Section 5.5.6, a reduction for lateral earth pressure was not considered.

5.5.5 BMP Design Criteria

5.5.5.1 Failure Modes

EM 1110-2-2504 describes the following three primary failure modes for sheet pile wall systems:

1. The unstable slopes may cause a deep-seated rotational failure of the entire soil mass. The slope failures are independent of the sheet pile embedment and location of the anchor system. This type of failure can be addressed by changing the geometry of the retained material or improving the soil strength.

   The double wall system of the BMP presented in the Revised 100% RD is evaluated using PLAXIS 2D, a finite element software program. The program can model complex soil profiles, structural sections and perform soilstructure interaction analysis to achieve a solution with compatible forces and displacements. The program evaluates the soil stability around the sheet piles to determine if slope failure is a concern.

2. The sheet piles with inadequate embedment depth can be subjected to rigid-body rotational failure due to the lateral pressures exerted by the retained material. The classical design procedures such as the “free earth” Limit Equilibrium Method calculate the sheet pile embedment depths by balancing the active pressures behind the wall against the passive pressures provided by soil in front of the sheet piles. Adequate embedment depth is achieved at depth where the sum of horizontal forces and sum of moments is zero. Rigid-body rotational failure can be prevented, according to EM 1110-2-2504, by incorporating safety factors to decrease the passive pressures as appropriate for different loading conditions.

The double wall system of the BMP is an atypical sheet pile system. Unlike a cantilever or anchored system, rotational failure is mitigated by the counterbalancing axial forces on the two walls. Instead of increasing the embedment depth of the single wall, the width of the double wall system can be increased to an extent such that it beneficially contributes to resolving the overturning forces into axial components along the length of the wall. Thus, this mode of failure is not applicable to the double wall system.

3. The sheet pile systems with stable slopes and adequate embedment may fail if the sheet pile sections, tie-rods, and/or the anchor components are overstressed or inadequately sized. Such failures can be prevented, according to EM 1110-2-2504, by incorporating safety factors in the design by limiting the allowable stress as appropriate for different loading conditions.

5.5.5.2 Safety Factors

The following safety factors and allowable stress limits were adopted in the design of the BMP with respect to the failure modes described in Section 5.5.5.1, consistent with EM 111-2-2504.

5.5.5.3 Embedment Depth

EM 1110-2-2504 recommends the minimum safety factors provided in Table 5-B to determine embedment depth for cantilever or anchored sheet pile wall systems. It should be noted that the safety factors are suitable for the “free earth” Limit Equilibrium Method where the sheet pile is considered a rigid body allowed to rotate about a point below ground level, and the active and passive pressures are balanced to determine the embedment depth. Adequate embedment depth is achieved at depth where the sum of horizontal forces and sum of moments is zero. The pressures, and resulting forces in the system, are considered independent of the wall displacement in the Limit Equilibrium Method.

The BMP design evaluated with the finite element analyses using soil structure interaction incorporates the nonlinear behavior of the soil, wall displacements and flexibility of the sheet pile and anchors. The active and passive pressures vary as the system flexes to achieve a solution by balancing the forces and displacements in the entire system. By inherently balancing the forces and displacements, the system achieves a larger safety factor against rotational failure than the Limit Equilibrium Method. Thus, the safety factors are not applied to determine effective soil parameters for calculating passive pressures.

The cantilever wall BMP presented in the 30% RD acted as both a floodwall and a retaining wall by maintaining differential water (higher water in the river) and soil elevations (excavation below riverbed elevation). However, the current BMP system in the new alignment primarily serves as a floodwall by maintaining a different water elevation between the excavation area and the San Jacinto River. The sheet piles are terminated in the fine grain soils of the Beaumont Clay layer. Hence, both the undrained (Q-Case) and drained (S-Case) conditions were evaluated to determine the stability of the BMP.

Table 5-B Safety Factors for Passive Pressures - EM 1110-2-2504

Loading Case	Floodwalls		Retaining Walls	
	Fine-Grain Soils	**Free-Draining Soils**	**Fine-Grain Soils**	**Free-Draining Soils**
Usual	1.50 Q-Case 1.10 S-Case	1.50 S-Case	2.00 Q-Case 1.50 S-Case	1.50 S-Case
Unusual	1.25 Q-Case 1.10 S-Case	1.25 S-Case	1.75 Q-Case 1.25 S-Case	1.25 S-Case
Extreme	1.10 Q-Case 1.10 S-Case	1.10 S-Case	1.50 Q-Case 1.10 S-Case	1.10 S-Case

Sheet Pile Sections

EM 1110-2-2504 recommends the maximum allowable stresses provided in Table 5-C for the sheet piles subject to different load case conditions. By definition of the various load case conditions (Section 5.5.3), the BMP is subject to Unusual and Extreme load case conditions less frequently than the Usual load case conditions. Hence, the allowable stresses are relatively higher for the more severe loading scenarios to provide design solutions appropriate for Unusual and Extreme load case conditions.

Table 5-C Allowable Stresses for Sheet Piles - EM 1110-2-2504

Load Case Conditions	Combined Bending and Axial Stress	Shear Stress
Usual	0.50 F_y	0.33 F_y
Unusual	0.67 F_y	0.44 F_y
Extreme	0.88 F_y	0.58 F_y

Tie-Rod Sections

The tie-rod sections, included in Table 5-D, are designed using allowable stress design methods in accordance with AISC 360. The tie-rods are critical to balance the forces and displacements of the BMP.

Table 5-D Allowable Stresses for Tie Rod Sections - AISC 360

Limit State	Overstrength Factors
Tensile Yielding	1.67
Tensile Rupture	2.00
Tensile Rupture of Threaded Parts	2.00

If one tie-rod fails, the loads will be redistributed to the adjacent tie-rods. The individual tie-rods are designed for 150 percent of the demand loads, accounting for a tie-rod failure event where the loads are redistributed to adjacent tie-rods and preventing progressive failure and thereby, increasing the safety factor.

Walers

The walers are longitudinal beams connected to the tie-rods on the exterior face of the sheet piles. The walers distribute the loads from the sheet piles to the tie-rods and minimize variations in displacement along the BMP. In order to provide a continuous longitudinal beam, the individual waler beams will be spliced using bolted connections.

The waler are evaluated as simply supported multi-span beams with tie-rods providing the support reactions. The walers are also evaluated for condition with a longer span (150 percent) accounting for a tie-rod failure thus able to redistribute loads to the adjacent tie-rods. The walers are designed using allowable stress design method in

Table 5-E Overstrength Factor for Walers - AISC 360

Limit State	Overstrength Factors
Flexure or Bending Stress	1.67
Shear	1.67

5.5.5.4 Deflection

Total system displacement comprised of structural steel deformation, rotation and translation of the entire BMP and soil system was evaluated for the proposed BMP.

Neither EM 1110-2-2504 nor ASCE 7-16 provide guidance on limiting system deflection. For a cantilever sheet pile system, structural steel can deform significantly before structural failure occurs; hence, structural steel deformation could not be used as a limiting parameter in the previous submittal (30% RD).

The combination of tie-rod anchors and adequate embedment of sheet piles restrain the deflection in the sheet piles. The deflection at the top of the sheet pile translates to local deformations in the structure. These deformations are accounted for by the bending stress in the sheet piles and tensile stress in the tie-rods. The stresses will be limited to the allowable stress (Section 5.5.5.2) and within the elastic range (less than F_y) to avoid structural failure of the BMP.

5.5.5.5 Corrosion Protection & Maintenance

The Northern Impoundment BMP structures were designed for temporary, short-term use. It was assumed that the sheet piles would remain in place for a period of approximately 7 years after installation. Figure 5-H shows the five exposure zones typically considered for corrosion. It also shows a schematic for varying thickness loss along the height of the steel sheet piles exposed to a marine environment.

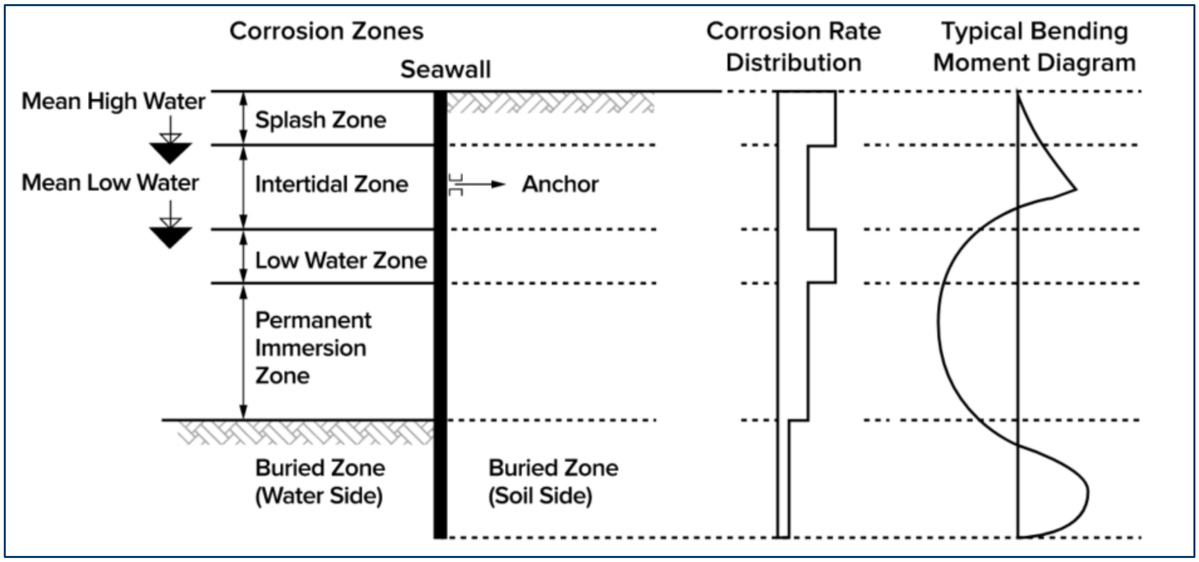

Figure 5-H Typical Thickness Loss - Nucor Skyline Catalog, Ports & Marine Construction

The loss of thickness due to corrosion relative to different exposure conditions are listed in Table 5-F. The corrosion rates are representative of industry-wide accepted rates where site-specific data is unavailable. Since the Northern Impoundment is located in brackish water, an average of total thickness loss for river (0.008 inches) and seawater (0.027 inches) exposure is appropriate (these two values are indicated in bold font in Table 5-F, below). The duration of exposure to each zone varies significantly on the exterior and interior face of the BMP. It is conservative to assume the same thickness loss on both sides of the sheet pile. A uniform sacrificial thickness of 0.035-inches (2 x 0.0175 inches) was included for each side of the sheet pile for the entire height of the wall. No additional maintenance should be required for the assumed 7-year RA period.

Table 5-F Loss of Thickness due to Corrosion

Description of Exposure[1]	Loss in 5 Years[1] (inches)	Loss in 25 Years[1] (inches)	Loss in 7 Years[2] (inches)
Common fresh water (river, ship canal) in the zone of high attack (water line).	0.006	0.022	**0.008**
Very polluted fresh water (sewage, industrial effluent) in the zone of high attack (water line).	0.012	0.051	0.016

Description of Exposure[1]	Loss in 5 Years[1] (inches)	Loss in 25 Years[1] (inches)	Loss in 7 Years[2] (inches)
Sea water in temperate climate in the zone of high attack (low water and splash zone).	0.022	0.074	**0.027**
Sea water in temperate climate in the zone of permanent immersion or in the intertidal zone.	0.010	0.035	0.013

Notes:

1. Eurocode 3 - Design of Steel Structures, Part 5: Piling, BS EN 1993-5:2007.
2. Interpolated between 5 Years and 25 Years.

5.5.6 BMP Wall Analysis

The BMP cross-sections were analyzed for stability and determining stress in the structural components using Plaxis 2D, a finite element software program developed by Bentley Systems, Inc. The program can model complex soil profiles, structural sections and perform soil-structure interaction analysis to achieve a solution with compatible forces and displacements. The analysis also incorporates a time variable simulating the various stages of construction, such as end of sheet pile installation, adding fill between the walls, installing tie-rods, dewatering the excavation area after BMP is installed, and excavation to allow for consolidation or dissipation of porewater pressures. Additional details of the analyses for all cross-sections are provided in Appendix I.

The finite element analyses using soil-structure interaction incorporate the non-linear behavior of the soil, wall displacements and flexibility of the sheet pile and anchors. The active and passive pressures vary as the system flexes to achieve a solution by balancing the forces and displacements in the entire system. By inherently balancing the forces and displacements, the system achieves a larger safety factor against rotational failure than the “free earth” Limit Equilibrium Method. Thus, the safety factors (Section 5.5.5.2) are not applied to determine effective soil parameters for calculating passive pressures.

The behavior of the BMP varies with the height of the sheet piles above riverbed and the subsurface strata. Hence, multiple cross-sections were evaluated to account for the variations in riverbed elevations, cross-slope of the riverbed along the BMP alignment, thickness of Alluvium Sediments, anticipated top of Beaumont Clay layers, and distance from the BMP to the excavation. Figure 5-I, below, shows the approximate extent of each cross-section selected for the analyses and the summary of results are provided in Table 5-H. These extents are approximate and may change in the final design to accommodate design optimizations, and other considerations related to standardizing construction practices.

Additional considerations were applied to Cross-Sections C2, C6, and C7 due to reasons described, below.

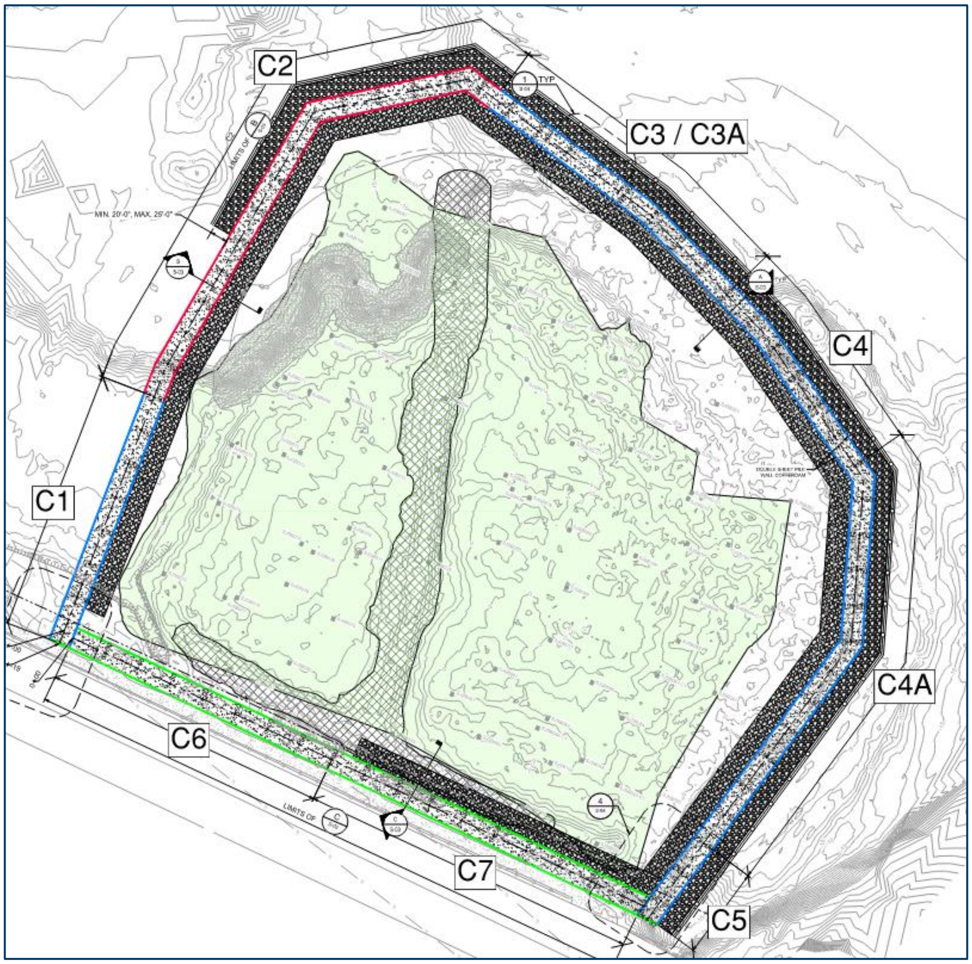

Figure 5-I BMP - Limits of Cross-Sections C1 to C7

5.5.6.1 Cross-Section C2

Cross-Section C2 represents the extent of the tallest height of the BMP above riverbed elevation (approximately -15 ft NAVD88). The approximate wall height on both the exterior and interior sides is 24 ft. The large height above the riverbed overstressed the sheet piles and tie-rods. Hence, a 30 ft wide Raised Bench (imported fill material) constructed above the Soil Buttress, to elevation -4 ft NAVD88 is required on the interior side to reduce the stresses. The sheet piles and tie-rods required to meet the demand loads are the among the largest standard sections available. The tie-rods are required to be installed at elevation +3 ft NAVD88.

This cross-section was analyzed and determined to be adequately designed assuming use of excavation methodology similar to that used in other areas in the Northern Impoundment as well as for other remedial alternatives. However, it should be noted that the areas in the northwest corner are subject to pronounced risk of hydraulic heave as described in the Geotechnical Engineering Report (Appendix B), and hence a different excavation methodology as described in Section 5.7 will be deployed in this area. The change in excavation method does not impact the design of the BMP structure.

5.5.6.2 Cross-Sections C6 and C7

Cross-Sections C6 and C7 represent the BMP along the alignment parallel to the I-10 Bridge. In the alignment previously presented in 30% RD, the BMP was placed directly at the edge of the existing berm and excavation limits extended to the sheet pile. The existing ground elevation varies between elevation 0 ft and Elevation +5 ft NAVD8S. The BMP design elevation at bottom of excavation is -14 ft NAVD88 and -20 ft NAVD88 for Cross-Section C6 and

Cross-Section C7, respectively. The TxDOT ROW runs between the elevated portion of the freeway and the southern boundary of the Northern Impoundment.

Several concepts for the BMP, as described in the BMP Design Structural Report (Appendix I), were evaluated to determine if there an implementable solution along the original alignment. The significantly large height retained above the anticipated excavation bottom, the inability due to space constraints to include a Soil Buttress, and the need for active excavation along the face of the BMP resulted in the BMP (and the anchor system, where applicable) extending into the deeper sand layers. Due to concerns with pile driveability and associated vibrations in the vicinity of the I-10 Bridge, the ExxonMobil pipeline assets, and other underground utilities and other considerations, these concepts were considered unfeasible.

The only workable solution was a double-wall system, approximately 30-ft wide, similar to the double-wall around the balance of the Northern Impoundment. This required moving the BMP alignment farther south into the TxDOT ROW to allow for a sloped Soil Buttress beginning at Elevation 0 ft NAVD88 and extending into the excavation area. This placed the double wall within the TxDOT ROW, with the outer wall being approximately 20 ft from the I-10 Bridge guardrails on the TxDOT ROW.

Additional details are provided in Appendix I.

5.5.7 Barge Impact

The impact energy from a barge moving at the river flow velocity will be absorbed in the following two stages -

1. Primary or first contact will be with a barrier wall system comprising of fiberglass reinforced polymer (FRP) composite piles. The barrier wall is designed to absorb impact energy corresponding to velocity of up to 2.2 ft/s (laden barge) or up to 5.3 ft/s (ballasted barge).
2. As the barge damages the barrier wall and breaks through, it will lose energy. The BMP will be subjected to the remaining energy of 1.8 ft/s (i.e., energy corresponding to the difference between approach velocity of 4 ft/s and energy absorbed by the barrier wall at 2.2 ft/s). In the 90% RD, the BMP was evaluated for impact velocity of 2.2 ft/s (laden barge) and 5.3 ft/s (ballasted barge). The analysis results are valid for this evaluation.

5.5.7.1 Barrier Wall

A FRP barrier wall will be installed at approximately 20 to 25 ft beyond the exterior wall of the BMP along the north and east side to provide increased protection in areas exposed to potential barge impacts. See Figure 5-F. The barrier wall will be comprised of 18-inch diameter FRP composite piles spaced at 8 ft on center. Four rows of 12-inch x 12-inch reinforced high-density polyethylene (HDPE) walers will be installed horizontally on the exterior side of the FRP piles, evenly spaced between Elevation +2 and +12 ft above mean water level (Figure 5Figure 5-J).

The barge will contact the walers and in turn, multiple FRP piles will be engaged, and the barrier wall system will deflect to absorb the impact energy. The system is designed to absorb impact from the design barge up to a velocity of 2.2 ft/s (laden) and 5.3 ft/s (ballasted barge). The largest moment demands on the pile sections are seen when the barge impact is at or near the top of the barrier wall. At lower elevations of impact, the moment demands are lower and do not govern the design.

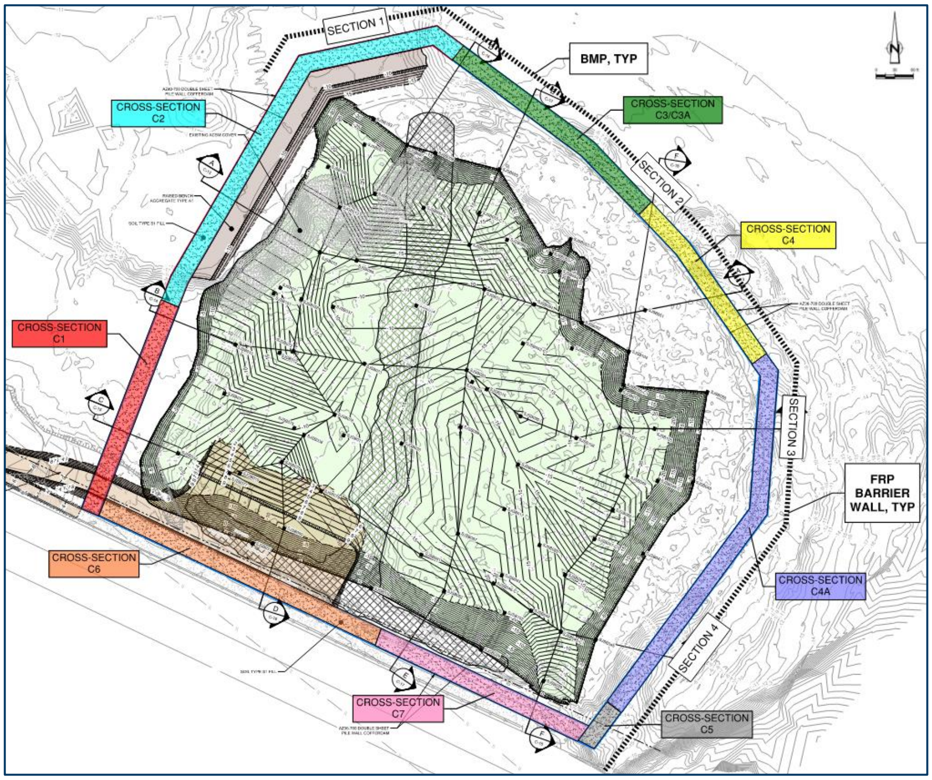

Figure 5-J FRP Barrier Wall - Alignment

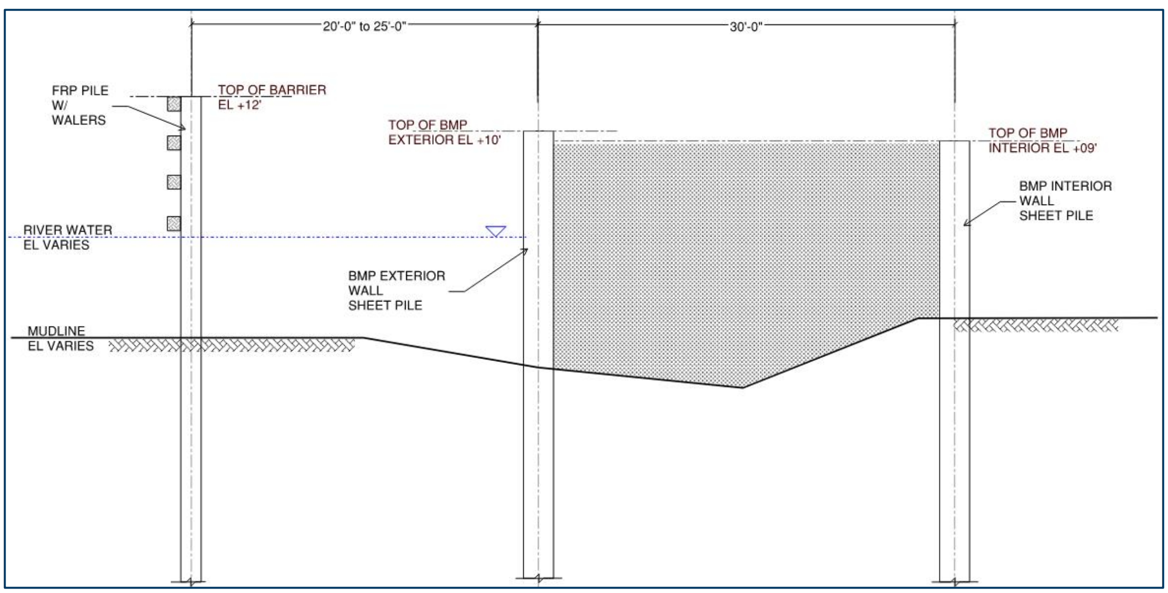

Figure 5-K FRP Barrier Wall - Typical Section

The details of the analysis and results are provided in Appendix I.

5.5.7.2 BMP Impact

The BMP was analyzed for barge impact near the top of the wall (exterior sheet pile). With the FRP barrier wall system as the primary protection, the BMP will absorb the excess impact energy equivalent to an impact from the design barge at velocity of 1.8 ft/s (See Section 5.5.7).

In the 90% RD, the BMP was evaluated for impact at a higher velocity, so the same analysis results (demand loads on BMP sheet pile) are valid for the current evaluation of impact at lower velocity.

Two Cross-Sections, C2 and C4 were analyzed with barge impact loads in Plaxis. These Cross-Sections have the largest retained height above the riverbed and are expected to be the most critical Cross-Sections for evaluating a potential impact at the top of the wall. A 400 feet long three-dimensional model was created with the same stratigraphy, material properties and stages as the analysis sections described in Section 5.5.6. The linear elastic plates representing the sheet piles were assigned orthotropic parameters to capture the difference in stiffness of the vertical and horizontal directions.

The barge impact load was applied as a static uniformly distributed load over a 50-ft x 1-ft area at top of the wall. Due to the instantaneous nature of the impact, the loads are evaluated using the undrained soil parameters and considered an Extreme load condition, with the impact near top of the wall with the water levels at +9 ft NAVD88.

The following two loading scenarios, considering a combination of multiple impact velocities and barge displacement conditions (ballasted or laden), were evaluated. The loads correspond to higher velocities of flow for impact, than as summarized in Table 5-A, with a barge in ballasted condition, hence conservative for the analysis. However, for the laden condition, the loads represent the limiting loads for the BMP.

Case 1: 20 kip/ft x 50 ft = 1000 kip

– Corresponds to contact with 54 ft wide barge in ballasted condition at impact velocity of 3.8 ft/s

Case 2: 28 kip/ft x 50 ft = 1400 kip

– Corresponds to contact with 54 ft wide barge in ballasted condition at impact velocity of 5.3 ft/s or,
– Contact with 54 ft wide barge in laden condition at impact velocity of 2.2 ft/s.

As Cross-Section C2 is not near the navigational waterway, any impact on the west and northwest portion of the BMP will likely be from barges moored on the north side of the BMP that may come off the mooring in a storm event. Thus, Cross-Section C2 is only evaluated for Case 1 loading scenario. The results from Cross-Section C4 are applicable to all other locations, except C2.

The barge impact loads caused localized deformation of the wall along with increase in soil shear strains. However, the strains did not indicate a global failure would occur. In this scenario, there would be localized damage to the BMP due to limiting flexural capacity. The analysis results are summarized in Table 5-G. The section stresses from demand loads are compared to the allowable stresses in the sheet piles for extreme event loading i.e., 0.88 Fy (combined bending moment and axial stress) and 0.58 Fy (shear stress).

Table 5-G ***Barge Impact Analysis Output***

Analysis Cross-Sections	Analysis Demands per LF			Sheet Pile Capacity (Extreme Load Condition)		Demand to Capacity Ratio	
	Moment (kip-ft)	Shear (kip)	Deflection (ft)	Moment (kip-ft)	Shear (kip)	Moment	Shear
C2, AZ 42-700N (Case 1)	342.4	64.5	1.4	325	351	1.05	0.18
C4, AZ 36-700N (Case 1)	159.6	39.6	0.8	275	276	0.58	0.14
C4, AZ 36-700N (Case 2)	251.2	39.6	1.6	275	276	0.91	0.14

The results show a 5% overstress in the sheet piles at Cross-Section C2 for impact with a ballasted barge at 3.8 ft/s. Impact forces are directly proportional to the impact velocity squared (Section 5.5.3.6). Therefore, the stresses in Cross-Section C2 will be lower for impact at 1.8 ft/s as the impact force will reduce by 27%. Considering the low probability of impact in the area of Cross-Section C2, reduction in impact force at lower velocity and engineering judgement, the 5% overstress for condition evaluated is considered acceptable for design.

The Cross-Sections closer to the navigational waterway would be expected to potentially encounter impact with barges, ballasted or laden, as they are towed. Results from Cross-Section C4 show that the BMP is adequate for impact with barges in ballasted and laden condition at velocity 2.2 ft/s even without the FRP barrier wall system.

It should be noted that the barges and tugboats typically slow down as the width of the navigational waterway reduces closer to the I-10 Bridge. Navigational signs can be posted on the exterior face of the BMP to require marine vessels to reduce speeds along the eastern side of the BMP.

Additional details of the analyses, results, and plots are provided in Appendix I.

5.5.8 Scour Protection at BMP Exterior

Scour protection countermeasures for the BMP exterior are developed based on Federal Highway Administration (FHWA) guidance provided in Hydraulic Engineering Circular No. 23 (HEC-23), Bridge Scour and Stream Instability Countermeasures (Publication No. FHWA-NHI-09-111, September 2009) which provides design guidelines for use of rock riprap to mitigate scour at bridge abutments. Although the BMP is not a bridge abutment, its influence on floodplain hydraulics is similar in that overbank flows are concentrated through a narrower section of the river resulting in localized increase in shear stress.

Design Guideline 14 was applied to the design of the rock riprap scour protection concepts. The median stone diameter for riprap scour protection is calculated based on depth, velocity and abutment geometry using the Isbash equation. The results from the Hydrodynamic Analysis (Appendix F) indicate maximum peak velocities would be approximately 3.14 ft/s. To account for uncertainties related to complex hydrodynamics and potential for localized flow accelerations along the BMP, an additional safety factor was applied to the predicted maximum velocity. The median rock size for the riprap was designed for a velocity of 6 ft/s.

Based on this approach, the riprap scour protection apron will consist of a median stone diameter of 10 inches and an overall layer thickness of 1.5 ft.

As noted in Section 5.5.3.3, scour protection is required around the majority of the perimeter of the wall, including the east side of the BMP as the channel narrows near the I-10 Bridge. A 25 ft wide riprap apron will provide sufficient stability along the exterior perimeter of the BMP.

5.5.9 Scour Protection at BMP Interior

Scour protection countermeasures for the BMP interior are designed by calculating the velocity of water reaching the base of the wall, resulting impact pressure, length of the turbulent flow at the base of the wall and potential for flow jump where the soil slopes away from the wall.

The most critical scour can occur in the initial stages where the river water level rises over the top of the BMP wall. When water rises 6 inches above the BMP wall, it can fill the entire area to the top of the wall within 1-2 hours. As the river water level continues to rise in the initial hours, the BMP will fill faster and reduce the time where the soils at the base of the BMP are directly exposed to the overtopping water.

Additional details of the analysis for a wide range of river water levels between elevation +10.1 ft to +14.0 ft are provided in Appendix I. However, only the initial stages where water level reaches elevation +10.5 ft is considered critical for interior wall scour.

Based on this approach, the interior riprap scour protection will consist of median stone diameter of 18 inches and an overall layer thickness of 3 ft. As an added measure, the riprap will be grouted with flowable concrete of 3000 psi strength to withstand the plunging water flow over the BMP wall. The riprap apron will be extended to 25 ft from the base of the BMP wall.

At the northwest corner of the BMP, the raised bench is required for stability of the wall. Due to limited space available without encroaching into the excavation area, the riprap will be incorporated into the bench to protect the entire 30-ft width of the raised bench. All the interior scour protection will be monitored routinely and maintained for the duration of the project.

5.5.10 Summary of Results

The summary of the structural sections required for the BMP is provided in Table 5-H. As extents of Cross-Sections 3 and 3A overlap, the BMP will be conservatively built as evaluated for Cross-Section 3.

Table 5-H Summary of Analysis Results

Analysis Section	Sheet Pile Section		Tie Rod Section		Waler Section
	Nucor Skyline	Length (ft)	Diameter (inches)	Spacing (ft)	
C1, C3, C3A, C4, C4A	AZ36-700N	50	2.25	5	MC 12X35
C2	AZ40-700N	55	3.00	5	MC 18X45.8
C5	AZ36-700N	60	2.25	5	MC 12X35
C6, C7	AZ26-700	60	2.25	5	MC 12X35

5.5.11 Pile Driveability and Vibration Analysis

During the March 25, 2020 TWG Meeting, the design team was asked to perform an evaluation to quantify the risks associated with pile driving-induced vibrations and potential releases from the Northern Impoundment that may result from these vibrations. A vibration analysis for driving large diameter steel pipe piles into deep sands was performed and included in the 30% RD. Since the submittal of the 30% RD, the BMP concept has changed from cantilever (large diameter pipe piles) to a double wall system with Z-shaped steel sheet piles. The alignment of the BMP has been revised to install the sheet piles outside the perimeter of the TCRA armored cap and beyond the edges of the steep slopes present near both the northwest corner and east side adjacent to the I-10 Bridge.

The Z-shaped sheet piles will be installed using a press-in method of installation. The first few pairs of sheet piles need to be installed using a vibratory hammer to set up the press-in equipment. Then a reaction-based press-in system will use these installed sheet piles to press-in the next pair of sheet piles and move forward to continue installing the remaining length of the BMP using the press-in method. As the press-in piling system uses hydraulic force without the use of percussion (impact hammer) or vibration to install piles, the noise and vibration impact on nearby structures can be diminished. The sheet piles will also be terminated in the Beaumont Clay layer instead of driving into the stiffer sand layers, thereby reducing the potential for vibrations significantly even while using a vibratory hammer for the initial set of sheet piles.

Pile driveability and vibrations resulting from the installation procedure are a function of the equipment selected by the RC. Since information on actual equipment is unavailable at this time, pile driveability and corresponding vibrations were evaluated for one impact hammer and one vibratory hammer. The Wave Equation Analysis of Pile Driving (WEAP) showed that both equipment types can install the sheet piles to required depth. WEAP output for PACO Model 36-5000 (impact hammer) and APE Model 100 (vibratory hammer) are provided in Appendix I.

Caltrans[4] provides guidance on calculating vibration amplitudes in terms of peak particle velocity (PPV) and threshold criteria for damage potential for various type of pile installation equipment. The equations used in the manual are based on several data points collected at various distances from the location of pile installation and for various installation equipment.

For Impact Hammers,

$$PPV_{Impact} = PPV_{Ref}\ (25/D)^n\ (E_{Equip}/E_{Ref})^{0.5}$$

[4] Transportation and Construction Vibration Guidance Manual, April 2020, California Department of Transportation

Where:

PPV_{Impact} = Vibration amplitude for the pile installation equipment at distance D from the location of installation.

PPV_{Ref} = Vibration amplitude for a reference impact hammer at 25 ft from the location of installation (0.65 in/sec).

D = Distance from pile installation equipment to the receiver in ft.

n = Constant related to the vibration attenuation rate through ground (maximum suggested value of 1.4).

E_{Ref} = Rated energy of the reference pile installation equipment (36,000 ft-lb).

E_{Equip} = Rated energy of the impact hammer to be used for pile installation (PACO Model 36-5000: 15,000 ft-lb).

For Vibratory Hammers,

$$PPV_{Vibro} = PPV_{Ref}\ (25/D)^n$$

Where:

PPV_{Vibro} = Vibration amplitude for the pile installation equipment at distance D from the location of installation.

PPV_{Ref} = Vibration amplitude for a reference impact hammer at 25 ft from the location of installation (0.65 in/sec).

D = Distance from pile installation equipment to the receiver in ft.

n = Constant related to the vibration attenuation rate through ground (maximum suggested value of 1.4).

The calculated PPV for the impact and vibratory hammer are shown in Figure 5-L. The threshold for damage to new residential structures, modern industrial or commercial building type structures due to vibrations from continuous or frequent intermittent sources such as the pile installation procedure is 0.5 in/sec (Table 19[4]). This threshold is considered appropriate for the structures near the BMP, including the I-10 Bridge. The anticipated vibration from the vibratory hammer is below the acceptable threshold at 35 ft or farther from the sheet pile installation. The vibration reduces significantly with the distance. The RC will be allowed to use a vibratory hammer or impact hammer only for the initial setup of sheet piles and with the press-in equipment at locations that are at least 35 ft away from the I-10 bridge. Thus, no significant impact to the I-10 bridge or other industrial structures is anticipated due to the sheet pile installation.

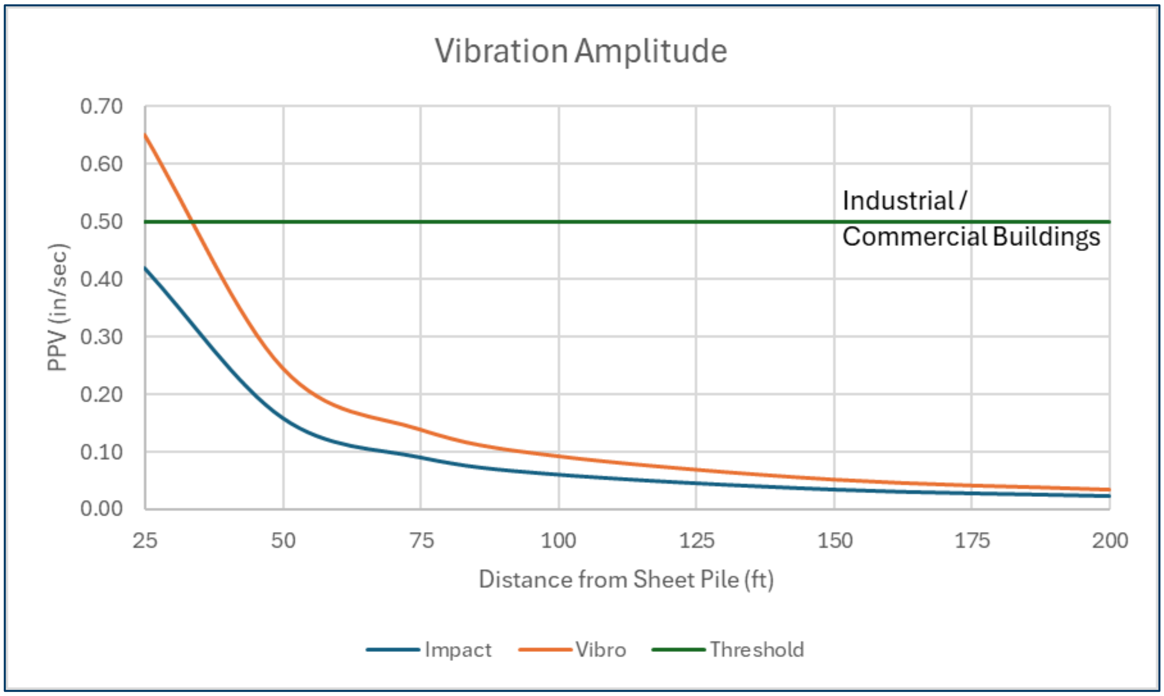

Figure 5-L *Vibration Amplitude (PPV) for Pile Installation Equipment*

The RC will be required to update the pile driveability and vibration analysis for the equipment to be used during the RA and for allowed use of a vibratory hammer at a minimum distance of 35 ft from the nearest structures.

5.6 Excavation Procedures

5.6.1 Pre-Excavation Sampling

Pre-excavation sampling will be completed after installation of the BMP wall is completed and prior to the commencement of excavation and mechanical dredging activities. Pre-excavation sampling will allow for delineation to be completed before excavation begins. The final excavation surface would be defined using all sampling data from prior investigations, as well as the pre-excavation sampling data, for EPA review and approval prior to any excavation. This will avoid potential delays and risks associated with conducting sampling during excavation and avoid the need for the RC to leave an area of excavation open pending the sampling results. Pre-excavation sampling will reduce the overall schedule and potentially could reduce the length of the overall excavation since there will not be time lost during excavation activities waiting on laboratory analytical results and over-excavating locations, if needed, above clean-up levels. This will also help limit the risk of severe weather and flooding events. Since the limits of the excavation will be known prior to the commencement of excavation activities, excavation can proceed uninterrupted. Based upon pre-excavation sampling results, design elevations will be revised prior to excavation, if needed. The final depths of the excavation will be confirmed post-excavation by comprehensive surveying to demonstrate that the surfaces defined by the pre-excavation sampling have been achieved. In addition, pre-excavation sampling avoids the need for personnel to enter areas being excavated to collect samples.

If the pre-excavation sampling results indicate that excavation is required at depths greater than originally anticipated, having this data prior to excavation will allow the RC time to evaluate options for safely addressing those areas, particularly areas vulnerable to hydraulic heave.

As detailed in the FSP (Appendix J, Attachment 3), Decision Units (DUs) were developed by overlaying a grid system on the NI and Northwest Corner. Given that the NI and the Northwest Corner are not a uniform size and shape, this resulted in some variability in the size and shape of DUs. Within each DU, nine discrete samples will be collected from sample locations at intervals 0 to 1 feet below the initial excavation elevation and from 1 to 2 ft below the initial excavation elevation as evenly spaced across the DU as possible, given the irregular shape of some of the DUs. A composite sample of these (9) discrete samples will be prepared for each DU for laboratory analysis. While composite sampling is proposed to confirm that remedial objectives have been met, it is important to note that extensive sampling of the NI was completed during the RI, PDI 1, PDI 2, and SDI field events. This robust data set has been used to inform the initial excavation elevations so that intervals with higher dioxin and furan concentrations have already been included in the areas identified for excavation. Therefore, the intervals identified for pre-excavation sampling are anticipated to have concentrations near or below the clean-up level, which further supports the use of composite sampling for confirming remedial objectives have been met. Additionally, a portion of each discrete sample that was used for the composite sample will also be held by the laboratory pending the results of the composite sample analysis.

A summary of completed and proposed sampling for the NI is as follows:

Phase	# of Borings	# of Samples Collected
Design (RI, PDI-1, PDI-2, SDI)	80	661
Pre-Excavation	162	324
Remedial Action (Design + Pre-Excavation)	242	985

Prior to sampling, the sample locations will be surveyed by a licensed surveyor and the depth of the pre-excavation sample will be based upon the initial excavation elevation. A drill rig will be used to collect a sample from each surveyed location. In order to minimize the potential for soil from a shallower depth to slough into the boring, an outer casing will be set to the depth of the initial excavation elevation.

Following laboratory analysis of the 0 to 1 ft composite sample, the result will be compared to the clean-up level. Results will be evaluated, as described below.

– If the result of the composite sample for a DU from 0 to 1 ft below the initial excavation elevation is below the clean-up level, the remedial action objective has been met and the DU will be excavated to the initial excavation elevation.
– If the result of the composite sample for a DU from 0 to 1 ft below the initial excavation elevation is above the clean-up level, the composite sample for the DU from the 1 to 2 ft interval below the initial excavation elevation will be analyzed by the Approved Laboratory.
– If the result of the 1 to 2 ft composite sample from the DU is below the clean-up level, the remedial action objective will be met by either:
  - The discrete samples from the 0 to 1 ft interval for the DU will be analyzed by the Approved Laboratory and discrete locations above the clean-up level will be excavated; OR
  - The DU will be excavated to 1 ft below the initial excavation elevation.
– If the result of the 1 to 2 ft composite sample from the DU is above clean-up level:
  - Analysis of the discrete samples from the 1 to 2 ft interval will be evaluated for the DU; and

The path-forward for that DU will be determined pending risk management evaluation with the EPA. The maximum overcut will vary dependent on the location, depth of excavation, and distance from the inner BMP wall. The pre-excavation sampling will define the maximum vertical extent of material exceeding the cleanup level. The excavation depths for each DU will be defined in consultation with the EPA based on the pre-excavation sampling analytical results and whether additional excavation at the location would potentially compromise the BMP, excavation integrity, or pose a safety risk to workers.

– For the northwest corner, a 6-inch overcut will be performed in that DU to serve as a final pass and remove any settled residuals.

5.6.2 Excavation Sequencing

To allow for the removal of waste material during the excavation season, the Northern Impoundment RA work will likely be divided into five cells, one of which would include the northwest corner which will be mechanically dredged. A single cell will be remediated each excavation season. Prior to commencing any excavation activities, the initial season will involve site preparation activities and installation of the BMP around the entire excavation area, as detailed in Section 5.5. The order of cell excavation will likely include a sequence that allows the cell containing the northwest corner to be remedied first and the cell containing the upland working area (southwest corner) to be excavated last, although the excavation volume for each season will be determined by the RC and optimized based on weather conditions and productivity achieved during each season. The conceptual project sequencing is shown on Figure 5-C.

5.6.3 Excavation Methodology

Following BMP installation and water removal, the material in a seasonal cell will be excavated. For the cells other than the one encompassing the northwest corner, excavation will be performed utilizing standard track-mounted excavators located on dry land. The excavator will be positioned where it can reach into the excavation and swing around to load trucks or place material directly into a mixing pad. Where required, the excavator could track down to a ledge or bench to reach deeper or further, but generally, the excavator would operate from upland locations. Excavation methodology is detailed below. The details provided below are for excavation of the cells other than the cell encompassing the northwest corner.

5.6.3.1 Pre-Excavation Dewatering

Following the installation of the BMP around the entire excavation area, river water will become trapped behind the BMP. At the beginning of each excavation season (and prior to removal of any portion of the TCRA armored cap to be removed during that excavation season), the river water located behind the BMP would be pumped out to allow waste material removal activities within each cell to be conducted using land-based equipment in relatively dry conditions. At the end of each excavation season, the exposed slope of the excavation will be capped. At the start of the next excavation season, water trapped behind the BMP will again be pumped out to allow the seasonal excavation to be reinitiated. Management of the pumped-out water is discussed in Section 5.9.

5.6.3.2 TCRA Armored Cap Removal

During each excavation season, after the cell to be excavated during that season is dewatered, the portions of the TCRA armored cap within that cell will be removed to expose the waste material for excavation. The location of the TCRA armored cap is shown on Design Drawing C-02 in Appendix G. Areas where the TCRA cap may be re-used are underlain by liner that segregates the rock from the underlying waste material. The RC will be directed to remove the rock in a manner that does not compromise the underlying liner as not to mix waste material with rock. Rock removal above the liner will be visually inspected to confirm that the liner has not been compromised. If any rock has been mixed with the waste material it will be sent off-site for disposal. It is anticipated that only the portion of the TCRA armored cap in the specific area in which waste material is being excavated will be removed (and the waste material exposed) at any given time. The rock may be salvaged for re-use or disposed of with the waste material. Depending on the space available on the Northern Impoundment, the rock removed during each excavation season may be stockpiled on the impoundment itself or at a nearby location. As part of TCRA armored cap removal, the geotextile and geomembrane barrier of the TCRA armored cap will be disposed of off-site.

5.6.3.3 Excavation Procedures

For each area in which the TCRA armored cap has been removed, excavation of the waste material to the target excavation elevations will take place using excavators. Any waste material that does not contain free liquids and/or does not require solidification may be loaded directly in haul trucks for off-site disposal. Waste material that contains free liquids and/or requires solidification will not be directly loaded into the haul trucks for off-site disposal and may be managed as described in Section 5.6.4.

As excavation activities advance below grade, dewatering sumps may be required to remove water in advance so the waste material can be dried out as much as possible prior to it being excavated. Following dewatering, the waste material may still be too wet (i.e., would not pass the paint filter test based on visual inspection) to be directly loaded into haul trucks. This material would need to be temporarily staged and allowed to dry naturally and/or be solidified for off-site disposal. An earthen ramp will be constructed over the lip of the BMP to allow truck traffic into and out of the Northern Impoundment. As part of the earthen ramp, the RC will incorporate measures to protect the top of the BMP, potentially using crane mats, steel plate, or construction techniques to protect the sheet pile wall. The RC will submit its means and measures for crossing the BMP with the earthen ramp prior to construction. Interior berms will be constructed seasonally to convey stormwater such that non-contact stormwater that falls directly onto the TCRA armored cap or areas of the excavation that have been confirmed clean can be segregated from contact stormwater that falls directly onto waste material. Non-contact water will be pumped off and handled as described in Section 5.8. Contact water that accumulates in the excavation area during the excavation season will be pumped out, as needed to maintain excavation operations, to a WTS where it will be treated and discharged to the river, as described in Section 5.8. Waste handling or waste management areas will not be conducted on surfaces that have been determined to be clean, without a barrier system, such as a liner. Contact water will be segregated from non-contact water by constructed berms or other stormwater controls as best management practices.

As discussed in Section 5.2, there are localized “hot spot” areas outside of the northwest corner with potential hydraulic heave risk. Section 31 23 16 of the Design Specifications (Appendix H) provides the requirements that the RC will meet in excavating within these potential heave areas. Prior to any excavation, stratigraphic borings and piezometers will be installed as described in Attachment B of the Design Specifications. The RC will coordinate with the engineer to review the data from these borings/piezometers in combination with the results of the pre-excavation sampling to define the safe excavation depths and delineate the areas with potential heave risk. The RC will then prepare a Heave Mitigation Plan for these areas that will provide detailed procedures for excavation. Options described in the specifications for the RC to consider include 1) limiting excavation to periods of low river/potentiometric levels, 2) excavating through a water column, and 3) excavating in localized trenches. The RC may use one or more of these options or propose another approach in the Heave Mitigation Plan. The Heave Mitigation Plan will be submitted to the engineer and EPA for approval prior to excavation in these areas.

At the end of an excavation season, the transition areas between clean surfaces and impacted material and any other potentially contaminated surfaces that are exposed will be secured. These areas will be graded to a stable slope (between 2:1 and 3:1) and covered with a 40-mil synthetic liner and non-woven geotextile that will be anchored into the soils. The liner will be covered with rip rap, which will be either imported or on-site rock that has been sampled and determined to be clean. The heave condition will be evaluated for the excavated surfaces using the data from the Pre-Excavation Stratigraphic Borings and Piezometers described in Attachment B of the design specifications. Areas susceptible to heave will be backfilled to elevations protective of the river reaching the top of the BMP at +10 NAVD88.

5.6.3.4 Excavation Season Production Rates

The approximate volume of material removal within the Northern Impoundment is estimated at 230,000 CY. To facilitate a seasonal excavation approach, the total volume of material would be divided into multiple cells, with a single cell excavated during each excavation season. Seasonal cell sizes will not be prescribed, but instead a target production rate will be maintained that should accomplish the full excavation over the course of five excavation seasons (including the northwest corner). The volume of waste that can be removed, transported, and disposed of during an excavation season (i.e., production rate) is based upon the following factors, and will continue to be analyzed/optimized throughout the RA:

– ***Volume and Removal Rates*** -The tentative cell sizes have been established so that the volume of planned removal from within each cell could be achieved within the excavation period.
– ***Excavation Depth*** - Depending upon the results of confirmation sampling, the depths of the seasonal excavations could increase, which may, in turn, limit the area that can excavated in that season.
– ***Access and Implementability*** - The tentative seasonal cells assume sustained access to each area for necessary excavation equipment and trucks.

– ***Transportation and Disposal*** **-** The target seasonal production rate that the tentative cell sizes are based on is dependent on the ability to efficiently and consistently load out and transport waste material to an off-site landfill.

The assumptions and limitations of waste transport and disposal as a basis of the design are further discussed in Section 5.8.2.

5.6.4 Solidification and Load-Out

If the waste material does not pass the paint filter test for direct load out, it may need to be solidified prior to transport to the off-site disposal facility. This may be achieved by mixing in drier material, either from the excavation or using a solidifying reagent, such as Portland cement or lime. Solidification activities will likely be conducted on a designated mixing pad inside the confines of the BMP, or at a nearby location as space becomes limited within the BMP, prior to load out in the haul trucks. Water collected within the mixing pad will be collected and pumped to a temporary storage tank and then to the WTS, or pumped directly to the WTS.

5.6.5 Excavation Area Restoration

There are no post-excavation restoration measures identified or required as part of the ROD. However, restoration activities may utilize the recycled TCRA armored cap rock, clean berm material, and/or clean imported sand or aggregate (including aggregate inside the BMP) for restoration activities in lieu of disposing of these clean materials. These post-excavation restoration measures may be employed during the work, at the end of a working season, or after the completion of all excavation activities. After excavation along the south edge of the impoundment has been completed, a soil embankment would be constructed at an approximate 4-foot horizontal to one-foot vertical (4:1) slope along the vertical excavation face to support the exposed bank. Rip rap will be placed on top of the soil embankment for erosion control. At the conclusion of the RA, the BMP will be removed from the waterway and will not require maintenance.

5.7 Northwest Corner

5.7.1 Background

The northwest corner design was initially submitted, in the November 2022 NW Corner Addendum, as a separate document from the June 2022 90% RD for other areas of the impoundment (*GHD, 2022f*). 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.

On June 8, 2022, an in-person meeting between the EPA and 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 and 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. The hydraulic heave evaulaion has been further updated and is discussed in Section 5.12.3, and as updated, is attached Appendix B1.

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 and 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 and MIMC, 2022d).

5.7.2 Remedial Evaluation

5.7.2.1 Overview

The northwest corner of the Northern Impoundment excavation area contains approximately 15,000 cubic yards (CY) of impacted material. Following issuance of the ROD, during the 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.

5.7.2.2 Northwest Corner Basis of Design

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.

Hydraulic heave is a mechanism 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 potential risk in the northwest corner is that 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.

5.7.2.3 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-M, below.

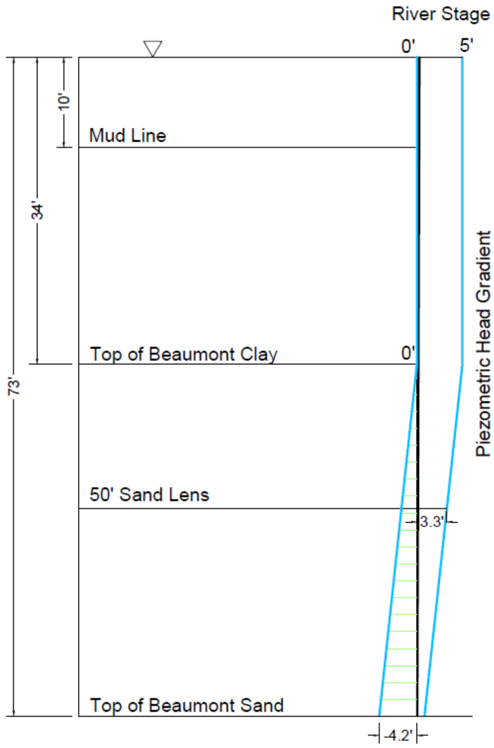

Figure 5-M ***Conceptual Dampening Effect***

The upward presssure from the piezometric head level in this 50-foot sand lens and the the weight of the overlying materials are the basis for the hydrauic heave evaluation in the northwest corner.

5.7.2.4 Hydraulic Heave Evaluation

Since submittal of the 90% RD - Northwest Corner Component, the Respondents have continued to evaluate the hydyraulic heave conditions at the work site and specifically in the northwest corner. The Updated Hydraulic Heave Analysis is included as Attachment E in Appendix B. The following assumptions are used is the updated analysis and provide the basis for the removal approach in the northwest corner:

- The San Jacinto River stage is assumed be at +5 ft NAVD88. At higher river stages, there would not be access to the work site and no removal activitities would be occurring.
- The Beaumont Sand is hydraulically connected to the San Jacinto River.
- The 50-ft sand lenses detected in the Beaumont Clay layer is hydraulically connected to the Beaumont Sand.
- The piezometric head in the 50-foot sand lens is assumed to be the San Jacinto River stage at + 5 ft NAVD88 dampened by 1.7 ft head loss, or +3.3 ft NAVD88.
- Conditions after removal and sand placement are to be protective of an overtopping event at river elevation +10 ft NAVD88 and +8.3 ft NAVD88 in the 50-foot sand lens.
- The hydraulic heave was evaluated by analyzing total stress.

The approach for the northwest corner described in this Revised 100% RD includes adjusting water levels and placing sand to specific elevations to offset heave considering the assumptions listed above and the Updated Hydraulic Heave Anaysis. The approach also assumes that removal will be to the design elevations. Following BMP installation in the

RA, the RC is required to complete stratigraphic borings in the area and install piezometers in the sand zone(s) that are encountered to measure potentiometric elevations prior to excavation commencing. In addition, preconstruction sampling will be conducted to define the final removal elevations. The specified water and sand elevations to manage the heave will be adjusted during the RA based on the updated potentiometric data from the RA borings and piezometers and the actual removal depths defined by the preconstruction sampling.

5.7.3 Mechanical Dredging

The approach for the northwest corner is to remove the material in the dry that can be performed without the potential for hydraulic heave, and then remove the remaining material by mechanical dredging techniques while maintaining sufficient water in the excavation to off-set the heave. Under this approach, the water level in the northwest corner will be lowered to -15 ft NAVD88; the impacted material above -15 ft NAVD88 will be excavated in the dry, and the remainder of the material to the target removal elevations will be removed via mechanical dredging. The following sections describe the procedures planned for the northwest corner.

Section 35 24 00 (the dredging specification in Appendix H) provides the RC requirements for dredging the northwest corner. Attachment A to the design specifications is a Residual Managment Plan that describes best management practices, dredging procedures and water management procedures for the RC to follow in the northwest corner to minimize dredging residuals and to control the residuals that are generated.

5.7.3.1 Site Preparation Activities

Prior to disturbing ground in the northwest corner, erosion control structures will be installed in conformance with the SWPPP. The site preparation activities will also include constructing roads and truck loading area(s) for the dry excavation. A mixing pad will 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 will be constructed adjacent to the dredging location to support a crane that will assist with assembling the dredging equipment and placing the dredging equipment into the water. The size of the pad will 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 will 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 will take place prior to work in other areas so that access for vehicles and a mixing pad is available.

5.7.3.2 Excavation and Dredging Procedures

5.7.3.2.1 Cell Dewatering

Following the installation of the BMP, river water will 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 bulk water located inside the BMP wall will be pumped out to achieve an elevation of -15 ft NAVD88 in the northwest corner. Removal and treatment of the bulk water within the BMP are discussed in Section 5.9. Once the water is pumped to -15 ft NAVD88, the existing bathymetry in the northwest corner will 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. At -15 ft NAVD88, approximately 0.67 acres of the northwest corner will be exposed for excavation using land-based equipment in relatively dry conditions. The remaining 0.33 acres, where the mudline is deeper, will remain flooded to off-set the potential for heave. Figure 5-N below shows the water extent within the northwest corner at a water elevation of -15 ft NAVD88 before and after the dry excavation work.

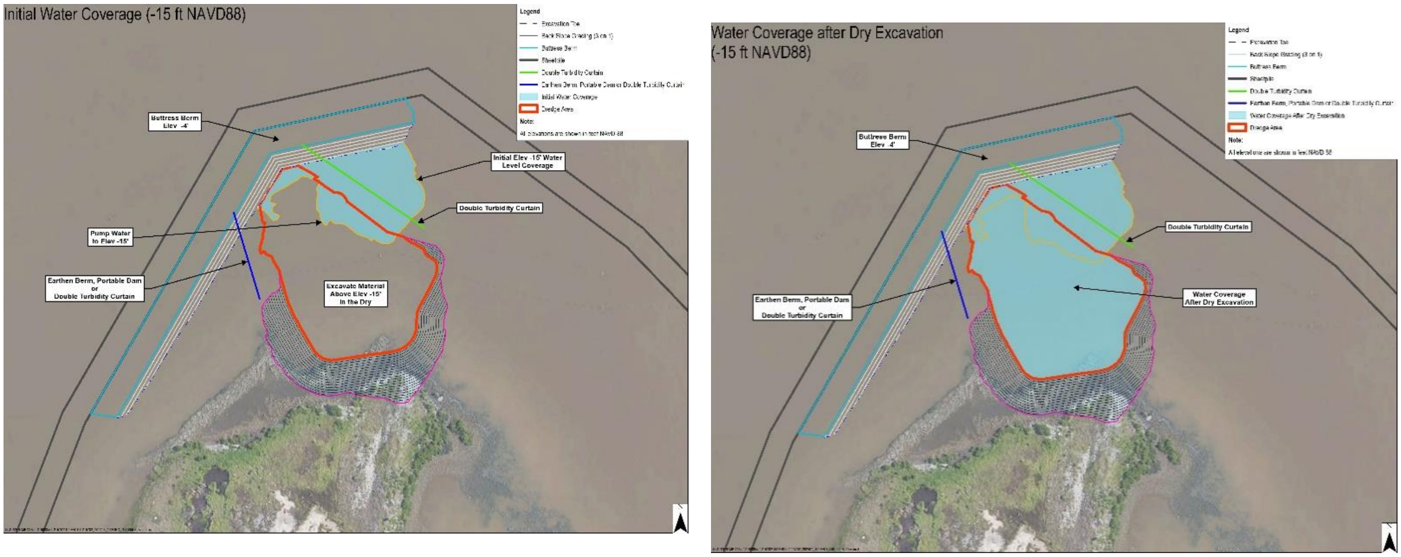

Figure 5-N *Mechanical Dredging Area Flooded to - 15 ft NAVD88 (Before and After Dry Excavation)*

5.7.3.2.2 TCRA Armored Cap Removal Above -15 ft NAVD88

After pumping the water down to -15 ft NAVD88, and prior to excavation activities, the TCRA armored cap atop the exposed 0.67 acres will be removed using standard land-based excavation equipment to access the underlying waste material for excavation. The rock suitable for potential reuse will be staged on the Northern Impoundment or at a nearby location. Any geotextile and/or geomembrane barrier of the TCRA armored cap will be removed and disposed of off-site with the excavated waste material.

5.7.3.2.3 Dry Excavation

After removal of the TCRA armored cap, excavation of approximately 8,000 CY of waste material to an elevation of -15 ft NAVD88 will take place in the dry using land-based excavation equipment. The excavator will 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 will be loaded directly into haul trucks for off-site disposal. Excavated material that is too wet (i.e., will not pass the paint filter test) to be directly loaded into haul trucks will be temporarily staged and allowed to drain by gravity and/or be solidified on the mixing pad prior to loading for off-site disposal. An earthen ramp will be constructed over the lip of the BMP wall (at a location adjoining the TxDOT right-of-way) to allow truck traffic into and out of the work area (see Drawing C-07 in Appendix G). As part of the earthen ramp, the RC will incorporate measures to protect the top of the BMP, potentially using crane mats, steel plate, or construction techniques to protect the sheet pile wall. The RC will submit its means and measures for crossing the BMP with the earthen ramp prior to construction.

Containment features will be installed within the northwest corner to control run-on and run-off from the excavation surface, as described in Section 5.7.3.3. Any water that contacts the excavation surface will be pumped out, as needed to maintain excavation operations, to the WTS where it will be treated and discharged as described in Section 5.9 Dredging Procedures**.**

After completion of the dry excavation, the northwest corner will be prepared for mechanical dredging by raising the water to a minimum elevation of -10 ft NAVD88. The water will be pumped into the northwest corner directly from the river and/or pumped to the area from the clean WTS effluent. During dredging, additional water will need to be added to account for the volume of dredge material that has been removed.

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. Features to contain the residuals during dredging are described in Section 5.7.3.6.

Figure 5-O, below, shows the limits of the flooded area at elevation -10 ft NAVD88, as contained by the natural bathymetry of the land around the northwest corner. It also shows the approximate locations of the containment features to control the spread of generated residuals that are described in Section 5.7.3.6.

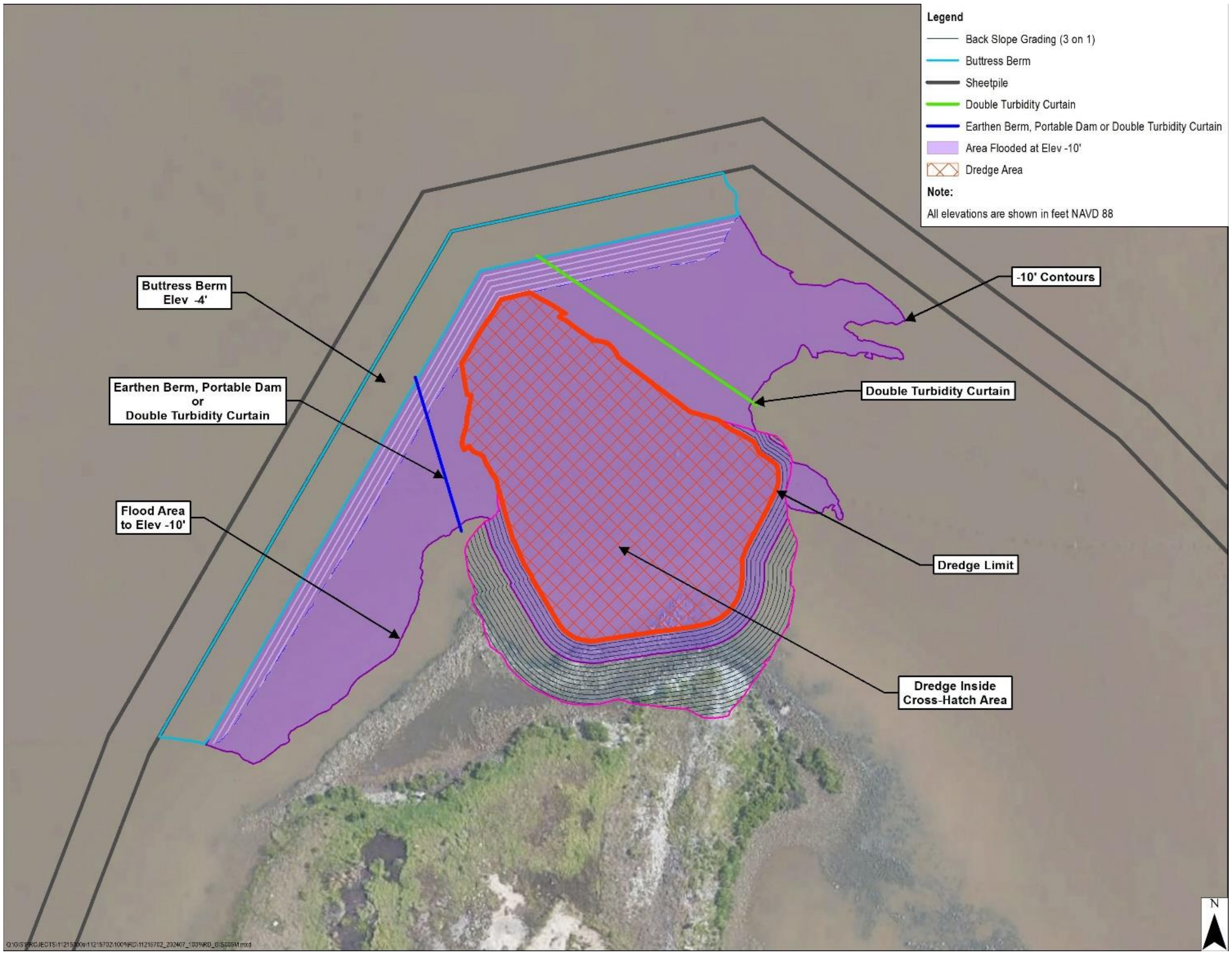

Figure 5-O ***Mechanical Dredging Area Flooded to - 10 ft NAVD88***

5.7.3.2.4 Dredging and Processing Equipment

Mobilization for the dredging operation will occur after construction of the staging area and concurrent with the dry excavation activities. Any equipment requiring assembly will likely require the assistance of a crane. It is expected that the dredge platform will be constructed of FlexiFloat sectional barges or similar and spuds will be installed on the platform for positioning purposes. After assembly of the FlexiFloat dredge platform, the mechanical dredging excavator will be tracked onto the barge or placed onto the barge with the crane. Material barges will 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 for processing.

An aboveground solidification containment area will be constructed adjacent to the shore and will be sized, subject to space limitations, to manage at least 2 days of dredged materials based on the RC’s planned production rate. The solidification containment area will be designed to manage both the solidification and loading operations. The containment area will be lined and it will be constructed within a larger bermed area that will also be lined to contain any spillage from the material management and loading operations. The containment area will be equipped with a sump to capture the water draining from the dredge spoil pile. If the TSS in the water from the containment sump is too high to treat in the WTS, additional solids removal methods will be required by the RC. For the purpose of the Revised 100% RD, it is assumed that if TSS removal is necessary, the water will be pumped to a geotextile tube that will drain directly back to the removal area. However, the RC will have the option to use another solids removal technology that can be demonstrated to be effective. Section 35 24 00 of the design specifications require that the RC provide a proposed method for solids removal from the containment sump water using either geotextile tubes or another proposed method.

The barge-mounted excavator will first remove the remaining TCRA armored cap material over the submerged portion of the northwest corner. The TCRA armored cap material will 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 will be outfitted with an environmental bucket designed to minimize turbidity and resuspension of sediment. Managing resuspension and residuals is discussed further in Section 5.7.3.6. The dredged sediment will be removed and placed into sealed hopper barges, which will be moored to the dredge platform while they are being loaded. Once full, the hopper barges will be transported to the edge of the dredge area for offloading at the stabilization containment area.

5.7.3.2.5 Dredging and Verification Procedures

A pre-dredge bathymetric survey will be performed to develop the pre-dredge surface. The information from the survey, in combination with the CAD surface of the target remediation limits, will provide the basis for the dredge prisms and target volumes for the dredging production passes. Additional bathymetric surveys will 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 will be equipped with real-time kinematic global positioning system (RTK-GPS) that will confirm that the removal activities met the horizontal and vertical requirements of the project. The RTK-GPS signals will 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 will 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 will 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 will be processed in real-time using Hypack, Inc. Dredgepack® software or similar.

The dredging operation will require the addition of makeup water to maintain the -10 ft NAVD88 water elevation. The make-up water will either be pumped into the northwest corner directly from the river and/or pumped to the area from the clean WTS effluent.

5.7.3.3 Solidification and Loading

After loading material into hopper barges and pushing the barges to the staging area with work boats, the material will be allowed to gravity drain. Water that accumulates in the hopper barges will be pumped to a settling tank where the sediments will settle out. The water will then be removed and pumped to the WTS, as described in Section 5.8. The accumulated sediments will be periodically removed from the settling tanks and incorporated in with the dredge spoils for solidification. If the TSS in the water from the settling tanks is too high to treat in the WTS, solids will be removed using the method as planned for the water from the containment sump described in Section 5.7.3.2.5

After the water is pumped from the hopper barges, a material handler or similar equipment, will be used to offload the dredge spoils from the hopper to the solidification containment area. The material will 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 will be required to perform its own treatability testing to define the reagents and mix ratios prior to the RA. After curing, the solidified material will be removed from the solidification containment area, loaded into haul trucks, and transported to the off-site landfill.

5.7.3.4 Clean-up Pass

After the production pass the residuals will be allowed to settle as described below in Section 5.7.3.6. A clean-up pass will be conducted to remove generated residuals that have settled (to the extent practicable). The depth of dredging for the clean-up pass will be a minimum of 6 inches below the base of the residual layer. A bathymetric survey will be performed to define the top of the residuals. The base of the residuals will be defined by the original dredged elevation, as measured by the operational data collected during dredging as described in Section 5.7.3.2.6, and then confirmed by the RC by probing.

Prior to the clean-up pass, a thin sand layer will be placed across the dredged area using a sprayer barge or similar subaqueous capping equipment. The purpose of the thin sand layer is to stabilize the residuals so they can be effectively captured by mechanical dredging techniques.

The clean-up pass will use the same general procedures for minimizing residuals described in below in Section 5.7.3.6 for the production pass with the addition of a shallow, level bottom cutting bucket to capture the residuals.

5.7.3.5 Residual Management Layer

After the clean-up pass, the suspended sediments in the water column will again be allowed to settle. The Residual Management Layer (RML) will not be placed until the turbidity is below 100 NTUs at three locations generally spaced equally across dredged area. The turbidity measurements will be taken with a hand-held turbidity meter within two feet of the mudline. The RC will have the option of waiting to allow the material to settle to the specified NTUs, or using polymers, coagulants and/or other additives to promote settling.

Granular material will 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 cover for the small mass of any remaining generated dredging residuals.

Initially, subaqueous capping techniques will be utilized to distribute the granular material in thin lifts to evenly cover the dredged surface while minimizing disturbance at the mudline. Bathymetric surveys will be performed during the placement of this initial cover layer to confirm that the appropriate thickness has been achieved throughout the dredging area. Once the initial two feet of granular material has been placed and confirmed by the bathymetric surveys, the RC may install the remaining granular material for the RML at a more rapid pace, while limiting the disturbance of the underlying RML that has already been placed.

During RML placement, the water will be maintained above the elevation of the granular material to continue to offset the heave potential. When the RML reaches -17 ft NAVD88, the water level can be lowered below the sand level, exposing the upper slope of the excavation. Any remaining residuals on the upper slopes will be excavated in the dry and the RML will then be raised to the target elevation of -14 NAVD88. The water that is displaced by the granular material will be captured and pumped to the WTS for treatment. Figure 5-P, below, shows the limits of the granular material after placement.

Granular material will 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 at a river level of +5 ft NAVD88 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 if the river would reach the top of the BMP at +10 ft NAVD88. Considering that this area may be dewatered for up to 7 years during construction across the Northern Impoundment, granular material will be added to elevation -14 ft NAVD88 to protect against heave during a potential high-water event.

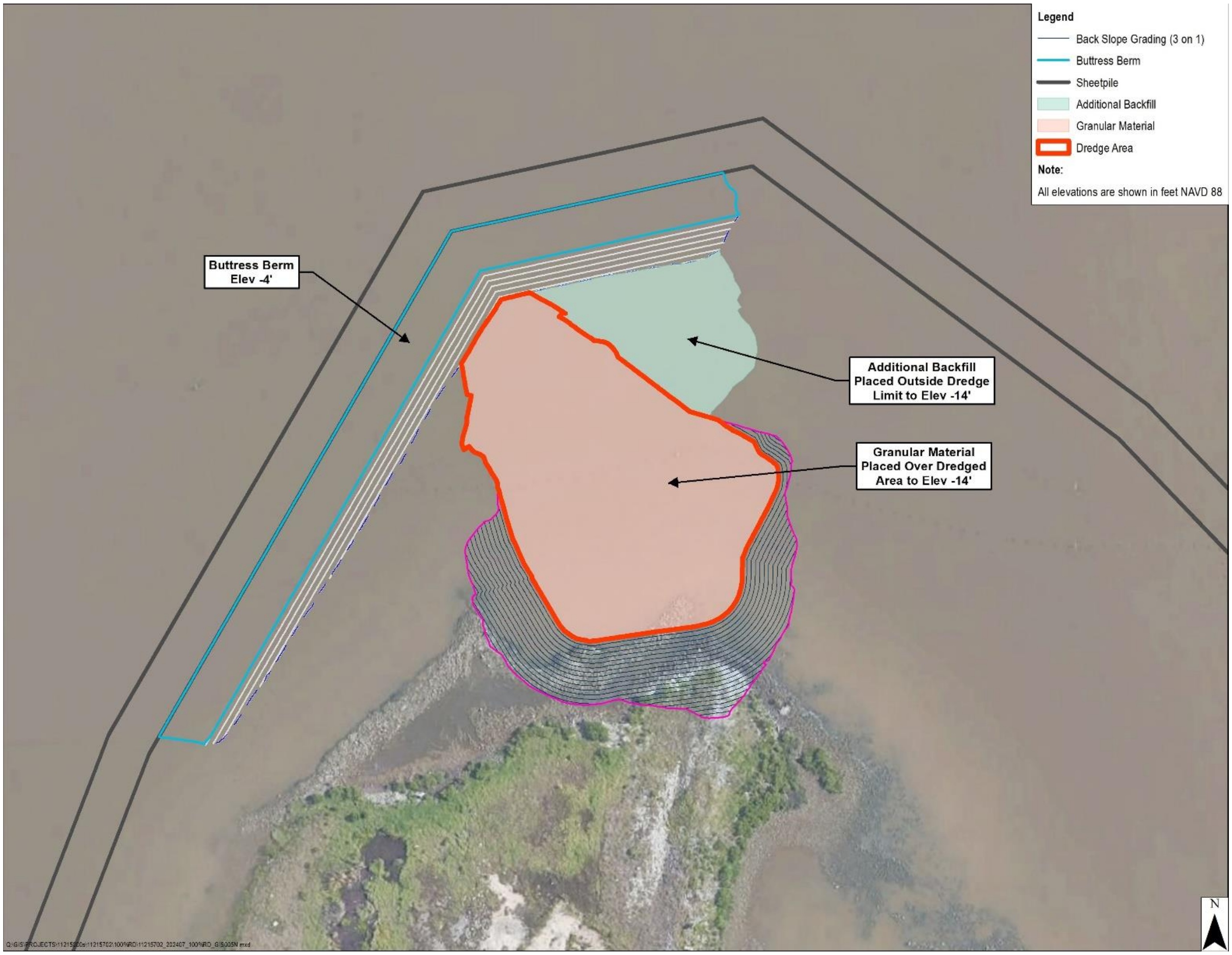

Figure 5-P *Post-Dredging Fill Placement to -14 ft NAVD88*

5.7.3.6 Residuals Management and Controls

Section 35-24-00 is the dredging specification in Appendix H and provides the RC requirements for dredging the northwest corner. Attachment A to the specifications is a Residual Management Plan that describes best management practices, dredging procedures and water management procedures for the RC to follow in the northwest corner to minimize dredging residuals and to control the residuals that are generated. The residual management procedures required by the RC are summarized below.

Construction of BMPs to Control Residuals

The existing bathymetry in the NWC effectively forms a natural bowl to contain water and migration of dredging residuals within the general vicinity of the NWC. Containment features will be constructed as best management practices (BMPs) along the northeast and southwest boundaries of the removal area to further contain the residuals to within the removal limits during the dredging and water management phases to the work in the NWC. The BMPs will extend to a minimum top elevation of -8 ft NAVD88. Several BMP types were considered including sheet piles, impermeable turbidity curtains, earthen dams, and portable dams (e.g. AquaDams®). Considering that the entire area will already be protected by sheet piles and the significant effort and cost to install additional internal piles around the NWC, other BMP options were considered more favorable as described below.

The river bottom surface topography on the northeast side of the dredging limits varies significantly from elevation -10 ft NAVD88 to -17 ft NAVD88. Earthen berms with sufficient slope to be stable during dredging are not feasible, and portable dams are not suitable due to the steep slopes of the river bottom profile. Therefore, a double-wall impermeable turbidity curtain will be constructed along this northeast boundary of the dredging area. The inner curtain will be anchored approximately 10 ft outside the outer limits of the dredge area. The outer curtain will be positioned just outside the inner curtain. Both curtains will be weighted at the bottom and extend the full length of the water column into the mudline and anchored in place. The RC will conduct daily visual inspections of the turbidity curtain to confirm its effectiveness in the field and make any adjustment or repairs as necessary.

On the southwest side of the dredging area, the river bottom topography is shallower with a maximum depth of about -15 ft NAVD88. An earthen berm with a top elevation of -8 ft NAVD88 is more feasible to construct in this area. The RC will have the option to use the double turbidity curtains, construct an earthen berm or use portable dams to contain the residuals on this southwest boundary.

The top elevation of the buttress berm on the north side of the excavation will be at -7 ft NAVD88 with approximately a 3-foot layer of rip rap on top, bringing the top elevation of the buttress to -4 ft NAVD88, which will provide effective containment in this area. Figure 5-M shows the northwest corner, the limits of the water at -10 ft NAVD88, and the BMP components to contain the residuals during dredging.

Dredging Procedures - The RC will 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.
– Overdredging - a six-inch overdredge will be used for the clean-up pass.

Settling of Residuals - After completion of the initial production pass, the residuals in the water column will be allowed to settle. The clean-up pass described in Section 5.7.3.4 will not be allowed to start until the turbidity is below 100 NTUs at three locations generally spaced equally across dredged area. The measurements will be taken with a hand-held turbidity meter within two feet of the mudline.

The RC will have the option of waiting to allow the material to settle to the specified NTUs, or using polymers, coagulants and/or other additives to promote settling based on treatability testing performed by the RC. A settling test treatability study was performed as part of the 2020 Approach B Water Filtration Testing (see Section 3.6.2 of the Revised 100% RD). 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 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 control 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, 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 is required by the specifications to evaluate the GHD treatability data and perform its own testing to develop a plan for application and mixing of polymers, coagulants and/or other additives, and be prepared to implement this technology in the event it is necessary to accelerate the settling. Attachment C of the specifications provide the requirements for the testing.

Sand to Stabilize Residuals - Prior to the clean-up pass, a minimum 3-inch sand layer will be placed across the entire northwest corner using a sprayer barge or similar subaqueous capping equipment. The purpose of the thin sand layer is to stabilize the residuals so they can be effectively captured by mechanical dredging techniques.

Clean-up Pass - A clean-up pass will be conducted after completion of production passes to remove the settled residuals to the extent practicable as described above in Section 5.7.3.4.

Residual Management Layer - To overcome the potential for hydraulic heave in the northwest corner while pumping out the contact water, imported granular material will be placed atop the dredged area to an elevation of -14 ft NAVD88. This fill material will also serve as a residuals management layer to cover the remaining residuals. The initial layers will 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 will be constructed to -14 ft NAVD88, which will protect from hydraulic heave up to the top of the BMP (a river level of +10 ft NAVD88) and will provide as much as 11 ft of imported granular material over the dredged area.

Dry Excavation of Residuals on Slope - During RML placement, the water will be maintained above the elevation of the granular material as it is placed to continue to offset the heave potential. The water that is displaced by the granular material will be captured and pumped to the WTS for treatment. At elevation -17 ft NAVD88, the area can be pumped dry, exposing the upper slope of the excavation. Any remaining residuals on the upper slopes will be excavated in the dry and the RML will then be raised to the target elevation of -14 ft NAVD88, effectively covering any residuals.

5.7.3.7 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 will be implemented. When removing waste material during the dry excavation phase, the area will need to be maintained to be free of water, as much as practicable. Measures that mayq 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. 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 will 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 will be required to develop a SWPPP for the Northern Impoundment prior to the start of the RA.

5.8 Characterization, Loading, Transportation, and Disposal

The RD elements related to the loading, transportation and off-site disposal of waste material from the Northern Impoundment are outlined in the TODP, included as Appendix J Attachment 8 to this Revised 100% RD.

5.8.1 Waste Characterization

As summarized in Section 3.3, the waste material in the Northern Impoundment is not a listed hazardous waste under 40 CFR Part 261, Subpart D. Furthermore, waste characterization samples collected during the PDI-1, PDI-2, and SDI were analyzed for ignitability, corrosivity, reactivity, and toxicity, as defined in Title 40 of CFR Part 261, Subpart C, to determine if the material was a characteristically hazardous waste. The results indicated that the material is not a characteristic hazardous waste under RCRA or TCEQ regulations.

GHD submitted a Waste Characterization Letter for the Northern Impoundment to the EPA on October 20, 2020 (GHD, 2020g). The evaluation described the detailed characterization evaluation and concluded that the waste has been characterized and classified in accordance with the RCRA regulations as non-hazardous waste. EPA concurred with the conclusions in a letter to GHD dated November 19, 2020 (EPA, 2020h). Additional testing was conducted during the Treatability Study to further classify the non-hazardous waste under applicable TCEQ regulations, 30 TAC §335.505, 335.506, and 335.508. The material was tested for leachability using TCLP. The results of the treatability testing indicate that the waste material from the Northern Impoundment is non-hazardous and is eligible for disposal as a Class II non-hazardous waste per 30 TAC §335.505, 335.506, and 335.508.

Solidification testing, in accordance with EPA Method SW-846 Test Method 9095B (i.e., paint filter test), was also conducted to determine the appropriate reagent dosages to solidify the waste material for transportation to an off-site disposal facility. Off-site disposal facilities typically require incoming waste to pass paint filter testing and sometimes meet a minimum UCS criteria. The results of the solidification testing indicated that these criteria can be met across a range of waste material percent solid scenarios utilizing Portland cement and/or lime with doses typically ranging from 0 to 20 percent solidification reagent depending on the actual percent solids present. The RC may conduct additional tests to determine the appropriate reagent dose at the time of the RA.

5.8.2 Loading, Transportation, and Disposal

5.8.2.1 Transportation Alternatives Evaluation

During the early phases of the RD, Respondents completed a transportation alternative evaluation, including barging. An RAO for the Site, as stated in the ROD, is to "*Prevent releases of dioxins and furans above cleanup levels from the former waste impoundments to sediments and surface water of the San Jacinto River*." Barging significantly increases the risk of a potential release to the river as compared to trucking due to multiple handling operations from loading and offloading material over the water. Specifically, waste material would have to be lifted up and over the BMP and over the FRP barge protection (for a significant portion of the BMP perimeter) and then placed in a barge moored in the river. This would entail waste being lifted approximately 60-feet laterally over the BMP at elevation 10 ft and over the FRP barrier at elevation 12 ft. With trucking, all loading operations would take place within the confined limits of the BMP and protected from the river. There is also the potential for a release while managing a barge that contains waste on the river, including releases during a flood event and during decontamination of the barge. A barging alternative also does not relieve the need for trucking as the evaluation determined that nearby landfills could not accommodate barge traffic directly. Barging would require an additional handling and transportation step by barging the waste material to a transfer station, offloading over the water into trucks, and then transporting waste material to a landfill by truck; consequentially increasing the impacts of greenhouse gas emissions. Moreover, the local community of Channelview has long expressed concern and objection to increased barge traffic on both the north and south sides of the I-10 bridge.

In addition, hydraulic pipelines were considered as another possible transportation alternative during the RD. The removal method presented in the Revised 100% RD is excavation in the dry for most of the impoundment and excavation through the water column by means of mechanical dredging in the Northwest Corner. Hydraulic pipelines are typically used in projects where hydraulic dredging is the removal method, not mechanical dredging. In order to move material via a hydraulic pipeline, the excavated material would have to be slurried by adding a significant amount of water. Once the material is transported via pipeline, the slurry would have to be dewatered prior to off-site disposal. This dewatering process would require significant property, would drastically increase the amount of contact water that would require treatment, would increase the chance of a release occurring should an overtopping event occur during dredging activities, and would likely extend the overall duration of the project. Therefore, hydraulic dredging is not considered a viable alternative for this project.

Based on further evaluation since the submittal of the 90% RD, Respondents still believe trucking to be the safest and most effective transportation method. After submittal of the 90% RD, there were additional meetings (July 28, 2022, November 15, 2022, March 22, 2023, August 16, 2023, and April 22, 2024) between the Respondents, EPA, GHD, and TxDOT regarding access to the right-of-way. In those meetings, TxDOT stated that with proper planning, access could be provided to the TxDOT right-of-way for transporting the material by truck, including during periods when the I-10 bridge replacement project was underway. With respect to the I-10 project, TxDOT has specifically and publicly expressed concern regarding barge traffic in the area of the site, and the risk of barge strikes. Specific plans will need to be developed and commitments from TxDOT will need to be obtained as details regarding the I-10 bridge replacement project become known. Further, the work on the Southern Impoundment RA has demonstrated that trucking is a safe and effective way to move material from the Site to a landfill at production rates similar to those planned for the Northern Impoundment.

5.8.2.2 Waste Material Transportation and Disposal

The total in-ground volume of material anticipated to be removed from the Northern Impoundment is approximately 230,000 CY. Removal will likely be completed over a minimum of five excavation seasons. Approximately 15,000 CY of material from the northwest corner during the first excavation season and approximately 53,000 to 55,000 CY of material will be excavated, transported, and handled over the course of each subsequent excavation season. The tentative seasonal cells have been sized based on the amount of waste material that could reasonably be excavated and transported for disposal during one excavation season, although there will be many factors during implementation, including weather and access issues involving the TxDOT ROW, that will determine the actual productivity rate and volumes removed during each excavation season. It should also be noted that the actual volume sent for disposal may be larger due to the addition of solidification reagent if the waste material is too wet (i.e., cannot pass the paint filter test) for transport to the disposal facilities. Based on solidification testing discussed in Section 3.3.5, it is estimated that the use of reagent could increase the total volume for disposal by approximately 10 percent or 23,000 CY. This could increase the total volume for disposal to approximately 253,000 CY.

Because of limited access and staging area at the Northern Impoundment, the transportation and off-site disposal of waste material may be a limiting factor to the overall volume that can be successfully removed in an excavation season. The single-entry point onto the Northern Impoundment is the existing road within the shared TxDOT ROW. An agreement will need to be reached with TxDOT for the use of that road during the Northern Impoundment RA. TxDOT currently uses that road to access the San Jacinto River I-10 Bridge for maintenance, but as previously referenced in Section 5.4 and discussed in detail in Section 5.11.3, TxDOT is planning to replace the bridge within the next two to three years. The Revised 100% RD assumes that there would be land access to the Northern Impoundment using the TxDOT ROW and that TxDOT will permit improvements to the existing access road, such as grading and widening, to allow for two-way traffic on that road. Even with these improvements, there will still be only a single land access point to the Northern Impoundment. The limited working areas, both on and adjacent to the Northern Impoundment, restrict the space available for truck staging, loading, and turnarounds.

One of the major factors influencing cell sizing is the ability to successfully transport and dispose of all removed waste material within an excavation season. Several off-site disposal facilities are currently under evaluation as disposal sites for the RA waste. These facilities are varying distances from the Northern Impoundment, ranging from 60 to 120 miles away. The transport distance to the furthest of these facilities was used as the design basis to influence the target cell size and excavation volume that can be completed in one excavation season. Based on the longest expected distance (120 miles, one way), it is estimated that haul trucks could complete a maximum of two roundtrips, or “turns,” per working day. Additional factors that were considered when determining the anticipated transportation production rates and cell sizing were based on experience with similar projects, and included anticipated downtime related to mechanical issues, traffic delays, bridge or roadway closures, and other factors. The limited number of truck turns, limited area for staging and loading haul trucks, and anticipated delays all influence the estimated volume of waste material that can be transported and disposed of during an excavation season.

5.9 Water Management

This section describes the basis of design and process design for the WTS that is proposed to treat water generated during the remediation of the site. The process design is based on the successful processes used during the remediation of the South Impoundment. The processes include a lamella filter, multimedia filters, 10 µm bag/cartridge filters, and 1 µm bag/cartridge filters to remove suspended solids and associated adsorbed dioxins and furans. In addition, granular activated carbon (GAC) is included to remove residual/dissolved dioxins and furans. Like the South Impoundment remediation, treated water will be held in the effluent tanks and analyzed for the contaminants of concern. The water will only be discharged to the San Jacinto River if it is verified to meet the ARARs. The system has provisions to retreat water that does not meet the ARARs, however, all treated effluent generated during the remediation of the South Impoundment complied with the limits established in the ARARs.

Following installation of the BMP, river water behind the BMP down to 2 ft above the lowest elevation at the time of dewatering will be treated by the non-contact water treatment system and returned to the river as described below and in the attached design drawings. Water in the BMP within 2 ft of the lowest elevation at the time of the dewatering activity and any other contact water generated during construction will be treated by contact water treatment system as described below and in attached design documents. At the conclusion of each excavation season, the exposed areas of the excavation will be covered.

During excavation activities, measures will be taken to segregate stormwater that comes into contact with impacted material from clean stormwater that only contacts TCRA armored cap or confirmed clean excavation areas. All contact water will be treated through the WTS.

The contact water treatment process will include removal, treatment, and discharge of contact water generated during the RA to allow excavation to continue. The water will be pumped from the excavation area to storage tank(s), treated to remove dioxins and metals below discharge criteria, and then discharged to the river. This section describes the basis of design and design elements for the WTS.

5.9.1 WTS Basis of Design

5.9.1.1 Contact Water Characterization

As described in Section 3.4, water treatability testing was performed in accordance with the TSWP (GHD, 2019b) to inform the RD of the WTS. The results from treatability testing indicated that the average TSS concentration for the simulated Northern Impoundment contact water sample could be as high as 4,600 mg/L. This represents a maximum expected value since waste solids were actively mixed with water in the pilot test excavation to increase TSS concentrations to create this contact water. This worst-case TSS value was used as the basis of design for water treatment.

Treatability testing results indicated that the majority of metals and dioxins found in contact water were associated with the suspended solids and were not found in the dissolved phase.

Seepage water that entered the pilot test excavation during the PDI-2 was characterized to determine the required treatment if a sufficient volume accumulates in the excavation during the RA.

Water characterization results from PDI-2 are presented in Table 3-2.

5.9.1.2 Parameters Requiring Treatment

As described in Section 3.4, discharge criteria were estimated for COPCs in the Northern Impoundment; those discharge limits are presented in Table 3-2. Dioxins and several metals, including copper, lead, and zinc, were detected in the simulated contact water sample above estimated discharge criteria. Dioxins were detected in the seepage water at levels above the ML, but no other COPCs were above discharge criteria. Treatability test results indicate that metals and dioxins are primarily associated with solids, demonstrating that a treatment system that removes solids should reduce COPCs to levels below the discharge criteria.

5.9.1.3 Treatment Process

The WTS is proposed to treat contact water generated during the RA at the Northern Impoundment. Contact water may be generated from the excavation, mechanical dredging, stormwater, seepage, overburden stockpiles, dewatering activities, WTS containment, and equipment decontamination. Contact water will be pumped to large, aboveground storage tanks. Water from the storage tanks will be processed through the WTS. WTS treatment processes will include chemically enhanced solids precipitation/flocculation, gravity settling, multimedia filtration, cartridge/bag filtration, and GAC adsorption. Treated water will be stored in large effluent tanks and tested before discharging to the river. Based upon water treatability testing results, described in Sections 3.4 and 3.6, the process described herein has been proven effective in laboratory, pilot testing, and remediation of the South Impoundment at reducing concentrations of COPCs in water to levels below their respective discharge limits.

5.9.1.4 Water Volume and Storage

For the Northern Impoundment, contact water includes any water from the following:

3. ***Rainwater:*** water from any rain event that contacts impacted material.
   a. Rainfall will comprise a majority of the contact water that will be generated.
   b. Although measures will be taken to segregate contact water from non-contact water, the storage and treatment capacities included herein were designed to account for a worst-case assumption that all stormwater that falls within the BMP area is managed as contact water. The area inside the BMP is ~730,000 square feet (ft^2).
   c. All rainfall collected inside the WTS containment areas will be treated by the WTS system. The WTS containment area is ~290,000 ft^2.
   d. Each area is multiplied by the 99^{th} Percentile for a 24-hour storm event during the period from November through July of 9.3 inches/day.
   e. The predicted contact water generated from the 99^{th} Percentile for a 24-hour storm event is ~790,000 ft^3 or ~5.9 million gallons.
   f. The estimated volume of contact water generated by rainfall during the period from November through July is 22 million gallons. This is based on the average total rainfall during the that period from 1880 to the present.
4. **Water in Excavation:** Water that contacts impacted material.
   a. Any water that contacts impacted material
   b. Water within the BMP below a level that is 2 ft above the lowest elevation at the time of dewatering non-contact water at the start of construction or non-contact water after an overtopping event, has been agreed to be treated as contact water.
   c. During the first year of construction, contact water is estimated to be ~3.9 million gallons.
5. ***Mechanical Dredge Water***
   a. During the first excavation season, a mechanical dredge shall be used for part of the excavation.
   a. Contact water will be generated by the dredging process and the clean-up pass.
   b. The estimated volume of water generated by mechanical dredging is ~240,000 ft^3 or ~1.8 million gallons.
6. ***Equipment Decontamination Water:*** water that will be associated with the washing/rinsing of equipment (e.g., truck wash).
7. ***Mounded Water:***
   a. Mounded water will primarily be generated at the start of excavation as the mounded water drains into the excavation.
   b. The following assumptions were used to model the steady state flow of mounded water into the excavation.
      – Mounded Water is in a cube/block above the low point of the excavation (-15 ft NAVD88)
      – Groundwater level is assumed to start at 1.5 ft NAVD88 across the block
      – Block is 750 ft long, 600 ft wide, and has 16.5 ft of water column height above the river bottom
      – All water will flow to the side of the cubic block facing this low point
      – No base flow from stored water below the river (i.e., cofferdam is watertight)
      – Homogeneous hydraulic conductivity of 3 ft per day (ft/day) across the block
   c. Modelling predicts the highest flowrate of mounded water into the excavation will be ~90,000 gpd.
   d. The estimated volume of mounded water that will flow into excavation during excavation from November through July is 18 million gallons.
   e. Daily and annual mounded water discharge will be reevaluated after the first excavation season.
8. ***Persistent Infiltration:*** water that infiltrates through impacted soil from the river when the base of the excavation is below the average mean sea level of the river (i.e., 1.5 ft NAVD88), however since the BMP wall will be driven into the underlying Beaumont Clay, such persistent infiltration is assumed to be insignificant.

a. The BMP is assumed to be watertight and is keyed into the Beaumont Clay. Therefore, persistent infiltration is assumed to be insignificant.

b. Water that infiltrates through clean soils or TCRA cap material is not considered contact water unless comingled with contact water.

9. ***Miscellaneous Contact Water:*** other water that comes into contact with waste material not associated with water types listed above. This includes water from an overtopping event that contacts contaminated surfaces or water generated by comingling of non-contact and contact water.

For the Northern Impoundment, non-contact water includes any water from the following:

1. ***Non-Contact Water*:** water removed from the BMP that does not come in contact with impacted material and is 2 feet above the lowest elevation at the time of the dewatering activity.
   a. The estimated volume of water generated during the first year of construction is ~19.4 million gallons, assuming the BMP is closed at low water level (~1.5 ft NAVD88).
   b. Rainfall that does not comingle with contact water and does not come into contact with impacted materials.
   c. Non-contact water will be processed to remove solids by the non-contact water treatment system. See Drawings P-001 in Appendix G for a process flow diagram (PFD) of the non-contact water treatment system.

A summary of the maximum expected contact water generated, shown in gpd, from each source is provided in Table 5-I, below.

Table 5-I Summary of Maximum Expected Contact Water Generated

Influent Sources	Estimated Water Generation	Notes
Contact Rainfall in BMP	4.2 million gallons after a 9.3 inch 24-hour rain event.	Assumes all rain that falls within the BMP could be contact water. Area = 730,000 ft^2. The 99th percentile 24-hour rain event (1930 to 2019) = 9.3 inches
Rain Collection - WTS and Effluent Containment Areas	1.7 million gallons after a 9.3 inch 24-hour rain event.	Assumes all rain that falls within the containment areas could be contact water. Combined area = 290,000 ft^2. The 99th percentile 24-hour rain event (1930 to 2019) = 9.3 inches
Contact Water (at start of construction)	3.9 million gallons	Contact water generated at the start of construction when the area behind the BMP is being dewatered for the last 2 feet above the lowest elevation.
Mechanical Dredge Water	1.8 million gallons	During the first year of excavation, a mechanical dredge will be used.
Mounded Water (gpd)	90,000 GPD	See assumption above
Truck Wash	Minimal volume	Assumed to be accounted for in the BMP-area contact water

Design Treatment Capacity of WTS

The design treatment rate for the WTS is 300 GPM with an influent storage capacity of 2.1 million gallons. The WTS was designed with treatment and storage capacity to dewater, store, and/or treat the contact water from the entire BMP area in approximately 8-15 days after a 99th percentile 24-hour rain event (1930 to 2019) = 9.3 inches. Dewatering time will be dependent on treatment flowrate and hours of operation or the WTS. The dewatering time assumes a laboratory turnaround time of 7 days. Since the 90th percentile 24-hour rain events will be less than two inches, the contact water accumulated in the entire BMP area can dewatered, stored, and/or treated in less than 24 hours for most rain events.

At the start of construction, the non-contact water (~19.4 million gallons) will be treated with the non-contact WTS at a high treatment rate (3,000 to 4,000 GPM). Depending on the treatment flowrate and hours of operation, the non-contact water is expected to be removed from within the BMP in approximately 2-3 weeks.

At the start of construction, the contact water (~3.9 million gallons) will be treated by the WTS at design rate of ~300 GPM. Depending on the treatment flowrate and hours of operation the contact water is expected to be removed from within the BMP in approximately 1-2 weeks. The dewatering time assumes a laboratory turnaround time of 7 days.

5.9.2 Treatment System Design

A treatment system with multiple processes will be employed to reduce concentrations of suspended solids, dioxins and furans, and metals in the contact water to meet discharge criteria.

- ***Non-Contact Water Treatment*** - The treatment system will use pumps, influent storage tanks, multimedia filters, and bag/cartridge filters to treat non-contact water generated during the RA by reducing suspended solids before discharging the treated water back to the river via a diffuser. No storage of treated non-contact water will occur.
- ***Contact Water Treatment -*** The treatment system will use pumps, influent storage tanks, chemical addition, inclined plate clarifier, sludge dewatering, multimedia filters, bag/cartridge filters, and GAC to treat contact water generated during the RA. The treated water will be stored in effluent storage tanks and tested for compliance with discharge criteria. Treated water that meets discharge criteria will be discharged to the river via a diffuser. If treated water does not meet discharge criteria, the water will be recirculated through the contact water treatment system. Any non-contact water that mixes with contact water or has come into contact or mixes with waste materials will be managed as contact water.

The treatment process is anticipated to include the following unit processes:

- ***Influent Storage*** - Two (2) B-31 Lake Tanks (1.33 million gallons of working capacity each) are proposed to store water prior to treatment. Storage tanks will allow for water to be removed from the excavation area and stored prior to treatment. No mixing is proposed for these tanks. Some TSS settling will occur in these tanks and will be removed as needed.
- ***Chemical Addition*** - Coagulant and flocculant will be used to precipitate and flocculate TSS and contaminants of concern. Organosulfide, acid and/or caustic may be used if needed for metals removal. Chemicals will be added to mixing tanks using metering pumps. The mixing tanks will have adequate residence time to allow for adequate solids and floc formation.
- ***Bulk Solids Removal Using an Inclined Plate Clarifier*** - Conditioned solids out of the flocculation tank will be settled in an inclined plate clarifier. An inclined plate clarifier is a vessel which includes multiple parallel plates at an angle greater than 45 degrees. As solid particles settle and contact the plates, the particles will be directed by gravity to the bottom of the clarifier, where the solids stream will be continuously removed. Because of the high surface area provided by the plates, an inclined plate clarifier requires a smaller footprint compared to a circular clarifier.
- ***Sludge Dewatering -*** Settled solids from the inclined plate clarification (underflow) will be pumped into a sludge dewatering box where solids will be dewatered by gravity. The liquid that drains out of the solids will be pumped back to the influent storage tanks for reprocessing. The dewatered solids will be moved to the excavation solids dewatering area and disposed of with other solids from the excavation.
- ***Multimedia Filtration*** - Clarified water from the inclined plate clarifier (overflow) will be pumped through the multimedia filtration system, which is a series of pressure vessels filled with media of different densities and particle sizes. Typically, anthracite, sand, and garnet are used. Larger solids will be captured by the largest media (anthracite). Smaller particles will be captured further into the bed by intermediate media (sand), with the smallest solids captured by the smallest media (garnet). As solids build up in the filter, the pressure across the filter will increase, which requires backwashing to remove the collected particles. The backwashing process will use a forward feed process that does not require a backwash tank or backwash pump.
- ***Bag/Cartridge Filtration*** - Filtrate from multimedia filters will then enter bag filters to remove residual solids. Bag filters use fabric to collect solids as water is pumped through the filter. The filter is designed to collect particles larger than the specified opening in the filter. Filtrate will enter the two sets of filters, the first with a filtration size of 10 µm, followed by the second with a filtration size of 1 µm. Both filters will be specified to have a minimum of

95% removal efficiency for particles at the given micron rating. Higher removal efficiencies are obtained for larger sized particles.

– ***GAC Filtration*** - GAC is a form of carbon that is processed to have small pores that increase the surface area available for adsorption. Residual organic compounds (e.g., dioxins, furans) in the filtrate from the bag filters will be removed with GAC.
– ***Effluent Storage*** - Four (4) B-36 Lake Tanks (1.51 million gallons of working capacity each) are proposed to store water after treatment. Storage tanks will allow for water to be stored while test results are pending.

Details of the basis of design of the WTS are provided below. Note, that the WTS design is subject to changes based on field performance.

5.9.2.1 Major Equipment List and Sizing Basis

The major WTS components and basis of sizing are detailed in Table 5-2. This includes sizing criteria assumptions, design value, and notes for each major equipment and process component.

5.9.2.2 Water Treatment Equipment Layout

The WTS, including the two (2) 1.33 million-gallon water storage tanks, water treatment equipment, and space for a second treatment system, will be staged within a lined containment area of approximately 100,000 ft^2. The effluent storage includes four (4), B-36 Lake Tanks (1.51 million gallons) and return pumping system. The WTS and effluent storage tank containment areas will be surrounded by an earthen berm covered with an impermeable geomembrane. The top of containment berms will be at or above +10 ft NAVD88. The layout of WTS and Effluent Storage Areas are provided in the attached design drawings.

At the time of the Revised 100% RD submittal, property access negotiations are still ongoing, so the location of the WTS has not yet been determined.

5.9.2.3 Specification and Equipment Data Sheet List

Detailed design drawings associated with the WTS, technical specifications detailing the potential water treatment equipment, consumables, staging/sequencing, and operation are included in Appendices G and H, respectively.

5.9.3 Operations and Maintenance Requirements

The WTS associated with the Northern Impoundment RA will operate intermittently primarily based on the need to treat contact water. A preliminary discussion of the Operations and Maintenance (O&M) requirements (including consumables and utilities) associated with the WTS is provided, below. In addition, the water treatment system operations include the following:

– The contractor operating the WTS (WTS Contractor), which may also be the RC, shall be a licensed operator as required.
– The WTS Contractor shall include provisions for back-up generator(s) as needed.
– The WTS Contractor shall provide a plan to protect equipment if a severe storm is predicted. Preparation may include provisions such as draining equipment, extra heaters, and/or moving equipment offsite until the storm passes.

5.9.3.1 Consumables

Effective treatment of contact water will require the use of several water treatment chemicals to facilitate solids separation, metals precipitation, and pH adjustment. A brief discussion of the water treatment chemicals is provided, below. All water treatment chemicals will be stored within sufficient secondary containment at the work site.

Coagulant - Coagulants (poly aluminum chloride or equivalent) will be dosed to facilitate enhanced removal of metals (through co-precipitation) and suspended solids in the inclined plate clarifier of the WTS. Required type and dosages will be confirmed based on on-site jar testing. It is anticipated that coagulant will be delivered to the work site in intermediate bulk container (IBC) totes (~300 gallons).

Polymer - It is anticipated that liquid polymers will be utilized to enhance the settling of suspended solids and precipitated metals in the inclined plate clarifier of the WTS. Polymer may also be required to enhance the dewatering of chemical sludge in the sludge dewatering boxes. Polymer will be activated/diluted prior to dosing into the water treatment process. Required type and dosages will be confirmed based on on-site jar testing. It is anticipated that polymer will be delivered to the work site in drums or IBC totes.

Organosulfide - Organosulfide is a flocculant that is a commonly used water treatment additive for removal of metals (via sulfide precipitation). Organosulfide may be added if influent soluble metals concentrations exceed the discharge criteria. Precipitated metals may be removed in the inclined plate clarifier and filtration processes of the WTS. It is anticipated that organosulfide will be delivered to the work site in IBC totes. No organosulfide was required during the Southern Impoundment remediation.

Acid/Caustic - Acid and/or caustic may be added to the water to adjust the water pH to optimize metals removal, enhance the effectiveness of the added coagulants, and/or return the treated water pH to within the discharge criteria range. It is anticipated that acid/caustic will be delivered to the work site in IBC totes. No acid or caustic were required during the Southern Impoundment remediation.

Bag/Cartridge Filters - Bag and cartridge filters with minimum 95% removal efficiency will be used. As the bag and cartridge filters are fouled (with captured solids), they will need to be removed and replaced.

GAC - The proposed GAC treatment vessels will be filled with bitumen-based GAC media. The GAC vessels will be configured in a lead- lag arrangement. Effluent quality of the lead GAC vessel will be monitored for chemical breakthrough (i.e., detection of COPCs in effluent) to identify the need for media replacement.

5.9.3.2 Power

The WTS (in addition to the other facilities) in the Northern Impoundment will require temporary source(s) of electricity for operation. The power requirements will be confirmed by the selected RC and will be obtained by temporary power connections from the local utility and/or by portable generators.

5.9.3.3 Labor

The WTS is expected to operate in a semi-automatic mode on an intermittent basis (i.e., after a rain event). The WTS will operate primarily during the initial phase of an excavation season to dewater the excavation cell and during precipitation events; thus, there may be periods of time in which the WTS is idle and treatment system operators are not required. Key process decisions and operations will be executed with oversight by the RC’s treatment system operators. When the system is being operated, it is expected to require one to three operators, depending on the activities being performed.

5.9.3.4 Residuals

The operation of the WTS will result in the generation of a number of residuals.

Tank Liners: The liners from the Lake Tanks will need to be disposed of at the conclusion of each excavation season. The liners will be characterized and disposed of as indicated in the TODP (Appendix J, Attachment 8), which references the applicable federal and state requirements.

Solids in Lake Tanks: Solids that collect in the Lake Tanks will need to be disposed of at the conclusion of each excavation season. The solids will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

Chemical Sludge: The contact water is expected to contain solids from the waste material in the excavation. It is anticipated that coagulants, organosulfide, and/or polymers will result in the precipitation of metals and removal of suspended solids. The resulting sludge will be withdrawn as the underflow of the inclined plate clarifier. The settled solids will be directed to sludge dewatering boxes where it is estimated that it will be gravity-thickened to a solids concentration of up to 6 to 8 percent (mass basis). Treatability testing showed that the clarifier underflow can be thickened easily. However, provisions for polymer addition are being included in the design to provide enhanced thickening. During operation of the WTS, thickened chemical sludge may be generated at a rate of approximately 700 pounds (lbs) per hour (dry solids basis). Once dewatered, the sludge dewatering boxes will be transported to the impacted solids dewatering pad for solidification and off-site disposal.

Spent Filter Bags/Cartridges: Filter bags/cartridges will become fouled with solids as the treatment system operates. These fouled filters will need to be removed and replaced. The spent filter bags will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

Exhausted GAC Media: GAC media has a finite capacity to remove dissolved constituents (including metals and dioxins and furans) from water. As previously noted, the GAC vessels will be operated in a lead-lag configuration. The discharges of both the lead and lag GAC vessels will be monitored to identify when the GAC media is exhausted. When concentrations of COPCs are detected at elevated levels in the water in the lead GAC vessel, the media in this vessel will be removed and replaced. Once back in service, this vessel will become the lag vessel, and the previous lag vessel will be operated as the lead vessel. The spent media will either be regenerated or will be characterized and disposed of as indicated in the TODP, which references the applicable federal and state requirements.

It is anticipated that all of the spent residuals will be disposed of as RCRA non-hazardous waste, as was the case for these spent residuals during the Southern Impoundment RA.

5.9.4 Compliance Monitoring

Routine effluent compliance monitoring requirements associated with the WTS are expected to include pH, TSS, metals, and dioxins and furans. Treated effluent samples from the WTS will need to be collected from a specified compliance monitoring point on the effluent line to the San Jacinto River. In accordance with 30 TAC Part 1 Chapter 319 Subchapter A Rule 319.5, Section A, (30 TAC 319.5 (a)), samples and measurements of the effluent will be taken at a location following the last treatment unit. Monitoring frequencies and sample types from 30 TAC 319.9 (c) Table 3 (for treatment units with effluent flow from 0.50 million gpd to less than 2.00 million gpd) are identified in Table 5-J, below:

Table 5-J Monitoring Frequencies and Sample Type

Parameter	Minimum Frequency of Measurement [1]	Standard Analytical TAT (business days)[2]	Sample Type
Flow	1 per operating shift	---	Instantaneous
pH	1 when effluent storage tank is ready for discharge	---	Grab
TSS[1]	1 when effluent storage tank is ready for discharge	3-5 days	Composite
Metals[1]	1 when effluent storage tank is ready for discharge	3-5 days	Composite
Dioxin/Furans[1]	1 when effluent storage tank is ready for discharge	7 days	Composite

Notes:

1 Samples will be collected from effluent storage tanks.

2 Flow rate and pH data will be collected on-site using real-time in-line monitors.

Process monitoring samples will also be collected within the treatment process to inform necessary operational adjustments, such as chemical dose refinement. During pilot testing, clarifier effluent and filter effluent turbidity were measured to evaluate performance of the system and adjust chemical dosage rates. Real-time turbidity readings (post clarifier, post filtration, post GAC) will be used as an indicator for operational performance as related to TSS and dioxin and furans. In addition, process monitoring samples will be collected within the treatment process (e.g., influent, post clarifier, post filtration, post lead GAC column) to inform necessary operational adjustments, such as chemical dose optimization and GAC change out. As discussed, turbidity will be monitored through online instrumentation to evaluate treatment system performance and adjust operations as needed. Actions to be taken in response to operational parameter monitoring may be incorporated into a future treatment system monitoring plan. Actions may include turning off pumps upon high turbidity.

Determination of discharge criteria is discussed in Section 3.4.1, with specific criteria specified in Table 3-2.

5.10 Monitoring and Controls

Monitoring and controls may be implemented during the RA at the Northern Impoundment to prevent releases of impacted material to the surrounding land, water, or air. The specific controls will be developed and/or refined in conjunction with the RC and will be included in revisions or modifications to the SWMP (Appendix J; Attachment 5) and CQA/QCP (Appendix J; Attachment 6). A summary is included in the following sections.

5.10.1 Dust Control

During implementation, the RC will be required to use methods that minimize production of dust from construction operations. The RC may be instructed to use potable water for potential misting operations to prevent airborne dust from dispersing into the atmosphere. Further detail is included in the SWMP (Appendix J; Attachment 5).

5.10.2 Stormwater Pollution Prevention Plan and Controls (SWPPP) and BMPs

Prior to beginning construction activities on the Northern Impoundment, soil erosion and sediment controls may be implemented. These structures would either be put and remain in place and be maintained throughout the implementation of the RA or may be put in place and maintained for a given work season.

When removing waste material, the excavation will need to be maintained to be free of water as much as possible. Within the confines of the BMP around the seasonal cell, 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. To the extent possible, measures will be put in place to segregate non-contact water (water that falls on the TCRA armored cap, BMP Soil Buttress area, and/or areas that have been confirmed clean) from contact water (water that has come into direct contact with waste material). In addition to stormwater controls outside of the excavation limits, the RC will provide, operate, and maintain dewatering equipment appropriately sized to maintain an excavation to be free of water, to the extent possible. The RC may be required to ensure that the pumping equipment, machinery, and tankage be in good working condition for potential emergencies, including power outages, and that appropriately trained workers be employed to operate the pumping equipment. All contact water will be pumped to the water storage tanks for eventual treatment and discharge.

The RC will also be responsible for managing any stormwater that may come into contact with temporarily staged and stockpiled excavated material. The dewatering pads and decontamination pads will be maintained by the RC to contain, collect, and transfer contact water to the water storage tanks for treatment. Stormwater that has not been in contact with impacted material would be discharged in accordance with the SWPPP that the RC will be required to develop. Details of the dewatering pads, overburden stockpiles, and decontamination pads are shown on Drawings C-24 through C-26 in Appendix G.

Excavation dewatering may employ methods such as sheeting and shoring; groundwater control systems; surface or free water control systems employing ditches, diversions, drains, pipes and/or pumps; and any other measures necessary to enable the removal of waste material in as dry of a condition, as possible. The RC will be required to use best management practices for the provision of all dewatering and water removal activities. A SWPPP will be developed for the Northern Impoundment excavation program prior to commencement of any waste material removal work. Further detail is included in the SWMP (Appendix J; Attachment 5)

5.10.3 Odors

There is potential for odors resulting from the Northern Impoundment RA or associated activities. Odors are most likely to occur during excavation activities when previously buried material are unearthed and exposed to air. As needed, the RC will implement odor mitigation and suppression measures during the implementation of the Northern Impoundment RA. Further detail is included in the SWMP (Appendix J; Attachment 5)

5.10.4 Turbidity Controls and Monitoring

The BMP and FRP barrier wall will be placed outside the TCRA armored cap, and thus will not be installed through waste material. Turbidity controls (e.g., turbidity curtains) are planned to be utilized during installation and removal of the BMP and FRP barrier walls as a construction best practice to limit the potential for off-site migration of turbidity. Turbidity monitoring is also planned to be utilized during installation and removal of the sheet and FRP piles as a construction best practice to compare downstream turbidity values with upstream values to monitor any significant contribution from BMP and FRP barrier wall installation and removal to downstream turbidity.

It is anticipated that BMP and FRP barrier wall installation would proceed incrementally in segments from upstream to downstream locations so that vessel movement is aided by the downstream currents. The turbidity curtains would be employed at locations where water flow is away from the work and has the potential for turbidity to be transported with the flow away from the work site. This would be the case for much of the area around the Northern Impoundment, from the northwest corner, along the north and down on the eastern side. On the western side of the Northern Impoundment, flow appears to be towards the impoundment at the corner furthest from I-10. Flow then decreases in location closer to I-10 where water depths are low and a backwater condition exists. The configuration of the turbidity curtain would be such that turbidity migration is mitigated and flow is parallel to the curtain to the extent possible.

During the SDI, and as required by the EPA, turbidity curtains were deployed in the northwest corner of the Northern Impoundment while soil borings were being installed. The initial plan was to utilize impermeable curtains that spanned the full extent of the water column (6 to 14 ft), but due to higher-than-expected water velocities in that area, it was not possible to maintain that configuration and the curtains had to be realigned to use shorter curtains across the deeper areas (ones that did not extend to the river bottom). In light of these challenges, a double layer, permeable Type III curtain extending to one-half the water column depth is being proposed for use during BMP and FRP barrier wall installation and removal. The Type III silt curtain is the most robust class that is commercially available. The use of a permeable curtain of manageable length is expected to help maintain placement and alignment of the curtain.

In addition to the use of silt curtains, monitoring will be performed to confirm that elevated levels of turbidity are not being generated during installation and removal of the sheet piles. Details of this monitoring are provided in the SWMP (Appendix J; Attachment 5). The turbidity monitoring equipment will consist of a buoy with solar charging capabilities, a water quality sonde for collecting turbidity readings, and a dual anchor to the riverbed. Turbidity measurements will be collected in NTUs using a data logger and transmitted in intervals to a database using cellular telemetry. The equipment will also contain a built-in GPS to record and transmit its location.

One turbidity monitoring buoy would be placed upstream of the work to collect background turbidity levels and another one would be placed downstream. Turbidity levels from both monitors would be compared to determine whether the downstream values exceed the upstream by a set threshold. If levels above the thresholds persist, the RC will investigate the source of the turbidity and address it as appropriate (if within RC’s control). Another monitor would be utilized as an early warning monitor that will be maintained in close proximity to the work as it progresses. The data will be used internally by the RC to provide an early indication of changes in typical turbidity readings as part of an adaptive management approach. Turbidity monitoring data would be collected once per hour at the start of work. If turbidity levels are below the thresholds included in the SWMP (Appendix J; Attachment 5), the monitoring frequency will be reduced to once per day thereafter.

5.11 Site Restoration

5.11.1 Removal of the BMP

In all areas, except for the southern wall, the BMP wall will be removed once all waste has been excavated. The BMP will be disassembled in a similar but reversed sequence to how it was installed. The sheet piles can seize or get hung-up in the interlocks due to corrosion over time or due to the presence of the sealant specified to avoid seepage through the interlocks. In such cases, complete removal of the BMP wall may not be possible without tearing the sheets and the sheet piles will be cut or driven below the mudline.

The recently excavated and exposed bank along the southern extent of the impoundment will need to be supported. Therefore, the BMP sheet piles in this area will be left in place but cut down to existing grade. A soil embankment will be placed along the southern edge of the excavation limit by sloping back into the river at an approximate 4:1 slope. Once the buttress is established to elevation 0 ft, the fill within the BMP walls will be removed to elevation 0 ft along with the tie-rods connecting the two walls. The BMP sheet piles will be cut from top of wall to the lowest of elevation +2 ft or at approximately 1 ft depth below the final grade. The fill material between the walls will be reinstalled to the new established top of wall elevation.

Erosion and scour protection (i.e., rip rap) will be placed at specified locations to protect the buttressed shoreline and prevent washout. Hydrodynamic modelling was performed to evaluate the potential scour along the end-state southern edge of the excavation to support the design of the armament of the backfilled slope. The results of the modelling are included in the Hydrodynamic Modelling Report, included as Appendix F.

5.11.2 TxDOT Access Road

Upon completion of the RA activities and removal of the BMP, the TxDOT access road would be restored to pre-construction conditions. This would include removing the access ramp over the BMP, removing additional aggregate fill used to raise the grade of the access road, and grading areas adjacent to the access road. Any modifications to the end-state of the access road will be coordinated through TxDOT.

5.12 Technical Challenges Associated with Design and Implementation

The remedial alternative for the Northern Impoundment outlined in the ROD was based upon data collected during the RI in 2011 and 2012. At the time the ROD was issued in 2017, a limited amount of subsurface data had been collected from the Northern Impoundment. Subsequent analytical results from the post-ROD PDI and SDI demonstrate that the remedial alternatives considered in the Feasibility Study (FS) and the ROD were not informed by the actual conditions that have since been determined to exist at the Northern Impoundment. The actual conditions have in turn had a significant impact on a number of elements of the RD, including: (1) the type and alignment of the BMP wall required to enclose the Northern Impoundment; (2) the safe excavation of impacted material “in the dry” without the risk of hydraulic heave in locations across the Northern Impoundment particularly in the Northwest Corner (3) the safe excavation of impacted material “in the dry” without the BMP being overtopped by the San Jacinto River during a weather event; and (4) a significant extension of the time required to implement the RD.

In addition, the ROD outlines the need to prevent releases to the San Jacinto River from the Northern Impoundment during construction; however, due to the sheer nature and location of the remedial alternative being imposed by the ROD, there is inherent risk associated with its undertaking causing a release to the river during construction that cannot be entirely eliminated during the design. The below section is intended to identify these technical implementation challenges that will impose risks for this project for all parties planning to undertake its construction.

5.12.1 Use of TxDOT ROW

There are two aspects of site access involving the TxDOT ROW that create technical challenges with respect to the implementation of the Revised 100% RD. One involves whether the TxDOT ROW road that borders the Northern Impoundment to the south and is essential to the execution of the RA, will be available to provide access for vehicles into the Northern Impoundment. The second involves whether TxDOT will allow the southern extent of the BMP wall to be constructed within its ROW.

Use of TxDOT ROW to Access the Site

The TxDOT ROW road is the only route to access the Northern Impoundment by land. During the RA, thousands of haul trucks will be required to drive onto the Northern Impoundment to transport the waste material offsite for disposal. This is in addition to access and egress of general site equipment and personnel. To support these activities, the TxDOT ROW road will need to be widened, and the elevation will be increased such that the road will serve as a ramp up over the +10 ft NAVD88 BMP wall into the Northern Impoundment to allow trucks to drive in and out.

Plans by TxDOT to replace and widen the I10 Bridge were not known or addressed in the ROD. TxDOT has not yet completed its design of the replacement bridge or established a construction schedule. Over the course of the RD, the Respondents have been in regular contact with TxDOT about plans for the Northern Impoundment RD and learned from TxDOT that construction of a replacement bridge could begin as soon as 2027 and could last up to 5 years. Given the time period for the RA, the implementation of the two projects will overlap. The concurrent construction of these two major infrastructure projects in the same location is a technical challenge for the implementation of the RA that will remain once this Revised 100% RD is finalized. This challenge will necessarily result in changes to the design and intended plans for the remedial alternative during construction to accommodate the TxDOT project. The preliminary schedule for implementation would necessarily be impacted to the extent there are periods of time during which TxDOT is unwilling to allow use of the ROW for ingress and egress to the Northern Impoundment.

Further, this design relies on TxDOT approving use of its ROW for construction and installation of the BMP, a portion of the BMP wall will be constructed on the ROW and will need to remain there throughout the period of implementation of the RD.

The Respondents were previously informed by the EPA that TxDOT has committed to work with the Respondents to provide access. As part of their efforts to obtain access, and prior to and following submission of the 100% RD, the Respondents attempted to engage TxDOT in discussions regarding the specific timing and terms under which it will allow the Respondents to use the ROW for purposes of the RA. TxDOT, however, has not been in a position to engage in such discussions. As Respondents are still working to obtain TxDOT’s approval to use the ROW; the need for access therefore remains dependent upon TxDOT approval.

5.12.2 Excavation Limits

Effects of Undefined Excavation Limits on BMP Design

The absence of a predefined excavation bottom elevation remains a technical challenge in relation to the BMP design. The elevation (or depth) of the required excavation has a direct effect on the design of the BMP and dictates the type, size, and tip elevations of the pilings. While the double wall system included in the Revised 100% RD can accommodate limited variable excavation elevations, there remains a limit to how many feet of additional excavation it can support without creating conditions that could impair the structural integrity of the BMP. To accommodate this unknown, the entire BMP has been designed to accommodate at least two feet of overexcavation, though overexcavation will remain technically challenging in many places due to the risk of hydraulic heave. In addition, to further reduce the risk from this challenge, the FSP will enable confirmation of excavation bottoms prior to excavation.

Effects of Undefined Excavation Limits on Schedule

The absence of a predefined excavation bottom elevation also presents a challenge in relation to the schedule for the RA. If during the RA, additional volume of material is identified above 30 ng/kg $TEQ_{DF,M}$, then the schedule for the RA construction will be longer as more material will be removed and there could also be delays as post-excavation confirmation sampling results are obtained. This would impose the many challenges (e.g., risk of flooding) on the project to be sustained over longer time periods, compounding the risk. Therefore, to further reduce the risk from this challenge and critical to the successful implementation of the Revised 100% RD, the FSP has been developed to enable the confirmation of excavation bottoms prior to excavation through the use of pre-excavation sampling.

Risk of Hydraulic Heave

Based on data from the SDI (combined with RI and PDI data), it was found that waste material extends to much deeper depths than was known at the time of the ROD. Considering these deeper impacts, significant geotechnical evaluation work was conducted to better understand the stratigraphy and geological conditions and how they could affect implementation of the remedy during excavation in the dry, as it is prescribed by the ROD. The potential for hydraulic heave during excavation in the dry was evaluated across the entire Northern Impoundment during this design and determined to exist in several areas of the Northern Impoundment. This potential for hydraulic heave will remain a risk for the project during construction, however measures are included in Revised 100% RD (as outlined in the Updated Hydraulic Heave Analysis Report) in an attempt to minimize its likelihood during construction.

5.12.3 Uncontrollable Weather Events

Risk of Overtopping and Release During Excavation

The proposed top elevation of the BMP is +10 ft NAVD88 (exterior wall), an elevation which exceeds historical water levels since 1994 during the excavation season proposed. Although the top elevation for the BMP is +10 ft NAVD88 (exterior wall), there is an inherent risk of a flooding event during excavation for the ROD selected remedy which could cause overtopping of the BMP and result in a release of waste material into the river and/or potentially put worker safety at risk. Moreover, when digging in and working below the river surface, the dynamics of the weather and associated river levels create an inherent risk of releases to the river, and there is no guarantee that future river levels during the excavation season will not exceed historical levels. Furthermore, it is not feasible or constructable to simply build a taller cofferdam that can protect against any possible weather event and river elevation while also accommodating equipment and personnel entry into and out of the cofferdam for excavation and waste material removal from below the river; limitations to enable both of these measures exist.

Schedule Interruptions Due to Weather Events

Over the course of the RA construction, the possibility for significant weather events and flooding exists at the work site. A HWPP has been developed to provide guidance on what measure will be undertaken to mitigate the potential consequences of high river levels and flooding at the work site. However, even if the measures in the HWPP are undertaken during RA construction, inevitably there will be an unknown number of demobilizations and remobilizations over the span of the RA construction in attempts to limit the consequences of flooding events. The timing, number, frequency and duration of these demobilizations and remobilizations will be unknown and remain a challenge throughout the RA. This represents a technical challenge inherent in the construction of the remedy selected in the ROD in order to attempt to meet the RAO that prevents releases from the Northern Impoundment to the river and will result in schedule challenges that will most likely lengthen the overall schedule for construction.

5.12.4 Water Treatment

Access to Property for Water Treatment System

Due to lack of usable land in the vicinity of the Northern Impoundment, the WTS will have to be located offsite on a separate piece of property. Approximately 15-20 acres of upland property will be necessary to support RA activities, including water storage and treatment, materials storage, office trailers and parking, truck staging and scales, and sheet pile loadout to marine vessels. Though several properties are being evaluated for long-term access and extensive discussions with property owners have occurred, an agreement for use of such an upland property has not yet been fully secured. Ideally, the offsite property would be located as close to RA activities as possible (and north of the I-10 Bridge), to minimize the distance that water would need to be conveyed for treatment and to minimize the travel distance between the Northern Impoundment and the WTS for site personnel. The details of the future TxDOT bridge replacement project will also affect the options available, as TxDOT's use of its ROW may cut off access to properties located to the west and TxDOT's bridge construction activities could eliminate any option of conveying impacted water to the south under the I-10 Bridge.

6. Sand Separation Area (SSA)

6.1 2019 Sediment Sampling Program

The ROD identifies MNR as the preferred remedial alternative for San Jacinto River sediments in the SSA. The rationale for selection of MNR as the preferred alternative was that the $TEQ_{DF,M}$ concentrations in the SSA are relatively low and there are data indicating that the area is subject to sediment deposition. Modelling of hydrodynamics and sediment transport conducted as part of the Remedial Investigation/Feasibility Study (RI/FS) suggests that the reach of the river adjacent to the SSA is an area of sediment deposition.

In accordance with the PDI-2 Work Plan (GHD, 2019d), sediment samples were collected during PDI-2 field activities from the SSA to meet the following objectives:

– Provide further characterization of the dioxin and furan concentrations in sediment of the SSA.
– Provide a radioisotope analysis of ^{210}Pb and ^{137}Cs to estimate the natural rate of sediment deposition.

^{137}Cs was released into the environment as a result of atmospheric testing of nuclear devices beginning in 1954 with a peak in 1963. Because natural occurrence is extremely rare and its presence can be related to a specific period of time, ^{137}Cs detections are useful in dating sediments. ^{210}Pb is used to calculate deposition rates because it occurs naturally.

Samples were collected from the locations shown on Figure 2-4 using Vibracore sampling devices and a dive team. Collection and analysis of samples were carried out in accordance with the PDI-2 Work Plan (GHD, 2019d).

6.1.1 SSA Analytical Sampling

Thirty-six sediment samples were collected for analysis of dioxins and furans. Samples were collected at the nine locations identified on Figure 2-4. At each location, samples were collected at depth intervals of 0 to 1 foot, 1 to 2 ft, 2 to 4 ft, and 4 to 6 ft below the sediment/surface water interface. Eurofins TestAmerica analyzed the samples for dioxins and furans by EPA Method 1613B and for percent solids by ASTM D2216.

6.1.2 SSA Isotope Sampling

Ninety-nine sediment samples were collected for analysis of ^{137}Cs and ^{210}Pb. Samples were collected at the same nine locations sampled for analysis of dioxins and furans. Samples were collected at depth intervals of 2.5 cm (0.98 inches) from the sediment/surface water interface to a depth of 82.5 cm (32.5 inches). Eleven intervals were sampled at each location. Teledyne Brown Engineering, Inc. analyzed all of the sediment samples for ^{137}Cs and ^{210}Pb by EPA Method 901.1.

6.1.3 SSA Investigation Results

6.1.3.1 SSA Analytical Results

Concentrations of $TEQ_{DF,M}$ are below the risk-based protective level of 30 ng/kg (as determined by the EPA in the ROD) in the top 24 inches of all but one of the SSA sampling locations - SJSSA06 (see Table 6-1 and Figure 2-4).

The laboratory report and data validation report for dioxins and furans are provided in Appendix E.

6.1.3.2 SSA Isotope Results

Cesium-137

^{137}Cs was not detected in any of the 99 samples. Because it was not detected, it can be concluded that sediment to a depth of 82.5 cm (2.71 ft) has been deposited in all areas of the SSA since the mid-1960s. This corresponds to an overall deposition rate of approximately 1.5 cm per year (cm/year).

The laboratory report and data validation report for ^{137}Cs are provided in Appendix E.

Lead-210

Radioactivity of ^{210}Pb decreases with depth at SJSSA01, SJSSA04, SJSSA07, and SJSSA02. The decrease in activity indicates that deposition is occurring at estimated rates ranging from 0.77 cm/year to 3.5 cm/year.

Radioactivity of ^{210}Pb at near shore location SJSSA05 increases with depth, indicating that erosion has occurred at this location. Radioactivity of ^{210}Pb at SJSSA08, SJSSA03, SJSSA06, and SJSSA09 is variable. This variability could be due to alternating periods of erosion and deposition caused by boat traffic, storm events, and/or natural river flows.

Table 6-1 summarizes the results for ^{210}Pb. The laboratory report and data validation report for ^{210}Pb are provided in Appendix E.

6.1.4 SSA Conclusions

Results of the 2019 sampling event indicate that, due to no radioactivity of ^{137}Cs above detection limits, the SSA has generally been depositional since the mid-1960s. Radioactivity of ^{210}Pb indicates that deposition is occurring in four locations at estimated rates of approximately 0.77 cm/year to 3.5 cm/year but that activities may be occurring in the SSA that are affecting deposition in other locations in the area. Concentrations of $TEQ_{DF, M}$ are below the risk-based protective level of 30 ng/kg (as determined by the EPA in the ROD) in the top 24 inches of all but one of the SSA sampling locations - SJSSA06 (see Table 6-1 and Figure 2-4). Changes in the shoreline are visible in historical aerials provided in Appendix E, Sand Separation Area Supporting Documents. The SSA has been superimposed on the historical aerial images. Many of the changes in the shoreline are due to man-made activities.

6.2 Monitored Natural Recovery

The ROD selected MNR as the remedy for sediments in the SSA. The EPA selected MNR on the basis of the relatively low concentrations of dioxins and furans in sediment, low potential for risk to human and ecological receptors, and evidence of net deposition of sediment. Data generated from the PDI-2 sampling event indicate that varying degrees of deposition are occurring in most of the mid shore and far shore areas. With the exception of the one near shore area (location SJSSA06), concentrations of $TEQ_{DF, M}$ at depths less than 24 inches are at or below the level that EPA identified in the ROD as being protective of human and ecological receptors. In one of the mid shore sample locations (SJSSA05), erosion appears to be occurring, however concentrations of $TEQ_{DF, M}$ at all depths at this location are below EPA's protective level of 30 ng/kg. In summary, eight out of nine total sample locations at depths less than 24 inches have $TEQ_{DF, M}$ concentrations below 30 ng/kg. This is consistent with the results observed during the RI. MNR activities moving forward include additional monitoring at the nine locations sampled for PDI-2 to (1) confirm that concentrations of $TEQ_{DF,M}$ remain below 30 ng/kg at depths less than 24 inches at the eight locations identified in PDI-2 and (2) and further monitoring of concentrations at sample location SJSSA06.

The MNR Plan is included as Attachment 9 in Appendix J. The MNR Plan discusses the processes of MNR as related to dioxins and furans, the site-specific characteristics considered in further development of the plan, parameters for monitoring MNR, sampling frequency, and the decision rule for evaluating the effectiveness of MNR. The implementation of ICs will also be considered for the area around SJSSA06 (Appendix J, Attachment 7).

7. Environmental Footprint (Greener Clean-Ups)

EPA's *Principals for Greener Clean-Ups* (EPA, 2009) have been considered in the development of the Northern Impoundment RD. The EPA and state agencies have developed a framework outlining the desired outcomes of a potential standard for greener clean-ups. The framework focuses on five principals associated with a clean-up project's environmental footprint. These principals are listed below along with the potential methods by which they may be incorporated into the Northern Impoundment RA.

Minimizing Total Energy Use and Maximizing Use of Renewable Energy. This includes reducing total energy use while also identifying means to increase the use of renewable energies throughout the clean-up. The selected RC may incorporate this principle into the RD by:

– Limiting traffic at the Northern Impoundment by requiring workers to carpool.

– Requiring the RC to, if appropriate, to use energy efficient equipment or vehicles.

Minimizing Air Pollutants and Greenhouse Gas Emissions. This includes reducing total air emissions, including emissions of air pollutants and GHGs, throughout the RA. The selected RC may incorporate this principle into the RD by:

– Implementing an Air Monitoring Plan to control dust in and around the Northern Impoundment.

– Requiring air emission control devices on equipment that deliver solidification agents.

– Specifying the use of electricity at the laydown and staging areas, where available, rather than portable diesel generators.

Minimizing Water Use and Impacts to Water Resources. This includes minimizing the use of water and impacts to water resources throughout the RA. The selected RC may incorporate this principle into the RD by:

– Employing best management practices for stormwater, erosion, and sedimentation control, as detailed in a SWPPP to be developed prior to the RA.

Reduce, Reuse, and Recycle Materials and Waste. This includes minimizing the use of virgin materials and generation of waste throughout the RA as well as maximizing the use of recycled materials. The selected RC may incorporate this principle into the RD by:

– Using recycled rock from the TCRA armored cap for restoration of the Northern Impoundment area.

– Using recycled non-impacted material from the historic central and southern berms on-site to construct site features and/or SWPPP controls.

– Using recycled aggregate from inside the two walls of the BMP as cover at the completion of the RA.

– Implementing a recycling program for workers.

– Considering recycled material when purchasing material for the RA.

– Reuse of SWPPP controls, where possible.

Protect Land and the Environment. This includes reducing impacts to land and the environment throughout the clean-up. The selected RC may incorporate this principle into the RD by:

– Minimizing the footprint of disturbed areas at the laydown and support areas, to the extent practicable.

8. Drawings and Specifications

8.1 Design Drawings

The Revised 100% RD design drawings are presented in Appendix G and include the following:

– 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 - Dredging Northwest Corner Works Plan.
– Drawing C-46 - Dredging Northwest Corner Dredging Controls.
– Drawing C-47 - Dredging Northwest Corner Dry Excavation.
– Drawing C-48 - Dredging Northwest Corner Wet Excavation.
– Drawing C-49 - Dredging Northwest Corner Sections - 1 of 2.
– Drawing C-50 - Dredging Northwest Corner Sections - 2 of 2.
– Drawing C-51 - Dredging Northwest Corner Sequencing - 1 of 3.
– Drawing C-52 - Dredging Northwest Corner Sequencing - 2 of 3.
– Drawing C-53 - Dredging Northwest Corner Sequencing - 3 of 3.
– Drawing C-54 - Dredging Northwest Corner Final Grade.
– Drawing C-55 - Dredging Northwest Corner Dredging Details.
– Drawing C-56 - Restoration Sections 1 of 2.
– Drawing C-57 - Restoration Sections 2 of 2.
– 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 S-06 - FRP Barrier Wall.
– Drawing P-00A - Water Treatment System Process Flow Diagram Symbols.
– Drawing P-00B - Water Treatment System Process Flow Diagram Schedules.
– Drawing P-001 - Water Treatment System Process Flow Diagram (Non-Contact Water).
– Drawing P-002 - Water Treatment System Process Flow Diagram (Contact Water)
– Drawing P-003 - Water Treatment System P&ID (Non-Contact Water) (1 of 3).
– Drawing P-004 - Water Treatment System P&ID (Non-Contact Water) (2 of 3).
– Drawing P-005 - Water Treatment System P&ID (Non-Contact Water) (3 of 3).
– Drawing P-006 - Water Treatment System P&ID (Contact Water) (1 of 4).
– Drawing P-007 - Water Treatment System P&ID (Contact Water) (2 of 4).
– Drawing P-008 - Water Treatment System P&ID (Contact Water) (3 of 4).
– Drawing P-009 - Water Treatment System P&ID (Contact Water) (4 of 4).
– Drawing P-010 - Water Treatment System Site Plan (Non-Contact Water).
– Drawing P-011 - Water Treatment System Equipment Layout (Non-Contact Water).
– Drawing P-012 - Water Treatment System Site Plan (Contact Water).

- Drawing P-013 - Water Treatment System Equipment Layout (Contact Water) (1 of 2).
- Drawing P-014 - Water Treatment System Equipment Layout (Contact Water) (2 of 2).
- Drawing P-015 - Mechanical Details 1 of 1.
- Drawing P-016 - Helical Pile Details.
- Drawing P-017 - Mechanical Schedule.

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

8.2 Technical Specifications

To supplement the Northern Impoundment Revised 100% RD design drawings, technical specifications are presented in Appendix H and include the following:

- Section 00 01 10 - Table of Contents.
- Section 00 01 20 - Seals.
- Section 01 10 00 - Summary.
- Section 01 30 00 - Administrative Requirements.
- Section 01 33 00 - Submittal Procedures.
- Section 01 35 00 - Temporary Traffic Controls.
- Section 01 35 29 - Health and Safety Requirements.
- Section 01 40 00 - Quality Requirements.
- Section 01 50 00 - Temporary Facilities and Controls.
- Section 01 57 13 - Temporary Soil Erosion and Sediment Controls.
- Section 01 57 19 - Temporary Environmental Controls.
- Section 01 60 00 - Product Requirements.
- Section 01 70 00 - Execution and Closeout Requirements.
- Section 01 91 00 - Water Treatment Consumables.
- Section 01 91 20 - Facility Testing and Commissioning.
- Section 02 55 00 - Waste Material Solidification.
- Section 02 61 14 - Material Handling and Transportation.
- Section 02 61 16 - Off-Site Transportation and Disposal.
- Section 22 05 03 - Pipe Data Sheet-PVDF Tubing and Carrier Piping.
- Section 23 05 53 - Identification for Piping and Equipment.
- Section 31 05 19.13 - Geotextiles for Earthwork.
- Section 31 10 00 - Site Clearing.
- Section 31 23 16 - Excavation.
- Section 31 23 19 - Dewatering.
- Section 31 23 23 - Fill.
- Section 31 35 26.16 - Geomembranes.
- Section 31 37 00 - Riprap.
- Section 31 41 16 - Sheet Piles.
- Section 32 31 13 - Chain Link Fences and Gates.
- Section 32 92 19 - Seeding.

- Section 35 24 00 - Dredging.
- Section 35 49 25 - Turbidity Curtain.
- Section 40 05 13 - Common Work Results for Process Piping.
- Section 40 05 33 - High Density Polyethylene Process Pipe.
- Section 40 05 51 - Common Requirements for Process Valves.
- Section 40 70 00 - Instrumentation for Process Systems.
- Section 46 07 01 - Water Treatment System (WTS).
- Attachment A - Residual Management Plan.
- Attachment B - Pre-Excavation Stratigraphic Borings and Piezometers.
- Attachment C - Treatability Testing to Identify Reagents and Dose for Enhanced Settling.

9. Supporting Deliverables

Pursuant to the SOW, supporting deliverables have been prepared as part of the Revised 100% RD, as summarized below.

- ***HASP***
- ***ERP***
- ***FSP***
- ***QAPP***
- ***SWMP***
- ***CQAQCP***
- ***ICIAP***
- ***TODP***
- ***MNR Plan***
- ***HWPP***

Most of these plans consider that the RC will be required to prepare its own plans that address the topics covered by these plans and detail the means and measures to be implemented to accomplish the objectives of such plans.

9.1 Health and Safety Plan

The Construction HASP (Attachment 1 in Appendix J) has been prepared in accordance with 29 CFR 1910 and 1926 to provide protection of human health and the environment during activities performed to implement the Northern Impoundment RA. It includes all physical, chemical and all other hazards posed by the work required to perform the Northern Impoundment RA.

9.2 Emergency Response Plan

The ERP (Attachment 2 in Appendix J) describes procedures to be used in the event that there is an emergency while work to implement the Northern Impoundment RA is being performed. The ERP includes procedures with respect to the entity(ies) responsible for responding to an emergency, the plan for meeting with those involved in the response, contingency plans for spills, and release reporting and response.

9.3 Field Sampling Plan

The FSP (Attachment 3 in Appendix J) describes the sampling activities for all media to be sampled during work to implement the Northern Impoundment RA. The FSP provides the rationale for sample collection and describes the protocol for sample handling and analysis.

9.4 Quality Assurance Project Plan

The QAPP (Attachment 4 in Appendix J) provides an explanation of the quality assurance and quality control procedures and Chain-of-Custody procedures for all sampling to implement the Northern Impoundment RA. This includes quality assurance during data generation and acquisition and during data validation and review.

9.5 Site-Wide Monitoring Plan

The SWMP (Attachment 5 in Appendix J) describes the procedures for monitoring to prevent the potential spread or off-site migration of contaminated media from the Northern Impoundment during and following implementation of the Northern Impoundment RA.

9.6 Construction Quality Assurance/Quality Control Plan

The CQA/QCP (Attachment 6 in Appendix J) describes the planned and systematic activities that verify that the remedial construction to implement the Northern Impoundment RA will meet requirements consistent with clean-up goals and performance requirements set forth in the ROD.

9.7 Institutional Controls Implementation and Assurance Plan

The ICIAP (Attachment 7 in Appendix J) describes the institutional controls expected to be applicable to the SSA and the process for developing and implementing them.

9.8 Transportation and Off-Site Disposal Plan

The TODP (Attachment 8 in Appendix J) details, for the Northern Impoundment RA, waste characterization activities and disposal options. It addresses the transportation routes for off-site shipments of waste material during implementation of the Northern Impoundment RA, identifies procedures to protect any communities that may be affected by such truck shipments, and describes the procedures for on-site management and loading of the waste materials.

9.9 Monitored Natural Recovery Plan (Operations & Maintenance Plan)

The MNR Plan (Attachment 9 in Appendix J), describes for the SSA the routine monitoring and testing to be conducted and procedures for data collection and evaluation, record keeping and reporting of data to be followed, after completion of the Northern Impoundment RA. As discussed with the EPA on May 7, 2020, the MNR Plan takes the place of the O&M Plan referred to in the SOW.

9.10 High-Water Preparedness Plan

The HWPP (Attachment 10 in Appendix J) describes the specific procedures to be followed during the Northern Impoundment RA for the protection of equipment, employees, and the environment during high-water, flooding, or severe weather events at the work site.

9.11 Operations & Maintenance Manual

Per discussion with the EPA, this plan is not anticipated to be necessary.

10. References

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- GHD, 2021c. *Supplemental Design Investigation Work Plan - Revision 1*, San Jacinto River Waste Pits Superfund Site. Prepared for McGinnes Industrial Maintenance Corporation, International Paper Company, and U.S. Environmental Protection Agency, Region 6. May 21, 2021.
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- GHD, 2021e. Letter to A. Howard, U.S. Environmental Protection Agency, regarding Turbidity Curtain Deployment During the Supplemental Design Investigation, dated September 28, 2021. GHD Services Inc.
- GHD, 2021f. Letter to A. Howard, U.S. Environmental Protection Agency, regarding Request for Northern Impoundment Schedule Extension, dated October 1, 2021. GHD Services Inc.

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Table 1-1

Response to EPA Comments on 100% Remedial Design
Revised Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site

Item No.	Comments Letter PDF Page	Reference	Comment	Response to Comment
1	3	100% RD Report - General Comment on the 100% RD	Multiple comments below suggest or require changes that could impact different parts of the 100% RD beyond the sections specifically referenced, including sections in other parts of the 100% RD Report and also its appendices. The Respondents need to ensure that when changes are made that the changes are tracked throughout the entire 100% RD and that all impacted sections and appendices are updated and internally consistent. This will prevent confusion or introduction of uncertainties that could require additional clarification; facilitate review of the revised deliverable; and clearly define the requirements and objectives for the selected Remedial Contractor (RC) as it implements the Remedial Design (RD).	This comment is received and noted. Respondents have made an effort to make such changes throughout the entire Revised 100% RD.
2	3	100% RD Report - General Comment on the 100% RD	The 100% RD allows the RC to decide specific means and methods for implementation of some aspects of the selected remedy. The RC's proposed means and methods must be provided to EPA for review and approval prior to remedy implementation through Respondents' submission to EPA of updated supporting deliverables, plans required pursuant to the Design Specifications, and if required, an updated RD deliverable.	This comment is received and noted. The RC's proposed means and methods will be provided to EPA in updated supporting deliverables, plans, and any other updated RD components for EPA review and approval.
3	3	100% RD Report - Section 2.4 PDI and SDI Conclusions and Recommendations	In the 3rd paragraph, 3rd line, "in the dry" should be added after "removed" to further clarify that the risk is posed based on excavation in the dry due to the potential for hydraulic heave.	The text has been revised to address the comment.
4	3	100% RD Report - Section 2.3.4 Waste Characterization Sampling	This section discusses the waste characterization sampling that has been conducted to date for the Northern Impoundments. The last sentence indicates that the data is presented in **Appendix A** and summarized in **Table 2-5**. Please update **Table 2-5** to include any relevant regulatory levels for the contaminants analyzed by TCLP.	Table 2-5 has been revised to address the comment.
5	3	100% RD Report - Section 3.4.2.3.1 Filtration Pilot Test Results	The third paragraph states that due to the strong correlation between total suspended solids (TSS) and dioxin and furan levels, TSS and turbidity as shown in **Figure 3-A** could potentially be used to indicate if the dioxin/furan level is below the Minimum Limit (ML). Please provide the data or references that support this statement. Also, please add the correlation coefficient R2 to **Figure 3-A** and reference of discussion on this issue in **Section 5.9**.	The text and Figure 3-A have been revised to address the comment. The data is provided in Figure 3-A.
6	4	100% RD Report - Section 3.4.1.1 Compliance with Texas Surface Water Quality Standard - Dioxins and Furans	The term Minimum Limit is not clearly defined in the 2nd paragraph, 3rd bullet. It is not clear if this is the same as the Limit of Detection and whether it is below the Method Detection Limit or the Limit of Quantification.	The Minimum Level (ML) is defined in the 4th bullet of this section as "The ML for each analyte is defined as the level at which the entire analytical system must give a recognizable signal and acceptable calibration point. It is equivalent to the concentration of the lowest calibration standard, assuming that all method specified sample weights, volumes, and clean up procedures have been employed.", which is directly from EPA correspondence dated February 18, 2020 (EPA, 2020b; included in Appendix D).
7	4	100% RD Report - Section 3.7 Treatability Study Conclusions	Under ***Water*** strike out "level of" from "level of TSS" in the first bullet	The text has been revised to address the comment.
8	4	100% RD Report - Section 5.1 Remedial Design Background	In the 3rd paragraph, 1st sentence, provide the maximum depth of expected excavation for implementation of the ROD as well as the average depth. This will provide context for the currently understood maximum depth of excavation of -28 ft NAVD88.	The text has been revised to address the comment.
9	4	100% RD Report - Section 5.1 Remedial Design Background – *Approach B Water Treatability Testing*	In the 3rd paragraph, the 100% RD Report states that water treatability was deemed to be technically infeasible. However, no attempts were made to treat the pool with flocculants or manage the residuals as part of the treatability testing. Because the treatability study was limited in scope, it was not sufficient to support a determination that water treatability is infeasible. The design currently provides for excavation through the water column for parts of the Site and water treatment as successfully performed at the Southern Impoundment for the dredge water. In addition, as previously commented by the EPA in April 2024, the RD should have a contingency plan to use an alternative method to remove the waste if the risk of hydraulic heave is detected and it is determined to not be safe to excavate in areas with planned excavation in the dry. This alternate method must be in compliance with the ROD, which includes excavation through the water column by mechanical dredging, and mechanical dredging is an identified heave mitigation option in Respondents' specifications (**Appendix H**). Because of the planned and potential use of excavation through the water column at the Site, the 100% RD should clarify the limited purpose of the Approach B water treatability testing and also its limited scope.	This treatability testing was strictly limited to an approach where material would be excavated through a water column and the water would be treated through recirculation and filtration in the excavation. The text has been revised to clarify this limited purpose of the Approach B water treatability testing.
10	4	100% RD Report - Section 5.2 Remedial Approach - General Comment	Other than the use of mechanical dredging, managing water elevations and sand/granular material placement in the Northwest Corner, no mention is made in the Report of other potential hydraulic heave mitigation strategies which are discussed in the Hydraulic Heave Report or suggested by the EPA and the USACE in EPA's prior comments and correspondence. For areas with potential heave outside of the Northwest Corner, the specifications identify only three potential excavation options in **Part 31 23 16 Excavation, Section 3.4 Heave Mitigation**, without additional options specified or potential methods to evaluate any other options later proposed by the RC. If evaluation and selection of mitigation options are to be left entirely up to the RC, the language in this section needs to be clarified to indicate that the RC will develop and present heave mitigation strategies in the Heave Mitigation Plan which should be provided for EPA review and approval prior to commencement of the excavation activities.	Section 31 23 16 Excavation, Paragraph 1.3.C, of the Design Specifications, requires the RC to submit a Heave Mitigation Plan and "Provide detailed procedures for excavation in the potential heave areas that includes provisions for off-setting heave." The RC has the option to consider mitigation measures listed in Paragraph 3.4 of the specification or propose other measures that will off-set heave. As stated in Response to EPA Comment #2, supporting plans that are updated with RC means and methods (including the Heave Mitigation Plan) will be provided to EPA for review and approval.
11	5	100% RD Report - Section 5.2 Remedial Approach - *BMP Alignment and Lateral Excavation Event*	In its 24 September 2024 Memo to the EPA regarding the 100% RD, TxDOT stated that: TxDOT's contractor "…has asked several times that the cofferdam be revisited and redesigned to minimize the footprint / encroachment within the ROW. As currently proposed, the cofferdam will interfere with TxDOT's proposed bridge pier protection system. We have reviewed the proposed cross-sections cut thru that section of the wall (Sections T, U, V, W, X and Y of the 100% set of plans (the relevant sheets are attached)) and there is very little excavation proposed in front of the wall or any significant excavation is considerably further away from the cofferdam. With such little excavation, there is not a need for a cofferdam with 30 ft between sheet pile walls. We request that the first sheet pile wall of the double wall cofferdam be placed 5 ft inside TxDOT's ROW and the second sheet pile wall be placed 20 ft from the first. This would result in a 25 ft of total encroachment and eliminate the overlap with the bridge pier protection system. In addition, this would allow more room for access for the bridge construction." The memo from TxDOT with attachments has been provided previously to the Respondents (and is attached to this document as well).	As described in Section 6.2.7 (Appendix I), several different options of the wall were considered for the southern alignment and the double wall system was the only workable solution. The 30-ft wide double wall system with a 30-ft wide soil buttress on the interior is required to provide a balanced system to withstand the high water levels on the exterior while accommodating the required excavation depths on the interior to remove all waste material as required by the ROD. Respondents are continuing to engage TxDOT and EPA on the BMP alignment on the TxDOT right-of-way in order to progress both projects forward. Respondents, EPA, and TxDOT have scheduled a call in December to continue discussions regarding the southern alignment and double wall system.
12	5	100% RD Report - Section 5.2 Remedial Approach - Seasonal Excavation and Top of Wall Elevation	It is discussed in this section that water that accumulates inside the area contained by the BMP wall during the non-excavation seasons will be returned to the river after being processed. Please provide additional discussion on what "processed" involves or references to the relevant sections of the design and specifications that describe how this water will be handled and treated, including if it is segregated into "contact" and "non-contact" water.	The text has been revised to address the comment and references Section 5.9.2 which describes how the non-contact water will be processed.
13	5	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	In the third paragraph, revise the second sentence to say that since 1994 there were no highwater events during the period from November to April that exceeded an elevation of +10 ft NAVD88 "in the vicinity of the Northern Impoundments." The 100% RD Report should also clarify that Respondents' hindcasting, as depicted in **Figure 5-2**, indicates that there have been no highwater events since 1994 during any month in the vicinity of the Northern Impoundments that have reached or exceeded an elevation of +10 feet NAVD88, with the exception of Hurricane Harvey in 2017. **Figure 5-2** and/or **Figure 5-3** should be the correct citation for this information, not **Figure 5-1**, which shows data from Sheldon gage; there were a few highwater events from the Sheldon gage exceeding an elevation of +10 ft NAVD88 during the period of November to April. This section should also reference the additional information that is provided in **Attachment 10** of **Appendix J**.	The text has been revised to address the comment.

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Item No.	Comments Letter PDF Page	Reference	Comment	Response to Comment
14	5	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	This section states that "[a]t the end of each excavation season, the exposed slope between the seasonal cell and the remaining Time Critical Removal Action (TCRA) armored cap will be covered with a cap, consistent with the design used during the TCRA." Does this other cap refer to the cover required in **Design Specification Part 31 23 16**, as shown in **Drawing C-21**? **Drawing C-21** references a detail drawing for this cover that is not included. Detailed information about this cover must be included in the final drawings to provide the RC with complete information about how to perform the Site remediation. Lack of this information could potentially lead to the RC constructing the cover in a manner that could be unprotective.	Details for the temporary cover have been added to Design Drawing C-06 and the C-06 detail reference has been added to Drawing C-21.
15	6	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	The 100% RD Report states that the water treatment system (WTS) and other equipment will be demobilized or partially demobilized during the non-excavation season and re-installed prior to the next excavation season. Repeated demobilization and remobilization create the potential for new issues and problems as equipment is re-installed and reconnected after prior demobilization. What plans and specifications discuss the procedures for demobilizing and reinstalling the WTS, including re-installation, inspection and equipment testing, to ensure their continued safe and effective operation? The current specifications and the Construction Quality Assurance/Quality Control Plan **Appendix J, Attachment 6**, appear focused on initial installation, and do not appear to address seasonal demobilization/remobilization, not do contingency plans for adverse weather events appear to address more prolonged seasonal demobilization. If not already addressed, the 100% RD should include a requirement for a detailed plan to address demobilization/remobilization procedures for reinstallation of the WTS, equipment and facilities, with guidance regarding the plan's contents.	Section 46 07 01 - Water Treatment System of the Design Specifications (Appendix H) has been revised to include a requirement for the RC to submit a Mobilization and Demobilization Plan that addresses seasonal demobilization/remobilization.
16	6	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	The Respondents have indicated that the BMP will not be intentionally flooded between excavation seasons, but are there any scenarios in which water may be introduced intentionally to the BMP, for instance to address seepage or mitigate heave, including between excavation seasons (other than filling for 'makeup water' in the Northwest Corner as discussed in **Section 5.7.3.2.5 Dredging and Verification Procedures**)? If so, how would that water be managed?	At this time, the design does not provide for the BMP to be flooded between excavation seasons. If water is intentionally introduced inside the BMP for some other use (i.e., heave mitigation) then the water will be managed in accordance with Section 5.9.2.
17	6	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	Discuss the timing and a more detailed process for how the water in the Northwest Corner, including mechanical dredge water, will be managed and treated.	Management of water in the Northwest Corner is described in more detail in Section 5.7.3.2.
18	6	100% RD Report - Section 5.2 Remedial Approach - *Seasonal Excavation and Top of Wall Elevation*	The June 90% RD presented intentional flooding of the BMP as a method to protect the structural integrity of the BMP because: 1) water will provide support for the BMP wall and off-set the forces acting on the BMP during a flood event; and 2) it would prevent scour from any uncontrolled overtopping in the event of a high-water event. In Respondents' Plan provided in response to the EPA's January 2024 Notice of Serious Deficiency, they stated both that "[i]ntentional flooding of the BMP is not required to maintain the structural integrity of the BMP" and "[i]ntentional flooding would also decrease differential pressures across the wall further increasing the factor of safety against compromising the BMP structural integrity" (**Section 3.7.2 of the Plan**). In EPA's Supplemental Comments on the 90% RD, EPA commented that while intentional flooding is perhaps not necessary for the structural integrity of the BMP, Respondents' statements indicate it affects at least the factor of safety for the BMP's structural integrity; for this reason, EPA requested that the relationship between intentional flooding and the factor of safety for the BMP should be clarified. This EPA comment has not been addressed in the 100% RD. The 100% RD should explain why the intentional flooding provided for in the 90% RD does or does not affect the factor of safety for the BMP's structural integrity given their prior statements.	Intentional flooding was proposed in the 90% RD as one approach to mitigate potential scouring on the interior of the BMP from uncontrolled overtopping during a high-water event. An additional benefit of the intentional flooding, although not required for BMP stability, was the offset in lateral forces acting on the exterior of the BMP. In the 100% RD, a different approach is being proposed to mitigate scouring on the interior of the BMP by using a grouted rip-rap layer. Also, at this time, the design does not provide for the BMP to be intentionally flooded. The 100% RD presentation of the BMP design addresses these comments about impacts from overtopping events on the BMP design, so a separate comparison of different methods (intentional flooding vs rip-rap protection) with regards to the factor of safety for the BMP's structural integrity is not considered necessary.
19	7	100% RD Report - Section 5.2 Remedial Approach - *Excavation Approach*	Section 5.2 states that the 100% RD "excavation surface results in approximately 230,000 cubic yards of total volume removed." Similar statements are made in **Sections 5.3.4, 5.6.3.4**, and **5.8.2.2**. None of these statements distinguish between volumes of waste exceeding the cleanup level and volumes of potentially unimpacted material excavated from the historic berm or TCRA cap rock, nor do any of these statements reference detailed calculations of estimated volumes as an attachment or appendix to the 100% RD. EPA's April 2024 Supplemental Comments stated that Respondents should include detailed calculations supporting the estimated volumes of material to be excavated, including calculations for each total presented in **Drawing C-19** in **Appendix G**. The EPA comments stated that these calculations and other information supporting the waste volume totals should clearly identify volumes of material to be excavated in comparison to volumes of waste to be disposed of off-site (if different); the excavation boundaries for each area (both lateral and vertical); and whether Respondents' waste volume totals include approximately 25,000 cubic yards (as estimated by Respondents) of potentially unimpacted material from the historic central and southern berm, which will be excavated for potential reuse. The design volume totals also should distinguish between TCRA cap material vs the volumes of the underlying waste. Respondents do not appear to have addressed these EPA comments in the 100% RD. Responsive information to these EPA comments should be incorporated into the revised 100% RD submittal. Harris County Pollution Control Services (HCPCS), in comment 186 in **Table 1-1** of the 100% RD report, stated that they estimated the amount of berm material to be 31,000 cubic yards based on five referenced borings below the cleanup level in the berm area. HCPCS also stated that it appeared this volume of berm material had been included in the volume of waste material. Respondents did not address this comment directly, first stating correctly that the berm material must be sampled before being reused, and then reiterating their estimated excavation volume (not waste volume) as 230,000 cubic yards. Without additional volume information, EPA is unable to evaluate this issue. The 100% RD should include detailed calculations of estimated volumes of material to be excavated as discussed in EPA's April 2024 comments. These calculations should distinguish between volumes of waste and volumes of excavated but potentially reusable material from the berms and also TCRA rock. Respondents should reference the calculations in the 100% RD Report text when discussing the estimated volume of material to be excavated; the 100% RD Report text also should clearly present not only the total estimated volume of material to be excavated, but also the total estimated volumes of both waste to be excavated for disposal and material to be excavated for potential re-use, including material from the historic berms.	The volumes were calculated using AutoCAD Civil 3D. Design Drawing C-19 has been updated to provide the AutoCAD Civil 3D cut/fills for the requested volumes. The estimated excavation volume of 230,000 cubic yards includes the unimpacted material within the center berm. The volume of potentially unimpacted material within the center berm is currently estimated to be 30,700 cubic yards. It should be noted that although the intent would be to separate out the center berm material during excavation activities, this material will be sampled as it is excavated and before it will be considered for re-use. If the material does not meet the criteria for reuse on-site, that portion of the center berm will be sent for off-site disposal along with the other known impacted material The estimated excavation volume of 230,000 cubic yards did not include the removal of rock cover, which is estimated to be 28,700 cubic yards. This is based on the measured average rock thickness of 1.5 feet over the portion of the excavation area that includes a rock cover (approx. 510,000 square feet). It should be noted that a small portion of the excavation area (14,000 square feet) extends beyond the limits of the current rock cover. This uncovered area is located along the eastern boundary of the excavation area, as indicated on Drawing C-02.
20	7	100% RD Report - Section 5.2 Remedial Approach - *Excavation Approach*	The statement that the entire Northwest Corner will be excavated by mechanical dredging to mitigate the hydraulic heave risk is not accurate as a portion of the material (above -15 ft NAVD88) will first be excavated in the dry before mechanical dredging is implemented. Also, briefly clarify in this section the sequence that this would occur in, i.e. excavation in the dry then the mechanical dredging, if that is the case.	The text has been revised to address the comment.
21	8	100% RD Report - Section 5.2 Remedial Approach - *Excavation Approach*	General Comment: The 100% RD Report provides a detailed description of the excavation approach that will be utilized to sequence and remove wastes in the Northwest Corner but fails to provide the same level of description for the other cells and the transition areas between the cells. The 100% RD Report should clarify if Respondents intend for specific means and methods to be decided by the RC, and the document should provide references to any applicable requirements or restrictions on those means and methods.	The sequence of excavation for each season will be determined based on RC means and methods and will be described in the Excavation Plan that is required by Section 31 23 16 - Excavation, of the Design Specifications (Appendix H). In response to this comment, additional requirements have been added to the RC Excavation Plan including providing a description of the transition areas between cells.

Table 1-1

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San Jacinto River Waste Pits Site

Item No.	Comments Letter PDF Page	Reference	Comment	Response to Comment
22	8	100% RD Report - Section 5.2 Remedial Approach - *Excavation Approach* - Figure 5-D	An explanation of what "min (minimum)" and "max (maximum)" mean in the legend of color values to the right of **Figure 5-D** should be provided. Additionally, explain the use of negative and positive numbers in this legend. Revise this legend to be more intuitive and/or add a verbal description in the caption explaining that the red color indicates areas where the hydraulic heave risk line is equal to or shallower than the excavation surface, oranges and yellows indicate areas where heave risk line is slightly deeper than the excavation surface, and green to blue colors indicate that the heave risk line is much deeper than the excavation surface.	Figure 5-D has been modified to address this comment.
23	8	100% RD Report - Section 5.2 Remedial Approach - *Excavation Approach* - Figure 5-D	In the discussion in this section, it is noted that **Figure 5-D** shows depths of excavations compared to hydraulic heave risk elevations to show 'hot spots' of hydraulic heave. Is it necessary to mechanically dredge any of the red areas in **Figure 5-D** outside of the Northwest Corner, or is there the potential to do so? Some of these areas have exceedances of the cleanup level (CUL) below the elevation subject to hydraulic heave considering a safety factor of 1.25. While the 100% RD Report does not discuss use of mechanical dredging outside the Northwest Corner, information is provided in the appendices that indicates that the RC may choose to use mechanical dredging to address heave in other areas. In **Section 7.2.2** (Outside the Northwest Corner) of **Attachment E** (Updated Hydraulic Heave Analysis), Appendix B, it states that potential mitigation methods for areas outside the Northwest Corner include excavation through the water column by mechanical dredging. In the Design Specifications **Part 31 23 16, Section 3.4 (Appendix H)**, three allowable options for addressing areas with hydraulic heave potential are specifically listed, including excavation through the water column. Excavation by mechanical dredging does not appear limited in these specifications to the Northwest Corner. The 100% RD Report should present information on how and when decisions will be made to address any other areas of potential heave outside of the Northwest Corner. For areas outside the Northwest Corner, the listed potential heave mitigation options identified in the Design Specifications should also be referenced in the 100% RD Report text, as well as the method for identifying the final mitigation plans (which appears to be the RC's Heave Mitigation Plan). The 100% RD Report text in **Part 5.7.2.4** (Hydraulic Heave Evaluation) indicates that there will be a comparison of final excavation surfaces (based on the planned pre-excavation confirmation sampling) with the calculated hydraulic heave surface (as potentially modified by the pre-excavation stratigraphic boring and piezometer data). However, this section is limited to the Northwest Corner. The 100% RD Report should clarify that the results of this comparison will be used to pre-identify areas of concern for heave throughout the Site and inform the RC's Heave Mitigation Plan, which is described in **Appendix H, Part 31 23 16 Excavation**. The 100% RD indicates that a final decision on how to address potential hydraulic heave in areas outside the Northwest Corner will be made once the final excavation surfaces and heave data are analyzed. If the RC's Heave Mitigation Plan does provide for implementation of excavation through the water column outside the Northwest Corner, what impacts will there be on the seasonal excavation plan, on the excavation cells, and on water management? How would dredge water in these other areas be segregated? It would seem prudent for safety and preventing delays to the schedule if the 100% RD includes contingency planning for using an alternative method to remove the waste through mechanical dredging if the risk of hydraulic heave is detected and it is determined to not be safe to excavate in the dry in areas outside the Northwest Corner. The design should be compatible with implementing the contingency plan without a significant delay in the project. Currently, the 100% RD provides plans to support dredging activities (including the Residual Management Plan and the addition of sand and water to manage heave) for the Northwest Corner only.	Section 31 23 16 - Excavation, in the Design Specifications (Appendix H) outlines the process to identify potential heave areas outside of the northwest corner. Prior to any excavation, stratigraphic borings and piezometers will be installed as described in Attachment B of the Design Specifications. The RC will coordinate with the engineer to review the data from these borings/piezometers in combination with the results of the pre-excavation sampling to define the safe excavation depths and delineate the areas with potential heave risk. The RC will then prepare a Heave Mitigation Plan for these areas that will provide detailed procedures for excavation in the potential heave areas. The Heave Mitigation Plan will be submitted for approval prior to any excavation in these areas. In response to this comment, Section 5.6.3.3 of the Revised 100% RD Report has been modified to reference the Heave Mitigation Plan as a submittal to EPA for approval prior to excavation. The options being considered to address the heave areas outside of the northwest corner have also been added to this section. While excavation through a water column is considered a heave mitigation option, it would likely only be done in localized areas with much different water management procedures than the Northwest Corner. These procedures will be defined in the Heave Mitigation Plan prior to any excavation.
24	9	100% RD Report - Section 5.2 Remedial Approach - *Water management*	More detail needs to be added to explain how solids will be treated before returning the bulk noncontact water to the river. It was mentioned in **Section 5.7.3.2.4** for dredging in the Northwest Corner that for the purpose of the 100% RD, it is assumed that if TSS removal is necessary, the water will be pumped to a geotextile tube that will drain directly back to the removal area. However, the RC will have the option to use another solids removal technology that can be demonstrated to be effective. If this solids removal plan for the Northwest Corner also applies to this section, please add this information.	Details regarding the treatment of non-contact water to remove solids is included in Section 5.9.2. The water that will be generated during mechanical dredging will be considered contact water. Treatment of contact water is also described in Section 5.9.2.
25	9	100% RD Report - Section 5.2 Remedial Approach - *Water management*	The design states that water will be pumped out of the cofferdam area and into influent storage tanks before it can be treated. The Site will be equipped with two such tanks. The water in these tanks will likely be highly contaminated with dioxin and other contaminants. Secondary containment is a typical requirement for water treatment and material staging areas, but the 100% RD does not show where this is required. Confirm that 100% RD will require the installation of secondary containment around the influent storage tanks to prevent contamination resulting from a leak or other failure of the tanks. In additon, the 100% RD does not show the exact location of the storage tanks; the EPA understands that at this time the Respondents have not obtained a location for the placement of these tanks, but the design does indicate that the water will be pumped from the containment to a most likely offsite location for treatment and storage prior to discharge. Please discuss the design requirements and cite the appropriate portions of the specifications, plans and/or design drawings that describe requirements for how water transfer lines will be protected to prevent releases. For example, during the Southern Impoundment remediation, a valve on the water conveyance piping was slightly open, causing a release. What requirements are in the design regarding installation and inspection of conveyance piping/transfer lines to prevent similar incidents?	All contact water storage tanks will be within secondary containment with the capacity to hold 110 percent of the largest tank. The secondary containment areas are shown on the Design Drawings (C-27, P-011, P-013, and P-014). Section 5.9.2.2 provides a description of the secondary containment areas. The water transfer piping outside of the containment areas will be double-wall HDPE. Section 40 05 33 - HDPE, of the Design Specifications (Appendix H), provides the HDPE piping requirements. Section 46 07 01 - Water Treatment System, of the Design Specifications (Appendix H), has been modified to require the RC to develop and follow a plan to systematically check each pipe connection, valve, and locking mechanism prior to any water transfer (where feasible).
26	10	100% RD Report - Section 5.2 Remedial Approach - *Water management*	The 100% RD states that "At the start of the next excavation season, the water inside the Northern Impoundment BMP will be processed and returned to the San Jacinto River and the process will start again." This is further explained by "bulk water trapped behind the BMP wall will be treated for solids and returned to the river until the water level is within 2 feet of the lowest point within the BMP. The remaining 2 feet of water and any infiltration or stormwater that accumulates in an open excavation will be pumped to on-site water storage tanks, treated through clarification and filtration, and discharged to the river after compliance with discharge concentration criteria is verified." This section should clarify how the two treatment systems discussed (one treating for solids, and another involving storing the water in tanks to be treated by clarification and filtration) will meet the relevant discharge requirements for dioxins and furans, with supporting information. The Remedial Approach should be clarified to discuss how "non-contact" water accumulated between excavation seasons that is discharged without testing will be managed inside the BMP to ensure that it does not contain suspended solids that could be contaminated, and if it does become contaminated, how the "contact" water will be segregated out for treatment and tested prior to discharge.	The text has been modified to clarify how non-contact water is managed verses contact water. Non-contact water is water that has not contacted impacted surfaces, meaning this water would only have been in contact with either the TCRA cap material or surfaces that have been remediated. Non-contact water will be pumped to the non-contact water treatment system and filtered to remove solids before discharging to the river. Because it is non-contact water, it does not require compliance sampling. The contact water is any water that has come in contact with impacted surfaces/material and also includes any non-contact water within 2 feet of the lowest point of the excavation. Any non-contact water that mixes with contact water will be managed as contact water. The contact water will be pumped from the excavation to the contact water treatment system, treated through chemical treatment, clarification, and filtration and discharged to the river. The contact water will be sampled and tested for compliance with WTS effluent discharge concentration criteria prior to discharge.
27	10	100% RD Report - Section 5.2 - *Re-Use of TCRA Armored Cap and Historic Berm Material*	The first sentence of this subsection should be clarified by referencing **Drawing C-02** in **Appendix G**, which shows the limits of the geomembrane, geotextile and ACBM used in construction of the TCRA cap. This information should also be included in **Section 5.6.3.2**.	Design Drawing C-02 reference has been added to both sections to address the comment.

Table 1-1

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28	10	100% RD Report - Section 5.3.1 Historic River Level Evaluation	Respondents' hindcast model is discussed extensively in this section and also in other sections of the 100% RD Report, but a report detailing the hindcast model and its conclusions is not included in the 100% RD. The last version of the Hindcast Model Memorandum provided to EPA was dated March 28, 2024. EPA subsequently provided comments on the March 2024 hindcast submittal in its April 2024 Supplemental Comments. EPA's April 2024 Supplemental Comments on this issue do not appear to be addressed either in an updated hindcast memo or in **Table 1-1** of the 100% RD Report providing Respondents' response to comments on the 90% RD. EPA's April 2024 Supplemental Comments included the comment that Respondents should calibrate their hindcast model with actual Site data and provide this information in the 100% RD. This Site data includes river elevation data from the on-site transducer installed in 2019, which would provide data for Tropical Storm Imelda and this year's flood events. The 100% RD Report does not indicate that this calibration was considered or occurred. Respondents should revise the 100% RD to include an updated report on the Site hindcast model and address the EPA comments on this issue, including the April 2024 Supplemental Comments. Respondents should also include a summary of the Site transducer data collected to date with the revised 100% RD, as well as continuing to send transducer data with the monthly reports. The data for the 100% RD should provide calculated river elevations at the Site based on the raw transducer data, beginning with the transducer's installation in 2019.	April 2024 Supplemental Comments were previously received and addressed within the 100% RD. Consideration for a longer working season is provided in Section 5.3.2, as was included in the 100% RD. The hindcast model was calibrated based on actual site data from the on-site transducer. The hindcast model was used to establish the basis of design for top of wall BMP elevation, which was increased to +10 ft NAVD88 for the 100% RD. As such, the top of wall BMP elevation has been established at +10 ft NAVD88 and both the hindcast model and top of BMP elevation are not planned to be revised moving forward. The final hindcast was submitted to EPA in March 2024. The calculated river stage data is provided in Attachment 3.9 of Appendix I (BMP Structural Report). Respondents have been submitting the requested river stage transducer data in the monthly reports and will continue to do so.
29	11	100% RD Report - Section 5.3.1 Historic River Level Evaluation	In the discussion of the creation of the hindcast model, this section mentions an issue with the transducer which collected data for the model which resulted in the creation of a corrupted data set between December 2021 and February 2023. The 100% RD mentions this only briefly and does not describe what became of the corrupted data. It is unclear whether any part of this data was used or considered in the model, and what effect the corrupted data had on the model.	The data that was determined to be corrupted was removed from the dataset and not used in the hindcast modelling.
30	11	100% RD Report - Section 5.3.1 Historic River Level Evaluation	Insufficient information is provided in the Report and in the March 2024 Hindcast Model Memo regarding the basis for the boxplots in **Figure 5-4**, and how they meaningfully add to the hindcast data already provided in **Figures 5-2** and **5-3**.	This comment is received and noted. Respondents provided Figure 5-4 to provide a different visual to view the hindcast data outputs. The data shown on Figure 5-4 is the same on-site hindcasted data represented in Figures 5-2 and 5-3.
31	11	100% RD Report - Section 5.3.2 Excavation Approach - *Water Management*	the 100% RD requires additional filtration "within 2 feet of the lowest point within the BMP." This should be amended to say, "within 2 feet of the highest point of the floor within the BMP." This adjustment needs to be made because the floor within the cofferdam area is uneven and dredging will make some points lower than others. The current wording would allow for the Remedial Contractor to treat water throughout the BMP only within two feet of the lowest point, even if that low point is an outlier. It would be more protective to require water treatment with additional filtration within two feet of the highest point of the cofferdam floor.	The non-contact water will be treated by filtration that will include a combination of multimedia filters followed by a series of bag or cartridge filters with the final filter at 1µm. P&IDs of the non-contact water treatment system are shown on Design Drawings P-003, P-004 and P-005. While both systems are capable to remove the suspended sediments to 1µm, the contact water treatment system can better handle higher sediments loads because there is additional chemical treatment and an inclined plate clarifier up-front of the filtration systems. Therefore, the non-contact water will be treated down to a depth not shallower than 2 feet so that the pump intake can be maintained 2 feet or above the bottom to control the amount of sediment that goes to the system. The water shallower than 2 feet will then be treated through the contact water treatment system. A requirement that the 2 feet be at the highest point of the cofferdam would not be more protective than what is proposed.
32	11	100% RD Report - Section 5.3.2 Excavation Season and BMP Height	In the first paragraph it is discussed how the area inside the BMP will be divided up into five cells, with the intention that each will represent one season worth of excavation area. Will there be some sort of physical demarcation of these cells that will also act to support segregation of "non-contact" and "contact" water as well as prevent the potential "contact" water from coming into contact with remediated areas of the Site? Provide a discussion of how this will be achieved and/or reference to other portions of the design where it is discussed.	The excavation limits may vary each year depending on productivity during each excavation season. The Temporary Seasonal Covers (C-06 of Appendix G) will be constructed as transitions to demarcate and prevent contact water from recontaminating previously remediated surfaces. The RC will be required to place berms, or similar BMPs, at the start of each excavation season, with the ability to adjust as work progresses. The RC means and methods will be described in the Excavation Plan that is required by Section 31 23 16 - Excavation, of the Design Specifications (Appendix H).
33	11	100% RD Report - Section 5.3.4 Excavation Extent and BMP Alignment - *Lateral Extent*	Was there consideration of using the berm to serve any additional purpose in the implementation of the design such as water management, control of hydraulic heave, or use for access to excavation areas? Does the central berm need to be removed as part of the management of the excavation slopes along the central berm?	After consideration of potential uses for the central berm, it was determined the central berm needs to be removed to adequately access and remove all waste material adjacent to the berm.
34	11	100% RD Report - Section 5.3.4 Excavation Extent and BMP Alignment - *Lateral Extent*	The planned excavation slope along the soil buttress between the BMP wall and the excavated areas appears to be 3:1. In those areas where mechanical dredging will be used, how will the slope be achieved? Common mechanical dredging methods typically do not cut slopes, but instead require the use of step cuts to be performed in the slope. This will result in flatter slopes composed of disturbed sediments that are difficult to cap if used in transition areas. Provide more detail on the dredging method that will be utilized or can be selected by the Remedial Contractor and how these slopes will be addressed after excavation and as part of the excavation of adjacent areas.	The RC will use an excavator mounted on a barge to perform the mechanical dredging/excavation. As stated in Section 5.7.3.2.5, the dredge excavator will be equipped with real time kinematic global positioning system (RTK GPS) that will confirm removal at a 3:1 slope. After dredging in this area, the excavation will be filled with sand that will cover the entire excavated slope extending up to the adjacent buttress.
35	12	100% RD Report - Section 5.3.4 Excavation Extent and BMP Alignment - *Lateral Extent*	This section indicates that there are "three boring locations (SJGB010, SJGB012, SJSB046-C1) [that have] results above 30 ng/kg [dioxin concentrations] in the deepest sample interval collected, as seen on **Figure 2-9**." This appears to be incorrect as **Figure 2-9** shows two other boring locations (SJSB036 and SJSB071) which also have dioxin concentrations above the cleanup level at depth, so that there are five known boring locations with dioxin concentrations above the cleanup level at depth. This statement should be corrected.	The text in Section 5.3.4 has been revised to address the comment by indicating the five boring locations that have 30 ng/kg dioxin concentrations in the deepest sample interval collected.
36	12	100% RD Report - Section 5.5.3.2 River Water Levels	The discussion in this section indicates that a water level of +10 ft NAVD88 was used for calculating hydrostatic pressure to the exterior and interior BMP faces at both the "unusual" and "extreme" flood levels. The historic data indicates that the extreme water elevation was higher than +10 ft NAVD88. Provide an explanation for the use of +10 ft NAVD88 in both scenarios that explains the differentiation between "unusual" and "extreme". This discussion should also address the same information as presented in **Section 3.2** of **Appendix I**.	See the response to Item #13 for discussion on water levels in the vicinity of the Northern Impoundment. Selection of high-water level of +10 ft NAVD88 is appropriate for design. In the 100% RD, Section 5.5.1 describes the load cases defined as Usual, Unusual and Extreme. The text has been updated to differentiate the Unusual and Extreme load condition to note the consideration of Barge Impacts as Extreme load. Both load cases are evaluated at the high-water level to result in maximum loading on the BMP. Additional note added to Section 5.5.3.2 for clarification. In Appendix I, Section 3 included the note for Barge Impact in Extreme load case condition. An additional note has been added to Section 3.2 of Appendix I for clarification.

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37	12	100% RD Report - Section 5.5.3.4 Scour at BMP Interior	This section states that, based on Respondents' hindcast model, "there have been five (5) instances of water level exceeding elevation +10 ft." What is the basis of this statement? Respondents' Figure 5-2 directly contradicts this, at least with respect to flooding hindcast at the Site. Are Respondents referencing river levels at the Sheldon gauge upriver, or a different historical timeframe than covered by the hindcast results in **Figure 5-2**? If so, that should be clarified; otherwise, this statement should be corrected.	The statement is based on Figure 5-4 in the 100% RD which references the on-site river levels and not the river levels at Sheldon gauge. The five (5) instances of water level exceeding elevation +10 ft NAVD88 occurred outside the planned excavation season as noted in Section 5.3.1. Additional text has been added to the sentence in Section 5.5.3.4 for clarification - "there have been five (5) instances of water level exceeding elevation +10 ft NAVD88 that occurred outside the planned excavation season." Figures 5-2 and 5-4 represent the same on-site river level data. Figure 5-4 has been revised to clarify the 5 instances (highest 1-day value) as the 1994 Flood Event (1 instance) and Hurricane Harvey in 2017 (4 instances).
38	12	100% RD Report - Section 5.4 Pre-RA Activities - General Comments	The 100% RD implementation involves interaction with several different stakeholders such as, but not limited to, TxDOT, Port of Houston, and the United States Coast Guard (USCG). The 100% RD needs to discuss how this will be carried out and provide clear direction to the selected RC that the requirement for continued coordination is required to be performed. The Respondents also need to stay engaged with these stakeholders and ensure that their specific requirements are being addressed and performed by the selected RC or the Engineer as required.	The text has been revised in Section 5.4.1 to include USCG and TxDOT and to state that the RC, once on-board, will continue to engage these stakeholders and coordinate accordingly as the project progresses.
39	12	100% RD Report - Section 5.4 Pre-RA Activities - General Comments	The USCG has commented that prior to the beginning of construction the Respondents need to develop a plan on how the BMP installation activities will be handled to protect working barges or watercraft from incidents with river traffic. The USCG could not provide specific comments because the actual ways and means for the watercraft usage during the BMP installation appears to be left up to the selected RC. Therefore, the Respondents, their Engineers, and selected RC need to discuss the USCG requirements and incorporate them into the final plans. There are requirements that will need to be developed well in advance of the RA implementation and will require continued updates and support throughout the RA implementation.	Respondents will continue to engage with USCG and the RC, once selected, will address USCG requirements along with the additional details regarding the watercraft usage.
40	13	100% RD Report - Section 5.5.3.6 Waves	Please provide additional support and explanation for the design assumption in the third paragraph which states that there will be significant lag between sustained winds and rising water (storm surge). This assumption is also used in the wave analysis added to the BMP Structural Design Report (**Appendix I**). According to the Greater Houston Flood Mitigation Consortium, storm surge in Galveston and Galveston Bay can begin to rise in advance of storm landfall and maximum wind speed.	Additional information on wind, water levels, and waves is provided in Appendix I (BMP Structural Report). The data shows an initial lag in rising water levels and wind speeds from a tropical storm event and then an overlap near peak winds. There is limited fetch available around the Northern Impoundment to generate winds and even limited winds coming from North.
41	13	100% RD Report - Section 5.5.9 Scour Protection at BMP Interior	Does the analysis supporting the scour protection indicate the amount of lateral forces that could transport the armor?	The lateral force of the overtopping water is accounted for in the calculations for required length of the rip-rap layer and the rock size. Calculations are provided in Attachment 3 of Appendix I.
42	13	100% RD Report - Section 5.5.11 Pile Drivability and Vibration Analysis	In the second to last paragraph, it is stated that the analysis shows that the anticipated vibration from the use of the vibratory hammer for installation of the sheet piles would be below the acceptable threshold at 25 ft and farther from the installation point. However, **Figure 5-L** shows that at 25 feet the value is 0.65 in/sec, which exceeds the threshold of 0.5 in/sec. Please verify this number is correct and agrees with analysis provided in **Appendix I** and discussed in the risks associated with vibrations due to construction of the BMP in **Section 6.8** of **Appendix I**.	The sentence is revised to note "The anticipated vibration from the vibratory hammer is below the acceptable threshold at 35 ft or farther from the sheet pile installation." The first few sheets will be installed with the vibratory hammer to setup the press-in equipment. Additional sentence added "The contractor will be allowed to use a vibratory hammer or impact hammer only for the initial setup of sheet piles and the press-in equipment and at least 35 ft away from the I-10 bridge." Both Section 5.5.11 of the 100% RD and Section 6.8 of Appendix I have been updated.
43	13	100% RD Report - Section 5.6.1 Confirmation Sampling - General Comment	Removing Superfund related waste is the primary goal of the remedial action as outlined in the ROD. Proper management of the Site remediation requires evaluating whether that goal was achieved and taking management actions if it is not. The Respondents have proposed performing pre-excavation confirmation sampling to delineate the final excavation surface and outline several potential benefits to the overall implementation of the RD during the RA. However, EPA requires additional supporting information for Respondents' proposed approach to address its concerns that lack of any postexcavation sampling could result in waste with concentrations exceeding the ROD criteria being exposed to biota and transport. Confirmation sampling needs to be considered as part of the overall determination for the success of the remedial action. The Respondents should provide a detailed discussion that demonstrates how the proposed confirmation sampling effort using pre-excavation samples will be protective. Respondents also should provide a more detailed discussion of the benefits of their proposed approach on implementation. This discussion should include contingencies for addressing scenarios such as time constraints from non-excavation events including storms or excavation depths increasing to the point of unacceptable risks. This discussion also should define what the potential risks are and what appropriate management should be taken, and how these risks differ between different areas of the Site.	This section has been revised accordingly. It is important to note that extensive sampling of the NI was completed during the RI, PDI 1, PDI 2, and SDI field events. This robust data set was used to inform the initial excavation elevation so that intervals with higher dioxin/furan concentrations have already been included in the area slated for excavation. Therefore, the intervals slated for pre-excavation sampling are anticipated to have concentrations at or below the clean-up level. Completing pre-excavation sampling will allow greater time for critical decisions to be made, if needed, in consultation with the EPA. It is believed that pre-excavation sampling will reduce the overall schedule and potentially decrease the excavation seasons since there won't be lost time during excavation activities waiting on laboratory analytical results and over-excavating locations. Exposure to biota and transport is not believed to be a concern because the pre-excavation sampling will demonstrate all material above the cleanup limit have been removed. A similar pre-excavation sampling program was implemented during the RA for the Southern Impoundment and was instrumental in the expedited completion of excavation activities.
44	14	100% RD Report - Section 5.6.1 Confirmation Sampling - General Comment	Respondents propose the use of composite samples in the proposed pre-excavation sampling in which nine samples from the proposed excavation surface in a decision unit (DU) are combined before they are analyzed. Lower contamination samples could dilute the average of the composite sample, causing higher contamination samples to go unaddressed. This would lead to an incomplete remediation. The ROD calls for meeting the cleanup level. Please discuss how the proposed composite sampling addresses confirmation that the ROD cleanup level has been met. Why has analysis of discrete samples not been used?	This section has been revised in response to this comment. Refer to the response provided for Comment #43. Additionally, a portion of each discrete sample that was used for the composite sample will be held by the laboratory pending the results of the composite sample analysis.
45	14	100% RD Report - Section 5.6.1 Confirmation Sampling - General Comment	Please clarify that the proposed confirmation sampling being discussed will be performed preexcavation by referring to it as "pre-excavation confirmation sampling" in the design to differentiate it from other confirmation sampling that may be performed elsewhere in other portions of the RD.	This section was revised to cite sampling as "pre-excavation sampling".
46	14	100% RD Report - Section 5.6.1 Confirmation Sampling - General Comment	Additional discussion should be provided of the benefits that the Respondents claim will occur from the use of the "pre-excavation confirmation sampling" in terms of reduction of potential releases from storm events, reduced overall schedule, and potentially decreased excavation seasons.	This section was revised to include additional details.
47	14	100% RD Report - Section 5.6.1 Confirmation Sampling	The first paragraph mentions the use of the data collected from the pre-excavation samples to revise the design elevations. It is assumed that this is in reference to the revisions of the final excavation surface that will result from these activities. Additional discussion should be provided in this discussion and/or a direct reference provided to where this process is already described. Additionally, there should be discussion as to how these proposed pre-excavation confirmation samples will demonstrate that all material above the ROD criteria has been successfully removed.	This section has been revised accordingly. Refer to the response provided for Comment #43. Also, it is important to note that the proposed sampling frequency would be the same for either pre- or post-excavation sampling.

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48	14	100% RD Report - Section 5.6.1 Confirmation Sampling	TxDOT, Respondents and EPA participated in a call on October 10, 2024, in which TxDOT's concerns regarding the footprint of the southern BMP wall were discussed. During the meeting, the Respondents stated that the proposed pre-excavation confirmation sampling would provide information on final excavation depths that would allow them to assess the layout of the inner soil buttress and possibly reduce the footprint within the TxDOT ROW, but that the pre-excavation confirmation sampling would not be performed until after the BMP wall was completed. If the data from the proposed pre-excavation confirmation sampling could be used to evaluate and facilitate the possible realignment of the BMP footprint in the TxDOT ROW, then the proposed pre-excavation confirmation sampling should be conducted prior to the construction of the BMP wall in areas where the data could be used to address TxDOT's concerns.	The entire pre-excavation sampling program would be completed at one time to minimize extending the project schedule. In addition, the pre-excavation sampling needs to be completed in the dry once the BMP is installed and the area inside the BMP dewatered in order to maintain sample integrity and confidence. The soil samples collected during the PDIs and SDI were conducted to confirmed clean levels below the cleanup limit which is the basis of design and to be confirmed by the pre-excavation sampling.
49	14	100% RD Report - Section 5.6.1 Confirmation Sampling	Provide a description of how the various sampling intervals will be utilized to determine the depth of the final excavated surfaces, i.e. if the 0-1 foot sample interval is above the ROD cleanup level, but a subsequent sample at the next depth interval is below the ROD cleanup level, will the material be excavated to the full extent of the subsequent sample' depth.	This was addressed in the 100% RD and additional text has been provided in Section 5.6.1 of the Revised 100% RD. To clarify, if the 0-1 foot sample interval is above the ROD cleanup level, but the 1-2 foot sample is below the ROD cleanup level: - The discrete samples from the 0 to 1 ft interval will be analyzed and discrete locations above the cleanup level, only, will be excavated; OR - The DU will be excavated 1 ft below the initial excavation interval.
50	15	100% RD Report - Section 5.6.1 Confirmation Sampling	The Respondents have stated that the design can only accommodate a maximum of 2 feet of overexcavation, however the excavation surface is not uniform in depth across the Site. Review of the currently proposed excavation surfaces shows a range of greater than 10 feet between the deepest and shallowest potential excavation depths. Please clarify if the maximum stated limit of 2 feet for over-excavation is for all locations of the planned excavation or only for those at the greatest depth. If the proposed pre-excavation sampling and analysis is limited to 2 feet below the current excavation surfaces, Respondents should provide information supporting this decision. The proposed preexcavation sampling should include a process for EPA consultation and potentially additional sampling if any samples at the 2-foot depth (or lower depths if collected in some areas) remain above the cleanup level. Respondents should consider archiving 2-3- and 3-4-feet intervals to allow for potential additional analysis to determine a clean bottom surface.	The text has been revised to address the comment.
51	15	100% RD Report - Section 5.6.1 Confirmation Sampling	Pre-excavation sampling locations should include targeted sampling to address areas of greater uncertainty, for example sidewalls and the area around boring SJS B046-C1.	The sampling program is designed to uniformly sample across the excavation area within the BMP wall and should not target anywhere as to bias the sampling program. Figure 2-1 in the FSP (included as Appendix J, Attachment 3) shows that there is adequate coverage across the entire site, including sidewalls, and in the immediate vicinity of boring SJSB046-C1.
52	15	100% RD Report - Section 5.6.1 Confirmation Sampling	In the last bullet of this section, it is stated that a 6-inch overcut will be performed in the decision unit as a final pass to remove any settled residuals. Would the starting depth of this overcut be based on the final excavation surface as determined by the pre-excavation samples?	That is correct. The starting depth of this overcut will be based on the final excavation surface as determined by the pre-excavation sampling.
53	15	100% RD Report - Section 5.6.2 Excavation Sequencing	This section states that the "RA work will likely be divided into five cells." What process would be utilized to delineate the work into "five cells"? Would this process be linked to the configuration of the decision units? How would the central berm be accounted for into this delineation?	Excavation seasons will be based on estimated production rates and are independent of the DUs. The DUs are identified prior to any excavation as part of the pre-excavation sampling program. The central berm will be removed during excavation and sampled and tested separately as described in Section 5.3.4.
54	15	100% RD Report - Section 5.6.2 Excavation Sequencing	Will the sequencing within each of the five proposed cells proceed progressively across the entire cell from top to bottom, or progress across the cell after the initial target excavation depth is achieved and then proceed from there across the cell? What slopes would be preserved in the excavations as it progresses?	The sequence of excavation for each season will be determined based on RC means and methods and will be described in the Excavation Plan as required by Section 31 23 16 - Excavation, of the Design Specifications (Appendix H).
55	15	100% RD Report - Section 5.6.2 Excavation Sequencing	With the concept of the Site being "divided into five cells," what procedures would be implemented to isolate the cells from each other during the excavation seasons to minimize the potential for material to be tracked from un-remediated cells into remediated cells?	Section 31 23 16 - Excavation, of the Design Specifications (Appendix H) has been revised to require the RC to include procedures to minimize the potential for material to be tracked from un-remediated cells into remediated cells in their Excavation Plan.
56	16	100% RD Report - Section 5.6.3.2 TCRA Armored Cap Removal	Please clarify the first sentence regarding whether the cap over the entire cell to be excavated will be removed at the start of the excavation season, or if portions will be left intact to reduce risk from potential storm or overtopping events. While the section later states that Respondents anticipate that only a portion of the TCRA armored cap in the specific area of waste excavation will be removed at any given time, this does not clearly link the size of the waste area where the cap has been removed to the waste area which could be covered by clean backfill quickly in advance of any adverse weather events, which would be recommended.	Portions of the TCRA cap over the entire cell to be excavated will be left intact to reduce risk from potential storm or overtopping events. The HWPP contains procedures to protect open excavations from adverse weather events.
57	16	100% RD Report - Section 5.6.3.3 Excavation Procedures	The design indicates an earthen ramp will be constructed over the top of the BMP to allow truck traffic into and out of the excavation area. Have studies been performed that demonstrate that BMP integrity will not be compromised by the truck traffic throughout the duration of the project. Also, should flooding occur within the impoundment, what procedures are in place to ensure the integrity of the ramp and/or providing requirements for its maintenance and repair?	The BMP walls will have a thin profile and the section will be buried under the ramp material. The tie-rods will also be buried sufficiently deep under the fill material between the walls to avoid impact from wheel loads. Wheel loads behind a wall typically generate a lateral earth pressure on the walls and will not govern the design over the demands from the hydrostatic pressure. However, as an added measure, the 100% RD (Section 5.7.3.2.3) has been updated to have the RC use crane mats, steel plate or other appropriate construction technique to protect the sheet piles. The means and measures shall be reviewed prior to construction. The HWPP includes site inspection upon re-entry procedures that includes inspection of site conditions after a high-water event.
58	16	100% RD Report - Section 5.6.3.3 Excavation Procedures	The design drawings (**Drawing C-16**) indicate that the earthen ramp which will be constructed for access of truck traffic into and out of the southwestern edge of the BMP is situated over wastes that require removal to a depth of -10 ft NAVD88. While general information concerning how waste is anticipated to be addressed appears in **Section 5.6.3** as well in other portions of **Section 5.6**, it is requested that a description of excavation and loading procedures to be used for waste materials beneath the ramp be provided, including any recommended controls for handling waste and loading trucks outside the BMP.	The RC is required to provide the sequence of excavation for each season in the Excavation Plan as required by Section 31 23 16 - Excavation, of the Design Specifications. This will include a requirement to describe the approach for excavation and loading procedures to be used for waste materials beneath the interior ramp.

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59	16	100% RD Report - Section 5.6.3.3 Excavation Procedures	It is stated in the 2nd paragraph of this section that berms will be constructed seasonally to segregate water that falls on previously remediated cells and water that accumulates on unremediated cells. What procedures will be used to ensure that within the active seasonal cell, stormwater does not run across unremediated surfaces and collect in areas already remediated?	The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. In response to EPA comments, requirements have been added to the Excavation Plan for the RC to provide means and methods to segregate non-contact and contact water and prevent contact water from coming into contact with non-impacted or remediated surfaces.
60	16	100% RD Report - Section 5.6.3.3 Excavation Procedures	The second paragraph states both that "[i]nterior berms will be constructed seasonally" and that contact water will be segregated "by constructed berms or other stormwater controls as best management practices." Does this mean that berms may not be used, or that other stormwater controls may be used in addition to the berms? What other procedures would be implemented to manage the potential for the generation of "contact water" moving from an un-remediated cell into a remediated cell both during excavation seasons and in-between excavation seasons?	The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. In response to EPA comments, requirements have been added to the Excavation Plan for the RC to provide means and methods to segregate non-contact and contact water and prevent contact water from coming into contact with non-impacted or remediated surfaces.
61	16	100% RD Report - Section 5.6.3.3 Excavation Procedures	How high will the berms discussed in the 2nd paragraph, that are designed to segregate the water that collects in the remediated and unremediated cells, be? What plans will be in place to handle the accumulation of water should it threaten to overtop these berms and cause "contact water" to flow into remediated cells? How will any water that becomes mixed with "contact water" be handled?	The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. In response to EPA comments, requirements have been added to the Excavation Plan for the RC to provide means and methods to segregate non-contact and contact water and prevent contact water from coming into contact with non-impacted or remediated surfaces. If non-contact water mixes with contact water, it will all be handled as contact water.
62	17	100% RD Report - Section 5.6.3.3 Excavation Procedures	The 3rd paragraph of this section indicates that the transition areas will be excavated, the TCRA cap removed, and the TCRA cap material re-used or disposed. How will "contact water" be controlled during the excavation of these transition areas and prevented from contaminating previously remediated cells? Additional details of these activities should be provided along with a reference to the design specifications to ensure that the selected contractor understands requirements that will need to be met.	The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. In response to EPA comments, requirements have been added to the Excavation Plan for the RC to provide means and methods to segregate non-contact and contact water and prevent contact water from coming into contact with non-impacted or remediated surfaces. If non-contact water mixes with contact water, it will all be handled as contact water.
63	17	100% RD Report - Section 5.6.3.3 Excavation Procedures	The 3rd paragraph specifies 2:1 slopes for the transition areas to be constructed at the end of the season. What is the basis for selecting the 2:1 slope? Has the stability of this slope been analyzed to ensure that equipment can be safely used on the slope to install the cover and riprap?	The text has been revised to specify a stable slope between 2:1 and 3:1. A 2:1 slope is considered constructable for a temporary cover placement, but if the RC determines that a 2:1 slope is not stable then a less steep slope would be required. The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. The Excavation Plan includes a requirement for the RC to address sloping of excavation faces and slope stability issues.
64	17	100% RD Report - Section 5.6.3.3 Excavation Procedures	How will slopes be maintained once they are created by excavation of waste materials, but prior to removal of the BMP and restoration of the Site? It appears the perimeter excavation slopes are 3:1. Has a slope stability analysis been performed on the waste slopes in a dewatered state other than the analysis that was performed as part of the design for the BMP?	The excavation slopes shown adjacent to the BMP represent the soil buttress that is considered an integral part of the BMP structure and will be maintained for the duration of the project.. The excavation slopes are not constructed in waste material. During the RD, a 3:1 slope was considered sufficient.
65	17	100% RD Report - Section 5.6.3.3 Excavation Procedures	Will the transition slopes that are capped between excavation seasons be removed during the next excavation season, or is it assumed only remediated surfaces will used to construct the transition zones? If unremediated surfaces are used or if "contact water" accumulates on these surfaces, how will the capping materials be handled if they are uncovered in subsequent seasons?	The transition slopes will be the unremediated material adjacent to the areas already remediated. At the end of an excavation season, the exposed unremediated surfaces will be capped with a temporary seasonal cover to prevent any generation of contact water. At the beginning of the next excavation season, the bottom HDPE liner in contact with the unremediated surface will be disposed of and the overlying clean cover material will be staged for future use. The transition slopes will then be remediated. A detail of the temporary seasonal cover has been added to Design Drawing C-06.
66	17	100% RD Report - Section 5.6.3.3 Excavation Procedures	The last sentence of this section indicates that areas susceptible to heave will be backfilled to elevations protective of the river reaching the top of the BMP at +10 NAVD88. Is this assumed to be a post excavation heave mitigation strategy that will be performed to minimize the chance of heave occurring in areas that have been remediated? The Hydraulic Heave Report identified several other options for heave mitigation which should be referenced or described here if they are being considered for RA implementation.	The referenced sentence is referring to backfilling areas as a post-excavation heave mitigation strategy to prevent heave from occurring in areas that have been remediated if the river stage reaches +10 ft NAVD88 during the RA. The options described in the Hydraulic Heave Report address heave mitigation during excavation, not post-excavation.
67	17	100% RD Report - Section 5.6.5 Excavation Area Restoration	Will all cells receive fill to be protective of hydraulic heave of a fully dewatered site with the external waster elevation at +10 NAVD88, as designed for the Northwest Corner?	Localized remediated areas that are susceptible to heave due to the depth of excavation will be backfilled to an elevation that is protective.
68	17	100% RD Report - Section 5.6.5 Excavation Area Restoration	While this section indicates that the BMP will be removed at the end of the project, there is no discussion of how the material/aggregate within the double wall BMP will be handled. Will this material be collected and disposed of offsite, or will it be placed within the area formerly within the BMP?	The text in Section 5.6.5 has been revised to clarify that the aggregate fill within the BMP may be collected and used for restoration activities in lieu of disposing off-site.
69	18	100% RD Report - Section 5.7.3.4 Clean-Up Pass	Use of polymers, flocculants, coagulants, and/or other additives to promote settling is discussed in **Section 5.7.3.6** and in **Part 31 23 16, Section 3.4** of the Design Specifications, but are not discussed as an option in this section. It would seem appropriate to utilize them as the initial step of settling out suspended solids to allow them to be more easily collected as part of the clean-up pass.	Section 5.7.3.4 references Section 5.7.3.6 for managing residuals. Section 5.7.3.6 "Settling of the Residuals" discusses the option for using polymers and coagulants for settling the material after the production pass and prior to the clean-up pass.
70	18	100% RD Report - Section 5.7.3.4 Clean-Up Pass	The discussion should be revised to include the specified minimum thickness of the sand layer needed to stabilize the residual layer. Also, clarify if the surface of the sand layer is the base of the residual layer after the sand is placed.	The text in Section 5.7.3.6 has been revised to state a minimum 3-inch sand layer. The base of the residuals will be defined by the original dredged elevation, as measured by the operational data collected during dredging as described in Section 5.7.3.2.6, and then confirmed by the RC by probing.
71	18	100% RD Report - Section 5.7.3.5 Residual Management Layer	The granular material that is to be placed in the Northwest Corner, which is designed to mitigate the potential for heave for the duration of the remedial action, is being placed before dewatering occurs. Is the purpose of the placement of this granular material to create saturated fill as part of the heave mitigation strategy?	The purpose of the granular material is to provide weight to offset heave as the water is removed and treated.
72	18	100% RD Report - Section 5.7.3.5 Residual Management Layer	Please provide the reference to the specifications for the granular fill.	A specification for the granular material has been added to the Design Specifications (Section 31 23 23 - Fill).

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73	18	100% RD Report - Section 5.7.3.6 Residuals Management and Controls - Construction of BMPs to Control Residuals	What material will be used to construct the buttress that is described in the 4th paragraph? Will this buttress be able to be constructed underwater? What will the slopes of the buttress be? Can these slopes be achieved if the buttress is to be installed underwater?	The buttress berm detail is shown on Design Drawing S-03 and Section 31 23 23 - Fill, of the Design Specifications, provides the material type. The buttress berm will be constructed of aggregate to allow placement under water, which will allow the specified slopes as shown on Drawing S-03 to be achieved.
74	18	100% RD Report - Section 5.9 Water Management - General Comment	The descriptions and sources of contact water and non-contact water, as well as the descriptions of both contact and non-contact bulk water, and how each of these should be treated, is not consistent within this section; with other sections of the 100% RD Report (including **Section 5.2** under ***Water Management***); and with the specifications in **Appendix H**, both at **Part 31 23 19 Dewatering** and **Part 46 07 01, Water Treatment System** (WTS), as well as potentially other references in the design. For example: - The dewatering specifications in **Appendix H (Part 31 23 19**) indicate that all water removed from the BMP in the first year after its construction will be treated as non-contact water; while **Section 5.2 *Water Management*** of the 100% RD Report and the WTS specifications in **Appendix H (Part 46 07 01)** indicate that only the first-year construction water down to 2 feet will be managed as non-contact water. - It is not clear that bulk water that comes into contact with impacted material/contaminated surfaces will be treated as contact water to any depth. - It is not clear whether water accumulated in the BMP between excavation seasons can be classified as bulk non-contact water which does not require treatment (except for solids) down to 2 feet. **Section 5.2 *Water Management*** of the 100% RD Report and **Design Specification Part 31 23 19 Dewatering** indicate that water accumulated in the BMP between seasons is or can be classified as bulk non-contact water, but the definition of "Bulk Non- Contact Water" in **Section 5.9** of the 100% RD Report and **Design Specification Part 46 07 01** (Water Treatment System (WTS)) both state that bulk non-contact water includes only water trapped behind the BMP during the first year of construction and water from overtopping events in subsequent years which has not been in contact with contaminated surfaces. - There is variance in the lists of potential sources of contact water, for instance whether they include dredge water, and whether overtopping water is listed under Miscellaneous Contact Water or under contact bulk water/non-contact bulk water. All references to water requiring treatment, how the types of water are described, and how these types of water will be treated should be clear and consistent throughout the design	The text in the referenced documents have been revised to make all sections and specifications consistent in how each type of water is defined and treated.
75	19	100% RD Report - Section 5.9 Water Management	This section states: "During excavation activities, measures will be taken to segregate stormwater that comes into contact with waste material from clean stormwater that falls on the TCRA armored cap or confirmed clean excavation areas…Contact water will be treated through the WTS." Provide additional details or reference the appropriate sections of the design that detail what measures will be taken to segregate contact water from non-contact water.	The Design Specifications (Section 31 23 16 - Excavation) require the RC to submit an Excavation Plan. In response to EPA comments, requirements have been added to the Excavation Plan for the RC to provide means and methods to segregate non-contact and contact water and prevent contact water from contaminating non-impacted or remediated surfaces.
76	19	100% RD Report - Section 5.9 Water Management	The second paragraph states "Water in the excavation 2 ft above the lowest elevation at the time of the dewatering activity…". Please revise this sentence to: "Water in the BMP 2 ft or more above the lowest elevation at the time of the dewatering activity…" in order to help clarify that this is not referring to contact water of any depth within an open excavation. Also see the clarification discussed in Comment 31 above.	The text in this section has been revised accordingly. Refer to the response provided for Comment #31.
77	19	100% RD Report - Section 5.9.1.4 Waste Volume and Storage	It is important to distinguish between bulk water within the BMP and water in an excavation which requires treatment through the WTS, as this distinction is important to ARAR compliance. To distinguish between bulk water within the BMP and water in an excavation (or otherwise has come into contact with impacted waste) which requires treatment as discussed in Section 5.9.2, the second bullet point should replace "excavation" with "BMP"to help clarify that this is not referring to contact water of any depth within an open excavation. Bullet point 3 (Bulk Non-Contact Water) should be removed from this list since it is, by definition, not a source of contact water. If bullet point 3 is moved elsewhere in this section, the same change in language suggested for bullet point 2 should be considered.	The text has been revised to consistently identify the two types of water as non-contact water and contact water. Non-contact water is water within the BMP that has not contacted impacted surfaces and occurs 2 ft or more above the lowest elevation at the time of the dewatering activity. The non-contact water will be treated by filtration that will include a combination of sand filters followed by a series of bag or cartridge filters with the final filter at 1µm. P&IDs of the non-contact water treatment system are shown on Design Drawings P-003, P-004 and P-005. The non-contact water does not require sampling prior to discharge. Contact water is any water that has contacted impacted surfaces, any water 2 feet above the lowest point of the excavation, and any non-contact water that has comingled with contact water. The contact water will be treated by chemical addition, an inclined plate clarifier, multimedia filters, bag/cartridge filters and GAC with the final filter at 1µm. P&IDs of the non-contact water treatment system are shown on Design Drawings P-006, P-007 and P-008. The contact water will be sampled and tested for compliance with WTS effluent discharge concentration criteria prior to discharge.
78	20	100% RD Report - Section 5.9.1.4 Waste Volume and Storage	In the second list of sources of contact water in this section providing estimated volumes, delete "2. Bulk Non-Contact Water" and accompanying text from the list of contact water sources, and similarly delete "Bulk Non-Contact Water" from **Table 5-1, Summary of Maximum Expected Contact Water Generated**.	The text and table have been revised to address this comment.
79	20	100% RD Report - Section 5.9.1.4 Waste Volume and Storage	"Miscellaneous Contact Water" is described in two ways in this section. "Miscellaneous Contact Water" is described as "other water that comes into contact with waste material," including "water from an Overtopping Event that contacts contaminated surfaces"". "Miscellaneous Contact Water" is also described (with estimates of contact water volumes) as "Excavated materials storage, dewatering areas, and other minor sources … assumed to be insignificant compared to other sources of contact water." Water from an overtopping event will not likely be a minor source, and overtopping water is also included under descriptions of bulk water. These descriptions should be consistent with each other and consistent with other descriptions in the 100% RD regarding miscellaneous contact water and handling overtopping water.	The text has been revised to consistently identify the miscellaneous contact water.
80	20	100% RD Report - Section 5.9.1.4 Waste Volume and Storage	This section's second list of contact sources with estimated volumes and **Table 5-1 Summary of Maximum Expected Contact Water Generated** include overtopping water as both bulk contact and bulk non-contact water without reference to whether it has been in contact with impacted material. These lists of contact water should be modified to be consistent with the dewatering specifications for addressing water from overtopping, which make a clear distinction between water from overtopping that has come into contact with impacted surfaces, and overtopping water that has not come into contact with impacted surfaces **(Appendix H, 31 23 19 Dewatering, Part 3.5 Dewatering Bulk Water, (C) and (D))**.	Table 5-I has been changed to only include contact water sources and identifies contact water at the start of construction as the last 2 feet of water above the lowest elevation and any water that has contacted impacted surfaces.

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81	20	100% RD Report - Section 5.9.1.4 Waste Volume and Storage	How will potential seepage that may occur due to the depression of the water table inside the BMP be addressed? The specifications require the dewatering system to control seepage (**Section 31 23 19 Dewatering in Appendix H**). Seepage occurring due to the depressed water table inside the BMP should be contact water; the 100% RD states that “Dioxins were detected in the seepage water at levels above the ML” (**Section 5.9.1.2 Parameters Requiring Treatment**). EPA previously commented that Respondents have not shown that seepage, including upwelling from the bottom of the excavation, would be negligible (Comment 32 in **Table 1-1**), but the response provided only addresses potential seepage through the BMP and did not fully address EPA's comment. The sources of contact water should include seepage.	The water sample referred to in Section 5.9.1.2 is from the treatability testing described in Section 3.4 (Sample ID EXC-1 in Table 3-2). This contact water sample was generated by creating an open excavation within the impacted material and collecting the sample of the water that accumulated in the excavation without filtering. The sample was meant to simulate conditions during an active excavation. While this water sample did exceed the ML for dioxin, the sample had a total suspended solids concentration of 240 mg/l. It was concluded that the dioxin was associated with the suspended solids and not dissolved within the water. During the RA, any seepage that occurs within active excavation areas will be managed as contact water. Other seepage that occurs within areas that have already been remediated or from areas that are still covered by the TCRA cap would not be considered contact water. The groundwater seepage in the remediated areas would not be through impacted materials and seepage in the capped areas would not transport suspended solids with dioxin upward through the TCRA cap material.
82	20	100% RD Report - Section 5.9.1.4 Water Volume and Storage - *Design Treatment Capacity of WTS*	The dewatering estimates given in the section and used to estimate flow rates and treatment rates of water are based on a turnaround time (TAT) of 7-days for sample results, which is the standard TAT for dioxins and furans. The field sampling plan provides for a possible expediated TAT of 3-4 days, which could reduce the holding time for the treated water and potentially accelerate the schedule. Based on the lessons learned from the RA for the Southern Impoundments, are these TATs reasonably achievable? If the Southern Impoundment experience indicates that TATs are typically longer, the schedule should be adjusted appropriately and the discussion updated, or it should be clearly stated that the RC contractor will be expected to contract with a lab that can meet these TATs.	The text in the FSP has been revised to be consistent with a 7-day TAT.
83	21	100% RD Report - Section 5.9.2 Treatment System Design	The design discusses how bulk “non-contact water” will be treated using pumps, influent storage tanks, multimedia filters, and bag canister filters. This process is designed to reduce the total suspended solid (TSS) concentration before the water is discharged back into the San Jacinto River through the diffuser(s). The sampling that is required in accordance with the Storm Water Pollution Prevention Plan (SWPPP) should be discussed and referenced in the SWPPP, the Sampling and Analysis Plan (SAP), and the Quality Assurance Project Plan (QAPP).	There is no requirement to sample non-contact water. Accordingly, no revisions are proposed to the SWPPP, SAP or QAPP.
84	21	100% RD Report - Section 5.9.2 Treatment System Design - General Comment	Throughout the 100% RD and its attachments where the WTS is discussed, the description of the system design, operation, and sample collection points does not appear to be uniform or consistent between the 100% RD Report and the Design Drawings. The EPA understands that some portions of the 100% RD are awaiting finalization pending the selection of a final location for the the WTS. The Respondents need to ensure that the WTS design is consistent across all portions of the 100% RD package and continues to remain so as the WTS design is updated based on site selection.	Respondents have made an effort to make the descriptions of the WTS design, operation and sample collection points consistent and uniform throughout the Revised 100% RD and will continue to do so with any updated design based on the site selection.
85	21	100% RD Report - Section 5.9.2 Treatment System Design	It is not clear in this section if testing or treatment of bulk “non-contact water” would be required if mixing with “contact water” has occurred, or if what was originally “non-contact water” has come into contact or mixed with waste materials. The relevant design specifications (**Appendix H, Part 31 23 19 Section 3.5** and **Part 46 07 01**), as well as the SWPPP and **Section 5.9 of the Design Report**, should be discussed and a description added concerning how “contact water” resulting from contact with waste material or resulting from an over-topping event would be handled.	The text in Section 5.9.2 has been revised to include the following statement "Any non-contact water that mixes with contact water or has come into contact or mixes with waste materials will be managed as contact water."
86	21	100% RD Report - Section 5.9.4 Compliance Monitoring	Should the discharge monitoring also consider sampling looking at dissolved oxygen levels? After storage and treatment, dissolved oxygen levels in the treated water may be very low, and a large discharge of low-oxygen water could result in localized harm to fish and invertebrate populations. Discuss the reasoning behind not performing sampling for dissolved oxygen levels.	Treated water from the WTS will discharge through a diffuser located in the San Jacinto River. The diffuser is designed to rapidly disperse the treated water into the river and minimize any localized differences in dissolved oxygen between the treated water discharge and the river. In addition, dissolved oxygen is not a discharge parameter that was identified for permit equivalency.
87	21	100% RD Report - Section 5.10.4 Turbidity Controls and Monitoring	The last sentence of this section states that turbidity monitoring data will be collected twice per day at the start of work, and only once per day thereafter if turbidity thresholds are below the thresholds in the SWMP. This contradicts information in the SWMP, which indicates turbidity readings will be collected at least hourly and monitored by the RC, with an alert configured for exceedance of the threshold. It would seem prudent to start with hourly measurements and then decrease the monitoring frequency if the accumulated data supports the reduction.	The text in Section 5.10.4 has been revised per the SWMP. Initial turbidity readings will be collected hourly and then decreased to daily if the data supports the reduction.
88	22	100% RD Report - Section 5.11 Site Restoration - General Restoration	A key component of the site restoration is the restoration of the southern slope of the excavation area. The Respondents have presented plans to restore the slope and provide a layer of protective riprap as part of the final end-state for this area. Discussion of this should be included in this section. Additionally, to date there has been discussions with TxDOT concerning this item and direction should be provided to the RC that coordination is will be required until completion of the project concerning this item. TxDOT has also provided a comment concerning the slope construction in its 24 September 2024 Memo to the EPA regarding the 100% RD, in which TxDOT stated that: TxDOT's contractor has asked: “The proposed 3ft thick riprap layer placed against sloped fill to restore the shoreline all the way up to TxDOT's ROW will need to have some embedded toe or apron in place. Attached is an exhibit detailing the needed toe apron for the proposed restoration.” The memo from TxDOT with attachments has been provided previously to the Respondents (and is attached to this document as well). Any change should also be made in **Section 5.6.5, Drawing C-56, and Drawing C-57.**	Sections U and V on Design Drawing C-56 and Sections W and X on Design Drawing C-57 have been adjusted to extend the riprap cover to the base of the restored slope, with an additional rock apron to be installed within a 3-foot deep excavation over a 6-foot length beyond the base of the slope, with a 1:1 slope coming back up to surface. In addition, the horizontal extent of the rock cover has been updated on Drawing C-22. The text in Section 5.6.5 or 5.11 already states that rip rap will be placed on top of the soil embankment.
89	22	100% RD Report - Section 5.11.1 Removal of BMP	This section states that “the BMP wall will be attempted to be removed.” The Respondents have stated in meetings with the EPA that the BMP wall would be cut off at the mudline if sheet piles could not be removed; this is discussed for the BMP in the southern part of the impoundments but not the remainder of the BMP. The 100% RD should contain a conceptual description of this process since the BMP is within the river and must be addressed in a manner satisfactory to the relevant stakeholders as discussed in **Section 5.11.1** as well as **Appendix F**.	Section 5.11.1 in the Revised 100% RD is updated to provide clarification - "The sheet piles can seize or get hung-up in the interlocks due to corrosion over time or due to the sealant specified to avoid seepage through the interlocks. In such cases, complete removal of the BMP wall may not be possible without tearing the sheets and the sheet piles will be cut or driven below the mudline."
90	22	100% RD Report - Section 5.12 Technical Challenges Associate with Design Implementation	There are logistical uncertainties outlined in **Section 5.12** of the Subject Document that need to continue to be considered. The design proposes to begin remediation efforts as soon as next year with the construction of the BMP; however, uncertainties remain that have the potential to impact overall timeline, including securing an area for the staging of the water treatment system and other equipment/vehicles, as well as the continuing need to coordinate with TxDOT on use of the ROW. These considerations should be discussed in terms of how they can affect the schedule. The RC should be directed to review these issues routinely and provide updates to the schedule as warranted	This comment is received and noted. The Respondents will continue to address these logistical uncertainties with EPA and stakeholders, in particular, TxDOT, as the remediation cannot proceed until, among other things, access issues with TxDOT are resolved.

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91	22	Appendix B - Geotech Report - Section 7.1.2 Sloped Stability	It is discussed in this section how there is potential for the vibrations caused by the installation of the sheet piles for the BMP to potentially result in slope failures. It appears that this determination was based upon calculations developed in the 30% RD. At that time, it was proposed that a vibratory hammer would be used to install the sheet piles that would be the basis for the BMP. The 100% RD states that the risk of failure and potentially for release in the 100% RD was mitigated by increasing the bench around the inner perimeter which resulted in the areas for potential sloped failures to be moved further from identified areas of waste materials; this increased the footprint of the wall in the TxDOT ROW. It also has been discussed that the vibratory hammer will be used for the initial pile installation then the Gilken unit. Would this process using the Gilken unit allow for a reduction in the safety buffer that was calculated based on the use of only the vibratory hammer and potentially allow for a reduction in the footprint of the wall, especially in the TxDOT ROW?	The 30-ft wide double wall system with a soil buttress on the interior provides a balanced system to withstand the high water levels on the exterior, along with potential vessel impact, while allowing for the full extent of excavation depths to remove the waste material. The balanced system design was not determined by the vibration analysis.
92	23	Attachment E - Updated Hydrualic Heave Report - Section 2 Previously Submitted Hydrualic Heave Assessment Reports	In its April 2024 Supplemental Comments, EPA requested that Respondents provide a transparent discussion of the changes in methodologies between each of Respondents' three heave analyses, and the reasons for those changes. While the 100% RD Hydraulic Heave Analysis contains a summary of the components of each version of the heave analysis, the difference between the second analysis and the third analysis in January 2024 is not transparent. The January 2024 analysis showed depths in the Northwest Corner where Respondents estimate hydraulic heave will become an issue being markedly different from the NWC 90% RD heave analysis; the "safe" excavation surface is in some places up to 12 feet lower in the Northwest Corner. The EPA's preliminary review of the hydraulic heave analysis indicated a new methodology for identifying total stresses in the analysis, but there may also be additional changes not identified by the EPA. This information should be provided in the Hydraulic Heave Report. While pre-excavation stratigraphic borings and piezometers will provide more definitive information on hydraulic heave potential, that data will not be available to potential remedial contractors considering the potential for heave.	The Updated Hydraulic Heave Report, Attachment E, has been revised to address this comment.
93	23	Attachment E - Updated Hydrualic Heave Report - Section 7.2 Monitoring and Mitigation Procedures	One of the possible mitigation strategies suggested that an RC may implement would be to perform excavation activities during low water stages. If this option is permitted, a maximum water elevation or river stage that would be used to determine stage excavating conditions needs to be provided that would not potentially trigger hydraulic heave. Also, more supporting information on the impact of the elevated river levels on the hydraulic heave line would be needed.	Soil borings and piezometers will be installed by the RC at critical locations to monitor the actual uplift pressures in real time prior to excavation activities. These pressures will allow for better estimation of the hydraulic heave safety factors during excavation activities and will help to define the maximum river water elevation that would not trigger hydraulic heave risk. Attachment B of the Design Specifications (Appendix H) provides the RC requirements for installation of the Pre-Excavation Stratigraphic Borings and Piezometers.
94	23	Appendix F - Hydrodynamic Modeling Report - General Comment	The Hydrodynamic Modeling Report has undergone several changes since its initial presentation. Throughout this process the revised model is referred to as a "calibrated hydrodynamic model." A review of the Hydrodynamic Modeling Report (HMR) does not seem to present information that indicates that when the model is revised that the grid must be recalibrated based on the new information utilized. Please provide either direction on where this information may be located in the current HMR, inclusion of additional documents that demonstrate the recalibration, or discussion of the performance of the recalibrated HMR. Additionally, going forward, recalibration of the model should be conducted as an ongoing exercise throughout the life of the project as changes to the design occur, with appropriate documentation.	The changes to the model are not considered significant, since the cells' dimensions were not changed and the bathymetry changes were minimal and in areas outside of the main channel and the area close to the site. Nevertheless, a verification of the model compared to a previously existing HEC-RAS model was conducted as shown in Appendix A of Appendix F. The measured velocity data was analyzed in Attachment 3 of the BMP Structural Report (Appendix I) and the values are comparable to the model velocity values. The design was not only based on the Hydrodynamic Model results but also based on measured on-site data. The Hydrodynamic Model was used in conjunction with on-site velocity data to establish the basis of design for the 100% RD, including the BMP and scour protection. As such, the Hydrodynamic Model is not planned to be revised moving forward.
95	24	Appendix F - Hydrodynamic Modeling Report - Table 12 and 16	These tables should be updated to reflect changes to **Table 11** and **Table 15** (which were updated to show cell maximums).	The referenced tables were revised per the comment.
96	24	Appendix F - Hydrodynamic Modeling Report - Figure 30, Figure 31, and Figure 32	The figure captions do not appear to be correctly paired with the figures or descriptions of them in the text. Please verify and revise as needed.	The referenced figure captions have been revised.
97	24	Appendix G - Design Drawing Package - Drawing C-02	**Drawing C-02** depicts the limits of the geomembrane, geotextile and ACBM used in construction of the TCRA cap. While not discussed in **Drawing C-02**, **Drawing C-01** indicates that the source of this information was a 2010 report from Anchor QEA. Respondents should verify this information using later reports, including the 2012 Removal Action Completion Report (RACR) and the 2014 Enhancement Completion Report. Figure 5-1 of the RACR depicts waterside geotextile as-builts which seem to differ from **Drawing C-02**. It is also not clear from **Drawing C-02** whether there is geotextile under the ACBM.	The two source references for the geomembrane and geotextile limits of the TCRA cap have been moved from Drawing C-01 to Drawing C-02. In addition, a reference was added to the 2012 Removal Action Completion Report (RACR) on Drawing C-02. The information in the 2014 Enhancement Completion Report indicated that additional rock was placed but no additional geomembrane or geotextile was placed. The 2012 RACR indicates that there was geotextile placed within the south central portion of the site to the east of the center berm. This area was previously defined as having Armored Cap Type A which did not include geotextile. This was revised on Drawing C-02. The northwest corner, including the area under the ACBM, does not have geotextile, as confirmed by Figure 5-1 of 2012 RACR.
98		Appendix G - Design Drawing Package - Drawing C-57	The material shown in the inside of the triangular area on top of the two BMP walls needs to be labeled (e.g. Soil type S1 fill).	Sections W and X have been revised to identify "Soil Type S1 Fill" to be placed between the BMP sheet piles.
99	24	Appendix H - Design Specifications - General Comment	In EPA's April 2024 Supplemental Comments on the 90% RD, it stated that the design should include hydraulic heave monitoring systems to be automated and checked continuously. In Respondents' 100% RD response to comments in **Table 1-1, EPA comment No. 21**, it states that "[i]n the 100% RD, the RC will be required to provide an updated plan for BMP monitoring" in response to EPA's comments that the design should include requirements/plans to protect personnel safety in the event of heave failure, potential wall distress, seep formation, loose barge alarms, and severe weather. Respondents' response does not reference where this plan would be found, and, after review, it is not clear how if the 100% RD includes a plan for BMP monitoring either in the specifications or supporting deliverables to address EPA's concern. Regarding heave, the only requirement EPA could identify for ongoing monitoring is the requirement in **Attachment B** to the **Appendix H Design Specifications** requiring that "Groundwater depths will be monitored at a minimum of twice daily during the active excavation days," with the possibility of the Engineer adjusting the frequency. The 100% RD should include a plan for BMP monitoring, which for heave should either include a requirement for real-time monitoring which is continuously monitored, or an explanation of why other monitoring procedures are adequate.	Hydraulic heave is not a concern for the structural stability of the BMP. The monitoring described in Attachment B of the Design Specifications (Appendix H) is sufficient to address heave concerns for excavations.
100	25	Appendix H - Design Specifications - Part 31 23 16 Excavation Section 3.8 (J) Excavation Impacted Materials	This section states "Upon completion of excavation, confirm removal to the required elevations for each seasonal area, in accordance with the Drawings, by survey or grade control system data." Have the Respondents considered confirmation by use of a survey only? This would be consistent with all other grade confirmation specifications. Other portions of the 100% RD require a survey for confirmation purposes, and allowing confirmation via use of a grade control system for this purpose could create unnecessary confusion. Moreover, survey data is considered to be more reliable than grade control system data, so the use of a survey would make excavation more accurate.	The text in Section 31 23 16 - Paragraph 3.8 (J) has been revised to eliminate grade control as a confirmation method and now requires confirmation surveys performed by a licensed surveyor in the state of Texas.

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101	25	Appendix H - Design Specifications - Part 31 23 16 Excavation Section 3.10 Tolerances	Tolerances are essentially permissions to dredge within certain distances of the designed elevation, given the reality that the excavation will often not be exactly correct. In **Part 31 23 16**, the Design Specifications state that tolerances for excavation must be "Within 2 inches greater or less than specified depth but not uniformly greater or less." This directive appears to be too ambiguous. Specifically, what is meant by "not uniformly greater or less?" Instead of allowing a contractor to determine what this, it is recommended a more specific directive be given such as "Tolerances must be within 2 inches greater than the specified depth." As the goal of the ROD is to remove all identified material over the cleanup level, it is best for any variation allowed by the tolerance should in effect be in favor of additional over-excavation and not under-excavation. The concern is that a DU will be excavated too shallow in a large percentage of the excavation area if this isn't specifically delineated. Allowing for widespread shallow excavation could narrowly miss deeper contamination and prevent achievement of the cleanup level. This comment should be applied to all other areas where excavation of waste materials is being performed.	The text in Section 31 23 16 - Paragraph 3.10 has been revised to state that the tolerance is "Equal to or 2 inches greater than specified depth."
102	25	Appendix H - Design Specifications - Part 31 23 19 Dewatering Section 3.5 Dewatering Bulk Water	This section distinguishes between Bulk Non-Contact Water from Season 1 (all water is pumped to the WTS for solids removal) and Bulk Non-Contact Water Between Seasons (removing bulk noncontact water for treatment for solids up to 2 feet above the lowest elevation at the time of the dewatering activity). This is inconsistent with Section 5.2 of the 100% RD Report - Water Management, which states that "Following installation of the BMP, and at the beginning of each excavation season, bulk water trapped behind the BMP wall will be treated for solids and returned to the river until the water level is within 2 feet of the lowest point within the BMP." This section in the Report indicates that bulk water from Season 1 and subsequent bulk water between seasons will be treated in the same manner. Also, the only type of bulk contact water discussed in this section is Bulk Contact Water from Overtopping Event. What about bulk contact water generated by rain/storm events or below 2 feet above the lowest elevation?	This section has been revised to be consistent with the revisions to Section 5.2 and Section 5.9.1. There will be two types of water that are typically generated, contact water and non-contact water. Non-contact water is water within the BMP that has not contacted impacted surfaces and occurs 2 ft or more above the lowest elevation at the time of the dewatering activity. The remaining 2 feet of water and any water that has accumulated within the BMP and has come in contact with impacted surfaces or has comingled with contact water will be managed as contact water. The term "Bulk Contact Water from Overtopping Event" has been changed to "Contact Water from Overtopping Event" and refers to a high volume of water that would be generated during the overtopping of the BMP when impacted surfaces are exposed. As a contingency, Section 31 23 19 - Dewatering, of the Design Specifications (Appendix H) requires the RC to mobilize a high volume contact water treatment system to treat this water.
103	25	Appendix H - Design Specifications - Part 31 23 19 Dewatering	The specifications should consider a requirement that dewatering procedures be designed with suction and other controls to mitigate uptake of residuals and minimize disturbance of contaminated material, such as a floating intake and drawing from deeper water.	Detail has been added to Section 31 23 19 - Dewatering, of the Design Specifications (Appendix H), to specify that the bottom of the non-contact water pump intake must be maintained at or above 2 feet above the bottom of the excavation. The RC has the option of using a floating intake to accomplish this.
104	26	Attachment A - Residual Management Plan - Dredging Equipment and Procedures	It is discussed in the third paragraph of this section that during dredging operations the operator is required to slow the rate at which buckets move the dredged material in accordance with **Specification Part 35 24 00**. The concern is that the buckets of contaminated dredged material will spill or increase sediment release if moved too quickly. Furthermore, the selected RC must prepare a Dredge Operations Plan as specified in **Paragraph 1.9.4** of the same dredging specification. The Design Specifications must be clear and specific as to how each part of the remediation is to be carried out. Additional measures such as sweeping and leveling movements with the excavator buckets are not addressed in the Design Specifications. This should be addressed to minimize the risk of contamination.	The RC is required to provide a Dredging Operation Plan describing their means and methods to minimize the risk of contamination during dredging. The engineer will review their plan to ensure it meets the specified requirements.
105	26	Appendix I - BMP Structural Design Report - Section 6.2 Analysis Sections	This section presents BMP construction stages in each section analysis, but it is not clear if the four construction stages, (i.e. exterior and interior sheet pile installation, initial fill to tie-rod height, tie rod installation, and final fill to BMP top) will be completed section by section or the entire BMP will be installed stage by stage. Please add a summary of the overall BMP installation stages including the construction sequence of each section to demonstrate how the entire BMP would be installed. It should be included in Appendix I and the main document as well.	The overall construction sequence will depend on contractor's means and methods, and will be reviewed and approved by the Engineer of Record prior to beginning construction. Section 6.2 notes the following for clarification - "The following sections provide the sequence of construction for each cross-section. The overall construction sequence is subject to the Contractor's means and methods and must be reviewed and approved by the Engineer."
106	26	Attachment 3.3 - Scour Protection - Scout Protection and BMP Interior - Section 2.3 Bench Hydraulics	In the calculation of the friction slope on Page 6, please clarify whether the selected value of Manning's roughness (n) of 0.045 is supported in the literature for grouted riprap, specifically whether the presence of grout filling pore spaces between riprap decreases the roughness in a meaningful way, therefore lengthening the hydraulic jump lengths. The equation(s) relating friction slope and head loss to the calculated Froude numbers and velocities should be included in the text for transparency.	The text has been revised to justify the selection of the Manning's roughness value of 0.045. This roughness coefficient was calculated based on equations outlined in Roughness of loose rock riprap of steep slopes (Rice et. al, 1998) and applying a reduction of 20% to account for grouting of rock. This reduction factor is based on guidance in hydraulic design manuals such as San Diego's 2014 Hydraulic Design Manual. The text has also been revised to clarify the calculations of the hydraulics at the toe of the bench. The friction slope and head losses were used in Equation 1 to calculate the depth and velocity at the toe of the bench. The velocity at the toe of the bench was then used to calculate the Froude number at the toe of the bench per Equation 3.
107	26	Attachment 3.6 - Barge Impact Rev1:June 2024 - General Comment on Barge Strike Protection Structural Strength	It is unclear whether the Fiberglass Reinforced Polymer (FRP) pile barrier would hold up against a potential barge strike. The Report notes that piles are not designed to absorb the full impact of a drifting barge moving at 3.14 ft/s (or 2.14 mph). The report states that a barge moving at that speed would break through the pile barrier but with substantially dissipated energy. Previous flooding in the San Jacinto River has caused barges to break loose, and the accident briefs indicated that river currents during that event were 5.73 ft/s (or 3.9 mph). This seems to indicate that a barge could strike the pile barrier and breach the wall. Additional research should be performed to determine whether the pile barrier needs be reinforced, or its construction made stronger to prevent a breach. Would an increase in the size and density of the barrier help prevent a barge strike from breaching the barrier?	As noted in Section 6.7 and Attachment 3.6, the FRP pile barrier system is designed to withstand impact energy of 829 kip.ft from the design barge. This is equivalent to head-on impact at 2.2 ft/s with a laden (loaded) barge and 5.3 ft/s with a ballasted (empty) barge. The BMP walls are designed for impact forces equivalent to energy absorbed by the barrier wall (i.e., head-on impact at 2.2 ft/s with a laden (loaded) and 5.3 ft/s with a ballasted (empty) barge). Additional explanation has been added in the report for clarification. The combined system (FRP pile barrier and BMP wall systems) can withstand impact at velocity up to 4.4 ft/s (loaded barge) and 10.6 ft/s (empty barge). The BMP walls will have localized damage at greater velocity but will not result in a collapse of the BMP walls. This performance is considered adequate and acceptable for design. The FRP barrier wall is designed as a sacrificial system. The piles absorb impact energy by accommodating large deflections and should not be reinforced. This absorption method also avoids damage to barge hulls to prevent undesired impact (hull damage, fuel leaks etc.). The flow velocity used in the design for protective barrier and evaluation of the BMP walls is an appropriate approach and consistent with the simulation models (hydrodynamic analysis) and the buoy data on site.
108	27	Attachment 3.6 - Barge Impact Rev1:June 2024 - General Comment on Barge Strike Protection	During the October 10, 2024, call between TxDOT, EPA, and the Respondents, TxDOT expressed concern with the overlap in the schedules between the two projects potentially resulting in conflicts with TxDOT's planned installation of 20 feet high rip-rap barge strike protection structures protecting the planned I-10 bridge support structures. TxDOT's concern about interference between the BMP and the construction of its bridge protection structures appears connected (at least partially) to TxDOT's request to reduce the footprint of the southern portion of the BMP. Could the proposed site Barge Strike Protection Structure be modified to act as an interim protective structure for the new I-10 bridge until the RA is complete, and subsequently removed once TxDOT has completed the protective structure installation?	The BMP wall system and FRP pile barrier system is designed to support and protect the excavation in the Northern Impoundment on a temporary basis. The TxDOT requirements for permanent bridge protection are above and beyond the requirements in the ROD for the Northern Impoundment and would require significant modifications to address TxDOT's bridge protection requirements. The Respondents are not and should not be required to include in the design bridge protection measures that are outside the scope of the work required in the ROD for RA activities associated with the Northern Impoundment.

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109	27	Attachment 3.6 - Barge Impact Rev1:June 2024 - Section 3.6.2 Impact Velocity and Section 6.7 Barge Impact	Respondents' use of 3.14 ft/s as the impact velocity in their barge impact analysis is not consistent with maximum velocities in site-specific velocity data provided by Respondents. For example, during the late January 2024 high-water event on the San Jacinto River, for which the Sheldon gage showed river levels of approximately 13 feet or a moderate flood stage, the actual – not modeled – river flow velocity data collected at the Site showed velocities of over 4 ft/s, as documented in Respondents' monthly report. According to Appendix C of Respondents' January 2024 Plan ("BMP Scour Protection"), Respondents stated that they used observations of river velocities during Tropical Storm Imelda for purposes of developing scour protection; together with other data, this resulted in approximate peak velocities during Imelda of 4-5 ft/s. In addition, as stated in a previous comment, accident briefs from a prior barge accident indicate that river currents during that event were 5.73 ft/s. To be conservative, the estimated velocity used for designing external scour protection was increased to 6 ft/s (**Section 6.4.1 BMP Exterior**) to provide an additional factor of safety, but the impact velocity used for barge protection remains 3.14 ft/s. As discussed in EPA's April 2024 Supplemental Comments on the 90% RD, Respondents should incorporate the Site velocity data into the hydrodynamic model and barge impact analysis. The discrepancy in the measured and simulated maximum current speeds indicates that Respondents' hydrodynamic model was most likely not calibrated using measured currents in proximity to the Site. Respondents should set up their hydrodynamic model to simulate the period of time when the currents were being measured and then use the data to calibrate their model. Respondents also should provide cumulative Site velocity data in an appendix to the 100% RD, as well as continuing to submit monthly reports with velocity data. This data should be provided in the 100% RD as the calculated river velocities based on the raw data.	The measured velocity data from the buoys installed on site was analyzed and is presented in Attachment 3.8 of Appendix I. The maximum values obtained were comparable to maximum velocity output from the hydrodynamic model. Additional clarification has been added in the Revised 100% RD report and Appendix I for the velocity of impact and energy absorbed by the barrier wall and BMP walls. The 4.4 ft/s velocity is the upper bound limit for impact with a laden (loaded) barge for a head-on impact. Scour protection has been designed for a different velocity to provide a higher factor of safety as noted in the report. The exterior riprap cannot be inspected after storms as readily as the interior scour protection or the condition of the sheet piles. Hence, a higher factor of safety is appropriate. Respondents have been submitting the requested river velocity data in the monthly reports and will continue to do so.
110	27	Appendix J - Supporting Deliverables - General Comment for Supporting Deliverables	It is understood by the EPA that the Supporting Deliverables are not expected to be complete and that the RC selected to perform the RA will be responsible for providing fully updated and complete sitespecific Supporting Deliverables. The EPA would like to re-iterate that the updated Supporting Deliverables must be provided for EPA's review and approval before remedial construction starts. The EPA would like to also note that the Supporting Deliverables within the 100% RD should include as much information concerning the work to be performed, hazards expected, requirements, and special site conditions as possible to assist the selected RC with developing the final required Supporting Deliverables.	This comment is received and noted.
111	28	Attachment 3 - Field Sampling Plan - North Impoundment - Section 2.1.1 Sampling Locations within a DU	**Figure 2.1** show decision units (DUs) that split across the Northwest Corner excavation area and the dry excavation area to the south that will be excavated several seasons after the Northwest Corner dredging occurs. Please explain why the DUs are designed in this way in the FSP, and whether there will be any issues caused with making decisions to excavate deeper across these boundaries in removal methods. The DU size (in acres) is not specified in **Section 2.1**, but the DU size illustrated in the figures appears larger than the ½ acre DUs discussed in the 90% RD and the staged deliverables submitted in May 2024. Please explain. If the DU size and DU locations are still conceptual, please discuss and clarify	The pre-excavation sampling will be conducted prior to any excavation (including the mechanical dredging of the Northwest Corner). The final excavation surfaces will be defined up front including any excavation across the boundaries between the Northwest Corner and the remainder of the area. The DUs are designed to grid off the site relatively evenly based on the area of the northern impoundment with respect to the center and southern berm. Based on the proposed number of pre-excavation sampling locations and the data previously collected in the PDIs and SDI, the DUs and sample locations are appropriate to accurately define the excavation surface to remove material above the remedial goal of 30 ng/kg.
112	28	Attachment 3 - Field Sampling Plan - North Impoundment - Figure 2.1	The proposed sample boring grid shows several locations where locations are collocated with existing borings from previous investigations to better understand the validity of the interpolated bottom of the waste between borings with steep sloping such as in the Northwest Corner. Could additional borings be added to slopes lower in the deeper parts of the excavation to improve the planned excavation surface in the bottom of these areas?	The pre-excavation sampling will be conducted prior to any excavation (including the mechanical dredging of the Northwest Corner). The final excavation surfaces will be defined up front including any excavation across the boundaries between the Northwest Corner and the remainder of the area. The DUs are designed to grid off the site relatively evenly based on the area of the northern impoundment with respect to the center and southern berm. Based on the proposed number of pre-excavation sampling locations and the data previously collected in the PDIs and SDI, the DUs and sample locations are appropriate to accurately define the excavation surface to remove material above the remedial goal of 30 ng/kg. The information obtained from the initial pre-excavation sampling will inform decisions on potential additional samples required to adequately define the excavation surface, as outlined in the flow chart of Figure 2.4 shown in the FSP.
113	28	Attachment 3 - Field Sampling Plan - North Impoundment - Section 3 Historical Berm Material Sampling	Please clarify how the estimated volume of approximately 25,000 CY of unimpacted berm material shown on Figure 2.1 was generated? Also, additional information on the basis for the light blue outline of "Non-Impacted Berm Material" used in past Pre-Design Investigation and RD submittals should be provided. The Pre-Design Investigation sampling events had a limited number of borings collected from the approximate centerline of each historical berm and did not finely delineate the boundaries of contaminated material from clean berm material. Are there plans to use other methods in the field, such as visual differences if they can be observed between the native berm material and the waste material during excavation, that could be used to guide stockpiling of berm material pending analysis to determine reuse potential? The proposed pre-excavation confirmation sampling should include sidewall delineation between the waste edge and the non-impacted berm material. This would allow for minimizing the amount of berm material that would need to be retained onsite pending classification and thus mitigate risk of potential releases or increased volumes that would need to be addressed as part of storm contingency planning.	The estimated volume of unimpacted berm material was generated using AutoCAD Civil 3D. The basis of the limits of the unimpacted berm material is based on historical clean soil sample data and aerial photography. During excavation, the staging of berm material will be determined based on historical borings and visual observation of the material type. However, any material staged for potential reuse will be sampled at a frequency of 1 sample per 500 cubic yards, as described in the FSP (Appendix J, Attachment 3).
114	28	Attachment 3 - Field Sampling Plan - North Impoundment - Section 3.2.1 Sample Collection Procedures	Prior to the RA work, the future Remedial Contractor should define the number of discrete aliquots within each 500 CY, and the method for collecting them in a representative manner (in-situ or from stockpiled material). The appropriate plans such as the FSP, QAPP, and TODP should be updated with this information to provide consistency.	This comment is received and noted. The RC's proposed means and methods will be provided to EPA in updated supporting deliverables, plans, and any other updated RD components for EPA review and approval.
115	29	Attachment 3 - Field Sampling Plan - North Impoundment - Section 5.2.1 Continuous Discharge	This section should be updated to reflect the approved language regarding corrective measures to be taken should the continuous discharge sample show exceedance of limits as laid out in **Section 5.5.4** of the Final 100% RD for the Southern Impoundment dated April 19, 2021, which states:"If analyses at the point of discharge indicate that effluent has not met discharge criteria for a regulated parameter, the EPA will be notified immediately and the system will then be shut down and/or effluent may be recirculated to the contact water storage tank(s), and additional performance checks may be performed on the treatment system, including but not limited to, checks and appropriate modifications with respect to chemical dose, checking to determine whether GAC and/or filter media and bag filters should be replaced, etc. Contingency measures may also include, but are not limited to, increased monitoring and notifications."	The Field Sampling Plan (FSP) has been revised accordingly.
116	29	Attachment 4 - Quality Assurance Project Plan - Northern Impoundment - Table 1	TCLP Dioxin/furans should be included in the Waste Characterization analyte list, as TCLP Dioxins/furans analysis may be required by the disposal facility to develop the Class 1 or Class 2 waste profile for Site waste. This analysis was performed for the Southern Impoundment RA and should be anticipated for the Northern Impoundment as well. In addition, the Water and Contact Water heading is inconsistent with the FSP in that it includes Dioxins/furans and TSS, as required by the FSP, but has omitted the metals required by the FSP. Pages 2-7 of this table include analytes such as Metals, TAL Volatiles, TCL Semi-volatiles, TCL Pesticides, PCBs, and TCL Metals under the heading "Excavation Confirmation Sampling Soil and Sediment". Please verify and revise **Table 1**.	The Quality Assurance Project Plan (QAPP) has been revised accordingly.
117	29	Attachment 4 - Quality Assurance Project Plan - Northern Impoundment - Table 2.1	It appears that the last few pages of the QAPP have been recycled from the QAPP for the Phase II Pre-Design Investigation (PDI-2). While information presented may be applicable to the 100% RD QAPP, the headers should be corrected so that it is clear for which document/sampling plan the information is provided.	The Quality Assurance Project Plan (QAPP) has been revised accordingly.
118	29	Attachment 5 - Site-Wide Monitoring Plan - Northern Impoundment - Figure 3.2	Please provide frequency plots for Ambient A, B, and D in addition to Ambient C as this is relevant to interpretation of the ambient data statistics.	The frequency plots for Ambient A, B, C, and D have been included as Attachment 2 in the Site-Wide Monitoring Plan (SWMP).

Table 1-1

Response to EPA Comments on 100% Remedial Design
Revised Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site

Item No.	Comments Letter PDF Page	Reference	Comment	Response to Comment
119	29	Attachment 5 - Site-Wide Monitoring Plan - Northern Impoundment - Section 3.4.1.2 Data Review	The ambient turbidity data herein was collected from December to March, within the planned excavation season, while the BMP installation may occur outside the planned excavation season (i.e., during hurricane season). The natural water conditions and river traffic conditions that impact turbidity may fluctuate seasonally. Please evaluate if any uncertainty or bias is created by using the ambient turbidity data collected in the winter/spring to establish the criteria for work that may be conducted in a different season.	We do not believe there is any bias. If any basis exists, it is likely conservative with background turbidity levels from spring/winter used for the summer and the hurricane season.
120	30	Attachment 5 - Site-Wide Monitoring Plan - Northern Impoundment - Section 3.4.2 Remedial Action Monitoring Locations	The first paragraph states that the data from ambient velocity monitors shows that the flow around the vicinity of the TCRA cap is along the northern edge in a south-easterly direction and along the eastern edge in a southerly direction. Please provide the relevant ambient velocity data summarized in a figure or table (e.g. a rose diagram) to support the conclusion. Additionally, Background Location B appears to be very close to the eastern edge of the BMP installation area, within the area of support boat traffic at the Site during BMP installation. Please provide the minimum distance expected from Location B to the eastern BMP installation area and provide a rationale/justification for the close proximity of this background location to the cap.	The on-site velocity data are included in Attachment 3 of Appendix I (BMP Structural Report) to support the interpretations of the flow shown on Figure 3.3. Background Location B will be located at a minimum of 100 feet away from the BMP. Installing Background Location B farther Northeast than shown on Figure 3.3 would make it susceptible to damage and disturbance from outside vessel traffic. Background Location B may be slightly adjusted to stay upstream of the active BMP activities.
121	30	Attachment 6 - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Section 3.1 Inspections	In **item iv**, in order to clarify what requirements need to be met as part of the inspection of materials after they have been installed, change "in accordance with the construction specifications" to "in accordance with the construction specifications, construction drawings, and contract documents." A similar change is also recommended for **items v., vii.a.**, and **vii.b.** in this section.	The Construction Quality Assurance/Quality Control Plan (CQA/QCP) has been revised accordingly.
122	30	Attachment 6 - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Section 3.1 Inspections	In item vii, it says that the inspections will be made by the Engineer. If the intention is that a designated representative will also be allowed to perform the inspections, the document should be updated so that the RC will understand that if they choose to allow for such delegation by the Engineer or chose to name specific other personnel with assigned titles and rolls to perform this duty, it should be clearly discussed in the final CQA/QCP.	Inspections will only be conducted and/or overseen by the Engineer.
123	30	Attachment 6 - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Section 4.1 Work Site Logbook	The EPA requests a BMP to be utilized that would include maintaining an electronic copy of the Engineer's logbook recording construction quality on-line in a manner accessible to the EPA, so that EPA can review the record daily as part of its oversight of the remedy implementation.	The Construction Quality Assurance/Quality Control Plan (CQA/QCP) has been revised.
124	30	Attachment 6 - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Section 6 Project Meetings	The last sentence of the 1st paragraph should be changed from "The timing and attendance, at such meetings will be determined by the RC and the Engineer and..", to "The timing and attendance, at such meetings will be determined by the EPA, the RC, and the Engineer and ….". This will ensure that the EPA can participate in the meetings and also include other appropriate parties outside of the EPA in the meetings as required.	The Construction Quality Assurance/Quality Control Plan (CQA/QCP) has been revised.
125	31	Attachment 6 - Construction Quality Assurance/Quality Control Plan (CQA/QCP) - Northern Impoundment - Section 6 Project Meetings	As part of the Site record keeping and information distribution, the EPA requests that all meeting minutes be distributed electronically within pre-determined time frames following the meetings. Furthermore, all meeting minutes should be maintained in an online shareable location so that they are accessible to the attendees or other parties that require access to them. If the RC decides to use an online site to make the minutes available to the attendees in lieu of emailing them to each attendee individually, the RC will be required to send a notification that the minutes have been uploaded to the site to attendees when the minutes are ready for review. In order to minimize issues with communicating the minutes due to the number of potential attendees at these meetings and their associated support staff, the RC should also request and maintain a list of points of contacts (POC) for each attendee for each meeting series. The designated POC will be responsible for distributing or notifying their organization or team of the minutes and distributing them internally to their organization/team.	The Construction Quality Assurance/Quality Control Plan (CQA/QCP) has been revised.
126	31	Attachment 7 - Institutional Controls Implementation and Assurance Plan - Sand Separation Area - Section 2.4 Key Stakeholders	This list provided of key stakeholders should be re-evaluated to determine if there are other stakeholders or agencies that would have an interest or mechanisms to implement potential institutional controls (ICs) for the Site.	The key stakeholders have been identified and noted in the Revised 100% RD. As the SSA process moves forward, the stakeholders will be evaluated with EPA to determine if other stakeholders need to be engaged.
127	31	Attachment 7 - Institutional Controls Implementation and Assurance Plan - Sand Separation Area - Section 3 Planned Remedial Action Institutional Controls	This section does not contain enough detail of the proposed institutional and administrative controls to provide detailed comments on the proposed approach. The plan should be updated following the proposed stakeholder discussions. Additionally, the EPA and other stakeholders will require the opportunity to review and comment on draft ICs that may be required before they are finalized and filed with the county.	This comment is received and noted. The TCEQ's Restrictive Covenant template has been included as an attachment to the ICIAP for reference purposes.
128	31	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 4.4 Case Studies	The Lavaca Bay site is provided as a case study; but it should be noted in this description of that site that once the performance objective was met in 2006, voluntary sediment monitoring has continued to be performed after 2006 to verify that MNR is still protective and progressing at that site.	The text in Section 4.4 has been revised to note that sediment monitoring has continued post-2006.
129	31	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 4.8 Potential for Disturbance and Perturbation	The current Monitored Natural Recovery (MNR) Plan for the Sand Separation Area (SSA) in this section discusses potential sources for disturbance of the SSA such a hurricanes and flooding, as well as anthropogenic sources of disturbance that could occur as well. The MNR Plan calls for a combination of monitoring and possible institutional controls to document MNR is occurring and successful for the implementation of the remedy for the SSA. The monitoring plan should address these potential occurrences and how they will be addressed should they occur or are an ongoing issue. This could be in the form of increased sampling for the initial period following completion of the RA, with subsequent additional sampling triggered by events such as hurricanes, extreme flooding, and changes to the operational use of the area for fleeting activities. Additionally, the plan should also address monitoring requirements that may be required to support the enforcement of any ICs that may be implement for the SSA that are not analytical in nature, such as monitoring of compliance with IC requirements that limit use of the area for fleeting activities, prohibitions on dredging, or limitations on recreational usages.	The text in Section 4.8 has been revised to include the completion of a site inspection annually.
130	32	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5 Monitoring Program	The proposed monitoring program schedule needs to take into account changes in the RA implementation schedule. Also, it should be noted that the five-year review process for the Site was initiated upon start of the RA for the Southern Impoundment, and that based on the current schedule for RA implementation for the Northern Impoundments, it is most likely that the Site will undergo at least two five-year reviews prior to the estimated completion timeframe for the Northern Impoundments. In addition, it should be noted that since waste material will remain in place in the SSA, that it will continue to require future five-year reviews if hazardous substances remain above levels that allow for unlimited use and unrestricted exposure. Those five-years reviews will require findings that MNR is a protective remedy. Should the five-year review determine that MNR is not protective or is not performing as required by the ROD, the remedy may need to be re-evaluated to achieve protectiveness.	This comment is noted and the text has been revised to remove reference to the first Five Year Review.
131	32	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5.1 Sampling Locations and Depth Intervals	The boundaries of the SSA need to be better defined to allow the decision units and sampling points to be determined for implementation of MNR. Currently the SSA boundary is not fixed and has changed during various stages of the RD development since the ROD was issued. By determining the SSA boundaries, including the location of the shoreline, a better monitoring plan can be developed along with potential institutional controls that will be in compliance with the ROD.	The area of the SSA and boundaries were established during the ROD by EPA. EPA provided a shapefile of the SSA boundary from the ROD and that shape has been used on all figures. As such, the boundary of the SSA has been established and will not change.
132	32	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5.3 Sampling Frequency	The proposed sampling schedule includes sampling events prior to the RA, then within 1, 3, and 5 years of RA completion. EPA policy is to initiate the first five-year review based on the start date of the Remedial Action, per the National Contingency Plan (NCP), 40 CFR Part 300.430(f)(4)(ii). The final sentence of this section should be revised to remove the statement that no additional sampling is proposed after the first five year review, because based on the Respondents' proposed schedule of seven years, that will occur prior to RA completion; additional sampling should be required after RA completion to determine if there are any effects on the SSA of the end-state of the impoundment excavation or as necessary for the continuing five-year review process.	This comment is noted and the text has been revised to remove reference to the first Five Year Review.
133	32	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5.4 Data Evaluation	EPA does not agree with the proposal to use the arithmetic mean concentration of all the nine composite samples, of which most have Dioxin/Furan concentrations below the clean-up level, to evaluate remediation progress and determine the completion of remediation. This will significantly reduce the observed concentration of hot spots, which should be the targeted remediation areas for the MNR, although the IC covers the whole SSA.	The result of each discrete sample utilized to calculate the arithmetic mean will be reported.

Table 1-1

Response to EPA Comments on 100% Remedial Design
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San Jacinto River Waste Pits Site

Item No.	Comments Letter PDF Page	Reference	Comment	Response to Comment
134	33	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5.5 Decision Rule	As noted in the comment on **Section 5.3** above, the first five-year review would be expected to occur during the RA construction period. In addition, both construction of the BMP and the end-state of the excavated Northern Impoundments could affect attenuation in the SSA. As such, the “decision rule” should be revised to reference the second five-year review after completion of the Northern Impoundments RA, or such time as is subsequently determined by EPA.	The text in Attachment 9 has been amended to remove reference to specific Five Year review periods.
135	33	Attachment 9 - Monitored Natural Recovery Plan - Sand Separation Area - Section 5.6 Sampling Duration	See comments on **Section 5.3** and **Section 5.5** above.	See response to comments on Section 5.3 and 5.5 above.
136	33	Attachment 10 - High-Water Preparedness Plan - Northern Impoundment - Table of Contents	The page numbering does not seem to be applied correctly, it goes from 1-7, then to 2-5. Please review and correct as appropriate.	The High-Water Preparedness Plan (HWPP) has been revised accordingly.
137	33	Attachment 10 - High-Water Preparedness Plan - Northern Impoundment - Section 5.2 Minor Flooding Event Preparedness	When the RC is selected and is performing the required updates to the Supporting Submittals, the High-Water Preparedness Plan (HWPP) should be updated to show areas where equipment will be moved in response to potential flooding events and in-between excavation seasons. Furthermore, if these areas will be used to store materials or equipment that could pose a threat of a release from containers, vehicles oils and fuels, or other materials, they should be covered by appropriate plans, as well have BMPs in place to address the potential for releases.	This comment is received and noted.
138	33	Attachment 10 - High-Water Preparedness Plan - Northern Impoundment - Section 5.4 Hurricane Preparation - *Phase I Preparations*	To better manage storm preparations, it is suggested that the RC coordinate with the Engineer and EPA to standardize the sequence and scheduling for storm preparation into a format/process that includes benchmarks and triggers that stage the hurricane response preparations. This process could also be expanded to include not only the actual formation of a storm, but also possibly be triggered in some circumstances by a forecast that a storm may begin to form. At that point planning could begin so that the site activities could be tailored to make transitioning into storm preparation more orderly and take less time.	This comment is received and noted.

LJA Comments for permits to work within TxDOT ROW

1	34	TxDOT Concerns	**Proposed cofferdam within TxDOT's ROW.** LJA has asked several times that the cofferdam be revisited and redesigned to minimize the footprint / encroachment within the ROW. As currently proposed, the cofferdam will interfere with TxDOT's proposed bridge pier protection system. We have reviewed the proposed cross-sections cut thru that section of the wall (Sections T, U, V, W, X and Y of the 100% set of plans (the relevant sheets are attached)) and there is very little excavation proposed in front of the wall or any significant excavation is considerably further away from the cofferdam. With such little excavation, there is not a need for a cofferdam with 30ft between sheet pile walls. We request that the first sheet pile wall of the double wall cofferdam be placed 5ft inside TxDOT's ROW and the second sheet pile wall be placed 20ft from the first. This would result in a 25ft of total encroachment and eliminate the overlap with the bridge pier protection system. In addition, this would allow more room for access for the bridge construction. Attached is an exhibit of the proposed modifications.	See response to EPA Comment #11.
2	34	TxDOT Concerns	**The proposed cofferdam should be designed to take into account the surcharge loads** from the proposed bridge pier protection riprap berms.	This will be discussed in future coordination with TXDOT. Respondents will continue to engage TxDOT and EPA on the BMP design and TxDOT's Interstate Highway-10 bridge project, including protective structures, in order to progress both projects forward.
3	34	TxDOT Concerns	**The proposed 3ft thick riprap layer placed against sloped fill to restore the shoreline** all the way up to TxDOT's ROW will need to have some embedded toe or apron in place. Attached is an exhibit detailing the needed toe apron for the proposed restoration	Refer to previous response to EPA comment #88.
4	34	TxDOT Concerns	**Submit the WEAP analysis to TxDOT Lab** that was performed on installation of the proposed cofferdam sheet piles with the use of both a vibratory and an impact hammer. The analysis reportedly showed vibrations below a certain threshold (considered a risk to an existing structure) at a distance of 25' away which is the distance to the existing WBML bridge.	The WEAP analysis was provided in the 100% RD as Appendix I, Attachment 3.7. The discussion on the vibration limits has been updated to match the graph.
5	34	TxDOT Concerns	**Coordination with TxDOT Area Office on the details of the access road improvements and maintenance.** The gravel road access to the superfund site is shown to be widened to accommodate two way truck traffic and maintained during the duration of the remediation process. The logistics of the joint use of this access road (for the remediation project and the bridge construction project) must be addressed and agreed upon with the TxDOT Area office including the maintenance requirements	This will be discussed in future coordination with TXDOT. Respondents will continue to engage TxDOT and EPA on the joint use of the access road, in order to progress both projects forward.

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB028	SJSB029	SJSB029	SJSB029	SJSB029	SJSB029
Sample Identification:		SL0580	SL0581	SL0582	SL0583	SL0584	SL0589	SL0585	SL0586	SL0587	SL0588	SL0500	SL0501	SL0502	SL0503	SL0504
Sample Date:		11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/19/2018	11/6/2018	11/6/2018	11/6/2018	11/6/2018	11/6/2018
Sample Type:							Duplicate									
Sample Depth:		(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs
Integral Sample ID:		SJSB028-C1	SJSB028-C2	SJSB028-C3	SJSB028-C4	SJSB028-C5	SJSB028-C10	SJSB028-C6	SJSB028-C7	SJSB028-C8	SJSB028-C9	SJSB029-C1	SJSB029-C2	SJSB029-C3	SJSB029-C4	SJSB029-C5
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	28.1	1.24 J	64	4.82 J	2.4 J	5.86 J	2.19 J	1.34 U	1.2 U	0.349 U	44.1	5.19 U	2.95 J	1.45 J	2 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	2130	1680	2570	2260	948	3270	683	1070	856	985	4720	2750	2110	690	791
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	19.2	0.34 J	6.55	1.33 U	0.94 J	2.1 U	0.183 U	0.26 U	0.333 U	0.072 U	9.89	1.25 J	0.39 J	0.349 U	0.46 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	46	23.5	38.6	32	13	39.9	9.57	16.8	16.3	20.9	104	42.5	37.5	11.3	20.1
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	2.14 J	3.07 U	0.798 U	0.181 U	0.19 J	0.261 U	3.32 U	3.27 U	3.32 U	3.23 U	0.706 U	3.21 U	3.23 U	3.86 U	3.17 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	5.9 U	0.144 U	3.37 U	0.93 J	0.993 U	1.71 U	0.288 U	0.243 U	0.262 U	3.23 U	1.89 J	0.208 U	3.23 U	0.22 J	3.17 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.97 U	0.352 U	3.32 U	3.33 U	3.34 U	0.605 U	0.26 J	0.284 U	0.192 U	0.26 J	0.845 U	0.486 U	0.504 U	3.86 U	0.286 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.83 J	0.09 J	1.27 U	0.259 U	0.214 U	0.7 J	0.0887 U	3.27 U	0.0543 U	3.23 U	0.78 J	3.21 U	3.23 U	0.137 U	3.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.72 J	0.582 U	0.94 U	0.93 J	3.34 U	1.2 U	0.399 U	0.439 U	0.53 J	0.582 U	2.46 J	0.752 U	0.804 U	3.86 U	0.67 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.933 U	0.1 J	0.435 U	0.203 U	0.112 U	0.0976 U	0.075 U	0.0823 U	3.32 U	3.23 U	0.59 J	3.21 U	3.23 U	3.86 U	0.082 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.47 J	1.08 U	1.31 J	1.48 J	0.358 U	1.89 J	0.6 J	0.766 U	0.71 J	0.674 U	3 J	1.78 U	1.84 J	0.57 J	0.96 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.06	3.07 U	1.87 U	0.62 J	0.495 U	1.26 J	0.21 J	3.27 U	0.16 J	3.23 U	1.09 U	3.21 U	3.23 U	3.86 U	3.17 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.75 J	0.28 J	0.384 U	0.39 U	0.23 J	0.229 U	0.164 U	3.27 U	0.0787 U	0.153 U	0.542 U	0.341 U	0.33 J	3.86 U	3.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.72	3.07 U	0.46 U	0.23 J	0.2 J	0.42 J	3.32 U	3.27 U	3.32 U	3.23 U	1.05 J	3.21 U	3.23 U	3.86 U	3.17 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	4.55	0.094 U	1.63 U	0.397 U	0.63 J	1.17 U	0.177 U	3.27 U	0.179 U	3.23 U	1.4 U	3.21 U	3.23 U	3.86 U	3.17 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	124	4.51	74.1	21.6	16	40.8	4.49	7.04	6.74	1.84	45.9	5.03	1.81 U	2.81 U	2.26
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	41.9	1.64 U	26.3	8.45	4.55	14.9	2.36	2.4 UJ	2.16 U	0.647 U	12.5 U	1.55 U	0.749 U	1.37 U	0.648 U
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	28.1	1.24 J	64	4.82 J	2.4 J	5.86 J	2.19 J	1.34 U	1.2 U	0.349 U	44.1	5.19 U	2.95 J	1.45 J	2 U
Total dioxin/furan	pg/g	2410	1710	2780	2330	986	3380	703	1090	880	1010	4930	2800	2150	704	815
Total dioxin/furan (ND*0.5)	pg/g	2410	1710	2790	2330	987	3380	703	1100	883	1010	4940	2800	2160	707	817
Total dioxin/furan (ND*1)	pg/g	2420	1710	2790	2330	989	3380	704	1100	885	1010	4950	2810	2160	710	819
Total heptachlorodibenzofuran (HpCDF)	ng/kg	36.8	0.71 J	14	1.71 J	2.29 J	3.5	0.31 J	3.27 U	0.66 J	3.23 U	31.2	2.3 J	0.38 J	3.86 U	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	132	69.4	119	90	38.4	120	27.3	52.3	54	68.7	466	121	106	32.1	68.6
Total hexachlorodibenzofuran (HxCDF)	ng/kg	21.1	0.19 J	4.64	1.68 J	0.66 J	1.91 J	0.19 J	3.27 U	0.16 J	3.23 U	13	0.65 J	3.23 U	0.35 J	0.12 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	27.8	14.6	15	23.3	7.62	19.3	4.85	12.4	15.5	20.5	59.5	15.4	22.4	6.35	18.8
Total pentachlorodibenzofuran (PeCDF)	ng/kg	19.4	3.07 U	1.67 J	0.62 J	0.63 J	4.12	0.21 J	3.27 U	0.16 J	3.23 U	6.09	3.21 U	3.23 U	3.86 U	3.17 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.51	1.24 J	1.34 J	3.33 U	0.71 J	1.57 J	0.24 J	3.27 U	0.88 J	2.51 J	3.47	3.16 J	1.74 J	3.86 U	2.72 J
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	173	6	102	31.1	21.7	57.3	7.21	8.6	8.16	2.45	54.6	6.63	2.22	2.59	3.06
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	52.9	2	31.4	10.3	6.17	18.2	2.96	1.89	1.69	0.77	10.6	1.79	1.24	1.2	0.829
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	173	5	101	30.6	21.5	56.5	7.02	7.16	6.93	1.97	47.3	5.36	0.767	0.159	2.47
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	174	6.9	104	31.5	21.8	58.1	7.41	10	9.39	2.93	61.9	7.9	3.68	5.02	3.64
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	52.4	0.7	30.4	9.96	6.03	17.5	2.81	0.476	0.459	0.341	3.46	0.582	0.601	0.108	0.233
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	53.3	3	32.3	10.7	6.3	18.8	3.11	3.31	2.91	1.2	17.7	2.99	1.88	2.29	1.43
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	58.1	0.6	33.8	11	6.6	19.3	2.91	0.704	0.806	0.21	5.57	0.503	0.349	0.079	0.389
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	58.4	2	34.7	11.2	6.72	19.9	3.03	2.08	1.97	0.657	12.4	1.64	0.969	1.11	0.859
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	58.8	2.5	35.6	11.4	6.83	20.4	3.16	3.46	3.14	1.1	19.2	2.78	1.59	2.15	1.33
Total tetrachlorodibenzofuran (TCDF)	ng/kg	222	6.2	124	39.2	24.4	70.6	6.89	9.89	8.48	1.84	72.1	6.94	0.647 U	0.771 U	2.74
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	46.7	0.615 U	29.9	8.45	0.669 U	16.1	2.36	0.779 U	0.56 J	0.647 U	1.22	0.73 U	0.749 U	1.37 U	0.71
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	58.8	1.5	35.1	12	7.02	20.7	3.2	1.19	1.22	0.714	8.14	1.77	1.53	0.399	0.832
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	59.2	2.4	35.9	12.3	7.13	21.2	3.35	2.59	2.39	1.19	14.9	2.95	2.12	1.48	1.35
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	59.5	3.4	36.7	12.6	7.24	21.7	3.5	3.99	3.57	1.67	21.7	4.14	2.71	2.56	1.87
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	80.2	76.6	71.7	69.4	71.6	70.4	72.9	72.2	75.1	72.1	76	72.1	70.7	62.2	75.8

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB029	SJSB029	SJSB029	SJSB029	SJSB030	SJSB030	SJSB030	SJSB030	SJSB030	SJSB030	SJSB030	SJSB030	SJSB030	SJSB031	SJSB031
Sample Identification:		SL0505	SL0506	SL0507	SL0508	SL0571	SL0572	SL0573	SL0574	SL0575	SL0576	SL0577	SL0578	SL0579	SL0509	SL0518
Sample Date:		11/6/2018	11/6/2018	11/6/2018	11/6/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/18/2018	11/8/2018	11/8/2018
Sample Type:																Duplicate
Sample Depth:		(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(0-2) ft bgs
Integral Sample ID:		SJSB029-C6	SJSB029-C7	SJSB029-C8	SJSB029-C9	SJSB030-C1	SJSB030-C2	SJSB030-C3	SJSB030-C4	SJSB030-C5	SJSB030-C6	SJSB030-C7	SJSB030-C8	SJSB030-C9	SJSB031-C1	SJSB031-C10
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	2 J	15.7	0.505 J	13.1	55.7	2.84 U	0.822 J	9.54	5.66 U	0.293 J	9.72	0.976 U	1.27 J	2.98 UJ	8.35
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	3470	1040	296	1320	1290	2130	329	744	175	108	163	195	424	155 J	168
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.25 J	0.86 J	3.09 U	3.21	9.23	0.71 J	0.154 U	2.06 J	0.0432 U	0.044 U	1.01 J	0.13 U	0.545 U	0.65 J	0.917 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	49.3	21.8	12	30.5	68.1	28.2	6.45	15	3.31	2.19 J	2.85 J	5.33	14.5	5.77	6.03
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.299 U	0.87 J	2.83 U	3.04 U	0.171 U	2.83 U	2.86 U	0.113 U	3.02 U	0.0813 U	0.102 U	2.7 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	0.125 U	0.0639 U	1.2 U	1.6 J	0.23 U	0.0628 U	0.424 U	0.0231 U	0.03 U	0.34 J	3.02 U	0.26 J	0.66 J	0.45 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.641 U	0.311 U	3.09 U	3.12 U	0.261 U	2.83 U	3.04 U	0.28 J	0.1 J	0.12 J	0.124 U	0.176 U	0.303 U	2.6 U	0.07 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	0.13 J	3.09 U	0.508 U	0.82 J	0.119 U	0.0429 U	0.124 U	0.0181 U	0.0299 U	0.0872 U	3.02 U	0.0909 U	0.0948 U	0.159 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.38 J	0.538 U	0.324 U	3.12 U	2.04 J	0.91 J	0.257 U	0.45 J	0.16 J	0.1 J	0.2 U	0.3 U	0.65 J	0.239 U	0.22 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	3.22 U	3.09 U	3.12 U	0.178 U	0.0854 U	0.0674 U	0.135 U	0.0215 U	2.86 U	2.95 U	3.02 U	3.21 U	0.071 U	0.0935 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	1.98 J	1.14 J	0.372 U	1.1 J	1.12 J	1.23 U	0.38 J	0.65 J	0.134 U	0.31 J	0.3 J	0.372 U	1.08 J	0.23 J	0.35 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.708 U	1.08 J	0.202 U	3.04 U	0.193 U	2.83 U	2.86 U	2.95 U	3.02 U	3.21 U	0.292 U	0.193 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.83 U	0.308 U	3.09 U	0.131 U	0.269 U	0.184 U	3.04 U	0.188 U	2.83 U	2.86 U	2.95 U	3.02 U	0.201 U	0.125 U	0.104 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.328 U	0.68 J	0.13 U	0.0353 U	0.16 J	2.83 U	2.86 U	2.95 U	3.02 U	0.109 U	2.6 U	0.0789 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	0.528 U	1.44 J	2.83 U	3.04 U	0.14 U	2.83 U	2.86 U	0.128 U	3.02 U	3.21 U	0.285 U	0.144 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	1.21 U	0.89	0.644 U	21	11.1	2.34	1.13	2.83	0.966 U	0.65	0.59 U	0.604 U	0.641 U	5.34	3.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.766 U	0.728 U	0.834 U	5.87	4.01 U	0.867 U	0.607 U	1.83	0.453 U	0.59	0.59 U	0.604 U	0.641 U	1.59	1.06
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	2 J	15.7	0.5 J	13.1	55.7	2.84 U	0.82 J	9.54	0.115 U	0.29 J	9.72	0.976 U	1.27 J	2.98 UJ	8.35
Total dioxin/furan	pg/g	3520	1080	308	1390	1440	2160	338	777	200	110	177	200	442	169	188
Total dioxin/furan (ND*0.5)	pg/g	3530	1080	310	1400	1450	2170	339	777	200	110	178	202	443	171	189
Total dioxin/furan (ND*1)	pg/g	3530	1080	311	1400	1450	2170	340	778	200	110	179	204	445	174	190
Total heptachlorodibenzofuran (HpCDF)	ng/kg	0.49 J	0.86 J	3.09 U	9.05	35.5	1.94 J	0.27 J	4.96	2.83 U	0.05 J	1.01 J	3.02 U	0.2 J	0.65 J	1.39 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	139	60.8	25.3	103	160	86.7	24.1	44.6	12.5	8.71	11	24.7	49.6	19.1	19.7
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.24 J	0.13 J	3.09 U	2.02 J	12.9	0.5 J	3.04 U	1.12 J	2.83 U	2.86 U	0.34 J	3.02 U	0.26 J	0.66 J	0.86 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	28.7	13.8	2.12 J	16.1	20.1	17	7.72	11.1	2.32 J	2.15 J	0.62 J	2.28 J	16.4	3.58	3.89
Total pentachlorodibenzofuran (PeCDF)	ng/kg	3.83 U	3.22 U	3.09 U	2.71 J	7.36	2.83 U	3.04 U	2.82 U	2.83 U	2.86 U	2.95 U	3.02 U	3.21 U	0.39 J	2.7 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.08 J	0.78 J	0.72 J	0.73 J	1.43 J	0.53 J	0.63 J	1.29 J	0.08 J	2.86 U	2.95 U	2.27 J	3.21 U	2.6 U	2.7 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	1.77	1.79	0.921	27.7	15.5	3.29	1.66	5.07	0.812	1.4	0.489	0.803	1.05	7.28	4.72
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	1.12	0.862	0.588	7.56	4.18	1.05	0.545	2.41	0.38	0.762	0.39	0.507	0.673	2.12	1.45
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.611	1.15	0.0416	27.2	13.4	2.6	1.21	4.87	0.027	1.3	0.0942	0.0248	0.198	7.05	4.57
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	2.93	2.43	1.8	28.1	17.7	3.99	2.12	5.28	1.6	1.46	0.883	1.58	1.91	7.5	4.87
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.433	0.205	0.0416	7.13	1.97	0.374	0.0997	2.25	0.07	0.7	0.0672	0.0248	0.1	1.95	1.34
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	1.81	1.52	1.13	8	6.39	1.72	0.99	2.58	0.68	0.824	0.713	0.989	1.25	2.29	1.56
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.336	0.216	0	8.08	2.51	0.325	0.151	2.27	0.03	0.7	0.064	0	0.199	2.21	1.51
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.899	0.759	1.1	8.41	4.6	0.943	0.55	2.39	0.34	0.8	0.341	0.919	0.675	2.35	1.59
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	1.46	1.3	1.1	8.75	6.69	1.56	0.948	2.5	0.66	0.8	0.619	0.919	1.15	2.48	1.67
Total tetrachlorodibenzofuran (TCDF)	ng/kg	2.61	0.42 J	0.619 U	31	22.2	3.86	1.6	3.99	0.45 J	0.39 J	0.59 U	0.604 U	0.45 J	7.97	5.57
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.766 U	0.728 U	0.834 U	5.87	0.586 U	0.8	0.607 U	2.38	0.566 U	0.59	0.59 U	3.31	0.641 U	1.95	1.06
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	1.87	0.759	0.209	8.82	3.39	1.25	0.314	2.66	0.11	0.76	0.154	0.112	0.472	2.32	1.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	2.45	1.36	0.769	9.13	5.54	1.9	0.735	2.81	0.44	0.82	0.453	0.592	0.982	2.46	1.72
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	3.02	1.96	1.33	9.44	7.7	2.55	1.16	2.96	0.77	0.87	0.751	1.07	1.49	2.59	1.81
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	62.3	74.6	76.8	76.2	85	86.5	81.8	82.9	81.7	82.4	81.1	80.6	74	88.5	88.4

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB031	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032	SJSB032
Sample Identification:		SL0510	SL0511	SL0512	SL0513	SL0514	SL0515	SL0516	SL0517	SL0561	SL0562	SL0563	SL0570	SL0564	SL0565	SL0566
Sample Date:		11/8/2018	11/8/2018	11/8/2018	11/8/2018	11/8/2018	11/9/2018	11/9/2018	11/9/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018	11/17/2018
Sample Type:													Duplicate			
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Integral Sample ID:		SJSB031-C2	SJSB031-C3	SJSB031-C4	SJSB031-C5	SJSB031-C6	SJSB031-C7	SJSB031-C8	SJSB031-C9	SJSB032-C1	SJSB032-C2	SJSB032-C3	SJSB032-C10	SJSB032-C4	SJSB032-C5	SJSB032-C6
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	1.17 U	1.88 U	1.84 U	2.9 U	4.65 J	1.58 J	2.9 J	0.801 J	56.7	102	31.4	21.5	2.21 J	3.22 J	0.521 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	650	449	331	375	416	113	239	165	1630	2730	1090	839	432	496	97.4
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.161 U	0.27 J	0.25 J	0.449 U	1.07 U	0.42 J	0.7 J	0.16 U	79	134	46.7	29.6	0.66 J	2.6 J	0.722 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	9.75	7.96	6.85	7.86	11.4	3.98	6.96	6.29	69.6	134	40.8	31.7	9.37	12.1	2.59 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 UJ	3 U	2.83 U	0.136 U	3.25 U	25.4	40.7	16	9.94	0.0833 U	0.81 J	0.26 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.1 J	0.0778 U	0.0583 U	2.89 U	0.213 U	0.147 U	0.131 U	3.25 U	236	400	159	87.8	0.6 J	6.84	1.95 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.76 U	3.01 U	0.21 J	2.89 U	0.188 U	0.0841 U	2.99 U	0.11 J	0.48 J	0.66 J	2.86 UJ	0.24 J	0.151 U	0.4 J	2.93 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.143 U	0.0677 U	0.0986 U	3.25 U	57.2	94.9	40.1	21	0.24 J	1.72 J	0.66 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.43 J	0.23 J	0.243 U	0.262 U	0.53 J	0.139 U	0.26 J	0.32 J	2.58 J	4.16	1.43 J	1.19 J	0.36 U	0.391 U	0.106 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.125 U	3.01 U	0.105 U	2.89 U	3 U	2.83 U	0.128 U	0.0837 U	15.7	24.6	14.8	5.72	3.05 U	0.513 U	0.203 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.431 U	0.342 U	0.42 J	0.62 J	0.449 U	0.199 U	0.29 J	0.374 U	0.813 U	1.25 U	0.701 U	0.578 U	0.418 U	0.69 J	0.101 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.17 J	0.12 U	0.105 U	3.25 U	141	233	92.4	48	0.27 J	3.96	1.28 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.76 U	3.01 U	0.13 J	0.177 U	0.152 U	0.0601 U	0.141 U	0.104 U	14.3	28.1	6.72	6.25	0.174 U	0.68 J	0.239 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.76 U	3.01 U	0.0634 U	2.89 U	0.11 J	0.0743 U	0.16 J	3.25 U	9.79	16.9	8.72	3.61	0.1 U	0.49 J	0.12 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	3 U	2.83 U	0.116 U	3.25 U	123	226	79.6	46.6	0.267 U	4.05	1.14 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	0.553 U	0.602 U	0.576 U	1.35 U	0.99	0.97	0.546 U	0.65 U	5210	10500	4620	2450	8.96	157	43.9
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.553 U	0.602 U	0.576 U	0.501 U	0.41 J	0.163 U	0.598 U	0.65 U	2800	6450	2650 J	1460	4.79	66.7	21.4
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	1.17 U	1.88 U	1.84 U	2.9 U	4.65 J	1.58 J	2.9 J	0.8 J	56.7	102	31.4	21.5	2.21 J	3.22 J	0.52 U
Total dioxin/furan	pg/g	700	457	339	383	434	120	250	173	10500	21100	8900	5060	459	757	169
Total dioxin/furan (ND*0.5)	pg/g	700	460	341	387	436	121	251	173	10500	21100	8900	5060	460	758	171
Total dioxin/furan (ND*1)	pg/g	700	462	343	390	437	121	252	174	10500	21100	8900	5060	461	758	173
Total heptachlorodibenzofuran (HpCDF)	ng/kg	2.76 U	0.46 J	0.46 J	0.4 J	1.96 J	1.16 J	1.91 J	3.25 U	146	245	83.4	53.5	0.66 J	4.94	0.26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	40.9	31	28.1	33.8	41.1	12.5	24	22.2	156	258	91.2	71.8	30.5	37.4	10.7
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.1 J	3.01 U	2.88 U	2.89 U	1.07 J	0.12 J	0.61 J	0.05 J	350	589	241	127	1.51 J	9.25	0.96 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	11.6	7.81	7.43	8.94	7.5	2.74 J	4.67	8.36	18.2	27.9	16.6	15.1	6.04	10.7	2.69 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	2.76 U	3.01 U	2.88 U	2.89 U	0.17 J	2.83 U	2.99 U	3.25 U	388	686	260	2.98 U	0.8 J	12.2	2.42 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.71 J	0.62 J	0.44 J	1.01 J	0.56 J	0.06 J	0.49 J	0.95 J	19.9	31.6	7.65	8.48	1.06 J	0.89 J	0.42 J
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	0.8	0.786	0.864	1.23	1.68	1.17	0.801	0.323	8190	17300	7390	3980	14.2	230	66.9
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.54	0.487	0.623	0.522	0.718	0.235	0.511	0.276	3180	7180	2960	1630	5.59	78.7	24.6
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.09	0.0579	0.225	0.107	1.49	0.99	0.0858	0.0316	8190	17300	7390	3980	13.9	230	66.7
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	1.51	1.51	1.5	2.35	1.87	1.35	1.52	0.615	8190	17300	7390	3980	14.4	230	67.1
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.09	0.0579	0.282	0.0516	0.538	0.0681	0.0596	0.0811	3180	7180	2960	1630	5.39	78.7	24.3
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	0.99	0.917	0.965	0.993	0.898	0.403	0.961	0.472	3180	7180	2960	1630	5.79	78.7	24.8
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.05	0.023	0.128	0.062	0.582	0.097	0.071	0.043	3430	7690	3180	1750	5.78	86	26.5
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.46	0.437	0.494	0.505	0.702	0.247	0.48	0.232	3430	7690	3180	1750	5.94	86	26.7
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	0.87	0.851	0.86	0.949	0.823	0.398	0.889	0.421	3430	7690	3180	1750	6.11	86.1	26.9
Total tetrachlorodibenzofuran (TCDF)	ng/kg	0.553 U	0.602 U	0.576 U	0.577 U	0.99	1.38	0.598 U	0.65 U	8180	15500	4270	3300	15.3	282	85.6
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.553 U	0.602 U	0.576 U	0.577 U	0.41 J	0.566 U	0.598 U	0.78	2130	4430	1200	893	4.79	67.9	21.4
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.35	0.24	0.363	0.253	0.818	0.175	0.22	0.156	3410	7660	3170	1740	6.01	85.7	26.3
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.77	0.666	0.719	0.726	0.97	0.333	0.653	0.362	3410	7660	3170	1740	6.19	85.8	26.5
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	1.2	1.09	1.07	1.2	1.12	0.49	1.09	0.568	3410	7660	3170	1740	6.36	85.8	26.8
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	84.3	79.6	84.4	84.4	82.6	82.2	81.9	75.9	84.4	81.4	82.9	83	77	80.5	82.5

Notes:
ng/kg - nanograms per kilogram
ug/kg - microgram per kilogram
pg/kg - picogram per kilogram
mg/kg - milligram per kilogram
Deg C - Degrees in Celsius
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
Dup - indicates the result from a duplicate sample
-- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB032	SJSB032	SJSB032	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB033	SJSB034	SJSB034	SJSB034
Sample Identification:		SL0567	SL0568	SL0569	SL0539	SL0540	SL0541	SL0542	SL0543	SL0544	SL0545	SL0546	SL0538	SL0519	SL0520	SL0521
Sample Date:		11/17/2018	11/17/2018	11/17/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/12/2018	11/14/2018	11/14/2018	11/15/2018	11/10/2018	11/10/2018	11/10/2018
Sample Type:																
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Integral Sample ID:		SJSB032-C7	SJSB032-C8	SJSB032-C9	SJSB033-C2	SJSB033-C3	SJSB033-C4	SJSB033-C5	SJSB033-C6	SJSB033-C7	SJSB033-C8	SJSB033-C9	SJSB033-C1	SJSB034-C1	SJSB034-C2	SJSB034-C3
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	5.79 U	0.333 J	0.77 U	105	133	112	44.3	5.59	0.815 J	1.23 J	0.583 U	17.4	1.01 U	0.646 J	1.96 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	80.9	49.2	32.9	481	1720	2180	829	200	90.1	127	109	588	272	319	180
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.39 J	0.06 J	0.322 U	41.1	197	201	71.5	7.5	1.05 J	0.92 J	0.51 J	6.85	0.344 U	0.0608 U	0.253 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	2.42 J	1.7 J	1.31 J	19.8	62.5	71.5	24.7	5.79	2.19 J	3.87	4.09	22.7	5.69	5.85	4.3
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.111 U	3.1 U	0.133 U	17.2	81.3	71.4	31.6	2.92	0.45 J	0.24 J	0.2 J	1.73 J	0.0928 U	0.06 J	2.93 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	1.38 J	0.159 U	1.32 J	109	651	584	241	26.3	3.21	2 J	1.65 J	12.9	0.62 J	0.158 U	0.278 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.89 U	3.1 U	3.08 U	0.258 U	0.57 J	0.633 U	0.257 U	2.78 U	2.94 U	0.109 U	0.21 J	0.192 U	2.79 U	2.74 U	2.93 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.34 J	0.03 J	0.295 U	24.2	144	138	54.8	6	0.743 U	0.57 J	0.361 U	3.33	0.106 U	2.74 U	0.178 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.0632 U	3.1 U	0.11 J	0.728 U	2.24 U	2.96 J	0.783 U	2.78 U	0.113 U	0.187 U	0.31 J	0.821 U	0.216 U	2.74 U	2.93 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0691 U	0.0388 U	0.0667 U	6.5	41.5	35.5	13.5	2.27 J	0.27 J	0.15 J	0.145 U	1.18 J	2.79 U	0.0571 U	2.93 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.0782 U	0.201 U	3.08 U	0.487 U	1.03 U	1.7 U	0.717 U	0.238 U	0.13 J	0.34 J	0.26 J	0.58 U	0.279 U	0.4 J	0.19 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	0.88 J	3.1 U	0.522 U	33.3	268	230	76.8	12.1	1.63 J	1.03 J	0.73 J	8.87	0.46 J	2.74 U	2.93 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.156 U	0.133 U	0.17 U	3.5 U	23.8	21.9	6.89	0.975 U	0.179 U	0.3 J	3.02 U	0.805 U	2.79 U	2.74 U	2.93 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0505 U	3.1 U	3.08 U	4.3	26	22.3	7.67 U	1.42 J	0.102 U	2.95 U	3.02 U	0.785 U	0.0489 U	2.74 U	0.07 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	0.731 U	3.1 U	0.512 U	26.8	214	186	60.7	9.37	1.14 U	0.87 J	0.53 J	6.45	0.32 J	2.74 U	2.93 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	27.3	2.98	21.8	1420	10600	8340	2510	274	39.6	26.2	20.2	184	11.8	3.27 UJ	6.07
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	12.7	1.69	10.2 J	879	5870	4740	1390	122	19.3	14	9.83	72.2	3.53	1.35 UJ	2.09
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	0.0841 U	0.33 J	0.77 U	105	133	112	44.3	5.59	0.81 J	1.23 J	0.583 U	17.4	1.01 U	0.646 J	1.96 U
Total dioxin/furan	pg/g	126	56	67.6	3170	20000	16900	5350	675	159	179	148	926	294	326	193
Total dioxin/furan (ND*0.5)	pg/g	127	56.4	69.1	3170	20000	16900	5360	676	160	179	148	927	296	329	195
Total dioxin/furan (ND*1)	pg/g	128	56.9	70.6	3170	20000	16900	5360	677	161	179	149	929	297	332	197
Total heptachlorodibenzofuran (HpCDF)	ng/kg	2.89 U	0.06 J	3.08 U	71.5	338	326	124	12.5	2.94 U	1.17 J	0.71 J	15.9	2.79 U	0.06 J	0.17 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	9.98	6.26	4.14	47.5	147	183	64.1	17.4	8.14	13.2	12.6	56	20.7	22.6	17.3
Total hexachlorodibenzofuran (HxCDF)	ng/kg	1.72 J	0.03 J	1.44 J	148	928	834	330	39.1	3.48	2.74 J	1.65 J	22	0.62 J	2.74 U	0.07 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	3.05	3.19	0.56 J	5.1	20.4	30.8	11.9	4.11	0.13 J	1.93 J	4.05	6.97	0.86 J	3.91	1.15 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	1.66 J	3.1 U	0.28 J	90.1	727	628	206	30.9	2.29 J	1.9 J	1.27 J	22.8	0.79 J	2.74 U	2.93 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.64 J	0.64 J	0.36 J	2.96 U	29.4	28.6	8.2	2.78 U	0.3 J	1.16 J	0.59 J	0.2 J	2.79 U	2.74 U	2.93 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	40.7	4.81	32.5	2350	16800	13400	4010	411	60.1	41.8	31	266	15.9	2.59	8.52
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	14.6	1.96	11.7	982	6630	5360	1590	145	22.2	16.4	11.5	87.5	4.5	0.984	2.69
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	40.3	4.68	32.1	2340	16800	13400	4010	410	59.5	41.8	30.9	265	15.8	0.0784	8.21
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	41.2	4.95	32.9	2350	16800	13400	4010	411	60.8	41.8	31.1	266	16	5.1	8.82
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	14.3	1.85	11.4	980	6630	5360	1590	145	21.7	16.4	11.4	87	4.4	0.0424	2.42
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	14.8	2.08	12	984	6630	5360	1590	146	22.6	16.5	11.7	88	4.6	1.93	2.96
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	15.6	1.99	12.5	1050	7150	5770	1710	158	23.7	17.6	12.4	96	4.96	0.04	2.72
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	15.9	2.07	12.7	1050	7150	5770	1710	159	24.1	17.6	12.5	96.3	5.02	1	2.9
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	16.1	2.15	12.9	1050	7150	5770	1710	159	24.5	17.6	12.5	96.6	5.09	1.96	3.08
Total tetrachlorodibenzofuran (TCDF)	ng/kg	46.2	3.28	33.5	1620	13300	12100	3430	450	61.8	38	31.7	311	17.7	0.548 U	6.63
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	18.7	3.44	10.2	517	3660	3450	954	133	19.3	14	9.83	79	3.53	0.761 U	2.09
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	15.7	2.02	12.5	1050	7120	5740	1700	156	23.7	17.6	12.4	95	5.02	0.195	2.82
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	15.9	2.13	12.7	1050	7120	5740	1700	157	24	17.6	12.5	95.6	5.12	1.17	3.04
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	16.1	2.23	12.9	1050	7120	5740	1700	157	24.3	17.6	12.6	96.1	5.22	2.15	3.26
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	80.6	74.5	79.5	81	77	74.6	78.3	82.6	79.1	80.1	80	89.7	86.5	84.2	81.9

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB034	SJSB034	SJSB034	SJSB034	SJSB034	SJSB034	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035	SJSB035
Sample Identification:		SL0522	SL0523	SL0524	SL0525	SL0526	SL0527	SL0528	SL0529	SL0530	SL0531	SL0532	SL0533	SL0534	SL0537	SL0535
Sample Date:		11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/10/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018	11/11/2018
Sample Type:															Duplicate	
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(12-14) ft bgs	(14-16) ft bgs
Integral Sample ID:		SJSB034-C4	SJSB034-C5	SJSB034-C6	SJSB034-C7	SJSB034-C8	SJSB034-C9	SJSB035-C1	SJSB035-C2	SJSB035-C3	SJSB035-C4	SJSB035-C5	SJSB035-C6	SJSB035-C7	SJSB035-C10	SJSB035-C8
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	2.73 U	18.8 J	0.729 U	0.441 U	0.377 U	0.362 U	12.1 U	0.564 U	0.337 U	1.46 U	1.18 U	0.299 J	1.08 J	0.544 J	0.789 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	787	170	159	229	121	315	481	120	141	213	173	99.7	140	144	157
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.6 J	2.78 J	0.26 J	0.13 J	0.0427 U	0.11 J	2.9	0.137 U	0.148 U	0.166 U	0.166 U	0.0489 U	0.22 J	0.0688 U	0.09 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	12.6	4.77	2.68 J	3.48 U	2.36 J	5.03	20.7	3.54	3.45	5.89	5.92	2.05 J	3.02	2.49 J	3.85
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	3.1 U	0.303 U	0.185 U	3.09 U	2.86 U	2.85 U	2.79 U	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0462 U	0.07 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.166 U	0.42 J	0.145 U	0.0637 U	0.0756 U	0.0751 U	0.546 U	0.137 U	0.104 U	0.0955 U	2.97 U	0.0894 U	0.276 U	2.93 U	0.147 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.184 U	3.03 U	0.199 U	0.071 U	2.86 U	2.85 U	0.12 J	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0534 U	0.195 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.16 J	0.18 J	0.12 J	3.09 U	2.86 U	0.032 U	0.29 J	2.82 U	2.9 U	0.05 J	2.97 U	2.98 U	2.78 UJ	2.93 U	2.86 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.393 U	0.152 U	0.116 U	0.121 U	0.177 U	0.21 J	0.65 J	2.82 U	2.9 U	0.28 J	2.97 U	2.98 U	0.0899 U	0.0844 U	0.193 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.11 U	0.1 U	0.25 J	3.09 U	2.86 U	2.85 U	0.107 U	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.06 J	2.86 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.638 U	0.131 U	0.24 U	0.227 U	0.278 U	0.41 J	0.43 J	0.239 U	0.132 U	0.428 U	0.33 J	0.2 J	0.33 U	0.282 U	0.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	0.108 U	0.126 U	3.09 U	0.114 U	2.85 U	0.35 J	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	0.202 U	2.93 U	2.86 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	3.1 U	3.03 U	2.97 U	3.09 U	2.86 U	2.85 U	2.79 U	2.82 U	2.9 U	0.0834 U	2.97 U	2.98 U	2.78 U	0.0961 U	0.144 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	3.1 U	0.0639 U	0.128 U	0.0537 U	2.86 U	2.85 U	0.108 U	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	0.0274 U	2.86 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	3.03 U	0.204 U	3.09 U	2.86 U	2.85 U	2.79 U	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	2.93 U	2.86 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	2.49 U	1.55	1.87	2.01 U	1.97 J	1.34	2.41	2.72 UJ	1.43	2.6 J	1.53	2.3 UJ	3.18 J	0.585 U	2.81
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.619 U	0.54 J	0.79 U	0.618 U	1.12 J	0.48 J	0.847 U	0.564 U	0.66	0.778 U	0.511 U	1.07 U	1.49 U	0.585 U	0.882 U
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	2.73 U	18.8 J	0.729 U	0.441 U	0.377 U	0.362 U	12.1 U	0.564 U	0.337 U	1.46 U	1.18 U	0.299 J	1.08 J	0.54 J	0.789 J
Total dioxin/furan	pg/g	800	199	164	229	126	323	509	124	147	222	181	102	148	147	165
Total dioxin/furan (ND*0.5)	pg/g	804	200	166	233	127	323	516	126	147	224	182	104	149	148	166
Total dioxin/furan (ND*1)	pg/g	808	200	167	237	128	324	523	129	148	225	183	106	150	149	167
Total heptachlorodibenzofuran (HpCDF)	ng/kg	1.27 J	5	0.26 J	0.2 J	2.86 U	0.11 J	11.6	2.82 U	2.9 U	0.59 J	2.97 U	2.98 U	0.22 J	2.93 U	0.07 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	41.4	16.4	9.7	11.9	9.44	21.7	56	13.2	13.8	26.3	23	8.48	12.6	10.5	14.3
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.16 J	1.19 J	0.38 J	0.17 J	2.86 U	2.85 U	3.71	0.13 J	0.03 J	0.16 J	2.97 U	2.98 U	2.78 U	0.06 J	0.14 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	8.22	2.37 J	1.4 J	3.1	0.55 J	7.1	9.06	2.82 U	2.34 J	4.96	4.08	0.2 J	1.92 J	1.61 J	0.37 J
Total pentachlorodibenzofuran (PeCDF)	ng/kg	3.1 U	3.03 U	2.97 U	3.09 U	2.86 U	2.85 U	1.84 J	2.82 U	2.9 U	2.84 U	2.97 U	2.98 U	2.78 U	2.93 U	2.86 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	0.37 J	3.03 U	2.97 U	3.09 U	2.86 U	0.32 J	0.15 J	2.82 U	2.9 U	0.35 J	2.97 U	2.98 U	2.78 U	0.07 J	2.86 U
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	1.87	2.32	2.5	1.49	3.24	2.02	3.23	1.8	2.27	3.15	1.94	1.83	4.11	0.696	3.45
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.659	0.827	0.706	0.495	1.35	0.701	0.889	0.474	0.884	0.667	0.468	0.708	1.05	0.405	0.768
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.113	2.2	1.93	0.0242	3.1	1.9	2.63	0.0155	2.11	2.63	1.59	0.032	3.2	0.0229	2.86
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	3.62	2.44	3.08	2.95	3.38	2.14	3.82	3.59	2.43	3.67	2.3	3.63	5.01	1.37	4.03
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.113	0.729	0.152	0.0242	1.23	0.591	0.336	0.0155	0.749	0.165	0.103	0.014	0.178	0.0229	0.165
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	1.21	0.925	1.26	0.966	1.47	0.811	1.44	0.933	1.02	1.17	0.833	1.4	1.92	0.787	1.37
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.016	0.755	0.224	0	1.32	0.676	0.407	0	0.803	0.293	0.186	0.02	0.318	0.006	0.311
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.597	0.829	0.733	0.997	1.41	0.743	0.934	1.01	0.898	0.763	0.505	0.738	1.17	0.386	0.85
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	1.18	0.903	1.24	0.997	1.5	0.81	1.46	1.01	0.992	1.23	0.824	1.46	2.03	0.766	1.39
Total tetrachlorodibenzofuran (TCDF)	ng/kg	1	2.43	1.87	1.01	1.97	1.34	3.5	0.564 U	1.43	2.6	1.68	1.21	4.57	0.585 U	4.15
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.619 U	0.605 U	0.594 U	0.618 U	1.12	0.57 U	0.559 U	0.564 U	0.66	0.567 U	1.01	0.595 U	0.746 U	0.585 U	0.572 U
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.384	0.887	0.301	0.07	1.38	0.822	0.781	0.0714	0.88	0.416	0.297	0.0705	0.393	0.0743	0.398
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.988	0.98	0.812	0.592	1.5	0.897	1.32	0.585	0.995	0.896	0.64	0.801	1.26	0.471	0.962
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	1.59	1.07	1.32	1.11	1.62	0.972	1.85	1.1	1.11	1.38	0.983	1.53	2.13	0.869	1.53
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	79.9	77.8	81.2	75.3	84.1	81.8	87.6	85.8	82.1	83	80.3	81.8	83.2	83	81.6

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits	Northern Impoundment - Waste Pits
Sample Location:		SJSB035	SJSB036	SJSB036	SJSB036	SJSB036	SJSB036	SJSB037	SJSB037	SJSB037	SJSB037	SJSB037	SJSB038	SJSB038	SJSB038	SJSB038
Sample Identification:		SL0536	SL0559	SL0560	SL0556	SL0557	SL0558	SL0552	SL0549	SL0550	SL0551	SL0553	SL0590	SL0591	SL0592	SL0593
Sample Date:		11/11/2018	11/16/2018	11/16/2018	11/16/2018	11/16/2018	11/16/2018	11/15/2018	11/15/2018	11/15/2018	11/15/2018	11/16/2018	12/9/2018	12/9/2018	12/9/2018	12/9/2018
Sample Type:																
Sample Depth:		(16-18) ft bgs	(3.5-4.5) ft bgs	(6-8) ft bgs	(10-11) ft bgs	(11-12) ft bgs	(12-13) ft bgs	(6.3-8) ft bgs	(10-11) ft bgs	(11-12) ft bgs	(12-13) ft bgs	(4-5.8) ft bgs	(8-9) ft bgs	(9-10) ft bgs	(10-11) ft bgs	(11-12) ft bgs
Integral Sample ID:		SJSB035-C9	SJSB036-C2	SJSB036-C3	SJSB036-C11	SJSB036-C12	SJSB036-C13	SJSB037-C2	SJSB037-C11	SJSB037-C12	SJSB037-C13	SJSB037-C3	SJSB038-C6	SJSB038-C7	SJSB038-C8	SJSB038-C9
Dioxins/Furans																
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ng/kg	1.06 U	369	18.4	38.6	0.403 J	2.9 J	1.6 J	14.8	0.841 J	0.769 J	384	1720	2.56 U	2.13 U	1.63 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	ng/kg	127	5460	357	106 Dup 433	21.1 Dup 86.3	46.2 Dup 221	800	545	163	153	5550	1730	675	793	987
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.165 U	654	9.65	22.2 Dup 68.8	0.35 U Dup 0.551 U	4.51 Dup 1.1 J	0.31 U	22.6	0.53 J	0.445 UJ	741	3430	5.46	3.3 J	0.33 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	5.25	188	8.23	11.1 Dup 2.78 J	0.6 J Dup 2.2 J	5.54 Dup 1.43 J	10.7	15.2	5.21	6.19	182	97.8	19.4	20.8	25.7
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ng/kg	0.0912 U	240	3.05 U	8.56 Dup 33.1	0.14 J Dup 0.244 U	1.45 U Dup 0.389 J	2.8 U	9.89	3.26 U	3.01 U	265	972	1.63 U	0.97 J	0.133 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.0663 U	2540	29.7	160 Dup 57.2	0.543 J Dup 2.16 J	3.56 Dup 17.3	2.8 U	72.5	0.33 J	0.77 U	2580	10500	15.5	7.77	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	2.96 U	1.97 J	0.135 U	0.0911 U Dup 2.97 U	0.104 U Dup 0.0689 U	0.0435 U Dup 0.19 J	0.155 U	0.4 J	3.26 U	3.01 U	2.12 U	2.6 U	0.44 J	0.49 J	0.408 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.96 U	596	7.44	14.1 Dup 28.1	0.141 U Dup 0.428 U	0.801 J Dup 3.97 U	2.8 U	16.5	0.0895 U	0.3 J	628	2590	4.04	2.37 J	0.124 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.255 U	12.1	0.4 J	0.174 J Dup 0.494 U	0.0765 U Dup 0.0997 U	0.288 U Dup 0.0911 U	0.202 U	0.612 U	0.3 J	3.01 U	11.2	9.86 U	0.692 U	0.71 J	0.668 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ng/kg	0.07 J	195	2.62 J	4.05 Dup 3.93	0.123 U Dup 0.0568 U	0.307 U Dup 1.18 J	2.8 U	4.45 U	3.26 U	3.01 U	184	611	1.18 U	0.82 J	0.123 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	0.33 U	3.91 J	0.442 U	0.197 U Dup 0.47 J	0.0709 U Dup 0.141 U	0.4 J Dup 0.137 U	0.393 U	0.71 J	0.274 U	0.259 U	4.82	5.44	1.09 J	1.04 J	1.32 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	1510	14.2	25.8 Dup 8.58	1.22 J Dup 0.212 U	1.62 J Dup 10.5	0.088 U	24.3	3.26 U	0.444 U	1430	2660	11.5	6.03	0.23 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	2.96 U	129	1.6 J	2.57 J Dup 0.876 J	0.11 U Dup 0.27 J	0.221 J Dup 1.28 J	0.115 U	3.02	3.26 U	3.01 U	118	284	2.68 J	1.36 U	0.54 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ng/kg	2.96 U	112	1.19 U	1.92 J Dup 2.38 J	0.139 U Dup 0.176 J	0.134 U Dup 0.683 U	2.8 U	2.86 J	3.26 U	0.0877 U	120	631	0.92 J	0.538 U	0.0816 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	1240	12.5	22.8 Dup 6.91	0.37 U Dup 0.79 J	9.83 Dup 1.65 J	2.8 U	21	0.174 U	0.314 U	1130	2120	12.2	6.5	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	ng/kg	0.24 J	62400	591	1240 Dup 217	33.2 Dup 5.51	358 Dup 51.7	1.35	2330	3.83	20.9	45500	136000	1210	313	4.88
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	0.592 U	43400	207	88 Dup 376	14.8 Dup 2.43	146 Dup 20.9	0.559 U	365	1.93	9.1	35000	80600	234	116	2.87
Octachlorodibenzofuran (OCDF) 13C12	ng/kg	1.06 U	369	18.4	14 Dup 38.6	0.4 J Dup 0.523 U	2.9 J Dup 0.881 U	1.6 J	14.8	0.84 J	0.76 J	384	1720	2.56 U	2.13 U	1.63 U
Total dioxin/furan	pg/g	133	119000	1260	2230 Dup 765	30.5 Dup 141	779 Dup 130	814	3440	176	190	93800	244000	2190	1270	1020
Total dioxin/furan (ND*0.5)	pg/g	134	119000	1260	2230 Dup 765	31.5 Dup 142	782 Dup 130	815	3450	177	192	93800	244000	2200	1270	1020
Total dioxin/furan (ND*1)	pg/g	135	119000	1260	2230 Dup 765	32.5 Dup 143	785 Dup 131	816	3450	177	193	93800	244000	2200	1280	1030
Total heptachlorodibenzofuran (HpCDF)	ng/kg	0.17 J	1180	13.6	118 Dup 36.6	2.77 U Dup 0.14 J	6.31 Dup 1.98 J	0.17 J	40	0.96 J	0.41 J	1250	5270	5.52	5.52	0.55 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	ng/kg	20.6	467	27.6	9.41 Dup 36.2	10.3 Dup 2.86 J	4.76 Dup 14.1	32.6	47.4	17.3	17.6	438	227	60.5	73.4	88.9
Total hexachlorodibenzofuran (HxCDF)	ng/kg	0.23 J	3740	42.3	194 Dup 83.1	2.16 J Dup 0.838 J	4.53 Dup 18.5	2.8 U	99.2	0.52 J	0.47 J	3780	11600	22.2	11.1	0.23 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	ng/kg	5.25	55.4	4.77	5.18 Dup 1.5 J	4.15 Dup 0.879 J	5.93 Dup 1.11 J	3.29	9.69	3.12 J	1.71 J	79.5	56.6	19	25.2	33.6
Total pentachlorodibenzofuran (PeCDF)	ng/kg	2.96 U	4080	40	23.6 Dup 72.7	0.37 J Dup 2.52 J	4.03 Dup 25.3	2.8 U	65.5	3.26 U	3.01 U	3760	7320	34.4	16.2	0.23 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	ng/kg	1.19 J	142	1.91 J	3.06 Dup 1.03 J	0.71 J Dup 0.0937 U	0.221 J Dup 1.28 J	0.17 J	3.02	0.12 J	3.01 U	131	323	4.27	1.32 J	4.88
Total TEQ 1998 (Avian) (ND*0.5)	ng/kg	0.676	108000	818	1650 Dup 334	8.28 Dup 49.5	75.1 Dup 518	1.84	2730	5.99	30.4	82300	221000	1460	438	8.7
Total TEQ 1998 (Fish) (ND*0.5)	ng/kg	0.426	47700	249	461 Dup 124	2.96 Dup 17.5	173 Dup 25.1	0.559	506	2.33	10.4	38400	90400	306	137	3.98
Total TEQ Dioxin 1998 (Bird) (ND=0)	ng/kg	0.265	108000	818	334 Dup 1650	8.02 Dup 49.4	518 Dup 75.1	1.44	2730	5.82	30.1	82300	221000	1460	437	8.6
Total TEQ Dioxin 1998 (Bird) (ND=1)	ng/kg	1.09	108000	818	334 Dup 1650	49.5 Dup 8.55	519 Dup 75.2	2.24	2730	6.17	30.7	82300	221000	1460	439	8.8
Total TEQ Dioxin 1998 (Fish) (ND=0)	ng/kg	0.0369	47700	249	124 Dup 461	2.78 Dup 17.4	25.1 Dup 173	0.158	506	2.18	10.2	38400	90400	306	137	3.83
Total TEQ Dioxin 1998 (Fish) (ND=1)	ng/kg	0.815	47700	249	462 Dup 124	17.5 Dup 3.15	25.1 Dup 173	0.96	506	2.48	10.7	38400	90400	306	138	4.14
Total TEQ Dioxin Texas TEF (ND=0)	ng/kg	0.031	50700	278	133 Dup 522	3.05 Dup 18.9	27.5 Dup 190	0.135	621	2.38	11.2	40600	97000	365	152	3.79
Total TEQ Dioxin Texas TEF (ND=0.5)	ng/kg	0.409	50700	278	522 Dup 133	3.2 Dup 19	27.6 Dup 190	0.503	621	2.48	11.4	40600	97000	365	153	3.9
Total TEQ Dioxin Texas TEF (ND=1)	ng/kg	0.788	50700	278	522 Dup 133	19 Dup 3.34	190 Dup 27.6	0.871	621	2.58	11.6	40600	97000	365	153	4
Total tetrachlorodibenzofuran (TCDF)	ng/kg	0.24 J	80400	837	1570 Dup 404	58.2 Dup 9.42	638 Dup 96.7	1.88	1460	3.83	34.5	75800	159000	1220	566	3.3
Total tetrachlorodibenzo-p-dioxin (TCDD)	ng/kg	1.05	22900	230	99.4 Dup 416	2.43 Dup 18.1	23.5 Dup 164	0.559 U	401	3.1	9.1	21900	38000	257	127	4.19
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	ng/kg	0.122	50500	276	519 Dup 133	3.07 Dup 18.9	188 Dup 27.3	0.482	618	2.48	11.3	40400	96700	364	151	4.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	ng/kg	0.516	50500	276	519 Dup 133	3.2 Dup 19	27.3 Dup 189	0.873	618	2.59	11.5	40400	96700	364	152	4.71
Total WHO Dioxin TEQ(Human/Mammal)(ND=1)	ng/kg	0.911	50500	276	519 Dup 133	3.34 Dup 19	189 Dup 27.4	1.26	618	2.71	11.7	40400	96700	365	153	4.8
Asbestos																
Asbestos	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
PCBs																
Aroclor (unspecified)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1016 (PCB-1016)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1262 (PCB-1262)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Aroclor-1268 (PCB-1268)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (7)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total PCBs (ND*0.5)	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (TPH)																
Total Petroleum Hydrocarbons	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C12-C28)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C25-C36) ORO	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C28-C35)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total Petroleum Hydrocarbons (C6-C12)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
General Chemistry																
Cyanide (total)	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Flash point (closed cup)	Deg C	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Moisture	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Percent solids	%	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Reactive cyanide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Sulfur	mg/kg	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Total solids	%	79.5	58.8	80.5	79.2 Dup 79.3	83 Dup 82.5	80.4 Dup 78.9	83.7	79.2	74.6	75.8	54	47.3 Dup 47.3	71.1 Dup 71.1	63.3 Dup 63.3	70.3 Dup 70.3

Notes:
- ng/kg - nanograms per kilogram
- ug/kg - microgram per kilogram
- pg/kg - picogram per kilogram
- mg/kg - milligram per kilogram
- Deg C - Degrees in Celsius
- s.u. - standard unit
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- UJ - Not detected; associated reporting limit is estimated.
- Dup - indicates the result from a duplicate sample
- -- Data not available

Table 2-2

First Phase Pre-Design Investigation Waste Characterization Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameters	Units	TCLP Regulatory Levels[1]	Method Detection Limits[2]	Northern Impoundment - East	Northern Impoundment - West	Northern Impoundment - West
			Sample Location:	SJSB038	SJSB037	SJSB036
			Sample Identification:	SL0594	SL0547	SL0554
			Sample Date:	12/18/2018	11/15/18	11/16/18
				-	-	-
TCLP-Volatile Organic Compounds (VOCs)						
1,1-Dichloroethene	mg/L	0.7	0.00008	0.20 U	0.032 U	0.032 U
1,2-Dichloroethane	mg/L	0.5	0.00008	0.20 U	0.032 U	0.032 U
1,4-Dichlorobenzene	mg/L	7.5	0.00032	0.20 U	0.048 U	0.048 U
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	200.0	0.0019	8.0 U	0.76 U	0.76 U
Benzene	mg/L	0.5	0.000062	0.20 U	0.025 U	0.025 U
Carbon tetrachloride	mg/L	0.5	0.000096	0.20 U	0.039 U	0.039 U
Chlorobenzene	mg/L	100.0	0.00011	0.20 U	0.044 U	0.044 U
Chloroform (Trichloromethane)	mg/L	6.0	0.000072	0.20 U	0.029 U	0.029 U
Tetrachloroethene	mg/L	0.7	0.000099	0.20 U	0.040 U	0.040 U
Trichloroethene	mg/L	0.5	0.0001	0.20 U	0.040 U	0.040 U
Vinyl chloride	mg/L	0.2	0.000075	0.080 U	0.030 U	0.030 U
TCLP-Semi-Volatile Organic Compounds (SVOCs)						
2,4,5-Trichlorophenol	mg/L	400.0	0.000018	0.10 U	0.013 U	0.013 U
2,4,6-Trichlorophenol	mg/L	2.0	0.000014	0.10 U	0.011 U	0.0099 U
2,4-Dinitrotoluene	mg/L	0.13	0.00027	0.10 U	0.020 U	0.019 U
2-Methylphenol	mg/L	200.0	0.00033	0.10 U	0.013 U	0.013 U
4-Methylphenol	mg/L	200.0	0.00048	0.10 U	0.0070 U	0.0067 U
Hexachlorobenzene	mg/L	0.13	0.00063	0.10 U	0.014 U	0.014 U
Hexachlorobutadiene	mg/L	0.5	0.00029	0.10 U	0.0095 U	0.0091 U
Hexachloroethane	mg/L	3.0	0.00029	0.10 U	0.0071 U	0.0068 U
Nitrobenzene	mg/L	2.0	0.00057	0.10 U	0.012 U	0.012 U
Pentachlorophenol	mg/L	100.0	0.0024	0.25 U	0.016 U	0.016 U
Pyridine	mg/L	5.0	0.0075	0.50 U	0.38 U	0.36 U
TCLP-Pesticides						
Chlordane	mg/L	0.03	0.0001	0.0010 U	0.0010 U	0.0010 U
Endrin	mg/L	0.02	0.00000069	0.00010 U	0.00010 U	0.00010 U
gamma-BHC (lindane)	mg/L	0.3	0.00000036	0.00010 U	0.00010 U	0.00010 U
Heptachlor	mg/L	0.008	0.00000068	0.00010 U	0.00010 U	0.00010 U
Heptachlor epoxide	mg/L	0.04	0.00000084	0.00010 U	0.00010 U	0.00010 U
Methoxychlor	mg/L	10.0	0.0000001	0.00010 U	0.00010 U	0.00010 U
Toxaphene	mg/L	0.5	0.0002	0.0020 U	0.0020 U	0.0020 U
TCLP-Metals						
Arsenic	mg/L	5.0	0.005	0.020 U	0.021 J	0.020 U
Barium	mg/L	100.0	0.0006	0.9 J	1.6	1.4
Cadmium	mg/L	1.0	0.0005	0.050 U	0.002 J	0.001 J
Chromium	mg/L	5.0	0.0009	0.050 U	0.010 U	0.010 U
Lead	mg/L	5.0	0.005	0.050 U	0.015 U	0.015 U
Mercury	mg/L	0.2	0.00002	0.0010 U	0.0001 U	0.0001 U
Selenium	mg/L	1.0	0.009	0.10 U	0.02 U	0.02 J
Silver	mg/L	5.0	0.002	0.050 U	0.004 U	0.004 U
TCLP-Herbicides						
2,4,5-TP (Silvex)	mg/L	1.0	0.000036	0.020 U	0.030 U	0.029 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/L	10.0	0.000045	0.100 U	0.150 U	0.150 U
General Chemistry						
Flash point (closed cup)	°C	> 60	NA	> 110	> 110	> 110
Percent solids	%	NA	NA	45.9 J	67.1 J	70.0 J
pH, lab	s.u.	>2 or <12	NA	7.84	8.09 J	8.54 J
Reactive cyanide	mg/kg	NA	17.4	17 U	100 U	100 U
Reactive sulfide	mg/kg	NA	0.2	70 U	48 U	46 U
Sulfur	mg/kg	NA	0.46	---	---	---
Total Petroleum Hydrocarbons (TPH)						
Gasoline Range Organics (GRO)	mg/kg	>1500[3]	0.62	---	---	---
Diesel Range Organics (DRO)	mg/kg	>1500[3]	0.79	---	---	---
Residual Range Organics (RRO)	mg/kg	>1500[3]	2.9	---	---	---
Polychlorinated Biphenyls (PCBs)						
Aroclor 1016	mg/kg	NA	2.1	---	---	---
Aroclor 1221	mg/kg	NA	2.1	---	---	---
Aroclor 1232	mg/kg	NA	2.1	---	---	---
Aroclor 1242	mg/kg	NA	2.1	---	---	---
Aroclor 1248	mg/kg	NA	2.1	---	---	---
Aroclor 1254	mg/kg	NA	2.1	---	---	---
Aroclor 1260	mg/kg	NA	2.1	---	---	---
Aroclor 1262	mg/kg	NA	2.1	---	---	---
Aroclor 1268	mg/kg	NA	2.1	---	---	---

Notes:

TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
Deg C - Degrees in Celsius
TCLP - Toxicity Characteristic Leaching Procedure
NA - Not Applicable
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.
--- - Not analyzed

[1] - TCLP Regulatory Levels from the *Guidelines for the Classification and Coding of Industrial and Hazardous Wastes* , November 2014, and Table 1 - Maximum Concentrations.

[2] - Method Detection Limits were taken from *Table 9 Analyte, Method Reporting Limits, and Method Detection Limits for Waste Characterization Samples* from the First Phase Pre-Design Investigation Report.

[3] - TPH Regulatory Standard is a Total value, not a TCLP.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB045 11187072-090719-SS-SJSB045-S- (8-10) 9/7/2019 (8-10) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (10-12) 9/7/2019 (10-12) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (12-14) 9/7/2019 (12-14) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (14-16) 9/7/2019 (14-16) ft bgs	SJSB045 11187072-090719-SS-SJSB045-S- (16-18) 9/7/2019 (16-18) ft bgs	SJSB045 11187072-091119-SS-SJSB045-S (0-2) 9/11/2019 (0-2) ft bgs	SJSB045 11187072-091119-SS-DUP-2 9/11/2019 (2-4) ft bgs Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.6 J	0.28 U	0.30 U	1.4 J	0.93 J	1.8 J	0.87 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	350	240	950	1900	350 J	410	230
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.57 J	0.37 U	0.38 U	0.44 U	0.37 U	0.26 U	0.23 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	6.9	33	70	11	10	6.1 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.52 J	0.81 J	0.95 J	0.67 J	1.3 U	0.93 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.37 J	0.19 U	0.22 U	0.25 J	0.27 J	0.53 J	0.38 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.53 J	0.25 U	0.43 U	0.76 U	0.31 U	0.26 U	0.22 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.32 J	0.20 U	0.23 U	0.22 U	0.20 U	0.27 J	0.26 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.57 J	0.24 U	0.44 U	0.80 U	0.31 U	0.27 U	0.22 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	2.3 U	1.6 U	1.7 U	1.8 U	1.7 U	1.9 U	1.9 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	0.67 J	1.3 J	3.2 J	0.77 J	0.62 J	0.21 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.36 U	0.29 U	0.37 U	0.39 U	0.44 J	0.85 U	0.54 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.49 U	0.36 U	0.61 U	0.51 U	0.46 U	0.37 U	0.36 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 J	0.15 U	0.18 U	0.17 U	0.15 U	0.17 U	0.15 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.39 U	0.33 U	0.39 U	0.42 U	0.36 U	0.34 U	0.27 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7.1	0.32 J	1.0 J	0.97 J	13 J	31	16
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.6	0.21 U	0.27 U	0.25 U	2.9	6.4	3.1
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.8 J	0.52 J	0.81 J	0.95 J	0.67 J	1.3 J	0.93 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36 J	29 J	110 J	250 J	41 J	44 J	22 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	4.4 J	3.0 J	2.1 J	3.6 J	3.0 J	3.4 J	3.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.8 J	7.0 J	20 J	47 J	8.2 J	9.8 J	4.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.42 U	0.34 U	0.45 U	0.46 U	0.44 J	0.85 J	0.54 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.64 J	0.55 J	1.9 J	7.9 J	0.66 J	0.37 U	0.36 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	9.0 J	0.32 J	1.6 J	1.9 J	16 J	47 J	25 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1 J	0.21 U	1.4 J	4.2 J	3.5 J	6.8 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.83	0.245	0.853	1.72	4.54	9.87	4.89
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.25	0.717	1.52	2.36	4.96	10.3	5.26

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB045 / 11187072-091119-SS-SJSB045-S (2-4) / 9/11/2019 / (2-4) ft bgs	SJSB045 / 11187072-091119-SS-SJSB045-S (4-6) / 9/11/2019 / (4-6) ft bgs	SJSB045 / 11187072-091119-SS-DUP-3 / 9/11/2019 / (6-8) ft bgs / Duplicate	SJSB045 / 11187072-091119-SS-SJSB045-S (6-8) / 9/11/2019 / (6-8) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (0-2) / 11/9/2019 / (0-2) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (2-4) / 11/9/2019 / (2-4) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (4-6) / 11/9/2019 / (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.29 U	0.89 J	0.38 U	0.28 U	9.7 J	7.4 J	11 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120	170	350	740	360	250	1000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.26 U	0.27 U	0.19 U	7.6	5.6	9.8
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.3 J	5.3 J	11	23	13	10	34
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.79 U	1.1 U	0.99 U	0.95 U	3.3 J	2.0 J	3.3 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 J	0.21 U	0.20 U	0.37 J	27	17	27
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.22 U	0.25 U	0.24 U	0.47 J	0.26 J	0.15 J	0.62 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.34 J	0.21 U	0.16 U	6.8	3.8 J	7.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 U	0.26 U	0.25 U	0.49 J	0.38 J	0.31 J	0.84 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	2.2 U	1.9 U	1.9 U	0.64 J	0.37 J	0.52 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.21 U	0.24 U	0.70 J	1.0 J	0.62 J	0.44 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.28 U	0.32 U	0.21 U	17	10	17
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.31 U	0.44 U	0.36 U	0.32 U	2.0 J	1.2 J	2.5 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.17 U	0.16 U	0.12 U	0.75 J	0.46 J	0.94 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.31 U	0.34 U	0.22 U	13	9.2	13
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8.9	18	12 J	2.8 J	760	530	740
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1	3.2	3.0	0.88 J	200	130	200
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.79 J	1.1 J	0.99 J	0.95 J	14 J	9.9 J	16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	12 J	18 J	35 J	63 J	40 J	30 J	97 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	3.3 J	2.5 J	2.9 J	42 J	26 J	42 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	4.0 J	6.9 J	11 J	9.1 J	6.8 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.31 U	0.34 U	0.27 U	52 J	34 J	53 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.31 U	0.44 U	0.36 U	0.32 U	3.7 J	1.5 J	3.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	12 J	33 J	18 J	4.0 J	1600 J	1100 J	1500 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.1 J	3.2 J	3.5 J	1.5 J	220 J	150 J	220 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.09	5.14	4.49	1.85	286	190	286
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.42	5.58	4.88	2.16	286	190	286

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (6-8) / 11/9/2019 / (6-8) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (8-10) / 11/9/2019 / (8-10) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (10-12) / 11/9/2019 / (10-12) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (12-14) / 11/9/2019 / (12-14) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (14-16) / 11/9/2019 / (14-16) ft bgs	SJSB045-C1 / 11187072-11719-KW-SJSB045-C1-S (16-18) / 11/9/2019 / (16-18) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.4 U	2.4 U	1.6 U	0.20 U	0.83 U	0.25 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	590	1600	2400	2900	3400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.6 J	1.6 J	1.5 J	0.072 U	0.46 U	0.087 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40	21	64	100	110	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.50 J	0.56 J	0.32 U	0.033 U	0.24 U	0.040 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.1 J	5.4 J	3.6 J	0.059 U	1.6 J	0.17 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.46 J	0.31 J	0.67 J	1.4 J	1.1 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.94 J	1.3 J	0.89 J	0.056 U	0.45 J	0.091 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	0.38 J	1.6 J	3.0 J	2.2 J	3.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	0.15 J	0.16 U	0.077 U	0.14 U	0.096 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.0 J	2.9 J	5.1 J	5.2 J	6.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.4 J	4.1 J	2.3 J	0.094 J	0.84 J	0.17 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.51 J	0.32 J	0.58 J	0.37 J	0.46 J	0.58 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.17 J	0.13 U	0.064 U	0.11 U	0.078 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.1 J	2.9 J	2.2 J	0.030 U	0.89 J	0.098 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	130	110	150	1.6	56	4.3
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	31	41	32	0.56 J	13	1.3 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.8 J	2.8 J	2.2 J	0.15 J	0.93 J	0.17 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100 J	69 J	200 J	300 J	330 J	380 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	5.5 J	8.3 J	4.9 J	0.077 U	2.1 J	0.26 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	20 J	16 J	48 J	72 J	82 J	93 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	7.8 J	10 J	7.2 J	0.19 J	2.9 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.3 J	2.2 J	6.6 J	12 J	14 J	17 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	230 J	330 J	270 J	5.2 J	100 J	9.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	36 J	47 J	39 J	7.0 J	23 J	12 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	46.8	54.6	50.4	3.76	22.4	5.80
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	46.8	54.6	50.4	3.79	22.4	5.81

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB046 11187072-100719-SS-SJSB046 (0-2) 10/7/2019 (0-2) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (2-4) 10/7/2019 (2-4) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (4-6) 10/7/2019 (4-6) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (6-8) 10/7/2019 (6-8) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (8-10) 10/7/2019 (8-10) ft bgs	SJSB046 11187072-100719-SS-SJSB046 (10-12) 10/7/2019 (10-12) ft bgs	SJSB046 11187072-100719-DUP-6 10/7/2019 (12-14) ft bgs Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	9.7 J	98	470	780	410	6.4 J	290
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	400	3800	4900	2900	5100	800	3300
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	8.7	78	240	1800	180	3.5 J	130
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22	130	190	190 J	210	29	120
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.4 J	23	85	660	61	1.7 J	38
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	31	210	820	5700	600	12	340
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 U	1.9 J	2.7 J	4.5 U	3.1 J	0.67 U	1.6 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	7.8	54	210	1400	150	3.1 J	87
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.80 J	3.7 J	7.2 J	13 J	7.4 J	0.79 J	4.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	3.5 J	14	76 J	11	0.44 J	5.8 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 J	4.8 J	7.1 J	7.5 J	7.1 J	1.8 J	4.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	28	160	590	2800	450	7.6	230
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.4 J	17	62	200 J	46	0.94 J	23
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 J	6.6 J	24	140 J	18	0.61 J	10
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	25	110	380	1500	290	4.4 J	140
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2600	8700	19000	30000	18000	310	8500
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	360	1700	6400	24000 J	4900	75	2400
Total heptachlorodibenzofuran (HpCDF)	pg/g	15 J	130 J	410 J	2800 J	310 J	6.5 J	210 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	63 J	380 J	520 J	470 J	590 J	110 J	330 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	48 J	320 J	1200 J	8300 J	920 J	19 J	520 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	68 J	92 J	90 J	100 J	30 J	56 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	88 J	450 J	1600 J	6800 J	1200 J	19 J	600 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.2 J	30 J	83 J	230 J	67 J	7.7 J	34 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	4100 J	14000 J	41000 J	140000 J	31000 J	490 J	15000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	420 J	1900 J	7000 J	27000 J	5300 J	84 J	2600 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	636	2660	8610	28500	6930	111	3370
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	636	2660	8610	28500	6930	111	3370

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB046 / 11187072-100719-SS-SJSB046 (12-14) / 10/7/2019 / (12-14) ft bgs	SJSB046 / 11187072-100719-SS-SJSB046 (14-16) / 10/7/2019 / (14-16) ft bgs	SJSB046 / 11187072-100719-SS-SJSB046 (16-18) / 10/7/2019 / (16-18) ft bgs	SJSB046 / 11187072-111119-KW-SJSB046-S(18-20) / 11/11/2019 / (18-20) ft bgs	SJSB046-C1 / 11187072-120919-BN-SJSB046-C1(0-2) / 12/9/2019 / (0-2) ft bgs	SJSB046-C1 / 11187072-120919-BN-SJSB046-C1(2-4) / 12/9/2019 / (2-4) ft bgs	SJSB046-C1 / 11187072-120919-BN-SJSB046-C1(4-6) / 12/9/2019 / (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	320	270	230	1.9 J	30	45	65
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2000	1800	2500	1800	1000 J	1600 J	1900 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	110	59	98	0.44 U	26	54	55
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	74	63	95	76	38	49	69
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	35	18	31	0.17 U	8.1	16	17
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	360	170	310	0.35 U	100	200	180
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.99 U	1.3 J	1.3 U	0.66 U	0.97 J	1.2 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	91	41	77	0.34 U	25	48	45
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.9 J	2.2 J	3.2 J	2.2 J	1.2 J	1.7 J	2.4 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	6.1 J	2.6 J	5.0 J	0.39 J	1.7 J	2.9 J	3.0 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.8 J	2.4 J	3.5 J	4.0 J	1.2 J	1.9 J	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	260	110	220	0.59 U	85	170	150
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	22	11	22	0.44 J	7.4	18	14
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	12	4.9 J	9.1	0.24 U	3.2 J	5.7 J	5.4 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	150	70	140	0.28 J	61	130	110
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7900	4500	8900	9.1	5100	8600	8400
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2500	1200	2400	2.6 U	1000	2400	1900
Total heptachlorodibenzofuran (HpCDF)	pg/g	180 J	97 J	160 J	0.44 J	44 J	84 J	96 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	200 J	180 J	260 J	220 J	130 J	150 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	540 J	250 J	460 J	0.39 J	150 J	280 J	270 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	37 J	48 J	54 J	21 J	29 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	660 J	300 J	580 J	0.88 J	240 J	480 J	420 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	30 J	17 J	31 J	11 J	12 J	24 J	23 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	14000 J	7300 J	15000 J	15 J	11000 J	25000 J	19000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2600 J	1200 J	2500 J	8.8 J	1100 J	2700 J	2200 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3420	1710	3400	3.39	1550	3350	2820
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3420	1710	3400	4.82	1550	3350	2820

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB046-C1	SJSB046-C1	SJSB046-C1	SJSB046-C1	SJSB046-C1	SJSB046-C1	SJSB046-C1
Sample Identification:		11187072-120919-BN-SJSB046-C1(6-8)	11187072-120919-BN-SJSB046-C1(8-10)	11187072-120919-BN-SJSB046-C1(10-12)	11187072-120919-BN-SJSB046-C1(12-14)	11187072-120919-BN-SJSB046-C1(14-16)	11187072-120919-BN-DUP3	11187072-120919-BN-SJSB046-C1(16-18)
Sample Date:		12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019	12/9/2019
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(16-18) ft bgs
Sample Type:							Duplicate	
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	370	270	2.6 U	50	4.9 U	180	93
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400 J	2100 J	1200 J	1800 J	1600 J	4100 J	1600 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	290	540	1.5 J	60	3.2 J	120	160
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130	120	41	72	68	150	67
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	120	180	0.56 J	24	1.4 J	38	45
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1400	2000	4.7 J	180	10	390	470
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	2.3 J	0.64 U	3.5 J	0.93 U	2.0 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	390	510	1.6 J	46	3.1 J	94	120
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.2 J	6.6 J	0.92 J	4.6 J	2.0 J	4.7 J	2.8 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	25	34	0.28 U	6.2 J	0.56 U	5.6 J	7.8
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.6 J	4.6 J	2.2 J	6.3 J	3.7 J	4.6 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1100	1400	3.7 J	140	9.5	280	340
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	70	89	0.48 J	13	1.3 J	25	39
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	46	56	0.24 J	7.4 J	0.59 J	11	13
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	590	710	2.3 J	93	7.3 J	180	240
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	21000	13000	160	5600	680	8400	12000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9100	13000	36	1600	130	3000	4300
Total heptachlorodibenzofuran (HpCDF)	pg/g	500 J	850 J	2.8 J	98 J	5.8 J	210 J	240 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	350 J	250 J	140 J	210 J	190 J	420 J	170 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2200 J	2900 J	7.2 J	270 J	17 J	570 J	680 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	77 J	56 J	37 J	60 J	49 J	71 J	34 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2700 J	3300 J	9.4 J	370 J	28 J	710 J	910 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	89 J	100 J	6.6 J	20 J	9.7 J	35 J	84 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	70000 J	74000 J	270 J	12000 J	1300 J	24000 J	35000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9900 J	15000 J	43 J	1800 J	150 J	3300 J	4800 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11700	14900	55.0	2230	205	3980	5690
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11700	14900	55.1	2230	205	3980	5690

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB047 11187072-100919-SS-SJSB047(8-10) 10/9/2019 (8-10) ft bgs	SJSB047 11187072-100919-SS-SJSB047(10-12) 10/9/2019 (10-12) ft bgs	SJSB047 11187072-100919-SS-SJSB047(12-14) 10/9/2019 (12-14) ft bgs	SJSB047 11187072-100919-SS-SJSB047(14-16) 10/9/2019 (14-16) ft bgs	SJSB047 11187072-100919-SS-SJSB047(16-18) 10/9/2019 (16-18) ft bgs	SJSB047 11187072-101019-SS-SJSB047(0-2) 10/10/2019 (0-2) ft bgs	SJSB047 11187072-101019-SS-SJSB047(2-4) 10/10/2019 (2-4) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.83 U	1.4 U	1.5 U	0.33 U	0.29 U	2.5 U	0.91 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	930	1000	1400	1100	500	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.29 U	0.22 U	0.65 J	0.27 U	0.29 U	0.57 J	0.17 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	49	34	48	65	46	22	43
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.052 U	0.22 J	0.33 U	0.29 U	0.34 U	0.13 J	0.16 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 J	0.084 U	0.24 U	0.21 U	0.25 U	0.11 J	0.098 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.62 U	0.60 U	0.75 U	0.70 U	0.82 U	0.38 J	0.47 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.083 U	0.26 U	0.22 U	0.27 U	0.064 U	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.81 J	1.3 J	1.5 J	1.2 J	0.65 J	0.95 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.19 J	0.21 J	0.23 J	0.11 U	0.27 J	0.13 J	0.24 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	1.8 J	3.0 J	3.2 J	2.7 J	1.6 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.070 U	0.23 U	0.20 U	0.18 U	0.054 U	0.043 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.20 J	0.36 U	0.38 U	0.39 U	0.11 U	0.097 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.059 U	0.066 U	0.16 U	0.14 U	0.16 U	0.048 U	0.094 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.067 U	0.077 U	0.24 U	0.22 U	0.19 U	0.056 U	0.043 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.42 J	0.31 J	0.27 J	0.13 U	0.20 J	1.0 J	0.27 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.27 J	0.22 J	0.27 U	0.28 U	0.28 U	0.36 J	0.10 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.29 J	0.44 J	0.65 J	0.29 U	0.34 U	1.6 J	0.52 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	120 J	160 J	200 J	160 J	85 J	150 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.48 J	0.28 J	0.23 J	0.22 U	0.27 J	0.24 J	0.55 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	47 J	30 J	43 J	47 J	45 J	17 J	35 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.31 J	0.10 U	0.24 U	0.22 U	0.20 U	0.066 U	0.053 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.9 J	5.6 J	9.5 J	7.6 J	9.3 J	1.9 J	6.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.0 J	1.1 J	0.96 J	0.50 J	0.82 J	1.8 J	0.93 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.0 J	2.9 J	5.1 J	4.3 J	5.2 J	2.0 J	4.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.99	1.35	1.27	1.54	1.23	1.12	1.30
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.03	1.41	1.69	1.98	1.67	1.19	1.35

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB047 / 11187072-101019-SS-SJSB047(4-6) / 10/10/2019 / (4-6) ft bgs	SJSB047 / 11187072-101019-SS-SJSB047(6-8) / 10/10/2019 / (6-8) ft bgs	SJSB047-C1 / 11187072-101719-SS-SJSB047-C1-(0-2) / 10/17/2019 / (0-2) ft bgs	SJSB047-C1 / 11187072-101719-SS-SJSB047-C1-(2-4) / 10/17/2019 / (2-4) ft bgs	SJSB047-C1 / 11187072-101719-SS-SJSB047-C1-(4-6) / 10/17/2019 / (4-6) ft bgs	SJSB047-C1 / 11187072-101719-SS-SJSB047-C1-(6-8) / 10/17/2019 / (6-8) ft bgs	SJSB047-C1 / 11187072-101719-SS-SJSB047-C1-(8-10) / 10/17/2019 / (8-10) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.48 U	27	390	410	5.5 J	1.8 U	45
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	830	2300	4300	2400	1300	1200	1200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.14 J	3.5 J	190	150	3.6 J	0.83 J	25
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	27	79	190	110	50	53	44
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 J	0.33 J	63	52	1.2 J	0.27 J	7.3
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 J	0.067 U	690	530	11	1.8 J	75
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.50 J	0.86 J	3.4 J	2.1 J	0.79 U	0.71 U	0.62 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 J	0.16 J	180	140	3.1 J	0.57 J	19
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.60 J	1.6 J	7.6 J	5.4 J	1.2 J	1.4 J	1.2 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 J	0.15 J	11	8.8 J	0.26 J	0.18 J	1.2 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	3.6 J	7.3 J	5.4 J	2.7 J	3.1 J	1.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	0.064 U	510	400	8.2 J	1.8 J	51
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.18 J	0.30 J	58	49	1.3 J	0.26 U	6.3 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.063 J	0.055 U	20	16	0.43 J	0.095 U	2.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.047 U	0.066 U	330	260	5.5 J	1.1 J	34
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.7	0.17 J	14000 J	13000	380	82	2000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.35 J	0.23 J	5800	4800	95	19	540
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.43 J	12 J	330 J	260 J	6.0 J	1.3 J	40 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110 J	250 J	550 J	330 J	180 J	170 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.40 J	1.3 J	1000 J	780 J	17 J	2.7 J	110 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	28 J	52 J	95 J	70 J	43 J	48 J	28 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	0.080 U	1300 J	1000 J	22 J	4.1 J	130 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.8 J	11 J	64 J	54 J	10 J	12 J	10 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3.2 J	0.93 J	39000 J	30000 J	630 J	130 J	3900 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.1 J	5.0 J	6300 J	5300 J	110 J	26 J	590 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.53	2.71	7470	6310	139	29.2	769
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.53	2.73	7470	6310	139	29.4	769

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB047-C1 11187072-101719-SS-SJSB047-C1-(10-12) 10/17/2019 (10-12) ft bgs	SJSB047-C1 11187072-101719-SS-SJSB047-C1-(12-14) 10/17/2019 (12-14) ft bgs	SJSB047-C1 11187072-101719-SS-SJSB047-C1-(14-16) 10/17/2019 (14-16) ft bgs	SJSB047-C1 11187072-101719-SS-SJSB047-C1-(16-18) 10/17/2019 (16-18) ft bgs	SJSB048 11187072-090819-SS-SJSB048-S- (0-2) 9/8/2019 (0-2) ft bgs	SJSB048 11187072-090819-SS-SJSB048-S- (2-4) 9/8/2019 (2-4) ft bgs	SJSB048 11187072-090819-SS-SJSB048-S- (4-6) 9/8/2019 (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	31	17	9.0 J	1.1 U	1.4 J	1.5 J	0.35 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1300	1100	930	1400	400	280	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	19	25	9.4	0.27 J	0.45 U	0.94 J	0.41 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	43	40	34	60	9.5	8.0	42
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	6.1 J	7.6	3.1 J	0.093 U	1.1 J	0.73 J	0.71 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	61	76	29	0.49 J	0.37 J	0.53 J	0.23 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.59 U	0.68 U	0.52 U	1.0 U	0.31 U	0.27 U	0.61 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	16	20	7.6	0.15 U	0.34 J	0.16 U	0.24 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 J	1.0 J	0.74 J	1.3 J	0.32 U	0.29 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.95 J	1.2 J	0.53 J	0.10 U	1.9 U	1.4 U	1.4 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.6 J	1.5 J	4.1 J	1.0 J	0.91 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	43	50	19	0.46 J	0.39 U	0.30 U	0.41 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.5 J	7.3	2.7 J	0.47 J	0.57 U	0.46 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	2.3 J	0.97 J	0.10 U	0.17 U	0.13 U	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	30	37	13	0.29 J	0.43 U	0.34 U	0.43 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1700	1900	950	16	1.7	1.8	0.26 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	490	600	220	3.5	0.64 J	0.24 U	0.26 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	32 J	39 J	15 J	0.27 J	1.1 J	2.2 J	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	140 J	120 J	100 J	220 J	33 J	27 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	91 J	110 J	42 J	0.49 J	4.2 J	3.5 J	2.0 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	31 J	25 J	22 J	55 J	6.9 J	6.2 J	21 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	120 J	140 J	51 J	0.95 J	0.51 U	0.34 U	0.43 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	10 J	11 J	6.5 J	13 J	0.57 U	0.46 U	2.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3500 J	4300 J	1500 J	23 J	2.7 J	2.6 J	0.84 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	530 J	650 J	240 J	10 J	0.64 J	0.31 J	2.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	685	821	327	7.28	1.21	0.505	1.18
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	685	821	327	7.35	1.70	1.02	1.72

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB048 / 11187072-090819-SS-SJSB048-S- (6-8) / 9/8/2019 / (6-8) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (8-10) / 9/8/2019 / (8-10) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (10-12) / 9/8/2019 / (10-12) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (12-14) / 9/8/2019 / (12-14) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (14-16) / 9/8/2019 / (14-16) ft bgs	SJSB048 / 11187072-090819-SS-SJSB048-S- (16-18) / 9/8/2019 / (106-18) ft bgs	SJSB048-C1 / 11187072-11719-KW-SJSB048-C1-S (0-2) / 11/7/2019 / (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.3 J	1.2 J	0.34 U	1.2 J	0.31 U	1.3 J	7.9 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1800	1700	1200	1300	920	1900	780
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.75 J	0.45 U	0.41 U	0.40 U	0.62 J	0.38 U	16
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	74	66	44	45	36	69	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.51 U	0.79 J	0.69 J	0.41 U	0.45 U	0.55 J	5.4 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.22 U	0.22 U	0.17 U	0.21 U	0.25 U	53
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.77 J	0.86 J	0.60 J	0.63 J	0.56 J	0.83 J	0.40 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.24 U	0.24 U	0.18 U	0.23 U	0.27 U	13
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 J	1.7 J	1.2 J	1.0 J	0.93 J	1.6 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	2.0 U	1.3 U	0.90 U	1.3 U	1.4 U	1.1 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	3.5 J	2.4 J	2.1 J	2.2 J	3.6 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.38 U	0.43 U	0.36 U	0.35 U	0.38 U	0.38 U	35
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.55 U	0.63 U	0.49 U	0.48 U	0.58 U	0.58 U	5.4 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.18 U	0.19 U	0.14 U	0.18 U	0.20 U	1.8 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.42 U	0.46 U	0.39 U	0.36 U	0.41 U	0.42 U	30
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.17 U	0.42 J	0.16 U	0.59 J	0.65 J	0.62 J	1400
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.25 U	0.34 U	0.26 U	0.38 J	0.26 U	0.32 U	460
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.75 J	0.79 J	0.69 J	0.41 U	0.62 J	0.55 J	26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	280 J	160 J	150 J	130 J	250 J	89 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	2.5 J	2.2 J	0.90 J	1.8 J	1.4 J	80 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	60 J	35 J	30 J	32 J	53 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.50 U	0.47 U	0.39 U	0.36 U	0.41 U	0.45 U	110 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.3 J	9.1 J	5.1 J	5.9 J	6.8 J	8.2 J	5.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.52 J	1.1 J	0.66 J	1.4 J	1.7 J	1.6 J	3300 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.8 J	2.6 J	3.9 J	3.7 J	4.7 J	5.8 J	510 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.87	1.83	1.23	1.65	1.08	1.93	623
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.46	2.52	1.77	2.03	1.66	2.56	623

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
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Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (2-4) 11/7/2019 (2-4) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (4-6) 11/7/2019 (4-6) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (6-8) 11/7/2019 (6-8) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (8-10) 11/7/2019 (8-10) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (10-12) 11/7/2019 (10-12) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (12-14) 11/7/2019 (12-14) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.1 U	9.2 J	0.37 U	3.4 U	0.24 U	1.5 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	490	380	1300	150	2000	2200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2.0 J	20	0.33 U	7.2	0.25 U	3.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19	16	48	6.4	91	98
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.70 J	7.8	0.22 U	2.6 J	0.031 U	1.3 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.7 J	55	0.63 J	25	0.41 J	11
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 J	0.28 J	0.51 J	0.13 J	0.86 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 J	13	0.15 J	6.1	0.18 J	2.6 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.54 J	0.38 J	0.93 J	0.22 J	2.2 J	2.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 J	1.0 J	0.069 U	0.44 J	0.073 U	0.25 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.96 J	2.8 J	0.36 J	4.9 J	5.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.5 J	33	0.26 J	16	0.31 J	6.8 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.59 J	5.3 J	0.24 J	2.8 J	0.33 J	1.4 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	1.6 J	0.058 U	0.86 J	0.062 U	0.35 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.1 J	28	0.24 J	15	0.26 J	6.4 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	42	1400	5.5	820	6.6	390
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48	430	2.7	230	2.9	100
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.2 J	32 J	0.55 J	12 J	0.34 J	5.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	53 J	42 J	150 J	20 J	290 J	300 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	8.4 J	81 J	0.78 J	37 J	0.60 J	16 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	11 J	39 J	5.7 J	66 J	78 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	11 J	93 J	0.50 J	49 J	0.67 J	23 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 J	7.9 J	6.5 J	3.0 J	10 J	13 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	340 J	3000 J	21 J	1700 J	22 J	790 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	54 J	480 J	7.0 J	260 J	9.6 J	120 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	55.1	592	4.94	323	6.34	147
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	55.1	592	4.95	323	6.35	147

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (14-16) 11/7/2019 (14-16) ft bgs	SJSB048-C1 11187072-11719-KW-SJSB048-C1-S (16-18) 11/7/2019 (16-18) ft bgs	SJSB048-C1 11187072-120519-SS-SJSB048-C1(18-20) 12/5/2019 (18-20) ft bgs	SJSB048-C1 1187072-120519-SS-DUP-1 12/5/2019 (20-22) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (0-2) 9/11/2019 (0-2) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (2-4) 9/11/2019 (2-4) ft bgs	SJSB049 11187072-091119-SS-SJSB049-S (4-6) 9/11/2019 (4-6) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.5 U	2.3 U	2.5 U	1.9 U	490	240	82
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2600	710	1200 J	62	5200	3200	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.2 J	5.3 J	0.63 J	0.13 U	830	190	94
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	87	30	47	2.3 J	260	120	60
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	1.9 J	0.20 U	0.17 U	260	56	30
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	9.7	18	0.92 J	0.19 J	2400	550	240
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 J	0.30 J	0.86 J	0.32 J	3.2 J	1.7 J	0.94 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	4.3 J	0.44 J	0.14 J	680	150	65
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	0.67 J	1.3 J	0.27 J	14	4.6 J	1.7 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.39 J	0.55 J	0.28 J	43	10 U	5.6 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.9 J	1.3 J	4.0 J	0.42 J	7.7 J	4.3 J	2.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.6 J	11	0.20 U	0.11 U	1600	430	150
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.5 J	2.0 J	0.60 J	0.17 U	150	46	12 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.38 J	0.49 J	0.23 J	0.11 J	76	16	6.1 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.0 J	9.9	0.47 J	0.11 U	1100	330	100
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	400	510	25 J	1.9	27000 J	14000 J	5700 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	96	160	6.9	0.56 J	20000 J	5000 J	1700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	5.1 J	8.6 J	0.63 J	0.17 U	1400 J	300 J	140 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	77 J	170 J	6.6 J	620 J	320 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	15 J	26 J	2.1 J	0.73 J	3600 J	820 J	350 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	54 J	19 J	47 J	2.9 J	110 J	61 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	22 J	36 J	0.47 J	0.12 U	4400 J	1200 J	380 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.9 J	3.0 J	7.9 J	0.17 U	160 J	61 J	14 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	750 J	1100 J	44 J	2.1 J	100000 J	35000 J	11000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	110 J	170 J	11 J	1.1 J	21000 J	5500 J	1800 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	143	219	11.8	0.965	23600	6640	2350
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	143	219	11.8	1.07	23600	6640	2350

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB049	SJSB049	SJSB049	SJSB049	SJSB049	SJSB049	SJSB050
Sample Identification:		11187072-091119-SS-SJSB049-S (6-8)	11187072-091119-SS-SJSB049-S (8-10)	11187072-091119-SS-SJSB049-S (10-12)	11187072-091119-SS-SJSB049-S (12-14)	11187072-091119-SS-SJSB049-S (14-16)	11187072-091119-SS-SJSB049-S (16-18)	11187072-091619-SS-SJSB050-(0-2)
Sample Date:	Units	9/11/2019	9/11/2019	9/11/2019	9/11/2019	9/11/2019	9/11/2019	9/16/2019
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.1 J	9.7 J	3.2 J	4.5 J	1.8 J	0.47 U	7.2 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	1600	1700	2600	2000	2000	2600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	6.6 J	2.2 J	2.8 J	0.49 U	0.37 U	1.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	64	59	75	99	75	77	91
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.9 U	3.6 U	2.5 U	3.0 U	1.5 U	1.6 U	0.42 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8.1	18	6.5 J	8.4	1.7 J	0.24 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.57 J	0.62 J	1.0 J	1.0 J	1.4 J	0.83 J	1.1 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	4.6 J	2.1 J	2.6 J	0.67 J	0.25 U	0.27 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.4 J	2.0 J	2.3 J	2.2 J	1.5 J	2.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.6 U	3.1 U	2.4 U	3.5 U	2.8 U	3.2 U	0.70 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.8 J	2.6 J	4.1 J	5.5 J	6.3 J	5.0 J	4.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6.4 J	14	5.8 J	7.4 J	1.9 J	0.39 U	0.38 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.1 J	1.6 J	1.1 J	0.89 J	0.52 U	0.60 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.63 J	0.19 U	0.48 J	0.18 U	0.20 U	0.21 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	4.2 J	9.4	4.1 J	4.5 J	1.1 J	0.41 U	0.42 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	320	720 J	330	340	77	11 J	11
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	73	170	74	77	17	2.1 J	3.4
Total heptachlorodibenzofuran (HpCDF)	pg/g	5.9 J	12 J	4.7 J	7.0 J	1.5 J	1.6 J	1.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	190 J	220 J	290 J	260 J	240 J	220 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	18 J	31 J	13 J	18 J	6.5 J	4.7 J	0.70 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	39 J	42 J	58 J	68 J	67 J	62 J	44 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17 J	37 J	16 J	19 J	2.9 J	0.41 U	0.42 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.3 J	7.9 J	15 J	10 J	5.5 J	9.6 J	6.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	520 J	1200 J	530 J	530 J	110 J	17 J	13 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	80 J	190 J	84 J	88 J	22 J	7.5 J	6.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	110	251	112	117	27.7	5.30	7.03
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	110	251	112	117	28.1	5.87	7.41

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB050	SJSB050	SJSB050	SJSB050	SJSB050	SJSB050	SJSB050
Sample Identification:		11187072-091619-SS-DUP-5	11187072-091619-SS-SJSB050-(2-4)	11187072-091619-SS-SJSB050-(4-6)	11187072-091619-SS-SJSB050-(6-8)	11187072-091619-SS-SJSB050-(8-10)	11187072-091619-SS-SJSB050-(10-12)	11187072-091619-SS-SJSB050-(12-14)
Sample Date:		9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019	9/16/2019
Sample Depth:		(2-4) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs
Sample Type:		Duplicate						
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.8 J	1.7 J	0.46 U	0.39 U	1.0 J	0.45 U	0.34 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1400	2300	850	1300	2500	2000	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.27 U	0.34 U	0.27 U	0.23 U	0.22 U	0.24 U	0.19 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	50	62	31	38	110	85	50
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.32 U	0.38 U	0.32 U	0.26 U	0.24 U	0.28 U	0.20 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.20 U	0.17 U	0.16 U	0.18 U	0.15 U	0.13 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 J	1.2 J	0.51 J	0.42 J	1.1 J	1.0 J	0.44 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.21 U	0.18 U	0.17 U	0.18 U	0.16 U	0.14 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.3 J	0.62 J	0.78 J	2.4 J	2.1 J	0.97 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.53 U	0.30 U	0.23 U	0.23 U	0.35 U	0.32 U	0.27 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	3.1 J	1.9 J	2.0 J	5.6 J	4.7 J	2.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.30 U	0.54 J	0.23 U	0.23 U	0.24 U	0.22 U	0.20 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 U	0.52 U	0.48 U	0.41 U	0.45 U	0.47 U	0.36 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.16 U	0.14 U	0.12 U	0.14 U	0.12 U	0.10 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.31 U	0.36 U	0.25 U	0.25 U	0.26 U	0.25 U	0.22 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	3.9	0.97 J	0.20 U	0.14 U	0.19 U	0.21 U	0.15 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.0 J	0.71 J	0.27 U	0.21 U	0.30 J	0.31 U	0.25 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.32 U	0.38 U	0.32 U	0.26 U	0.24 U	0.28 U	0.20 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	160 J	120 J	150 J	280 J	230 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	0.30 J	0.23 J	0.23 J	0.35 J	0.32 J	0.27 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	24 J	30 J	34 J	36 J	78 J	66 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.36 U	1.5 J	0.28 U	0.25 U	0.26 U	0.26 U	0.22 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.2 J	5.4 J	7.3 J	6.2 J	17 J	13 J	5.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5.9 J	2.8 J	0.20 U	0.14 U	0.47 J	1.4 J	0.37 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.0 J	4.1 J	3.2 J	1.6 J	8.4 J	8.1 J	2.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.79	2.69	0.868	1.09	3.06	2.23	1.55
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.13	3.05	1.33	1.48	3.38	2.71	1.81

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB050 11187072-091619-SS-SJSB050-(14-16) 9/16/2019 (14-16) ft bgs	SJSB050 11187072-091619-SS-SJSB050-(16-18) 9/16/2019 (16-18) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(0-2) 10/10/2019 (0-2) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(2-4) 10/10/2019 (2-4) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(4-6) 10/10/2019 (4-6) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(6-8) 10/10/2019 (6-8) ft bgs	SJSB050-C1 11187072-100919-SS-SJSB050C1(8-10) 10/10/2019 (8-10) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.41 U	0.31 U	0.18 U	0.83 U	0.26 U	1.4 U	0.52 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	40	450	750	1500	2300	130
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 U	0.16 U	0.17 U	0.20 U	0.24 U	0.22 U	0.15 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	45	0.94 J	16	33	58	97	6.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.26 U	0.20 U	0.20 U	0.23 U	0.25 U	0.26 U	0.18 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.13 U	0.14 U	0.18 U	0.17 U	0.19 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.61 J	0.15 U	0.33 U	0.44 U	0.62 U	1.0 U	0.15 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.13 U	0.15 U	0.20 U	0.18 U	0.22 U	0.15 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.16 U	0.39 J	0.77 J	1.2 J	2.0 J	0.16 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.36 U	0.26 U	0.11 J	0.25 J	0.094 U	0.27 J	0.076 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.9 J	0.14 U	0.79 J	1.5 J	2.6 J	4.5 J	0.34 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.22 U	0.16 U	0.16 U	0.17 U	0.17 U	0.22 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 U	0.29 U	0.27 U	0.29 U	0.33 U	0.36 U	0.21 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.098 U	0.092 U	0.12 U	0.11 U	0.13 U	0.090 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.23 U	0.17 U	0.17 U	0.18 U	0.18 U	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.19 U	0.13 U	3.5	0.86 J	0.44 J	0.31 J	3.0
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.27 U	0.17 U	1.3 J	0.85 J	0.51 J	0.44 J	0.70 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.26 U	0.20 U	0.20 U	0.23 U	0.25 U	0.26 U	0.18 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	3.8 J	51 J	110 J	180 J	320 J	15 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.26 J	0.11 U	0.25 J	0.18 U	0.27 J	0.15 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	38 J	0.78 J	9.2 J	20 J	40 J	72 J	2.2 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.29 U	0.23 U	0.17 U	0.19 U	0.18 U	0.18 U	0.22 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.5 J	0.29 U	0.49 J	1.5 J	6.6 J	12 J	0.21 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.80 J	0.13 U	4.6 J	1.7 J	0.88 J	0.89 J	4.4 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.1 J	0.17 U	2.1 J	3.1 J	4.1 J	7.5 J	0.91 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.29	0.0214	2.07	1.74	1.96	2.81	1.14
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.77	0.351	2.27	1.97	2.22	3.10	1.31

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB050-C1	SJSB050-C1	SJSB050-C1	SJSB050-C1	SJSB050-C1	SJSB051	SJSB051
Sample Identification:		11187072-100919-SS-SJSB050C1(10-12)	11187072-100919-SS-SJSB050C1(12-14)	11187072-100919-SS-SJSB050C1(14-16)	11187072-100919-SS-SJSB050C1(16-18)	11187072-101019-SS-DUP-7	11187072-091019-SS-SJSB051-S (0-2)	11187072-091019-SS-SJSB051-S (2-4)
Sample Date:		10/10/2019	10/10/2019	10/10/2019	10/10/2019	10/10/2019	9/10/2019	9/10/2019
Sample Depth:		(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs
Sample Type:						Duplicate		
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.24 U	0.32 U	1.1 U	0.24 U	0.19 U	2.5 J	4.0 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	340	2000	1800	960 J	250 J	2300	5500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	0.24 U	0.21 U	0.19 U	0.13 U	0.28 U	0.53 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	14	100	96	41 J	8.7 J	60	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.21 U	0.27 U	0.24 U	0.21 U	0.16 U	0.35 U	0.67 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.21 U	0.19 U	0.16 U	0.13 U	0.19 U	0.33 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.38 U	0.97 U	0.88 U	0.51 U	0.17 U	0.62 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.23 U	0.21 U	0.18 U	0.14 U	0.19 U	0.32 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 J	2.6 J	2.7 J	0.92 J	0.17 U	1.4 J	3.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.33 J	0.24 J	0.088 U	0.11 J	1.5 U	2.3 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.71 J	5.7 J	5.4 J	2.0 J	0.39 J	3.2 J	6.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.18 U	0.19 U	0.18 U	0.11 U	0.29 U	0.58 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.24 U	0.41 U	0.38 U	0.30 U	0.23 U	0.45 U	0.94 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.15 U	0.13 U	0.11 U	0.087 U	0.15 U	0.25 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 U	0.20 U	0.21 U	0.18 U	0.12 U	0.33 U	0.67 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2.4	0.15 U	0.12 U	0.14 U	0.097 U	1.4 J	0.30 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.76 J	0.59 J	0.24 J	0.19 U	0.17 U	0.67 J	0.43 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.21 U	0.27 U	0.24 U	0.21 U	0.16 U	0.35 U	0.67 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40 J	260 J	240 J	110 J	25 J	160 J	330 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.33 J	0.24 J	0.18 U	0.11 U	1.9 J	2.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.1 J	67 J	59 J	22 J	5.2 J	31 J	53 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.17 U	0.20 U	0.21 U	0.18 U	0.15 U	0.33 U	0.67 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.57 J	9.7 J	8.8 J	2.2 J	0.46 J	2.4 J	1.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.7 J	0.70 J	0.99 J	0.14 U	0.097 U	2.6 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.2 J	6.4 J	5.3 J	1.2 J	0.18 J	2.4 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.35	3.05	2.57	0.99	0.212	2.62	4.00
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.54	3.38	2.88	1.33	0.473	3.02	4.98

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB051 11187072-091019-SS-SJSB051-S (4-6) 9/10/2019 (4-6) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (6-8) 9/10/2019 (6-8) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (8-10) 9/10/2019 (8-10) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (10-12) 9/10/2019 (10-12) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (12-14) 9/10/2019 (12-14) ft bgs	SJSB051 11187072-091019-SS-SJSB051-S (14-16) 9/10/2019 (14-16) ft bgs	SJSB051 11187072-091019-SS-DUP-1 9/10/2019 (16-18) ft bgs Duplicate
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.38 U	1.2 J	2.6 J	0.58 J	0.85 J	0.74 J	0.61 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	2200	1400	1400	2600	1500	850
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.40 U	0.34 J	0.50 J	0.14 J	0.25 J	0.22 J	0.15 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	81	49	51	70	66	40
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.48 U	0.76 J	0.76 J	0.71 J	0.75 J	0.74 J	0.56 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 U	0.24 J	0.17 J	0.15 J	0.27 J	0.18 J	0.19 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.73 J	1.2 J	0.95 J	0.79 J	1.1 J	0.90 J	0.74 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.22 U	0.17 J	0.15 J	0.12 J	0.17 J	0.14 J	0.032 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.5 J	1.2 J	1.0 J	1.5 J	1.3 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.5 U	1.6 U	1.5 U	1.4 U	1.5 U	1.5 U	1.3 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	4.4 J	2.9 J	2.7 J	3.1 J	3.6 J	3.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.32 U	0.29 J	0.28 J	0.22 J	0.28 J	0.17 J	0.19 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.60 U	0.080 U	0.28 J	0.060 U	0.37 J	0.33 J	0.24 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 U	0.024 U	0.021 U	0.019 U	0.026 U	0.019 U	0.027 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.34 U	0.13 J	0.18 J	0.13 J	0.15 J	0.083 J	0.058 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.21 U	0.13 J	2.2	0.11 J	0.56 J	0.11 J	0.096 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.34 J	0.23 J	0.93 J	0.14 J	0.25 J	0.17 J	0.17 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.48 U	1.5 J	1.9 J	1.1 J	1.3 J	1.3 J	0.98 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	220 J	290 J	150 J	180 J	210 J	220 J	140 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.5 J	2.9 J	3.1 J	2.5 J	2.9 J	2.7 J	2.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	76 J	44 J	51 J	42 J	65 J	41 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.34 U	0.92 J	1.3 J	0.86 J	1.1 J	0.69 J	0.82 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.9 J	13 J	9.2 J	7.6 J	8.0 J	12 J	6.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.21 U	0.92 J	3.9 J	0.49 J	3.0 J	1.0 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.2 J	8.2 J	5.8 J	4.1 J	6.0 J	5.5 J	3.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.00	2.52	2.95	1.61	2.83	2.27	1.62
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.48	2.64	3.03	1.71	2.91	2.35	1.70

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB051	SJSB052	SJSB052	SJSB052	SJSB052	SJSB052	SJSB052
Sample Identification:		11187072-091019-SS-SJSB051-S (16-18)	11187072-091219-SS-SJSB052-S (0-2)	11187072-091219-SS-SJSB052-S (2-4)	11187072-091219-SS-SJSB052-S (4-6)	11187072-091219-SS-SJSB052-S (6-8)	11187072-091219-SS-SJSB052-S (8-10)	11187072-091219-SS-SJSB052-S (10-12)
Sample Date:		9/10/2019	9/12/2019	9/12/2019	9/12/2019	9/12/2019	9/12/2019	9/12/2019
Sample Depth:		(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.75 J	1.3 J	0.33 U	0.30 U	0.58 U	0.46 U	1.6 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1500	440	280	610	1200	640	1700
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 J	0.29 U	0.25 U	0.26 U	0.38 U	0.33 U	0.25 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	67	31	13	23	48	29	74
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.67 J	2.0 U	1.6 U	1.5 U	1.6 U	1.7 U	2.1 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 J	0.44 J	0.26 J	0.16 U	0.20 U	0.23 U	0.22 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.70 J	0.25 U	0.25 U	0.67 J	0.62 J	0.97 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.33 J	0.38 J	0.17 U	0.22 U	0.23 U	0.38 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	0.90 J	0.26 U	0.46 J	1.1 J	0.66 J	1.6 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	2.6 U	2.7 U	2.1 U	3.4 U	3.0 U	3.2 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.5 J	1.5 J	0.72 J	1.0 J	2.7 J	1.8 J	3.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.25 J	0.57 J	0.76 J	0.23 U	0.36 U	0.28 U	0.28 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.33 J	0.36 U	0.38 U	0.33 U	0.47 U	0.48 U	0.37 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.023 U	0.13 U	0.16 U	0.13 U	0.16 U	0.19 U	0.14 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.045 U	0.25 U	0.29 U	0.25 U	0.38 U	0.31 U	0.32 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.11 J	2.8	3.8	3.2	0.43 J	1.8	0.46 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.19 J	0.58 J	0.78 J	0.76 J	0.30 U	0.56 J	0.40 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.3 J	2.0 J	1.6 J	1.5 J	1.6 J	1.7 J	2.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	58 J	38 J	79 J	170 J	100 J	210 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.1 J	4.4 J	4.5 J	2.9 J	4.7 J	4.2 J	5.1 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	66 J	11 J	7.6 J	17 J	41 J	30 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.68 J	0.57 J	0.76 J	0.25 U	0.38 U	0.31 U	0.32 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.7 J	0.39 J	0.38 U	0.95 J	4.6 J	4.7 J	8.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.70 J	3.8 J	4.3 J	4.6 J	0.43 J	2.6 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.2 J	0.80 J	0.78 J	1.3 J	1.9 J	2.3 J	5.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.40	1.71	1.53	1.64	1.33	1.53	2.38
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.48	2.07	1.94	1.99	1.99	2.01	2.80

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB052	SJSB052	SJSB052	SJSB052	SJSB052-C1	SJSB052-C1	SJSB052-C1
Sample Identification:		11187072-091219-SS-SJSB052-S (12-14)	11187072-091219-SS-SJSB052-S (14-16)	11187072-091219-SS-DUP-4	11187072-091219-SS-SJSB052-S (16-18)	11187072-100819-SS-SJSB052-C1 (0-2)	11187072-100819-SS-SJSB052-C1 (2-4)	11187072-100819-SS-SJSB052-C1 (4-6)
Sample Date:		9/12/2019	9/12/2019	9/12/2019	9/12/2019	10/8/2019	10/8/2019	10/8/2019
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Sample Type:				Duplicate				
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.30 U	0.32 U	0.34 U	0.38 U	1.4 J	0.31 J	0.53 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1500	140	1400	1000	1300	460	100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.27 U	0.32 U	0.31 U	0.47 J	0.12 J	0.12 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	53	4.4 J	55	46	39	33	3.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.7 U	2.5 U	2.0 U	2.5 U	0.26 J	0.075 J	0.027 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.21 U	0.21 U	0.25 U	0.75 J	0.066 J	0.10 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.61 J	0.25 U	0.90 J	0.59 J	0.86 U	0.51 U	0.22 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.19 U	0.44 J	0.23 U	0.26 U	0.28 J	0.040 J	0.038 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	0.26 U	2.2 J	1.1 J	1.1 J	0.98 J	0.13 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 U	3.8 U	3.0 U	4.1 U	0.30 J	0.15 J	0.088 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.1 J	0.24 U	3.1 J	3.0 J	2.3 J	2.0 J	0.18 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.24 U	0.67 U	0.54 U	1.1 U	0.75 J	0.15 J	0.041 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.36 U	0.29 U	5.2 J	0.39 U	0.44 J	0.21 J	0.071 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.17 U	0.18 U	0.20 U	0.13 J	0.044 J	0.030 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.26 U	0.31 U	0.31 U	0.33 U	0.47 J	0.043 U	0.042 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.44 J	0.15 U	1.0 J	49 J	23	0.41 J	0.85 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.33 J	0.19 U	3.0	5.5	5.0	0.11 J	0.24 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.7 J	2.5 J	2.0 J	2.5 J	0.96 J	0.25 J	0.16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	170 J	14 J	170 J	140 J	120 J	68 J	8.4 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	4.7 J	6.3 J	5.7 J	6.1 J	1.5 J	0.30 J	0.19 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	38 J	2.8 J	52 J	37 J	21 J	15 J	1.7 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.67 J	7.7 J	1.9 J	2.8 J	0.33 J	0.061 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.0 J	0.29 U	19 J	5.9 J	10 J	2.8 J	0.29 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.93 J	0.15 U	1.9 J	88 J	47 J	1.8 J	1.7 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.3 J	0.19 U	8.0 J	8.5 J	13 J	1.8 J	0.57 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.84	0.130	9.89	11.6	9.18	1.16	0.436
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.24	0.694	10.1	12.1	9.22	1.20	0.493

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB052-C1	SJSB052-C1	SJSB052-C1	SJSB052-C1	SJSB052-C1	SJSB052-C1	SJSB053
Sample Identification:		11187072-100819-SS-SJSB052-C1 (6-8)	11187072-100819-SS-SJSB052-C1 (8-10)	11187072-100819-SS-SJSB052-C1 (10-12)	11187072-100819-SS-SJSB052-C1 (12-14)	11187072-100819-SS-SJSB052-C1 (14-16)	11187072-100819-SS-SJSB052-C1 (16-18)	11187072-101319-SS-SJSB053 (0-2)
Sample Date:		10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/8/2019	10/13/2019
Sample Depth:		(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.25 J	0.37 U	0.17 U	0.69 U	0.26 U	0.24 U	10 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	790	1400	740 J	1100	900	1300	720
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 J	0.13 U	0.079 U	0.25 U	0.13 U	0.13 U	2.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	31	60	31	43	39	56	36
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.072 J	0.12 J	0.037 U	0.055 U	0.076 J	0.087 J	0.32 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	0.12 J	0.059 U	0.057 U	0.088 J	0.048 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.50 U	0.73 U	0.67 U	0.72 U	0.83 U	0.78 U	0.57 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.093 J	0.13 J	0.060 U	0.099 J	0.092 J	0.087 J	0.32 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 J	1.5 J	0.91 J	1.1 J	1.1 J	1.5 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	0.26 U	0.13 U	0.21 U	0.17 U	0.18 U	0.17 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	3.8 J	2.1 J	3.0 J	3.2 J	4.0 J	2.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.077 U	0.055 U	0.060 U	0.058 U	0.051 U	0.16 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 J	0.33 J	0.24 J	0.31 J	0.42 J	0.33 J	0.34 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.028 U	0.049 U	0.047 U	0.078 J	0.083 J	0.065 J	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.041 U	0.081 U	0.059 U	0.064 U	0.059 U	0.052 U	0.18 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.74 J	0.28 J	0.11 J	0.056 U	0.22 J	0.044 U	0.33 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.30 J	0.32 J	0.25 J	0.15 J	0.17 J	0.17 J	0.53 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.20 J	0.25 J	0.079 J	0.25 J	0.21 J	0.22 J	5.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100 J	180 J	120 J	150 J	140 J	180 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.26 J	0.51 J	0.13 J	0.39 J	0.43 J	0.33 J	0.55 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	26 J	40 J	29 J	44 J	43 J	49 J	26 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.094 U	0.073 U	0.071 U	0.067 U	0.059 U	0.18 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.2 J	7.0 J	5.0 J	10 J	9.0 J	11 J	3.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.1 J	1.4 J	1.3 J	0.85 J	1.1 J	1.5 J	0.76 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.9 J	4.4 J	3.6 J	5.4 J	3.9 J	6.6 J	2.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.44	2.25	1.33	1.65	1.73	2.02	1.54
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.47	2.32	1.39	1.71	1.79	2.08	1.79

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB053 11187072-101319-SS-SJSB053 (2-4) 10/13/2019 (2-4) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (4-6) 10/13/2019 (4-6) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (6-8) 10/13/2019 (6-8) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (8-10) 10/13/2019 (8-10) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (10-12) 10/13/2019 (10-12) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (12-14) 10/13/2019 (12-14) ft bgs	SJSB053 11187072-101319-SS-SJSB053 (14-15) 10/13/2019 (14-15) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.57 U	1.1 U	2.0 U	2.8 U	0.50 U	0.29 U	120
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	570	640	800	810	1300	21 U	2100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.050 U	0.15 J	0.43 J	0.69 J	0.11 J	0.14 J	17
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22	22	32	34	53	0.97 J	110 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.050 U	0.073 U	0.067 U	0.060 U	0.048 U	1.4 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	0.095 U	0.096 U	0.12 U	0.086 U	0.10 U	0.28 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.42 J	0.42 J	0.62 J	0.42 J	0.51 J	0.25 J	0.75 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.097 U	0.093 U	0.095 U	0.12 U	0.087 U	0.099 U	0.44 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.52 J	0.54 J	0.79 J	0.80 J	1.1 J	0.12 J	2.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.067 U	0.094 J	0.089 U	0.16 J	0.077 U	0.14 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.3 J	2.1 J	2.3 J	3.3 J	0.18 J	5.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.063 U	0.087 U	0.099 U	0.093 U	0.088 U	0.066 U	0.062 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 U	0.17 U	0.19 U	0.14 U	0.25 J	0.12 U	0.21 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 U	0.074 U	0.072 U	0.099 U	0.071 U	0.081 U	0.19 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.065 U	0.088 U	0.099 U	0.096 U	0.087 U	0.068 U	0.063 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.22 J	1.3 J	0.98 J	0.23 J	0.14 U	0.13 U	0.057 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.18 J	0.55 J	0.29 J	0.21 J	0.15 U	0.11 U	0.24 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.33 J	1.0 J	1.7 J	0.11 J	0.14 J	58 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	81 J	79 J	110 J	130 J	180 J	3.2 J	250 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.095 U	0.094 J	0.12 U	0.16 J	0.10 U	6.3 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	20 J	18 J	28 J	31 J	38 J	1.2 J	41 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.086 U	0.11 U	0.13 U	0.14 U	0.097 U	0.092 U	0.19 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.8 J	3.2 J	4.0 J	4.7 J	5.7 J	0.12 U	8.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.55 J	1.7 J	1.7 J	0.64 J	0.55 J	0.13 U	0.18 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.3 J	1.7 J	2.6 J	2.9 J	2.6 J	0.11 U	2.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.827	1.32	1.31	1.17	1.68	0.0660	3.32
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.917	1.44	1.44	1.28	1.79	0.220	3.33

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB053	SJSB053	SJSB053-C1	SJSB053-C1	SJSB053-C1	SJSB053-C1
Sample Identification:		11187072-111019-KW-SJSB053-S(14-16)	11187072-111019-KW-SJSB053-S(16-18)	11187072-110919-KW-SJSB053-C1-S (0-2)	11187072-110919-KW-SJSB053-C1-S (2-4)	11187072-110919-KW-SJSB053-C1-S (4-6)	11187072-110919-KW-SJSB053-C1-S (6-8)
Sample Date:		11/10/2019	11/10/2019	11/9/2019	11/9/2019	11/9/2019	11/9/2019
Sample Depth:		(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs
Sample Type:							
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.5 U	0.59 U	1.8 U	3.4 U	3.3 U	9.3 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	92	130	150	600	940	1000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.14 U	0.19 U	0.40 U	0.47 U	0.71 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.8 J	4.0 J	7.1	24	38	42
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.073 U	0.12 U	0.21 U	0.25 U	0.35 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 U	0.059 U	0.066 U	0.074 U	0.15 U	0.14 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.31 U	0.27 U	0.31 U	0.41 U	0.57 U	0.60 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.067 U	0.058 U	0.063 U	0.070 U	0.15 U	0.14 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.25 J	0.19 J	0.22 J	0.65 J	0.80 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 U	0.12 U	0.14 U	0.054 U	0.20 U	0.27 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.33 U	0.41 U	0.35 U	1.5 J	1.9 J	2.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.13 U	0.14 U	0.047 U	0.16 U	0.17 U	0.14 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 J	0.16 J	0.13 J	0.099 U	0.23 J	0.14 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	0.069 J	0.048 U	0.052 U	0.11 U	0.074 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.058 U	0.050 U	0.047 U	0.050 U	0.061 U	0.084 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.068 J	0.057 J	1.1 J	0.14 J	0.15 J	0.094 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.062 U	0.046 U	0.37 J	0.11 J	0.092 J	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.37 J	0.21 J	0.39 J	0.77 J	0.72 J	1.5 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	10 J	17 J	26 J	86 J	130 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.19 J	0.14 J	0.074 U	0.20 J	0.63 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	6.6 J	5.8 J	21 J	29 J	39 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.13 J	0.14 J	0.048 U	0.16 J	0.17 J	0.31 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.67 J	2.0 J	0.84 J	4.8 J	5.4 J	6.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.068 J	0.12 J	1.8 J	0.34 J	0.44 J	0.27 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.1 J	2.6 J	0.83 J	2.9 J	2.9 J	3.3 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.247	0.271	0.748	0.759	1.27	1.28
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.339	0.350	0.806	0.855	1.34	1.40

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB053-C1	SJSB053-C1	SJSB053-C1	SJSB053-C1	SJSB054	SJSB054	SJSB054
Sample Identification:		11187072-110919-KW-SJSB053-C1-S (8-10)	11187072-110919-KW-SJSB053-C1-S (10-12)	11187072-110919-KW-SJSB053-C1-S (12-14)	11187072-110919-KW-SJSB053-C1-S (14-16)	11187072-101319-SS-SJSB054 (0-2)	11187072-101319-SS-SJSB054 (2-4)	11187072-101319-SS-SJSB054 (4-6)
Sample Date:		11/9/2019	11/9/2019	11/9/2019	11/9/2019	10/13/2019	10/13/2019	10/13/2019
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.82 U	0.80 U	0.82 U	1.1 U	130 J	29 U	0.36 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	510	1300	410	1300	690	310	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	0.13 U	0.12 U	0.23 U	370	66 J	0.23 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	18	50	15	57	49 J	15 J	53
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.033 U	0.087 U	0.028 U	0.053 U	150 J	29 J	0.092 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.056 U	0.062 U	0.067 J	0.091 U	1300	180	0.59 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 U	0.76 U	0.35 U	0.80 U	1.5 U	0.51 UJ	0.57 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.055 U	0.060 U	0.050 U	0.090 U	340	47 J	0.17 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 J	1.0 J	0.35 J	1.6 J	4.6 J	1.5 J	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.22 U	0.14 U	0.24 U	20 J	2.5 J	0.081 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.91 J	2.6 J	0.87 J	4.5 J	1.5 U	0.48 U	3.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.14 U	0.042 U	0.20 U	850	88	0.28 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.097 U	0.25 J	0.14 J	0.31 J	140 J	13 J	0.35 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 J	0.048 J	0.056 J	0.062 U	42 J	5.1 J	0.064 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.047 U	0.047 U	0.078 J	0.056 U	730	78	0.24 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.92 J	0.10 J	1.6	0.18 J	50000 J	2900	13
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.29 J	0.18 J	0.39 J	0.22 J	11000	1200	3.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.13 J	0.29 J	0.12 J	0.23 J	620 J	110 J	0.38 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	61 J	170 J	53 J	190 J	110 J	50 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.19 J	0.27 J	0.26 J	0.24 J	1900 J	260 J	0.76 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	39 J	12 J	49 J	26 J	15 J	49 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.14 J	0.078 J	0.20 J	2600 J	280 J	0.52 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.2 J	6.8 J	2.4 J	10 J	140 J	15 J	9.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.6 J	0.25 J	2.2 J	0.92 J	89000 J	8800 J	24 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.7 J	3.4 J	1.6 J	6.7 J	12000 J	1300 J	10 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.848	1.69	1.12	2.12	16600	1550	6.42
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.936	1.76	1.15	2.20	16600	1550	6.43

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB054 11187072-101319-SS-SJSB054 (6-8) 10/13/2019 (6-8) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (8-10) 10/13/2019 (8-10) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (10-12) 10/13/2019 (10-12) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (12-14) 10/13/2019 (12-14) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (14-16) 10/13/2019 (14-16) ft bgs	SJSB054 11187072-101319-SS-SJSB054 (16-18) 10/13/2019 (16-18) ft bgs	SJSB055 11187072-091019-SS-SJSB055-S (0-2) 9/10/2019 (0-2) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.24 U	0.28 U	0.19 U	4.2 U	0.63 U	0.25 U	0.61 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1900	1700	1300	550	310	2000	410 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	0.52 U	0.15 U	8.0	0.98 J	0.18 U	0.25 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	70	67	61	25	12	82	20
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.052 U	0.15 U	0.061 U	3.0 J	0.52 J	0.097 U	0.70 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.38 J	1.0 J	0.27 J	29	3.0 J	0.34 J	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.93 J	0.56 J	0.68 J	0.44 J	0.15 J	0.90 J	0.85 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 U	0.29 J	0.058 U	7.5	0.80 J	0.21 J	0.15 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.4 J	1.5 J	1.3 J	0.69 J	0.21 J	1.7 J	0.037 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 J	0.086 U	0.074 U	0.56 J	0.099 U	0.087 U	1.5 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	4.0 J	3.3 J	1.3 J	0.12 U	5.8 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.24 J	1.0 J	0.18 J	19	1.8 J	0.12 J	0.63 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.27 J	0.47 J	0.38 J	3.4 J	0.30 J	0.43 J	0.30 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.071 U	0.066 U	0.059 U	1.0 J	0.079 U	0.070 U	0.020 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.087 U	0.78 J	0.072 U	17	1.6 J	0.20 J	0.051 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	9.4	39	9.2	850	82	11	1.1 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.8 J	11	2.4	270	23	2.6	0.22 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.33 J	0.84 J	0.15 J	13 J	1.7 J	0.28 J	1.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	230 J	200 J	210 J	81 J	43 J	250 J	63 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.52 J	1.3 J	0.27 J	43 J	4.3 J	0.55 J	2.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	55 J	43 J	53 J	21 J	11 J	68 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.24 J	2.6 J	0.18 J	58 J	5.1 J	0.32 J	3.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.1 J	7.3 J	8.2 J	6.3 J	2.0 J	13 J	7.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	21 J	79 J	18 J	2000 J	160 J	19 J	7.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	10 J	16 J	8.2 J	300 J	27 J	9.6 J	8.8 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	5.92	17.5	5.26	369	32.7	6.51	1.27
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	5.94	17.6	5.28	369	32.7	6.52	1.36

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055
Sample Identification:		11187072-091019-SS-SJSB055-S (2-4)	11187072-091019-SS-SJSB055-S (4-6)	11187072-091019-SS-SJSB055-S (6-8)	11187072-091019-SS-SJSB055-S (8-10)	11187072-091019-SS-SJSB055-S (10-12)	11187072-091019-SS-SJSB055-S (12-14)	11187072-091019-SS-SJSB055-S (14-16)
Sample Date:		9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019	9/10/2019
Sample Depth:		(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.72 J	0.57 J	0.79 J	1.4 J	1.5 J	0.72 J	1.6 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	280	240	720	260	110	300	630
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.26 J	0.19 J	0.29 J	0.28 J	0.32 J	0.21 J	0.41 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24	11	27	9.0	4.3 J	16	29
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.69 J	0.79 J	0.83 J	0.69 J	0.88 J	0.61 J	1.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 J	0.16 J	0.17 J	0.29 J	0.28 J	0.17 J	0.25 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.51 J	0.31 J	0.62 J	0.37 J	0.41 J	0.46 J	0.84 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.022 U	0.14 J	0.15 J	0.25 J	0.15 J	0.20 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.63 J	0.35 J	0.64 J	0.32 J	0.33 J	0.41 J	0.63 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 U	1.4 U	1.8 U	1.4 U	1.4 U	1.1 U	2.0 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 J	0.74 J	1.7 J	0.57 J	0.45 J	1.3 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.22 J	0.24 J	0.27 J	0.43 J	0.30 J	0.25 J	0.29 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.21 J	0.12 J	0.17 J	0.12 J	0.17 J	0.16 J	0.26 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.019 U	0.019 U	0.020 U	0.016 U	0.015 U	0.021 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.089 J	0.091 J	0.14 J	0.21 J	0.17 J	0.11 J	0.15 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.38 J	0.19 J	0.13 J	5.1	0.69 J	0.79 J	0.15 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.12 J	0.22 J	0.13 J	1.4	0.26 J	0.25 J	0.075 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	1.2 J	1.6 J	1.4 J	1.6 J	1.0 J	2.0 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	58 J	44 J	110 J	30 J	13 J	70 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	2.4 J	3.3 J	2.7 J	2.9 J	2.0 J	3.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	11 J	29 J	8.3 J	3.5 J	22 J	36 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.66 J	0.85 J	1.1 J	1.5 J	0.88 J	0.75 J	1.3 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.9 J	1.2 J	5.1 J	1.6 J	0.76 J	4.3 J	6.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.0 J	0.69 J	0.83 J	9.2 J	1.3 J	1.8 J	0.56 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.5 J	2.0 J	4.0 J	2.8 J	0.86 J	3.1 J	3.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.01	0.741	1.19	2.45	0.819	1.04	1.32
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.07	0.814	1.28	2.53	0.890	1.09	1.42

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB055 11187072-091019-SS-SJSB055-S (16-18) 9/10/2019 (16-18) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (0-2) 10/14/2019 (0-2) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (2-4) 10/14/2019 (2-4) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (4-6) 10/14/2019 (4-6) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (6-8) 10/14/2019 (6-8) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (8-10) 10/14/2019 (8-10) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (10-12) 10/14/2019 (10-12) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.60 J	2.7 J	1.3 J	0.14 U	0.35 J	0.43 J	0.50 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	400	860	600	430	250	670	500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.16 J	1.2 J	0.61 U	0.12 U	0.12 U	0.12 U	0.068 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19	34	24	19	12	31	23
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.58 J	0.48 J	0.33 J	0.071 J	0.094 J	0.044 U	0.083 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	1.9 J	1.6 J	0.11 U	0.075 U	0.088 U	0.078 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.49 J	0.77 U	0.49 U	0.33 U	0.35 U	0.54 U	0.44 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	0.58 J	0.58 J	0.10 U	0.070 U	0.083 U	0.073 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.47 J	0.88 J	0.65 J	0.48 J	0.31 J	0.59 J	0.41 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	0.24 J	0.17 J	0.067 U	0.092 J	0.15 J	0.12 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	2.3 J	1.7 J	1.5 J	1.3 J	2.7 J	1.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.19 J	1.4 J	1.3 J	0.062 U	0.052 U	0.078 U	0.052 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.17 J	0.61 J	0.43 J	0.15 U	0.13 U	0.15 U	0.21 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.018 U	0.25 J	0.098 J	0.072 U	0.045 U	0.058 U	0.048 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.085 J	1.3 J	1.2 J	0.064 U	0.055 U	0.084 U	0.053 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.12 J	110	93	2.1	0.39 J	0.26 J	0.62 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.025 U	21	20	0.49 J	0.19 J	0.12 U	0.22 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.97 J	2.5 J	1.3 J	0.20 J	0.21 J	0.12 J	0.15 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	89 J	140 J	100 J	84 J	55 J	150 J	110 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.5 J	3.3 J	2.7 J	0.11 U	0.092 J	0.15 J	0.12 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	29 J	29 J	24 J	21 J	18 J	35 J	29 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.81 J	3.3 J	3.9 J	0.064 U	0.055 U	0.084 U	0.061 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.4 J	4.7 J	4.0 J	3.9 J	3.6 J	6.4 J	5.8 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.55 J	190 J	160 J	3.7 J	0.71 J	0.81 J	1.1 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.7 J	26 J	23 J	2.4 J	2.2 J	3.0 J	3.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.841	34.3	31.0	1.22	0.595	0.881	1.12
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.920	34.3	31.1	1.34	0.697	1.07	1.16

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB055 11187072-101419-SS-SJSB055 C1 (12-14) 10/14/2019 (12-14) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (14-16) 10/14/2019 (14-16) ft bgs	SJSB055 11187072-101419-SS-SJSB055 C1 (16-18) 10/14/2019 (16-18) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (0-2) 11/11/2019 (0-2) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (2-4) 11/11/2019 (2-4) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (4-6) 11/11/2019 (4-6) ft bgs	SJSB056 11187072-111119-SS-SJSB056 (6-8) 11/11/2019 (6-8) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.092 U	0.49 J	0.42 J	2.5 J	0.83 J	0.19 U	0.19 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	210	500	51	480	340	220	390
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.031 U	0.058 U	0.18 U	0.47 J	0.14 U	0.13 U	0.13 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	24	2.7 J	24	14	10	17
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.036 U	0.056 J	0.073 J	0.16 U	0.14 U	0.14 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.066 U	0.092 U	0.35 J	0.17 U	0.15 U	0.12 U	0.14 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.37 U	0.54 U	0.25 U	0.62 J	0.36 J	0.33 J	0.37 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.060 U	0.086 U	0.11 J	0.20 U	0.17 U	0.14 U	0.16 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.56 J	0.14 J	0.87 J	0.45 J	0.39 J	0.32 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.074 J	0.18 J	0.078 J	0.35 J	0.14 J	0.14 J	0.081 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.67 J	2.4 J	0.26 J	1.9 J	1.1 J	0.92 J	1.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.050 U	0.075 U	0.28 J	0.19 U	0.14 U	0.14 U	0.13 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.12 U	0.17 U	0.11 U	0.56 J	0.26 U	0.27 J	0.23 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.040 U	0.057 U	0.037 U	0.13 U	0.11 U	0.087 U	0.11 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.052 U	0.079 U	0.26 J	0.21 U	0.15 U	0.15 U	0.14 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.52 J	0.55 J	15	4.7	2.2	0.46 J	0.32 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.24 J	0.22 J	3.7	1.5	0.81 J	0.20 U	0.18 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.036 U	0.11 J	0.33 J	0.47 J	0.14 U	0.14 U	0.14 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	52 J	140 J	10 J	96 J	65 J	45 J	72 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.074 J	0.18 J	0.58 J	0.35 J	0.14 J	0.14 J	0.16 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	19 J	41 J	2.7 J	27 J	16 J	13 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.085 U	0.079 U	0.75 J	0.21 U	0.15 U	0.15 U	0.16 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.9 J	8.6 J	0.28 J	4.9 J	1.6 J	3.1 J	2.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.90 J	1.2 J	28 J	6.8 J	2.7 J	0.46 J	0.32 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.9 J	5.9 J	4.4 J	3.8 J	2.1 J	0.49 J	0.18 U
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.575	0.980	5.42	3.29	1.48	0.660	0.528
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.671	1.12	5.49	3.35	1.65	0.803	0.782

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB056	SJSB056	SJSB056	SJSB056	SJSB056	SJSB056-C1	SJSB056-C1
Sample Identification:		11187072-111119-SS-SJSB056 (8-10)	11187072-111119-SS-SJSB056 (10-12)	11187072-111119-SS-SJSB056 (12-14)	11187072-111119-SS-SJSB056 (14-16)	11187072-111119-SS-SJSB056 (16-18)	11187072-120319-SS-SJSB056-C1(0-2)	11187072-120319-SS-SJSB056-C1(2-4)
Sample Date:		11/11/2019	11/11/2019	11/11/2019	11/11/2019	11/11/2019	12/3/2019	12/3/2019
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-0) ft bgs	(2-4) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.0 J	0.35 J	4.0 J	1.5 J	1.1 J	7.1 U	11 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	81	17	350	190	59	140 U	150 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.13 U	0.53 J	0.14 U	0.55 J	0.17 U	0.98 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.9 J	0.89 J	14	8.2	3.0 J	2.5 U	4.8 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.14 U	0.54 J	0.13 U	0.14 U	0.11 U	0.31 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.12 U	0.31 J	0.13 U	0.31 J	0.10 U	0.12 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.16 U	0.30 J	0.48 J	0.32 J	0.43 J	0.25 U	0.27 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.14 U	0.17 U	0.15 U	0.16 U	0.11 U	0.13 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	0.14 U	0.25 U	0.26 J	0.28 J	0.14 J	0.15 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.075 U	0.12 J	0.24 J	0.074 U	0.078 U	0.15 U	0.14 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.16 U	0.13 U	1.2 J	0.71 J	0.45 J	0.22 J	0.33 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 U	0.10 U	0.14 U	0.34 J	0.14 U	0.094 U	0.11 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.20 U	0.27 U	0.17 U	0.25 U	0.16 U	0.15 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.093 U	0.29 J	0.093 U	0.10 U	0.086 U	0.11 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.16 U	0.12 U	0.16 U	0.19 J	0.16 U	0.094 U	0.11 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	10	1.5	5.2	11	0.16 U	1.1 J	1.6
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	0.57 J	1.7	2.9	0.16 U	0.48 J	0.72 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.15 U	0.14 U	1.1 J	0.14 U	0.55 J	0.45 J	2.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	2.7 J	64 J	33 J	8.8 J	10 J	13 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.36 J	0.12 J	0.84 J	0.15 U	0.31 J	0.15 J	0.14 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.9 J	0.30 J	15 J	9.4 J	1.9 J	2.3 J	2.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.16 U	0.15 U	0.18 U	0.53 J	0.24 U	0.094 U	0.11 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.20 U	2.1 J	1.2 J	0.25 U	0.16 U	0.15 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	16 J	2.1 J	9.1 J	18 J	0.16 U	1.6 J	2.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	0.57 J	2.4 J	2.9 J	0.19 J	0.48 J	0.72 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.59	0.776	2.73	4.34	0.201	0.626	0.980
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.76	0.928	2.91	4.44	0.457	0.792	1.14

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB056-C1	SJSB056-C1	SJSB056-C1	SJSB056-C1	SJSB056-C1	SJSB056-C1	SJSB056-C1
Sample Identification:		11187072-120319-SS-SJSB056-C1(4-6)	11187072-120319-SS-SJSB056-C1(6-8)	11187072-120319-SS-SJSB056-C1(8-10)	11187072-120319-SS-SJSB056-C1(10-12)	11187072-120319-SS-SJSB056-C1(12-14)	11187072-120319-SS-DUP-1	11187072-120319-SS-SJSB056-C1(14-16)
Sample Date:		12/3/2019	12/3/2019	12/3/2019	12/3/2019	12/3/2019	12/3/2019	12/3/2019
Sample Depth:		(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(14-16) ft bgs
Sample Type:							Duplicate	
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.8 U	35	2.4 U	3.3 U	2.5 U	4.3 U	2.6 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120 U	260	88 U	160 U	320	370	270
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.19 U	1.9 J	0.33 U	0.94 U	0.31 U	0.55 U	0.62 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.3 U	14	2.7 U	6.8	15	17	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.087 U	0.20 J	0.16 J	0.90 J	0.13 J	0.064 U	0.10 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.094 U	0.11 U	0.53 J	0.064 U	0.075 U	0.34 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.079 U	0.23 U	0.25 U	0.83 J	0.40 U	0.44 U	0.26 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.11 U	0.11 U	0.60 J	0.068 U	0.078 U	0.13 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.082 U	0.30 J	0.18 J	0.79 J	0.46 J	0.46 J	0.26 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.090 U	0.13 U	0.081 U	0.81 U	0.16 U	0.13 U	0.16 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 J	0.40 J	0.36 J	1.1 J	1.3 J	1.3 J	0.98 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.094 U	0.17 U	0.13 U	0.36 U	0.067 U	0.067 U	0.054 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.18 U	0.12 U	0.39 J	0.12 U	0.12 U	0.097 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.081 U	0.088 U	0.61 J	0.050 U	0.063 U	0.070 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.091 U	0.080 U	0.081 U	0.35 J	0.070 U	0.067 U	0.055 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.45 U	0.86 J	2.9	0.20 U	0.14 U	0.050 U	0.086 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.099 U	0.11 U	0.92 J	0.23 J	0.11 U	0.10 U	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.47 J	11 J	0.77 J	2.0 J	0.73 J	1.2 J	0.93 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	29 J	8.9 J	24 J	62 J	69 J	45 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.13 J	0.11 U	2.6 J	0.16 J	0.13 J	0.63 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	5.1 J	2.7 J	8.0 J	19 J	20 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.094 U	0.17 J	0.13 J	0.72 J	0.087 U	0.067 U	0.063 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.29 J	0.29 J	1.3 J	3.2 J	3.4 J	2.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.63 J	1.4 J	4.0 J	0.41 J	0.59 J	0.31 J	0.16 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.099 U	0.91 J	1.1 J	0.55 J	2.3 J	2.3 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.0260	0.406	1.27	1.25	0.423	0.457	0.503
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.260	0.597	1.40	1.33	0.596	0.624	0.593

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB056-C1 11187072-120319-SS-SJSB056-C1(16-18) 12/3/2019 (16-18) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (0-2) 11/5/2019 (0-2) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (2-4) 11/5/2019 (2-4) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (4-6) 11/5/2019 (4-6) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (6-8) 11/5/2019 (6-8) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (8-10) 11/5/2019 (8-10) ft bgs	SJSB057 11187072-110519-SS-SJSB057 (10-12) 11/5/2019 (10-12) ft bgs
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.2 U	490 J	520 J	55	6.8 J	0.94 U	6.1 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	440	5200	2400	670	94	48	85
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.45 U	990	1300	110	13	0.36 U	2.0 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	18	310	190 J	43	4.7 J	4.0 J	6.1
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.058 U	300	410 J	34	4.0 J	0.27 U	1.9 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.090 U	3000	4400	350	39	0.71 J	0.75 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.41 U	3.6 U	5.6 U	0.64 U	0.25 U	0.35 U	1.2 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.097 U	740	1100	92	10	0.25 U	0.59 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 J	21 J	16 U	1.9 J	0.27 U	0.28 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	45 J	56 J	5.0 J	0.64 J	0.21 U	1.1 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 J	8.7 J	9.0 J	1.1 J	0.25 J	0.42 J	1.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.069 U	2000	2900	230	26	0.53 J	0.21 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.19 J	200 J	300 J	21	2.3 J	0.26 J	0.45 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.076 U	90 J	120 J	9.1	1.1 J	0.15 U	1.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.071 U	1300	1900	140	15	0.31 J	0.32 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.15 U	31000 J	51000 J	8200	890	18	2.9
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.18 J	20000	31000	2600	270	5.2	1.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.5 J	1600 J	2100 J	180 J	20 J	0.63 J	4.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	80 J	700 J	410 J	99 J	13 J	11 J	13 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.44 J	4400 J	6400 J	510 J	58 J	1.3 J	3.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	24 J	110 J	83 J	18 J	3.0 J	3.3 J	6.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.073 U	5200 J	7400 J	570 J	64 J	1.1 J	0.53 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.5 J	230 J	330 J	27 J	2.7 J	0.71 J	0.91 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.44 J	130000 J	210000 J	13000 J	1500 J	29 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.5 J	22000 J	34000 J	2800 J	290 J	5.8 J	1.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.896	24200	37600	3540	372	7.54	2.93
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.962	24200	37600	3540	372	7.60	2.93

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB057	SJSB057	SJSB057	SJSB058	SJSB058	SJSB058	SJSB058
Sample Identification:		11187072-110519-SS-SJSB057 (12-14)	11187072-110519-SS-SJSB057 (14-16)	11187072-110519-SS-SJSB057 (16-18)	11187072-101419-BN-SJSB058-S (0-2)	11187072-101419-BN-SJSB058-S (2-4)	11187072-101419-BN-SJSB058-S (4-6)	11187072-101419-BN-SJSB058-S (6-8)
Sample Date:		11/5/2019	11/5/2019	11/5/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
Sample Depth:		(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	2.2 U	0.53 U	0.34 U	13	690	1100	8.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	99	85	69	520	6600	13000	400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.65 U	0.11 U	0.096 U	4.7 J	1900	2100	14
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	4.0 J	3.5 J	3.1 J	35	540	620	18
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.36 U	0.081 U	0.032 U	0.62 J	780	820	5.6 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	0.15 J	0.12 J	2.2 J	8200	7200	44
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.33 U	0.25 U	0.25 J	6.3 J	6.3 J	0.38 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.42 J	0.083 U	0.062 U	0.78 J	2000 J	1800 J	11
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 U	0.21 U	0.23 U	0.83 J	30 J	41 J	0.62 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 U	0.077 U	0.091 U	0.15 U	110 J	120 J	0.90 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.47 J	0.36 J	0.32 J	0.92 J	11 J	14 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	0.13 J	0.098 J	1.4 J	4200	3900	23
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.19 J	0.21 J	0.24 J	0.28 U	260	430	2.6 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.040 U	0.047 U	0.32 J	200 J	210 J	1.4 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.64 J	0.11 J	0.058 U	0.87 J	2200	2900	15
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	41	2.7	2.5	25	100000 J	150000 J	800
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	11	0.92 J	0.87 J	8.0	24000 J	31000 J	230
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.23 J	0.096 J	14 J	3200 J	3800 J	24 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	13 J	10 J	8.6 J	83 J	1100 J	1400 J	67 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.4 J	0.35 J	0.21 J	9.9 J	12000 J	11000 J	66 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.8 J	2.8 J	2.5 J	11 J	220 J	230 J	17 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.6 J	0.29 J	0.098 J	9.2 J	10000 J	11000 J	60 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.86 J	0.73 J	0.58 J	1.0 J	310 J	510 J	3.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	66 J	5.2 J	3.8 J	55 J	180000 J	270000 J	1400 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	13 J	1.4 J	1.2 J	9.4 J	27000 J	34000 J	250 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	15.8	1.55	1.46	11.9	36100	48400	324
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	15.9	1.59	1.50	12.0	36100	48400	324

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB058	SJSB058	SJSB058	SJSB058	SJSB058	SJSB058	SJSB070
Sample Identification:		11187072-101419-BN-SJSB058-S (8-10)	11187072-101419-BN-SJSB058-S (10-12)	11187072-101419-BN-SJSB058-S (12-14)	11187072-101419-BN-SJSB058-S (14-16)	11187072-101419-BN-SJSB058-S (16-18)	11187072-111219-SS-SJSB058 (18-20)	11187072-111219-SS-SJSB070 (0-2)
Sample Date:	Units	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	11/12/2019	11/12/2019
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(18-20) ft bgs	(0-2) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	25 J	6.4 J	270 J	3.0 U	20 U	0.37 U	710
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	670	360	3400	140	410	120	2000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	47	14	590	5.7 J	35	0.15 U	1900
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	28 J	20	160	8.0	22 J	5.6 J	190
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	17 J	5.3 J	200	2.1 J	15 J	0.16 U	610
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	150	50	1700	18	120	0.12 U	6700
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.18 U	0.55 J	0.82 U	0.13 J	0.40 J	0.16 U	4.7 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	37	13	440	4.9 J	31 J	0.14 U	1700
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.95 J	0.94 J	9.0 J	0.23 J	0.94 J	0.17 U	14
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 J	0.92 J	26 J	0.30 J	1.7 J	0.23 J	46 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	2.0 J	3.2 J	0.38 J	1.2 J	0.38 J	5.9 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	88	29	940	9.2	70	0.18 U	4200
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.7 J	3.0 J	96 J	0.66 J	6.2 J	0.35 U	390
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.3 J	1.6 J	51 J	0.61 J	3.3 J	0.10 U	170 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	59	19	630	6.7	42	0.18 U	2700
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1900	790	6400	310	1500	0.60 U	27000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	920	280	8700	99	600	0.20 U	39000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	81 J	24 J	990 J	9.9 J	61 J	0.16 U	2900 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	80 J	77 J	370 J	27 J	68 J	23 J	370 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	220 J	74 J	2500 J	28 J	180 J	0.23 J	9600 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	23 J	60 J	9.1 J	16 J	6.9 J	98 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	240 J	78 J	2600 J	26 J	180 J	0.18 U	11000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.7 J	5.4 J	96 J	1.8 J	6.2 J	0.35 U	410 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5800 J	1600 J	62000 J	630 J	3800 J	0.96 J	300000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1000 J	310 J	9700 J	110 J	670 J	0.70 J	44000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1160	376	9890	136	788	0.153	43900
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1160	376	9890	136	788	0.524	43900

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB070 11187072-111219-SS-SJSB070 (2-4) 11/12/2019 (2-4) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (4-6) 11/12/2019 (4-6) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (6-8) 11/12/2019 (6-8) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (8-10) 11/12/2019 (8-10) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (10-12) 11/12/2019 (10-12) ft bgs	SJSB070 11187072-111219-SS-SJSB070 (12-14) 11/12/2019 (12-14) ft bgs
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1400	920	480	370	14	7.8 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	15000 J	11000 J	6000 J	4500	300	410 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2800	1900	980	790	29	16
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	960	630	330	260	15	19
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	860	550	290	240	9.6	5.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	9100	5800	3100	2200	97	51
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.8 J	6.1 J	3.2 J	2.0 J	0.38 U	0.47 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2300	1500	780	570	24	13
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	55	39	20	14	0.61 U	0.72 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	110 J	61 J	37 J	33	0.45 J	0.85 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	15	11 J	6.1	4.4 J	0.73 J	1.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	6500	4300	2100	1400	65	36
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	550	410	200	130	6.0 J	3.6 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	250 J	170 J	78 J	57	2.8 J	1.6 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3800	2800	1500	920	40	23
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	35000 J	24000	12000	9700	2400	1600
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	62000 J	41000 J	22000 J	15000 J	730	430
Total heptachlorodibenzofuran (HpCDF)	pg/g	4900 J	3200 J	1700 J	1300 J	48 J	26 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2000 J	1300 J	710 J	560 J	44 J	63 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	13000 J	8600 J	4300 J	3200 J	140 J	75 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	320 J	220 J	110 J	75 J	8.8 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17000 J	12000 J	5600 J	3800 J	170 J	94 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	640 J	410 J	230 J	150 J	6.4 J	5.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	350000 J	280000 J	130000 J	86000 J	5100 J	2600 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	70000 J	45000 J	25000 J	17000 J	800 J	470 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	68600	45600	24300	16700	1000	609
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	68600	45600	24300	16700	1000	609

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB070	SJSB070	SJSB071	SJSB071	SJSB071	SJSB071	SJSB071
Sample Identification:		11187072-111219-SS-SJSB070 (14-16)	11187072-111219-SS-SJSB070 (16-18)	11187072-111219-SS-SJSB071 (0-2)	11187072-111219-SS-SJSB071 (2-4)	11187072-111219-SS-SJSB071 (4-6)	11187072-111219-SS-SJSB071 (6-8)	11187072-111219-SS-SJSB071 (8-10)
Sample Date:		11/12/2019	11/12/2019	11/12/2019	11/12/2019	11/12/2019	11/12/2019	11/12/2019
Sample Depth:		(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs
Sample Type:								
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.52 J	0.41 J	820 J	1200 J	1.2 J	1.1 J	0.39 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	110 J	310 J	8100 J	11000 J	110 J	38 J	46 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.35 U	0.22 U	1600	2500	0.97 U	0.70 U	0.20 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.0 J	13	460	650	3.5 J	1.7 J	1.7 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.094 J	0.054 U	460	770	0.37 J	0.15 J	0.089 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.81 J	0.52 J	4200	8300	2.7 J	0.73 J	0.089 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.37 U	5.3 U	6.6 J	0.24 U	0.24 U	0.20 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.065 U	0.090 U	1100	2100	1.0 J	0.19 U	0.085 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.19 U	0.39 U	32 J	36	0.20 U	0.12 U	0.13 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 J	0.19 J	56	100 J	0.10 U	0.13 U	0.16 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.41 J	1.0 J	10 J	13	0.23 J	0.20 J	0.23 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.64 U	0.65 U	3200	5000	1.8 J	0.38 U	0.24 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 J	0.11 U	320 J	380 J	0.24 J	0.13 U	0.098 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.047 U	0.072 U	120	200 J	0.11 U	0.14 U	0.063 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.38 J	0.29 J	2200	3000	1.1 J	0.090 U	0.058 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	17	11	20000	24000	67	7.9	3.3 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.7	3.0	31000 J	41000 J	19	2.4 U	1.4 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.54 J	0.22 J	2600 J	4200 J	1.8 J	0.85 J	0.29 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	22 J	61 J	1000 J	1400 J	12 J	5.3 J	6.6 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.93 J	0.70 J	6300 J	14000 J	3.7 J	0.73 J	0.16 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.4 J	16 J	140 J	220 J	2.3 J	2.4 J	4.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	1.1 J	8500 J	13000 J	4.5 J	0.56 J	0.24 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.2 J	2.7 J	320 J	400 J	0.24 J	0.28 J	0.91 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	31 J	20 J	220000 J	260000 J	110 J	14 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.6 J	4.8 J	34000 J	46000 J	21 J	3.6 J	3.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.86	4.58	34700	45900	26.8	0.913	0.0710
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.90	4.69	34700	45900	26.8	2.24	1.03

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Units	SJSB071 11187072-111219-SS-SJSB071 (10-12) 11/12/2019 (10-12) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (12-14) 11/12/2019 (12-14) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (14-16) 11/12/2019 (14-16) ft bgs	SJSB071 11187072-111219-SS-SJSB071 (16-18) 11/12/2019 (16-18) ft bgs
Dioxins/Furans					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.11 UJ	0.24 J	1.7 J	1.8 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	98 J	130 J	59	63
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 U	0.11 U	1.9 J	1.7 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.7 J	5.9 J	3.0 J	2.6 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.053 U	0.038 U	0.52 J	0.47 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.071 U	4.6 J	4.6 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.32 U	0.14 U	0.14 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.095 U	0.067 U	1.3 J	1.3 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.29 U	0.24 U	0.14 U	0.15 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 J	0.089 J	0.27 J	0.43 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.38 J	0.48 J	0.13 U	0.14 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.30 U	0.23 U	3.3 J	2.4 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.12 U	0.094 U	0.35 U	0.31 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.051 U	0.21 J	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.063 U	2.0 J	1.6 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	6.1 U	1.1 U	110	110
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.7 U	0.43 U	32	33
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.23 J	0.11 J	3.0 J	2.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	17 J	21 J	8.5 J	7.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.53 J	0.089 J	6.8 J	6.3 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	7.0 J	1.6 J	1.4 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.45 J	0.23 J	8.5 J	6.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.6 J	1.3 J	0.35 U	0.31 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	10 J	1.8 J	190 J	180 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.7 J	1.2 J	34 J	35 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.222	0.155	44.4	45.3
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.48	0.523	44.6	45.4

Notes:
pg/g - picogram per gram
U - Not detected at the associated reporting limit.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB072 11215702-072021-SS-SJSB072(8-10) 07/20/2021 (8-10) ft bgs	SJSB072 11215702-072021-SS-SJSB072(10-12) 07/20/2021 (10-12) ft bgs	SJSB072 11215702-072021-SS-SJSB072(12-14) 07/20/2021 (12-14) ft bgs	SJSB072 11215702-072021-SS-SJSB072(14-16) 07/20/2021 (14-16) ft bgs	SJSB072 11215702-072021-SS-SJSB072(16-18) 07/20/2021 (16-18) ft bgs	SJSB072 11215702-072021-SS-SJSB072(18-20) 07/20/2021 (18-20) ft bgs	SJSB072 11215702-072021-SS-SJSB072(20-22) 07/20/2021 (20-22) ft bgs	SJSB072 11215702-072021-SS-SJSB072 (20-22)-R 07/20/2021 (20-22) ft bgs Lab Duplicate	SJSB072 11215702-072021-SS-SJSB072(22-24) 07/20/2021 (22-24) ft bgs	SJSB073 11215702-072021-SS-SJSB073(0-2) 07/20/2021 (0-2) ft bgs	SJSB073 11215702-072021-SS-SJSB073(2-4) 07/20/2021 (2-4) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.49 U	5.3 U	0.046 U	0.49 U	2.3 U	0.88 U	1.3 U	2.6 U	0.88 U	20	440
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	72	190	42	38	89	190	120	130	43	550	3500
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.32 J	10	0.050 U	0.11 U	1.7 J	0.35 U	2.7 J	4.1 J	0.032 U	6.4 J	1000
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	2.6 J	8.2	1.8 J	1.9 J	4.1 J	8.4	7.7	5.5 J	1.8 U	33	260
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.14 J	3.4 J	0.056 U	0.13 U	0.85 J	0.033 U	0.92 U	1.3 U	0.037 U	1.5 U	330
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.96 J	33	0.083 J	0.16 J	5.0 J	0.024 U	8.3	12	0.072 J	16	3300
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.22 J	0.26 J	0.20 J	0.16 U	0.32 J	0.31 U	0.31 U	0.25 U	0.31 U	0.092 U	2.7 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 J	8.7	0.039 U	0.081 U	1.4 J	0.025 U	2.1 J	3.3 J	0.036 J	3.4 J	820
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.14 J	0.36 J	0.088 U	0.16 U	0.28 J	0.27 J	0.18 J	0.26 U	0.088 J	1.1 J	12
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.89 U	1.3 U	0.85 U	0.77 U	0.84 U	0.050 J	0.039 U	0.25 U	0.053 J	2.8 U	57
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.28 J	0.21 J	0.17 J	0.14 U	0.44 J	0.70 J	0.32 J	0.32 U	0.21 J	0.56 U	5.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	24	0.30 J	0.41 J	3.1 J	0.028 U	5.6 J	8.8	0.081 J	7.0	1900
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.13 J	1.9 J	0.061 U	0.12 U	0.075 U	0.057 U	0.44 J	0.70 J	0.050 U	0.068 U	190
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 J	0.98 J	0.030 U	0.063 U	0.20 J	0.019 U	0.26 U	0.45 J	0.11 U	0.44 J	83
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.50 J	14	0.073 J	0.10 U	1.5 J	0.028 U	3.1 J	4.7 J	0.035 U	0.98 J	1200
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	25	710	2.7	2.6	70	0.40 J	180	270	1.7	13	77000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.4	260	0.85 J	1.2	25	0.18 J	53	87	0.52 J	4.9	22000
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.57 J	17 J	0.056 U	0.13 U	3.1 J	0.091 J	4.5 J	7.0 J	0.037 U	19 J	1600 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11 J	28 J	8.0 J	6.5 J	15 J	38 J	21 J	18 J	7.3 J	88 J	550 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	51 J	0.94 J	0.94 J	8.2 J	0.050 J	12 J	18 J	0.19 J	29 J	4700 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	3.9 J	5.3 J	2.2 J	5.6 J	13 J	5.7 J	5.7 J	3.1 J	8.7 J	68 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.3 J	60 J	0.38 J	0.41 J	7.0 J	0.031 U	14 J	22 J	0.081 J	13 J	4700 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	2.2 J	2.0 J	0.19 U	0.82 J	2.4 J	1.7 J	1.8 J	0.56 J	0.52 J	220 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	50 J	1400 J	5.4 J	4.9 J	140 J	0.66 J	320 J	510 J	2.4 J	30 J	120000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	9.4 J	280 J	4.1 J	1.2 J	28 J	1.8 J	59 J	96 J	0.96 J	4.9 J	24000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	12 J	340 J	1.2 J	1.5 J	33 J	0.46 J	74 J	120 J	0.75 J	9.4 J	31000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	12 J	340 J	1.3 J	1.7 J	34 J	0.52 J	74 J	120 J	0.81 J	9.6 J	31000 J

Notes:
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- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Parameters	Units	SJSB073 11215702-072021-SS-SJSB073(4-6) 07/20/2021 (4-6) ft bgs	SJSB073 11215702-072021-SS-SJSB073(6-8) 07/20/2021 (6-8) ft bgs	SJSB073 11215702-072021-SS-SJSB073(8-10) 07/20/2021 (8-10) ft bgs	SJSB073 11215702-072021-SS-SJSB073(10-12) 07/20/2021 (10-12) ft bgs	SJSB073 11215702-072021-SS-SJSB073(12-14) 07/20/2021 (12-14) ft bgs	SJSB073 11215702-072021-SS-SJSB073(14-16) 07/20/2021 (14-16) ft bgs	SJSB073 11215702-072021-SS-SJSB073(16-18) 07/20/2021 (16-18) ft bgs	SJSB074 11215702-072221-SS-SJSB074(0-2) 07/22/2021 (0-2) ft bgs	SJSB074 11215702-072221-SS-SJSB074(2-4) 07/22/2021 (2-4) ft bgs	SJSB074 11215702-072221-DUP-5 07/22/2021 (2-4) ft bgs Field Duplicate	SJSB074 11215702-072221-SS-SJSB074(4-6) 07/22/2021 (4-6) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	350	780 J	1300 J	1.8 U	0.32 U	1.5 U	0.15 U	140	1600	950	600
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400	10000	19000	160 U	200 U	390	220	2200	41000 J	21000 J	17000 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	770	1700	2800 J+	2.2 U	0.64 U	0.92 U	0.11 U	280	4200 J	1900	1200
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	170	590 J	950 J	9.4	19	24	11	110	4000 J	1800	1700
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	240	520 J	850 J	0.85 U	0.17 U	0.51 U	0.13 U	85	1100	610	420
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2400	5600	8400	6.0	0.82 J	1.8 J	0.97 J	910	9900 J	5900 J	5100 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.2 J	5.4 U	12 U	0.30 U	0.19 U	0.21 U	0.17 U	1.3 J	8.7 J	6.5 J	4.0 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	620	1500	2200	1.3 J	0.46 U	0.64 U	0.38 U	240	2700	1600	1400
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	41 J	52 J	0.30 U	0.23 U	0.24 U	0.20 U	3.6 J	80	45	32
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	42	100 U	140 U	3.0 U	2.3 U	2.5 U	2.3 U	13	130	86	110
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.2 J	17 U	10 U	0.28 U	1.3 U	1.9 U	0.17 U	2.7 J	25	16	8.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1400	4500	5000	4.5 U	1.9 U	2.7 U	1.6 U	680	5300 J	3900 J	3600 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	130	400 J	460 J	0.24 U	0.25 U	0.15 U	0.13 U	49	480	390	190
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	66	170 J	210 J	0.37 U	0.16 U	0.11 U	0.093 U	28	250	160	160
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	820	2700	2900	2.2 J	0.14 U	0.99 J	0.13 U	370	3300	2600	1500
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	91000	160000	200000	90	3.4	28	5.9	19000 J	180000 J	160000 J	63000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	16000	50000	60000	30	4.1	11	4.5	5600 J	49000 J	41000 J	22000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1200 J	2800 J	4600 J	3.0 J	1.1 J	2.4 J	0.13 U	440 J	6300 J	3200 J	2000 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	350 J	1300 J	2100 J	60 J	77 J	82 J	48 J	230 J	6600 J	3200 J	2700 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3500 J	8500 J	12000 J	10 J	3.6 J	4.9 J	3.6 J	1300 J	15000 J	8800 J	7800 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	160 J	210 J	19 J	20 J	23 J	14 J	32 J	450 J	250 J	350 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	3300 J	11000 J	13000 J	7.9 J	1.9 J	3.7 J	1.6 J	1600 J	13000 J	10000 J	7600 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	150 J	400 J	460 J	0.45 U	0.25 U	0.15 U	0.13 U	52 J	600 J	480 J	240 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	78000 J	290000 J	350000 J	210 J	24 J	63 J	24 J	34000 J	210000 J	160000 J	110000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	17000 J	55000 J	66000 J	36 J	5.1 J	11 J	4.5 J	6100 J	54000 J	46000 J	24000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	26000 J	68000 J	83000 J	41 J	4.7 J	15 J	5.4 J	7800 J	70000 J	59000 J	30000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	26000 J	68000 J	83000 J	41 J	5.2 J	15 J	5.6 J	7800 J	70000 J	59000 J	30000 J

Notes:
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- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
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Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB074 11215702-072221-SS-SJSB074(6-8) 07/22/2021 (6-8) ft bgs	SJSB074 11215702-072221-SS-SJSB074(8-10) 07/22/2021 (8-10) ft bgs	SJSB074 11215702-072221-SS-SJSB074(10-12) 07/22/2021 (10-12) ft bgs	SJSB074 11215702-072221-SS-SJSB074(12-14) 07/22/2021 (12-14) ft bgs	SJSB074 11215702-072221-SS-SJSB074(14-16) 07/22/2021 (14-16) ft bgs	SJSB074 11215702-072221-SS-SJSB074(16-18) 07/22/2021 (16-18) ft bgs	SJSB075 11215702-072021-SS-SJSB075(4-6) 07/20/2021 (4-6) ft bgs	SJSB075 11215702-072021-SS-SJSB075(10-12) 07/20/2021 (10-12) ft bgs	SJSB075 11215702-072021-SS-SJSB075(12-14) 07/20/2021 (12-14) ft bgs	SJSB075 11215702-072021-SS-SJSB075(14-16) 07/20/2021 (14-16) ft bgs	SJSB075 11215702-072021-SS-SJSB075(16-18) 07/20/2021 (16-18) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	7.1 J	0.38 U	0.32 U	0.32 U	0.34 U	0.14 U	970 U	3.0 U	0.11 U	1.1 U	0.10 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	82	58	55	51	200	11000 U	130 U	52 U	240 U	190 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.3 J	0.22 U	0.16 U	0.13 U	0.42 U	0.14 U	2300	5.4 J	0.096 U	0.48 U	0.48 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	34	2.9 J	1.8 J	2.2 J	2.2 J	9.6	660	7.0 U	1.9 U	15 U	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.87 J	0.063 U	0.059 U	0.099 U	0.12 U	0.027 U	710	2.5 J	0.10 U	0.19 U	0.30 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	7.8	0.44 J	0.28 U	0.13 U	0.38 J	0.067 J	8400	25	0.33 J	0.41 J	0.90 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.55 U	0.20 U	0.19 U	0.11 U	0.25 U	0.26 U	6.3 U	0.30 U	0.25 U	0.28 U	0.37 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	0.12 U	0.13 U	0.054 U	0.20 U	0.019 U	2100	6.3	0.32 U	0.14 U	0.34 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	0.082 U	0.074 J	0.11 U	0.19 J	0.27 J	34 J	0.39 J	0.10 U	0.62 J	0.43 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.036 U	0.11 U	0.11 U	0.19 U	0.22 U	110 U	2.1 U	2.9 U	1.9 U	1.9 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.4 J	0.19 U	0.061 U	0.22 U	0.24 U	0.67 J	9.6 U	0.43 U	0.36 U	1.1 U	0.72 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5.6 J	0.33 J	0.17 J	0.033 U	0.30 J	0.18 J	5500	22	1.7 U	1.4 U	1.4 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.64 J	0.065 U	0.043 U	0.11 J	0.054 U	0.12 J	330 J	1.8 J	0.069 U	0.23 U	0.066 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.32 J	0.035 U	0.024 U	0.056 J	0.10 J	0.016 U	230 J	1.0 J	0.065 U	0.11 U	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.6 J	0.20 J	0.12 J	0.032 U	0.16 J	0.056 J	2800	12	0.065 U	0.19 U	0.33 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	200	12	6.2	0.76 U	5.7	0.66 U	130000	690	1.3 U	5.9 U	13
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	63	3.7	2.3	0.26 U	1.8	0.38 J	40000	190	0.98 U	1.8 U	5.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.3 J	0.35 J	0.16 J	0.34 J	0.74 J	0.096 J	3800 J	10 J	0.10 U	0.28 J	0.56 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110 J	13 J	7.1 J	9.6 J	7.6 J	37 J	1500 J	18 J	11 J	43 J	36 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	14 J	0.56 J	0.47 J	0.35 J	0.88 J	0.28 J	12000 J	40 J	4.2 J	2.3 J	3.5 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	21 J	2.7 J	1.4 J	7.9 J	6.8 J	11 J	170 J	5.1 J	4.8 J	15 J	13 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	17 J	0.69 J	0.36 J	0.033 U	0.55 J	0.29 J	13000 J	55 J	2.2 J	1.4 J	2.6 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.1 J	0.17 J	0.18 J	2.9 J	1.8 J	2.4 J	350 J	1.8 J	0.71 J	3.1 J	2.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	370 J	22 J	10 J	1.1 J	7.7 J	1.3 J	230000 J	1300 J	5.0 J	10 J	29 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	69 J	4.0 J	2.7 J	7.9 J	4.6 J	2.0 J	44000 J	220 J	3.7 J	3.2 J	6.6 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	87 J	5.1 J	3.0 J	0.15 J	2.5 J	0.78 J	55000 J	270 J	0.033 J	0.10 J	6.6 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	87 J	5.1 J	3.1 J	0.37 J	2.6 J	0.84 J	55000 J	270 J	0.88 J	1.8 J	6.7 J

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San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB076 11215702-072221-SS-SJSB076(0-2) 07/22/2021 (0-2) ft bgs	SJSB076 11215702-072221-SS-SJSB076(2-4) 07/22/2021 (2-4) ft bgs	SJSB076 11215702-072221-SS-SJSB076(4-6) 07/22/2021 (4-6) ft bgs	SJSB076 11215702-072221-SS-SJSB076(6-8) 07/22/2021 (6-8) ft bgs	SJSB076 11215702-072221-SS-SJSB076(8-10) 07/22/2021 (8-10) ft bgs	SJSB076 11215702-072221-SS-SJSB076(10-12) 07/22/2021 (10-12) ft bgs	SJSB076 11215702-072221-SS-SJSB076 (10-12)-R 07/22/2021 (10-12) ft bgs Lab Duplicate	SJSB076 11215702-072221-SS-SJSB076(12-14) 07/22/2021 (12-14) ft bgs	SJSB076 11215702-072221-SS-SJSB076(14-16) 07/22/2021 (14-16) ft bgs	SJSB076 11215702-072221-SS-SJSB076(16-18) 07/22/2021 (16-18) ft bgs	SJSB077 11215702-072121-SS-SJSB077(6-8) 07/21/2021 (6-8) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	72	910	1400	3.6 J	0.35 J	2.7 J	1.7 U	0.58 J	0.81 J	0.24 U	1300
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1200	4500	16000 J	150	84	200	170	350	130	400	8900
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	150	2300	2900	6.6 J	0.43 J	5.2 J	3.1 J	1.0 J	0.70 J	0.21 U	2400
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	51 J	350	1200	6.4 J	3.4 J	8.9	8.7	19	10	18	550
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	46	780	1000	2.5 J	0.16 J	1.8 J	0.96 U	0.42 J	0.084 J	0.027 U	770
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	500	8400 J	11000 J	24	1.1 J	19	11	3.0 J	1.1 J	0.39 J	7100
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.96 J	3.6 J	7.0 J	0.051 U	0.28 J	0.071 U	0.24 U	0.61 J	0.31 J	0.45 U	7.4 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	130	2300	3000	6.8	0.30 J	4.4 J	3.0 J	0.87 J	0.31 J	0.13 J	1800
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	18	35	0.054 U	0.19 J	0.082 U	0.24 U	0.85 J	0.34 J	0.53 J	41 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	8.1	140	210	0.14 U	0.13 J	0.35 J	0.26 U	0.046 U	0.065 J	0.23 U	120
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	9.1 J	13	0.24 J	0.28 J	0.29 J	0.35 U	1.5 J	0.56 J	1.4 J	18 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	310	6000 J	6400 J	17	0.96 J	14	13	2.1 J	0.72 J	0.41 J	4600
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	20	270	420	1.5 J	0.19 J	0.98 J	0.61 J	0.21 U	0.15 J	0.22 J	400
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	16	260	360	0.15 U	0.073 U	0.59 J	0.51 J	0.044 U	0.029 U	0.019 U	220
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	160	2600	3200	9.7	0.54 J	7.5	6.4	0.95 J	0.31 J	0.16 J	2800
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	7600 J	110000 J	150000 J	540	28	360	260	43	9.8	6.5	170000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2100 J	36000 J	45000 J	150	7.9	110	82	15	3.5	2.2	44000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	230 J	3600 J	4600 J	11 J	0.72 J	8.5 J	5.1 J	1.7 J	0.90 J	0.32 J	3900 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	690 J	2200 J	19 J	12 J	24 J	22 J	69 J	26 J	77 J	1100 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	740 J	13000 J	16000 J	31 J	1.5 J	27 J	17 J	3.8 J	1.7 J	0.76 J	10000 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	22 J	110 J	260 J	3.6 J	3.9 J	3.4 J	3.7 J	17 J	7.5 J	21 J	190 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	720 J	13000 J	16000 J	38 J	2.1 J	32 J	33 J	4.0 J	1.5 J	0.81 J	11000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	22 J	300 J	420 J	1.5 J	0.40 J	0.98 J	0.87 J	0.68 J	0.66 J	4.2 J	400 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	13000 J	160000 J	230000 J	930 J	51 J	640 J	490 J	78 J	19 J	11 J	240000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2300 J	40000 J	50000 J	160 J	8.8 J	120 J	92 J	17 J	4.5 J	5.7 J	48000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3000 J	49000 J	63000 J	210 J	11 J	150 J	110 J	21 J	5.2 J	3.7 J	63000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3000 J	49000 J	63000 J	210 J	11 J	150 J	110 J	21 J	5.2 J	3.7 J	63000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB077 11215702-072121-DUP-3 07/21/2021 (6-8) ft bgs Field Duplicate	SJSB077 11215702-072121-SS-SJSB077(8-10) 07/21/2021 (8-10) ft bgs	SJSB077 11215702-072121-SS-SJSB077(10-12) 07/21/2021 (10-12) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (10-12)-R 07/21/2021 (10-12) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(12-14) 07/21/2021 (12-14) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (12-14)-R 07/21/2021 (12-14) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(14-16) 07/21/2021 (14-16) ft bgs	SJSB077 11215702-072121-SS-SJSB077 (14-16)-R 07/21/2021 (14-16) ft bgs Lab Duplicate	SJSB077 11215702-072121-SS-SJSB077(16-18) 07/21/2021 (16-18) ft bgs	SJSB078 11215702-072121-SS-SJSB078(0-2) 07/21/2021 (0-2) ft bgs	SJSB078 11215702-072121-SS-SJSB078(2-4) 07/21/2021 (2-4) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1400	1700	1.4 J	2.0 U	0.95 J	0.87 U	8.3 J	5.4 J	0.83 J	560 J	1100 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	9700	10000	100	150	73	120	480	480	89	5600	15000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2500	3900	2.1 J	3.4 J	0.84 J	1.0 U	14	11	0.32 J	1300	2300
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	610	720	4.4 J	8.7	2.7 J	5.7 J	21	27	3.9 J	440 J	1100
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	760	1000	0.67 J	1.3 U	0.33 J	0.41 U	4.5 J	3.6 J	0.18 J	480 J	730 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8700	9800	6.9	14	2.2 J	3.5 J	41	36	0.033 U	4700	7100
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.6 J	5.2 J	0.32 J	0.31 U	0.17 U	0.26 U	0.24 U	0.41 U	0.077 U	38 J	5.8 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2300	2500	1.8 J	3.3 J	0.74 J	0.98 J	11	8.1	0.032 U	1200	1800
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	48 J	37 J	0.13 U	0.20 U	0.18 U	0.15 U	0.27 U	0.48 J	0.088 U	4.5 U	6.4 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	140	160	0.075 U	0.31 U	0.050 U	0.14 U	0.25 U	0.57 J	0.031 U	22 U	37 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	12 J	0.11 U	0.27 U	0.16 U	0.21 U	0.24 U	0.39 U	0.076 U	4.0 U	5.7 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5400	5900	5.1 J	9.5	1.6 J	2.1 J	27	22	0.038 U	3100	3300
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	460	530	0.091 U	0.98 J	0.077 U	0.23 J	2.4 J	1.9 J	0.069 U	170 J	260 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	280	280	0.077 U	0.42 J	0.050 U	0.18 U	1.4 J	1.0 J	0.031 U	170 J	170 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3200	3500	2.5 J	6.4	1.1 J	1.2 J	16	15	0.040 U	1700	1800
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	140000 J	200000 J	100	340	48	51	730 J	690 J	1.0 U	80000	190000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	44000 J	54000 J	38	110	18	17	260	250	0.058 U	24000	26000
Total heptachlorodibenzofuran (HpCDF)	pg/g	4000 J	5900 J	3.3 J	6.1 J	1.2 J	1.8 J	23 J	18 J	0.65 J	2100 J	3700 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1300 J	1500 J	17 J	23 J	9.9 J	19 J	74 J	66 J	16 J	820 J	2300 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	13000 J	14000 J	8.7 J	21 J	3.0 J	5.6 J	58 J	51 J	0.033 U	6500 J	9500 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	200 J	190 J	8.4 J	9.6 J	3.3 J	5.9 J	23 J	14 J	5.2 J	93 J	150 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	13000 J	14000 J	7.6 J	25 J	2.7 J	5.0 J	62 J	56 J	0.072 U	7600 J	7800 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	460 J	530 J	0.14 U	3.9 J	0.077 U	1.5 J	6.0 J	4.2 J	0.34 U	170 J	260 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	250000 J	300000 J	200 J	640 J	100 J	96 J	1400 J	1300 J	1.0 J	160000 J	160000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48000 J	59000 J	43 J	130 J	20 J	22 J	290 J	270 J	0.74 U	27000 J	28000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	61000 J	77000 J	50 J	150 J	24 J	23 J	350 J	330 J	0.071 J	33000 J	47000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	61000 J	77000 J	50 J	150 J	24 J	23 J	350 J	330 J	0.21 J	33000 J	47000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB078 11215702-072121-SS-SJSB078(4-6) 07/21/2021 (4-6) ft bgs	SJSB078 11215702-072121-SS-SJSB078(6-8) 07/21/2021 (6-8) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (6-8)-R 07/21/2021 (6-8) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(8-10) 07/21/2021 (8-10) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (8-10)-R 07/21/2021 (8-10) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(10-12) 07/21/2021 (10-12) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (10-12)-R 07/21/2021 (10-12) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(12-14) 07/21/2021 (12-14) ft bgs	SJSB078 11215702-072121-SS-SJSB078(14-16) 07/21/2021 (14-16) ft bgs	SJSB078 11215702-072121-DUP-2 07/21/2021 (14-16) ft bgs Field Duplicate	SJSB078 11215702-072121-SS-SJSB078(16-18) 07/21/2021 (16-18) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1200	0.74 J	2.1 U	1.7 J	1.5 U	3.1 J	1.5 U	0.073 U	0.069 U	0.33 U	4.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	12000	91 J	200 J	92	130	320	280	89	100	130	240
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	2300	0.33 J	3.3 J	1.6 J	2.2 U	2.5 J	2.0 U	0.69 J	0.21 J	0.19 U	4.5 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	710	3.1 J	6.4 J	4.4 J	8.0	9.1	9.4	2.7 J	4.9 J	6.3	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	730	0.050 U	0.85 U	0.64 J	0.65 U	0.94 J	0.73 U	0.21 J	0.047 U	0.18 U	1.1 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8200	1.6 J	8.8	5.1 J	6.2	9.9	7.6	1.7 J	0.58 J	0.89 J	13
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.2 J	0.093 U	0.35 U	0.056 U	0.22 U	0.17 U	0.28 U	0.090 U	0.081 U	0.28 U	0.10 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2100	0.50 J	2.7 J	1.5 J	1.8 J	2.3 J	2.3 J	0.52 J	0.030 U	0.12 U	3.4 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	45 J	0.11 U	0.29 U	0.065 U	0.26 U	0.20 U	0.29 U	0.11 U	0.088 U	0.29 U	0.11 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	160	0.033 U	0.27 U	0.063 U	0.13 U	0.092 U	0.19 U	0.033 U	0.029 U	0.11 U	0.38 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	14 J	0.093 U	0.45 U	0.056 U	0.26 U	0.17 U	0.37 U	0.090 U	0.078 U	0.26 U	0.098 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5300	1.8 J	8.0	4.4 J	5.6 J	7.1	7.4	1.3 J	0.48 J	0.17 U	8.1
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	440	0.071 U	0.97 J	0.51 J	0.56 J	0.076 U	0.62 J	0.068 U	0.089 U	0.41 UJ	1.1 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	270	0.029 U	0.42 J	0.061 U	0.21 J	0.082 U	0.28 J	0.031 U	0.028 U	0.11 U	0.32 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3300	1.0 J	4.8 J	2.6 J	3.4 J	3.7 J	3.8 J	0.071 U	0.032 U	0.17 U	4.8 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	250000	66 J	290 J	150	250	200	250	32	15	22	230
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	58000	25 J	110 J	47	74	68	83	12	5.6	9.6	92
Total heptachlorodibenzofuran (HpCDF)	pg/g	4000 J	0.64 J	5.7 J	2.8 J	3.8 J	4.5 J	3.8 J	1.1 J	0.21 J	0.19 U	7.7 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1600 J	13 J	25 J	13 J	22 J	34 J	32 J	15 J	19 J	27 J	31 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	12000 J	2.1 J	14 J	6.6 J	9.3 J	13 J	11 J	2.2 J	0.58 J	0.89 J	20 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	220 J	3.0 J	6.4 J	3.5 J	4.8 J	5.8 J	6.8 J	2.0 J	8.8 J	11 J	7.3 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	13000 J	4.4 J	20 J	9.3 J	14 J	15 J	17 J	1.3 J	0.48 J	0.29 U	20 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	440 J	0.51 U	2.1 J	0.51 J	1.5 J	0.58 U	1.8 J	0.34 U	2.3 J	0.60 U	2.1 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	320000 J	130 J	570 J	300 J	500 J	380 J	490 J	64 J	26 J	38 J	460 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	63000 J	25 J	120 J	47 J	81 J	68 J	92 J	12 J	8.0 J	9.6 J	100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	86000 J	32 J	140 J	64 J	100 J	91 J	110 J	16 J	7.3 J	12 J	120 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	86000 J	32 J	140 J	64 J	100 J	91 J	110 J	16 J	7.3 J	12 J	120 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB078 11215702-072121-SS-SJSB078 (16-18)-R 07/21/2021 (16-18) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(18-20) 07/21/2021 (18-20) ft bgs	SJSB078 11215702-072121-SS-SJSB078(20-22) 07/21/2021 (20-22) ft bgs	SJSB078 11215702-072121-SS-SJSB078 (20-22)-R 07/21/2021 (20-22) ft bgs Lab Duplicate	SJSB078 11215702-072121-SS-SJSB078(22-24) 07/21/2021 (22-24) ft bgs	SJSB079 11215702-072521-SS-SJSB079(0-2) 07/25/2021 (0-2) ft bgs	SJSB079 11215702-072521-SS-SJSB079(2-4) 07/25/2021 (2-4) ft bgs	SJSB079 11215702-072521-SS-SJSB079(4-6) 07/25/2021 (4-6) ft bgs	SJSB079 11215702-072521-SS-SJSB079(6-8) 07/25/2021 (6-8) ft bgs	SJSB079 11215702-072521-SS-SJSB079(8-10) 07/25/2021 (8-10) ft bgs	SJSB079 11215702-072521-DUP-7 07/25/2021 (8-10) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.7 U	0.88 U	4.5 J	4.1 J	0.88 U	620	1500	950	1200	1200	1700
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	240	130	240	230	63	5100	12000	5600	6500	9000	11000
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.1 J	0.35 U	7.3	6.4	0.35 U	1200	2800	1900	2000	2100	2800
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.8	6.3	12	10	2.6 U	410	880	340	470	570	850
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 U	0.034 U	2.3 J	2.2 U	0.036 U	420	1000	620	650	640	1300
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10	0.22 J	22	23	0.070 J	4800	10000	6500	6500	7000	20000
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.25 U	0.31 U	0.31 U	0.32 U	0.045 U	2.0 U	6.4 J	2.2 U	7.0 J	4.9 J	3.8 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.2 J	0.028 U	5.6 J	5.3 J	0.030 U	1200	2500	1700	1700	1900	4400
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	0.25 J	0.37 J	0.34 J	0.049 U	13 J	27 J	15 J	31 J	32 J	39 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	0.043 J	0.46 J	0.47 J	0.057 J	84 J	130	87 J	100	97 J	300
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.39 U	0.51 J	0.41 J	0.39 U	0.27 J	7.9 J	15 J	2.1 U	9.0 J	9.9 J	12 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	9.1	0.19 J	16	13	0.034 U	3600	5200	4100	4200	4500 J	26000 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.89 J	0.10 J	1.6 J	1.3 J	0.050 U	210	340	200	330	290	320 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.42 J	0.11 U	0.73 J	0.68 J	0.024 U	170	260	210	190	230 J	780 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	5.1 J	0.096 J	9.5	8.4	0.033 U	2000	2600	1800	2400	2400 J	11000 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	280	5.0	570 J	450	0.57 J	77000 J	120000 J	70000 J	130000 J	120000 J	120000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	110	1.8	190	150	0.25 J	23000 J	37000 J	19000 J	35000 J	31000 J	31000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.9 J	0.14 J	13 J	11 J	0.10 J	1900 J	4500 J	3000 J	3300 J	3400 J	5300 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	28 J	25 J	32 J	32 J	12 J	750 J	1600 J	720 J	1000 J	1200 J	1800 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	16 J	0.28 J	33 J	33 J	0.13 J	7100 J	15000 J	9400 J	9700 J	10000 J	30000 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.2 J	8.8 J	7.4 J	8.1 J	5.0 J	80 J	160 J	80 J	140 J	140 J	170 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	23 J	0.37 J	41 J	34 J	0.034 U	8900 J	12000 J	9200 J	10000 J	11000 J	60000 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 J	1.6 J	3.3 J	2.8 J	1.2 J	210 J	340 J	200 J	330 J	290 J	320 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	580 J	8.2 J	1100 J	840 J	0.92 J	130000 J	220000 J	140000 J	240000 J	210000 J	240000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	120 J	2.9 J	210 J	170 J	1.4 J	25000 J	41000 J	21000 J	38000 J	33000 J	34000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	140 J	2.6 J	260 J	200 J	0.37 J	32000 J	52000 J	28000 J	50000 J	45000 J	50000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	140 J	2.7 J	260 J	200 J	0.42 J	32000 J	52000 J	28000 J	50000 J	45000 J	50000 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB079 11215702-072521-SS-SJSB079(10-12) 07/25/2021 (10-12) ft bgs	SJSB079 11215702-072521-SS-SJSB079(12-14) 07/25/2021 (12-14) ft bgs	SJSB079 11215702-072521-SS-SJSB079(14-16) 07/25/2021 (14-16) ft bgs	SJSB079 11215702-072521-SS-SJSB079(16-18) 07/25/2021 (16-18) ft bgs	SJSB080 11215702-072221-SS-SJSB080(0-2) 07/22/2021 (0-2) ft bgs	SJSB080 11215702-072221-SS-SJSB080(2-4) 07/22/2021 (2-4) ft bgs	SJSB080 11215702-072221-SS-SJSB080(4-6) 07/22/2021 (4-6) ft bgs	SJSB080 11215702-072221-SS-SJSB080(6-8) 07/22/2021 (6-8) ft bgs	SJSB080 11215702-072221-SS-SJSB080(8-10) 07/22/2021 (8-10) ft bgs	SJSB080 11215702-072221-SS-SJSB080(10-12) 07/22/2021 (10-12) ft bgs	SJSB080 11215702-072221-SS-SJSB080(12-14) 07/22/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.5 J	0.10 U	0.88 J	0.15 U	370	370	220	68	25	0.37 U	0.32 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	100	100	460	240	7000 J	3900	3100	1500	750	57	58
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	6.9	0.24 J	0.68 J	0.068 U	990	710	660	150	57	0.58 U	0.16 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	5.2 J	4.1 J	21	14	530	280	210	120	57	1.9 J	2.9 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	2.3 J	0.11 J	0.35 J	0.060 U	300	210	170	50	16	0.13 U	0.061 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	23	1.4 J	2.0 J	0.049 U	3100	2100	1700	610	160	1.5 J	0.23 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.070 U	0.11 U	0.19 U	0.18 U	3.0 J	2.0 J	1.3 J	0.79 J	0.49 U	0.20 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	6.8	0.36 J	0.65 J	0.045 U	840	590	460	150	44	0.42 J	0.092 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.075 U	0.12 U	0.23 U	0.21 U	14	8.0 J	5.7 J	3.3 J	1.4 J	0.070 U	0.073 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.61 U	0.038 U	0.11 U	0.042 U	45	32	21	10	2.4 J	0.11 U	0.028 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.067 U	0.11 U	1.4 J	0.18 U	6.3 J	4.3 J	3.3 J	0.24 U	0.81 J	0.062 U	0.22 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	14	1.8 J	1.7 J	0.16 U	1900	1300	810	360	110	0.98 J	0.13 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.4 J	0.11 U	0.16 U	0.37 U	140	94	58	23	9.0	0.055 U	0.055 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.58 J	0.042 U	0.10 U	0.044 U	92	66	38	19	4.7 J	0.038 U	0.027 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	8.1	0.70 J	1.1 J	0.16 U	1000	690	420	180	59	0.46 J	0.042 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	380	6.4	30	1.1 J	47000 J	28000 J	19000 J	7500 J	3300 J	26	2.7
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	140	1.9	12	0.14 U	17000 J	11000 J	6900 J	2300 J	1100 J	9.0	1.1 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	12 J	0.35 J	1.0 J	0.27 U	1500 J	1100 J	930 J	240 J	90 J	0.89 J	0.16 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	13 J	19 J	80 J	54 J	1000 J	540 J	420 J	230 J	140 J	8.9 J	11 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	35 J	1.7 J	2.6 J	0.19 U	4600 J	3200 J	2500 J	900 J	240 J	2.2 J	0.32 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	12 J	27 J	15 J	99 J	58 J	44 J	25 J	19 J	6.0 J	5.8 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	33 J	3.8 J	2.8 J	0.56 U	4500 J	3000 J	1900 J	830 J	260 J	2.2 J	0.13 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.8 J	0.11 U	3.5 U	2.4 U	170 J	110 J	67 J	27 J	12 J	1.6 J	1.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	730 J	9.7 J	53 J	1.1 J	71000 J	51000 J	33000 J	13000 J	6200 J	48 J	4.5 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	150 J	4.5 J	12 J	1.0 U	19000 J	12000 J	7600 J	2500 J	1300 J	14 J	2.2 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	190 J	3.1 J	16 J	0.32 J	23000 J	14000 J	9200 J	3200 J	1500 J	12 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	190 J	3.1 J	16 J	0.64 J	23000 J	14000 J	9200 J	3200 J	1500 J	12 J	1.5 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB080 11215702-072221-SS-SJSB080(14-16) 07/22/2021 (14-16) ft bgs	SJSB080 11215702-072221-SS-SJSB080(16-18) 07/22/2021 (16-18) ft bgs	SJSB080 11215702-072221-DUP-4 07/22/2021 (16-18) ft bgs Field Duplicate	SJSB081 11215702-080521-BN-SJSB081(0-2) 08/05/2021 (0-2) ft bgs	SJSB081 11215702-080521-BN-SJSB081(2-4) 08/05/2021 (2-4) ft bgs	SJSB081 11215702-080521-BN-SJSB081(4-6) 08/05/2021 (4-6) ft bgs	SJSB081 11215702-080521-BN-SJSB081(6-8) 08/05/2021 (6-8) ft bgs	SJSB081 11215702-080521-BN-DUP-13 08/05/2021 (6-8) ft bgs Field Duplicate	SJSB081 11215702-080521-BN-SJSB081(8-10) 08/05/2021 (8-10) ft bgs	SJSB081 11215702-080521-BN-SJSB081 (8-10)-R 08/05/2021 (8-10) ft bgs Lab Duplicate	SJSB081 11215702-080521-BN-SJSB081(10-12) 08/05/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.32 U	0.89 U	0.32 U	110 J	730 J+	460	0.85 U	0.72 U	510	320	3.4 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	120	72	72	2700	2500	2600	340	320	2400	2300	240
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	0.55 U	0.18 U	66 J	1600	830	0.35 J	0.30 U	1000 J	560 J	7.4
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	6.4	3.5 J	3.5 J	110	230	180	15	14	130	110	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.055 U	0.22 J	0.051 U	19 J	530 J+	310	0.10 U	0.063 U	400 J	230 J	2.8 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 U	1.3 J	0.35 J	220	4700	3100 J	0.60 J	0.29 J	3500 J	1900 J	41 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.28 U	0.22 U	0.99 U	4.9 J	1.8 U	0.38 J	0.33 U	1.2 U	3.9 U	0.27 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	0.42 J	0.10 U	67 J	1500	850	0.20 J	0.086 J	920 J	400 J	10
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.18 J	0.077 U	1.1 U	14 J	13 J	0.46 J	0.41 U	1.3 U	5.6 J	0.54 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	0.31 U	0.023 U	1.4 U	84 J	42	0.16 J	0.11 U	56 J	27 J	0.87 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.46 J	0.27 U	0.27 U	0.97 U	7.1 J	9.3 J	0.86 J	0.80 U	4.5 J	4.8 U	1.1 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	1.1 J	0.27 J	180	4200	2200	0.52 J	0.27 J	2300 J	800 J	38 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.073 U	0.20 J	0.055 U	14 J	290	260	0.12 U	0.085 U	110	54 J	1.5 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.028 U	0.059 J	0.022 U	8.1 J	180 J	94	0.089 J	0.040 U	96 J	45 J	1.2 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	0.66 J	0.10 J	110	2200	1400	0.28 J	0.056 U	1000 J	450 J	14
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.1 U	27 J	6.3 J	5600	93000 J	92000 J	8.0	3.2	45000 J	23000 J	530 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.34 U	9.1 J	2.1 J	1700	36000 J	37000 J	3.8	1.4	13000 J	7700 J	210
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.095 J	1.0 J	0.29 J	110 J	2500 J	1300 J	0.35 J	0.73 J	1700 J	930 J	12 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24 J	12 J	13 J	360 J	470 J	380 J	52 J	58 J	310 J	290 J	48 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	2.3 J	0.45 J	350 J	7400 J	4700 J	1.1 J	0.45 J	5200 J	2600 J	61 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.7 J	3.6 J	4.5 J	59 J	99 J	79 J	14 J	16 J	57 J	63 J	16 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.038 U	2.4 J	0.49 J	430 J	10000 J	5700 J	0.88 J	0.33 J	5100 J	2000 J	72 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.1 J	0.81 J	0.93 J	14 J	290 J	260 J	0.68 J	2.7 J	110 J	64 J	1.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	1.9 J	50 J	11 J	12000 J	170000 J	150000 J	13 J	5.4 J	70000 J	39000 J	1100 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.6 J	10 J	2.6 J	1900 J	40000 J	41000 J	3.8 J	3.5 J	14000 J	8400 J	230 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.15 J	13 J	2.9 J	2300 J	47000 J	47000 J	5.2 J	2.0 J	19000 J	11000 J	280 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.44 J	13 J	3.0 J	2300 J	47000 J	47000 J	5.3 J	2.1 J	19000 J	11000 J	280 J

Notes:
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- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB081 11215702-080521-BN-SJSB081 (10-12)-R 08/05/2021 (10-12) ft bgs Lab Duplicate	SJSB081 11215702-080521-BN-SJSB081(12-14) 08/05/2021 (12-14) ft bgs	SJSB081 11215702-080521-BN-SJSB081(14-16) 08/05/2021 (14-16) ft bgs	SJSB081 11215702-080521-BN-SJSB081(16-18) 08/05/2021 (16-18) ft bgs	SJSB082 11215702-080921-BN-SJSB082(0-2) 08/09/2021 (0-2) ft bgs	SJSB082 11215702-080921-BN-SJSB082(2-4) 08/09/2021 (2-4) ft bgs	SJSB082 11215702-080921-BN-SJSB082(4-6) 08/09/2021 (4-6) ft bgs	SJSB082 11215702-080921-BN-SJSB082(6-8) 08/09/2021 (6-8) ft bgs	SJSB082 11215702-080921-DUP-16 08/09/2021 (6-8) ft bgs Field Duplicate	SJSB082 11215702-080921-BN-SJSB082(8-10) 08/09/2021 (8-10) ft bgs	SJSB082 11215702-080921-BN-SJSB082 (8-10)-R 08/09/2021 (8-10) ft bgs Lab Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	2.3 U	0.45 U	0.52 U	0.45 U	220 J	8.3 J	17	0.30 U	0.29 U	3.8 J	2.2 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	160	620	690	210	3100	230	350	300	210	940	630
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.4 J	0.20 U	0.30 U	0.18 U	300	19	43	0.33 U	0.28 U	2.8 J	0.93 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.2	31	35	11	160	7.0	15	16	8.6	30	25
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.9 U	0.062 U	0.068 U	0.071 U	84 J	7.9	16	0.15 U	0.15 U	0.86 U	0.36 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	18 J	0.25 J	0.16 J	0.12 J	960	69 J	170	0.70 J	0.58 J	8.5	2.9 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.35 U	0.64 U	0.61 U	0.29 U	3.0 U	0.33 U	0.44 U	0.40 U	0.33 U	0.48 U	0.50 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4.2 J	0.17 J	0.10 J	0.052 U	260	17	43	0.24 J	0.20 J	2.3 J	0.67 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.82 J	0.71 J	0.26 U	7.1 J	0.40 J	0.74 J	0.43 J	0.27 J	0.76 J	0.64 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.41 U	0.20 U	0.18 U	0.11 U	15 J	1.4 J	3.0 J	0.15 U	0.083 U	0.25 U	0.14 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.76 U	2.7 J	3.1 J	1.1 J	5.0 U	0.50 U	0.60 U	0.87 J	0.50 U	1.7 J	1.5 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	12 J	0.22 J	0.068 U	0.17 J	1100	47	130	0.53 J	0.39 J	6.9	2.1 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.0 J	0.31 J	0.15 U	0.096 U	93 J	3.1 J	9.3	0.22 J	0.15 J	0.95 J	0.37 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.57 J	0.052 U	0.040 U	0.036 U	34 J	2.0 J	4.8 J	0.096 J	0.077 J	0.31 J	0.10 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.0	0.068 U	0.069 U	0.052 U	1200	22	71	0.31 J	0.24 J	4.6 J	1.5 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	410	4.3	0.85 J	0.87 J	44000 J	1300 J	3900 J	14	9.7	320 J	110 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	150	1.1 J	0.47 J	0.39 J	10000	520 J	1500 J	5.5	3.9	84 J	29 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.5 J	0.20 J	0.30 J	0.14 J	450 J	31 J	70 J	0.54 J	0.49 J	4.7 J	1.8 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	32 J	140 J	150 J	56 J	390 J	35 J	51 J	49 J	33 J	100 J	80 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	26 J	0.61 J	0.44 J	0.20 J	1500 J	100 J	250 J	1.2 J	0.94 J	13 J	4.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	12 J	40 J	48 J	20 J	70 J	14 J	16 J	12 J	8.9 J	23 J	20 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	29 J	0.22 J	0.069 U	0.17 J	3500 J	110 J	320 J	1.2 J	0.63 J	19 J	5.7 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.3 J	6.4 J	8.7 J	3.7 J	110 J	6.0 J	14 J	2.0 J	1.5 J	5.4 J	3.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	740 J	4.6 J	1.8 J	1.6 J	90000 J	2600 J	8200 J	26 J	18 J	610 J	210 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	170 J	7.1 J	8.2 J	3.1 J	11000 J	570 J	1700 J	7.3 J	5.6 J	94 J	34 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	200 J	2.7 J	1.5 J	0.78 J	15000 J	670 J	2000 J	7.7 J	5.4 J	120 J	42 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	200 J	2.8 J	1.7 J	0.87 J	15000 J	670 J	2000 J	7.7 J	5.4 J	120 J	42 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB082 11215702-080921-BN-SJSB082(10-12) 08/09/2021 (10-12) ft bgs	SJSB082 11215702-080921-BN-SJSB082(12-14) 08/09/2021 (12-14) ft bgs	SJSB082 11215702-080921-BN-SJSB082(14-16) 08/09/2021 (14-16) ft bgs	SJSB082 11215702-080921-BN-SJSB082(16-18) 08/09/2021 (16-18) ft bgs	SJSB083 11215702-072221-BN-SJSB083(0-2) 07/22/2021 (0-2) ft bgs	SJSB083 11215702-072221-BN-SJSB083(2-4) 07/22/2021 (2-4) ft bgs	SJSB083 11215702-072221-BN-SJSB083(4-6) 07/22/2021 (4-6) ft bgs	SJSB083 11215702-072221-BN-SJSB083(6-8) 07/22/2021 (6-8) ft bgs	SJSB083 11215702-072221-BN-SJSB083(8-10) 07/22/2021 (8-10) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(8-10)-WC 07/22/21 (8-10) ft bgs	SJSB083 11215702-072221-BN-SJSB083(10-12) 07/22/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.26 U	0.55 U	0.32 U	0.28 J	510	35	3.3 J	0.078 U	530	370	6.5 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	980	600	1000	190	2400	1700	1700	1000	3800	4100	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.22 U	0.43 U	0.28 U	0.27 J	750	69	0.44 J	0.23 J	450	140	12
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	23	42	6.8	160	71	77	51	160	180	62
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.033 U	0.058 U	0.15 U	0.16 J	250	23	0.051 U	0.059 U	160	46	5.2 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.30 J	0.24 U	0.29 U	0.40 J	2800	280	1.0 J	0.64 J	1700	500	44
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.53 U	0.49 U	0.69 U	0.29 J	3.2 J	0.31 U	0.93 J	0.78 J	0.70 U	2.1 J	0.89 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 J	0.047 U	0.12 J	0.13 J	760	75	0.36 J	0.041 U	410	140	12
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.74 J	0.57 J	0.87 J	0.20 J	11 J	0.39 U	1.9 J	1.4 J	8.0 J	7.2 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.086 U	0.092 U	0.12 U	0.073 J	49 J	5.0 J	0.024 U	0.038 U	28 J	9.8 J	0.29 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.0 J	1.7 J	2.2 J	0.67 J	5.5 J	3.2 J	4.3 J	3.2 J	5.7 J	8.8 J	3.2 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	0.051 U	0.20 J	0.12 J	2100	200	0.62 J	0.74 J	980	330	16
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.21 J	0.30 J	0.054 U	210	12	0.15 U	0.15 U	91	31	1.2 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.033 J	0.032 U	0.061 J	0.018 U	87 J	9.0	0.024 U	0.042 U	44	16	0.30 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.15 J	0.053 U	0.16 J	0.034 U	1300	98	0.34 J	0.079 U	560	190	8.1
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	6.0	0.50 U	5.4	1.5	220000	4400	16	29	38000	11000	430
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.2	0.26 U	1.7 J	0.50 J	23000	1700	5.9	9.7	11000	3100	140
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.18 J	0.43 J	0.50 J	0.49 J	1200 J	110 J	0.44 J	0.23 J	740 J	240 J	20 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	91 J	180 J	31 J	380 J	190 J	220 J	120 J	460 J	490 J	180 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	0.33 J	0.65 J	0.60 J	4200 J	420 J	1.4 J	0.64 J	2400 J	740 J	59 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	28 J	24 J	50 J	12 J	72 J	28 J	67 J	37 J	71 J	92 J	42 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.55 J	0.054 U	0.51 J	0.12 J	5200 J	460 J	0.96 J	0.74 J	2400 J	770 J	34 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.4 J	4.2 J	8.7 J	2.7 J	210 J	14 J	11 J	6.5 J	91 J	37 J	7.6 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	12 J	0.87 J	10 J	2.7 J	160000 J	8200 J	29 J	57 J	67000 J	21000 J	820 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.1 J	2.8 J	7.4 J	2.5 J	25000 J	1800 J	7.8 J	9.7 J	12000 J	3400 J	160 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	4.1 J	0.85 J	3.6 J	0.96 J	46000 J	2200 J	9.8 J	14 J	15000 J	4400 J	200 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	4.1 J	1.1 J	3.7 J	0.99 J	46000 J	2200 J	9.8 J	14 J	15000 J	4400 J	200 J

Notes:
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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
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Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB083-Waste 11215702-072221-BN-SJSB083(10-12)-WC 07/22/21 (10-12) ft bgs	SJSB083 11215702-072221-BN-SJSB083(12-14) 07/22/2021 (12-14) ft bgs	SJSB083 11215702-072221-BN-SJSB083(14-16) 07/22/2021 (14-16) ft bgs	SJSB083 11215702-072221-BN-SJSB083(16-18) 07/22/2021 (16-18) ft bgs	SJSB083 11215702-072221-BN-SJSB083(18-20) 07/22/2021 (18-20) ft bgs	SJSB084 11215702-072021-BN-SJSB084(0-2) 07/20/2021 (0-2) ft bgs	SJSB084 11215702-072021-BN-SJSB084(2-4) 07/20/2021 (2-4) ft bgs	SJSB084 11215702-072021-BN-SJSB084(4-6) 07/20/2021 (4-6) ft bgs	SJSB084 11215702-072021-BN-SJSB084(6-8) 07/20/2021 (6-8) ft bgs	SJSB084 11215702-072021-BN-SJSB084(8-10) 07/20/2021 (8-10) ft bgs	SJSB084 11215702-072021-BN-SJSB084(10-12) 07/20/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.14 U	2.3 J	0.080 U	7.3 J	0.34 U	570	100	6.7 U	1.0 U	6.9 U	1.4 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1100	1300	980	360	19 J	7000	2500	2300	1600	1900	1400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.6 J	1.6 J	0.40 J	0.30 J	0.29 U	320	65	1.2 J	0.45 J	0.27 J	0.23 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	39	51	40	19	1.1 U	270	77	84	63	71	52
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.68 J	0.32 J	0.049 U	0.036 U	0.11 U	110	19	0.46 J	0.076 U	0.080 U	0.062 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.5 J	3.1 J	0.88 J	0.029 U	0.75 J	1100	200	2.8 J	1.4 J	0.25 J	0.24 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.26 U	0.54 J	0.42 J	0.35 J	0.073 U	4.3 J	1.2 J	0.85 J	0.92 J	0.78 J	0.88 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.3 J	0.76 J	0.27 J	0.029 U	0.23 U	300	52	0.85 J	0.57 J	0.15 J	0.055 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.30 U	1.1 J	0.93 J	0.099 U	0.12 U	11	2.4 J	2.0 J	1.6 J	1.7 J	1.1 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 J	0.053 U	0.034 U	0.028 U	0.16 U	20	4.6 U	1.2 U	1.1 U	1.0 U	1.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.2 J	2.7 J	2.4 J	1.3 J	0.13 U	8.6 J	2.9 J	4.2 J	3.1 J	3.6 J	2.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3.4 J	1.9 J	0.53 J	0.039 U	0.49 J	860	220	2.4 J	1.6 J	0.63 J	0.64 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.58 J	0.14 U	0.16 U	0.11 U	0.14 U	82	21	0.52 J	0.14 U	0.34 J	0.40 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.079 U	0.053 U	0.034 U	0.028 U	0.082 U	35 J	6.7 J	0.092 J	0.098 J	0.049 U	0.042 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.0 J	0.97 J	0.37 J	0.043 U	0.38 J	530	200	1.6 J	0.89 J	0.21 J	0.21 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	95	50	16	1.2 J	12	18000	8100	120	52	8.4	18
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	34	17	6.0	0.11 U	3.3	9600	2300	29	15	2.8	4.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.3 J	2.3 J	0.40 J	0.82 J	0.51 J	530 J	110 J	2.5 J	0.67 J	1.0 J	0.44 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	170 J	130 J	54 J	3.3 J	770 J	270 J	240 J	200 J	210 J	190 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	7.1 J	3.8 J	1.1 J	0.029 U	1.4 J	1600 J	300 J	5.8 J	3.4 J	1.4 J	1.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	30 J	39 J	38 J	12 J	1.5 J	130 J	48 J	63 J	47 J	53 J	50 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	6.6 J	2.9 J	0.90 J	0.043 U	1.4 J	2200 J	630 J	6.2 J	3.1 J	1.1 J	1.1 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.0 J	6.2 J	7.6 J	1.6 J	0.56 J	100 J	29 J	11 J	8.4 J	11 J	8.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	180 J	99 J	31 J	1.3 J	24 J	62000 J	22000 J	230 J	100 J	17 J	33 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	38 J	17 J	8.5 J	0.32 U	3.8 J	11000 J	2600 J	38 J	22 J	9.0 J	10 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	47 J	24 J	8.9 J	0.59 J	4.7 J	12000 J	3200 J	45 J	22 J	6.0 J	7.7 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	47 J	24 J	9.0 J	0.72 J	4.8 J	12000 J	3200 J	45 J	23 J	6.1 J	7.8 J

Notes:
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- ft bgs - Feet below ground surface
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Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB084 11215702-072021-BN-SJSB084(12-14) 07/20/2021 (12-14) ft bgs	SJSB084 11215702-072021-BN-SJSB084(14-16) 07/20/2021 (14-16) ft bgs	SJSB084 11215702-072021-BN-SJSB084(16-18) 07/20/2021 (16-18) ft bgs	SJSB085 11215702-072321-BN-SJSB085(0-2) 07/23/2021 (0-2) ft bgs	SJSB085 11215702-072321-BN-SJSB085(2-4) 07/23/2021 (2-4) ft bgs	SJSB085 11215702-072321-BN-SJSB085(4-6) 07/23/2021 (4-6) ft bgs	SJSB085 11215702-072321-BN-SJSB085(6-8) 07/23/2021 (6-8) ft bgs	SJSB085 11215702-072321-BN-SJSB085 (6-8)-R 07/23/2021 (6-8) ft bgs Lab Duplicate	SJSB085 11215702-072321-BN-SJSB085(8-10) 07/23/2021 (8-10) ft bgs	SJSB085 11215702-072321-BN-SJSB085(10-12) 07/23/2021 (10-12) ft bgs	SJSB085 11215702-072321-BN-SJSB085(12-14) 07/23/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.84 U	1.7 U	2.8 U	770	13 J	0.88 U	2.5 J	0.31 U	1.1 U	0.66 U	0.64 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1700	1300	1800	5300	1600	1000	2500 J	810 J	750	2100	1700
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.11 U	0.24 J	0.72 J	1200	16	0.64 U	1.3 J	0.49 U	1.0 J	0.24 U	0.20 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	56	72	300	59	34	72 J	30 J	24	82	73
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.087 U	0.10 U	380	5.4 J	0.20 U	0.40 U	0.065 U	0.26 U	0.048 U	0.10 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.40 J	0.19 J	0.44 J	3600	54	2.0 J	3.5 J	0.37 U	2.5 J	0.28 J	0.37 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	1.0 J	0.66 J	4.5 J	0.82 U	0.44 U	0.68 U	0.47 U	0.42 U	1.1 U	0.87 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 J	0.12 J	0.25 J	960	14	0.59 J	1.0 J	0.14 U	0.77 J	0.11 U	0.12 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	1.2 J	1.4 J	16	1.7 J	0.68 J	1.5 J	0.80 J	0.53 J	1.7 J	1.9 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 U	1.2 U	1.2 U	49	1.1 J	0.12 U	0.044 U	0.10 U	0.12 U	0.20 U	0.12 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.5 J	3.4 J	3.9 J	9.4 J	2.8 J	1.5 J	3.1 J	1.4 U	0.98 J	3.8 J	3.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.73 J	0.55 J	0.62 J	2400	45	1.5 J	2.5 J	0.35 J	1.7 J	0.17 J	0.30 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.54 J	0.16 U	0.14 U	240	4.4 J	0.21 J	0.49 J	0.15 J	0.27 J	0.35 J	0.29 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.078 U	0.052 U	0.050 U	100	1.8 J	0.092 J	0.12 J	0.031 U	0.090 J	0.033 U	0.026 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	0.11 J	0.15 J	1600	26	0.97 J	1.6 J	0.24 J	0.95 J	0.083 J	0.14 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8.1	4.7	3.9	98000 J	1700 J	65	97 J	17 J	55	3.4	12
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2.8	1.5 J	1.4 J	31000 J	530	19	31 J	4.6 J	18	1.5 J	3.6
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.12 U	0.52 J	1.1 J	1900 J	27 J	1.0 J	2.2 J	0.16 J	1.5 J	0.24 J	0.27 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	220 J	200 J	230 J	710 J	150 J	110 J	200 J	83 J	79 J	240 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	1.7 J	1.9 J	5300 J	82 J	3.1 J	5.2 J	0.61 J	3.9 J	0.59 J	0.62 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	58 J	58 J	60 J	130 J	27 J	28 J	45 J	26 J	19 J	57 J	47 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.79 J	1.1 J	6200 J	110 J	3.7 J	6.4 J	0.86 J	4.1 J	0.35 J	0.69 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	10 J	11 J	13 J	260 J	9.1 J	6.0 J	8.7 J	6.8 J	4.1 J	11 J	9.7 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	16 J	9.8 J	7.9 J	170000 J	2900 J	120 J	180 J	29 J	100 J	5.4 J	21 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	12 J	12 J	11 J	34000 J	580 J	24 J	38 J	8.9 J	23 J	7.0 J	9.8 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.0 J	3.6 J	3.8 J	42000 J	720 J	27 J	44 J	7.4 J	25 J	4.2 J	7.0 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.1 J	3.7 J	3.9 J	42000 J	720 J	27 J	44 J	7.4 J	25 J	4.3 J	7.0 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Parameters	Units	SJSB085 11215702-072321-BN-SJSB085(14-16) 07/23/2021 (14-16) ft bgs	SJSB085 11215702-072321-BN-SJSB085(16-18) 07/23/2021 (16-18) ft bgs	SJSB086 11215702-080421-BN-SJSB086(0-2) 08/04/2021 (0-2) ft bgs	SJSB086 11215702-080421-BN-SJSB086(2-4) 08/04/2021 (2-4) ft bgs	SJSB086 11215702-080421-BN-SJSB086(4-6) 08/04/2021 (4-6) ft bgs	SJSB086 11215702-080421-BN-SJSB086(6-8) 08/04/2021 (6-8) ft bgs	SJSB086 11215702-080421-BN-DUP-12 08/04/2021 (6-8) ft bgs Field Duplicate	SJSB086 11215702-080421-BN-SJSB086(8-10) 08/04/2021 (8-10) ft bgs	SJSB086 11215702-080421-BN-SJSB086(10-12) 08/04/2021 (10-12) ft bgs	SJSB086 11215702-080421-BN-SJSB086(12-14) 08/04/2021 (12-14) ft bgs	SJSB086 11215702-080421-BN-SJSB086(14-16) 08/04/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.8 U	0.52 U	0.45 U	1.9 U	0.48 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U	0.45 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	1300	580	1300	700	880	490	1700	1400	760	1800
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.85 U	0.28 U	0.31 U	1.0 U	0.18 U	0.18 U	0.27 U	0.18 U	0.25 U	0.27 U	0.18 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	66	51	25	69	38	30	17	70	66	35	72
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.20 U	0.071 U	0.075 U	0.43 J	0.058 U	0.069 U	0.053 U	0.063 U	0.062 U	0.057 U	0.045 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.86 J	0.67 J	0.32 J	0.52 J	0.054 J	0.040 U	0.18 J	0.049 U	0.065 U	0.43 J	0.23 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.73 U	0.82 U	0.60 U	0.61 U	0.55 U	0.45 U	0.37 U	0.92 U	1.0 U	0.42 U	0.99 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 U	0.27 J	0.17 J	0.38 J	0.084 J	0.040 U	0.084 J	0.080 J	0.067 U	0.21 J	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	1.2 J	0.94 J	1.4 J	0.97 J	0.67 J	0.48 U	1.8 J	1.8 J	0.78 J	1.7 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.13 U	0.20 U	0.25 U	0.13 U	0.13 U	0.12 U	0.13 U	0.16 U	0.11 U	0.13 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	2.8 J	1.9 J	2.9 J	2.0 J	1.3 J	0.89 J	3.9 J	4.2 J	1.7 J	3.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.70 J	0.58 J	0.47 J	0.51 J	0.042 U	0.069 J	0.36 J	0.052 U	0.070 U	0.30 J	0.14 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.37 J	0.39 J	0.27 J	0.27 J	0.19 J	0.17 J	0.14 J	0.14 U	0.32 J	0.21 J	0.32 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 J	0.048 U	0.089 U	0.10 U	0.069 U	0.069 U	0.069 U	0.035 U	0.076 U	0.045 U	0.031 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.33 J	0.31 J	0.21 J	0.18 J	0.042 U	0.051 U	0.11 J	0.050 U	0.072 U	0.18 J	0.053 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	21	16	11	0.89 J	0.35 U	0.40 U	1.0 J	0.30 U	0.23 U	6.5	1.7
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.3	5.2	2.7	0.24 J	0.13 J	0.21 J	0.29 J	0.24 J	0.25 J	1.4 J	0.54 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.28 J	0.31 J	2.0 J	0.17 J	0.14 J	0.27 J	0.15 J	0.25 J	0.27 J	0.11 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	170 J	64 J	140 J	83 J	89 J	61 J	230 J	210 J	83 J	200 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	1.1 J	0.78 J	1.5 J	0.32 J	0.19 J	0.45 J	0.26 J	0.23 J	0.72 J	0.48 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	46 J	43 J	17 J	24 J	17 J	18 J	14 J	54 J	58 J	17 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.5 J	1.4 J	1.1 J	1.5 J	0.14 J	0.069 J	0.46 J	0.052 U	0.073 U	0.48 J	0.14 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.3 J	10 J	2.8 J	2.8 J	2.2 J	2.3 J	1.8 J	8.3 J	9.6 J	2.6 J	7.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	38 J	29 J	19 J	3.1 J	1.0 J	0.88 J	1.6 J	1.0 J	0.73 J	13 J	3.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	13 J	12 J	6.1 J	3.5 J	2.4 J	2.3 J	2.3 J	6.7 J	7.9 J	3.5 J	7.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11 J	8.7 J	4.9 J	2.3 J	1.2 J	1.1 J	1.0 J	2.0 J	2.3 J	3.2 J	2.9 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11 J	7.6 J	5.0 J	2.3 J	1.3 J	1.2 J	1.1 J	2.2 J	2.3 J	3.2 J	2.9 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB086 11215702-080421-BN-SJSB086(16-18) 08/04/2021 (16-18) ft bgs	SJSB087 11215702-081021-BN-SJSB087(0-2) 08/10/2021 (0-2) ft bgs	SJSB087 11215702-081021-BN-SJSB087(2-4) 08/10/2021 (2-4) ft bgs	SJSB087 11215702-081021-BN-SJSB087(4-6) 08/10/2021 (4-6) ft bgs	SJSB087 11215702-081021-BN-SJSB087(6-8) 08/10/2021 (6-8) ft bgs	SJSB087 11215702-081021-BN-DUP-17 08/10/2021 (6-8) ft bgs Field Duplicate	SJSB087 11215702-081021-BN-SJSB087(8-10) 08/10/2021 (8-10) ft bgs	SJSB087 11215702-081021-BN-SJSB087(10-12) 08/10/2021 (10-12) ft bgs	SJSB087 11215702-081021-BN-SJSB087(12-14) 08/10/2021 (12-14) ft bgs	SJSB087 11215702-081021-BN-SJSB087 (12-14)-R 08/10/2021 (12-14) ft bgs Lab Duplicate	SJSB087 11215702-081021-BN-SJSB087(14-16) 08/10/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.58 U	90	330	48	3.3 U	0.88 U	14	0.88 U	1.9 U	2.6 U	9.9 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1100	2000	4300	2600	830	520	990	1100	300	420	930
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.18 U	150	810	89	0.92 U	0.35 U	24	0.35 U	3.0 J	2.9 J	20 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	45	89	220	82	29	21	45	40	11	14	36
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.042 U	54	270 J+	30	0.30 U	0.036 U	8.2	0.061 U	0.98 U	0.94 U	9.2
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.064 J	1100	2800	370	0.98 J	0.17 J	66	0.30 J	9.5	8.4	74 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 U	1.2 U	2.3 U	1.0 U	0.49 U	0.42 U	0.63 U	0.60 U	0.31 U	0.28 U	0.59 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.034 U	260	710	95	0.33 J	0.068 J	17	0.11 J	2.8 J	2.8 J	18 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.97 J	3.0 J	11 J	2.3 J	0.76 J	0.56 J	1.2 J	1.1 J	0.29 J	0.39 J	0.95 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	19	46 J	6.2 J	0.081 J	0.065 J	1.1 J	0.16 J	0.20 J	0.20 U	1.3 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	2.9 J	6.5 J	3.2 J	1.5 J	1.4 J	2.3 J	2.8 J	0.57 J	0.70 U	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.065 J	1200	1800	250	0.58 J	0.13 J	40	0.18 J	7.4	6.7	42 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.23 J	23	130	11	0.086 U	0.13 J	3.1 J	0.15 U	0.64 J	0.64 J	3.1 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.025 U	37	71 J	12	0.046 U	0.024 U	1.8 J	0.045 U	0.39 U	0.39 J	1.9 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.045 U	440	930	100	0.35 J	0.030 U	20	0.084 U	4.3 J	3.8 J	21 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.17 U	12000 J	48000 J	4200 J	22 J	3.3 J	1200 J	5.0	280	270	1100 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.17 J	3100 J	19000 J	1800 J	6.8 J	1.3 J	430	1.7 J	80	75	440 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.28 J	250 J	1300 J	140 J	1.5 J	0.12 J	37 J	0.14 J	4.7 J	4.8 J	35 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	160 J	250 J	490 J	210 J	88 J	74 J	130 J	150 J	33 J	45 J	150 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	1600 J	4000 J	550 J	1.4 J	0.30 J	96 J	0.57 J	15 J	13 J	110 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	46 J	44 J	83 J	39 J	21 J	18 J	27 J	40 J	8.1 J	10 J	39 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.065 J	2600 J	4100 J	530 J	1.7 J	0.22 J	90 J	0.18 J	17 J	16 J	96 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.1 J	31 J	140 J	18 J	3.8 J	3.7 J	7.7 J	4.3 J	1.7 J	2.5 J	9.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.51 J	21000 J	91000 J	7900 J	35 J	6.5 J	2300 J	8.6 J	540 J	540 J	2100 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.9 J	3400 J	21000 J	1900 J	9.7 J	3.6 J	470 J	4.8 J	88 J	83 J	480 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.5 J	4600 J	25000 J	2300 J	10 J	2.4 J	570 J	3.4 J	110 J	110 J	570 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.6 J	4600 J	25000 J	2300 J	10 J	2.4 J	570 J	3.5 J	110 J	110 J	570 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth:	Units	SJSB087 11215702-081021-BN-SJSB087 (14-16)-R 08/10/2021 (14-16) ft bgs Lab Duplicate	SJSB087 11215702-081021-BN-SJSB087(16-18) 08/10/2021 (16-18) ft bgs	SJSB088 11215702-080621-BN-SJSB088(0-2) 08/06/2021 (0-2) ft bgs	SJSB088 11215702-080621-BN-SJSB088(2-4) 08/06/2021 (2-4) ft bgs	SJSB088 11215702-080621-BN-SJSB088(4-6) 08/06/2021 (4-6) ft bgs	SJSB088 11215702-080621-BN-SJSB088(6-8) 08/06/2021 (6-8) ft bgs	SJSB088 11215702-080621-BN-SJSB088 (6-8)-R 08/06/2021 (6-8) ft bgs Lab Duplicate	SJSB088 11215702-080621-BN-DUP-14 08/06/2021 (6-8) ft bgs Field Duplicate	SJSB088 11215702-080621-BN-SJSB088(8-10) 08/06/2021 (8-10) ft bgs	SJSB088 11215702-080621-BN-SJSB088(10-12) 08/06/2021 (10-12) ft bgs	SJSB088 11215702-080621-BN-SJSB088(12-14) 08/06/2021 (12-14) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	27	2.6 U	400	420	970	960	860	1200	1200	0.54 U	0.071 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1400	210	1600	1400 J-	3900	4600	5700	6000	6300	170	150
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	52 J	0.68 U	890	940	2100	2200	2000	2700	2400	0.33 J	0.051 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	52	10	120 J	120 J	300	340	370	420	420	9.5	7.0
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	18	0.26 U	310	300 J+	820	700	760	970	770	0.060 U	0.062 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	180 J	0.50 J	2900	2900	7700	7300	9400	9800	7700	0.75 J	0.047 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 U	0.35 U	5.5 J	1.6 U	7.0 J	2.9 U	9.2 U	5.5 J	5.4 J	0.11 U	0.34 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	49 J	0.24 U	770	800	2100	1900	2100	2500	2000	0.18 J	0.048 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	0.38 U	12 J	8.7 J	20 J	30 J	25 J	28 J	29 J	0.12 U	0.28 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.2 J	0.17 U	38 J	32 J	110 J	98 J	140	150 J	91 J	0.022 U	0.10 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	0.90 J	2.0 U	1.4 U	8.2 J	2.6 U	15 U	12 U	12 J	0.10 U	0.57 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	120 J	0.31 U	2100	2300	4900	4500	5800	7000	5200	0.45 J	0.071 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.4 J	0.43 U	300	300 J+	330	320	380	290	300	0.13 U	0.093 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	5.6 J	0.17 U	81 J	95 J	210 J	210 J	220	290	200 J	0.023 U	0.034 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	54 J	0.32 U	1700	1800	2400	2300	2800	2900	2400	0.18 J	0.075 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2600 J	5.8	130000 J	170000 J	130000 J	120000 J	130000 J	110000 J	130000 J	10	0.79 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1200 J	1.8 J	25000 J	25000 J	35000 J	40000 J	55000 J	49000 J	36000 J	3.9	0.32 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	83 J	0.56 J	1400 J	1400 J	3400 J	3400 J	3300 J	4400 J	3700 J	0.49 J	0.062 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	190 J	44 J	250 J	250 J	640 J	700 J	750 J	910 J	850 J	35 J	33 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	260 J	0.50 J	4300 J	4300 J	11000 J	10000 J	13000 J	14000 J	11000 J	0.93 J	0.10 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	45 J	15 J	59 J	31 J	110 J	140 J	160 J	150 J	140 J	11 J	11 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	260 J	0.35 U	6000 J	6400 J	92000 J	11000 J	14000 J	15000 J	12000 J	0.78 J	0.075 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	13 J	2.1 J	300 J	300 J	330 J	320 J	430 J	320 J	300 J	0.13 U	2.3 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	5500 J	7.8 J	160000 J	200000 J	190000 J	180000 J	320000 J	200000 J	190000 J	17 J	1.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1300 J	3.1 J	28000 J	27000 J	39000 J	45000 J	62000 J	53000 J	39000 J	3.9 J	2.0 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1500 J	2.7 J	39000 J	43000 J	50000 J	54000 J	71000 J	63000 J	51000 J	5.2 J	0.58 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1500 J	3.0 J	39000 J	43000 J	50000 J	54000 J	71000 J	63000 J	51000 J	5.3 J	0.68 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB088 11215702-080621-BN-SJSB088(14-16) 08/06/2021 (14-16) ft bgs	SJSB088 11215702-080621-BN-SJSB088(16-18) 08/06/2021 (16-18) ft bgs	SJSB088 11215702-080621-BN-SJSB088 (16-18)-R 08/06/2021 (16-18) ft bgs Lab Duplicate	SJSB088 11215702-080621-BN-SJSB088(18-20) 08/06/2021 (18-20) ft bgs	SJSB088 11215702-080621-BN-SJSB088(20-22) 08/06/2021 (20-22) ft bgs	SJSB088 11215702-080621-BN-SJSB088(22-24) 08/06/2021 (22-24) ft bgs	SJSB089 11215702-080721-BN-SJSB089(0-2) 08/07/2021 (0-2) ft bgs	SJSB089 11215702-080721-BN-SJSB089(2-4) 08/07/2021 (2-4) ft bgs	SJSB089 11215702-080721-BN-SJSB089(4-6) 08/07/2021 (4-6) ft bgs	SJSB089 11215702-080721-BN-SJSB089(6-8) 08/07/2021 (6-8) ft bgs	SJSB089 11215702-080721-BN-DUP-19 08/07/2021 (6-8) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.39 U	9.2 U	20	0.40 U	0.17 U	0.20 U	28	1.3 U	0.39 U	0.39 U	0.39 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	390	150 J	280 J	220	290	210	1900	480	910	1100	1600 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.13 U	17 J	57	0.26 U	0.26 U	0.21 U	41	2.1 J	0.35 U	0.16 U	0.14 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	20	8.4 J	16	11	16	11	55	17	41	48	72
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.061 U	6.6 J	23	0.14 U	0.077 U	0.0030 U	13	0.74 J	0.16 J	0.072 U	0.081 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	64 J	260 J	0.64 J	0.28 J	0.23 U	100	7.6	0.99 J	0.087 U	0.18 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.43 U	0.39 U	0.040 U	0.70 J	0.34 J	0.85 J	0.43 J	0.58 J	0.74 J	0.84 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	16 J	54	0.18 U	0.0075 U	0.21 U	27	2.0 J	0.28 J	0.11 J	0.11 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.44 J	0.44 U	0.79 J	0.38 J	0.66 J	0.035 U	1.5 J	0.52 J	0.85 J	1.4 J	1.8 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.094 U	1.5 U	3.2 J	0.14 U	0.14 U	0.0030 U	1.8 J	0.17 U	0.11 U	0.18 U	0.11 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.1 J	0.40 U	0.82 U	0.042 U	0.84 J	0.52 J	2.3 J	1.1 J	2.4 J	3.0 J	3.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.054 U	40 J	130 J	0.90 J	0.28 U	0.32 U	62	4.3 J	0.96 J	0.063 U	0.072 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.098 U	2.9 J	7.8	0.14 J	0.11 J	0.33 J	4.6 J	0.45 J	0.23 J	0.36 J	0.31 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.035 U	1.8 J	5.3 J	0.083 U	0.086 U	0.0025 U	3.0 J	0.22 U	0.064 U	0.037 U	0.042 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.056 U	19 J	75	0.66 J	0.22 U	0.25 U	32	2.0 J	0.64 J	0.065 U	0.075 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.2 J	930 J	3600 J	2.6	3.5	0.77 J	1600 J	110	37	1.0 J	2.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.51 J	410 J	1400 J	1.6	1.2 J	0.36 J	630 J	39	13	0.71 J	1.1 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.11 J	28 J	95 J	0.55 J	0.42 J	0.32 J	63 J	3.4 J	0.66 J	0.16 J	0.14 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	96 J	29 J	47 J	49 J	81 J	54 J	170 J	68 J	120 J	150 J	220 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.24 J	90 J	360 J	1.2 J	0.65 J	0.60 J	160 J	11 J	1.6 J	0.38 J	0.41 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	35 J	9.5 J	13 J	20 J	30 J	19 J	37 J	21 J	33 J	39 J	47 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.060 U	94 J	320 J	2.6 J	0.79 J	0.66 J	160 J	9.8 J	2.3 J	0.066 U	0.079 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.4 J	3.8 J	9.5 J	2.8 J	8.7 J	6.3 J	10 J	5.0 J	7.4 J	8.1 J	7.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.1 J	2000 J	6700 J	13 J	7.9 J	1.4 J	3600 J	210 J	70 J	2.2 J	4.2 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.8 J	440 J	1600 J	3.1 J	4.4 J	5.2 J	690 J	45 J	18 J	5.0 J	5.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	1.2 J	520 J	1800 J	2.5 J	2.2 J	1.0 J	820 J	53 J	18 J	2.5 J	3.5 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.3 J	520 J	1800 J	2.5 J	2.2 J	1.1 J	820 J	53 J	18 J	2.5 J	3.5 J

Notes:
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J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
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TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
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Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB089 11215702-080721-BN-DUP-19-R 08/07/2021 (6-8) ft bgs Lab Duplicate	SJSB089 11215702-080721-BN-SJSB089(8-10) 08/07/2021 (8-10) ft bgs	SJSB089 11215702-080721-BN-SJSB089 (8-10)-R 08/07/2021 (8-10) ft bgs Lab Duplicate	SJSB089 11215702-080721-BN-SJSB089(10-12) 08/07/2021 (10-12) ft bgs	SJSB089 11215702-080721-BN-SJSB089 (10-12)-R 08/07/2021 (10-12) ft bgs Lab Duplicate	SJSB089 11215702-080721-BN-SJSB089(12-14) 08/07/2021 (12-14) ft bgs	SJSB089 11215702-080721-BN-SJSB089(14-16) 08/07/2021 (14-16) ft bgs	SJSB089 11215702-080721-BN-SJSB089(16-18) 08/07/2021 (16-18) ft bgs	SJSB090 11215702-080221-BN-SJSB090(0-2) 08/02/2021 (0-2) ft bgs	SJSB090 11215702-080221-BN-SJSB090(2-4) 08/02/2021 (2-4) ft bgs	SJSB090 11215702-080221-BN-SJSB090(4-6) 08/02/2021 (4-6) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.38 U	0.92 U	0.92 U	1.2 U	0.45 U	0.067 U	0.11 U	0.39 U	820	170 J-	11 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	940 J	770	740	390 J	210 J	66	940	25	5100	1600	850
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.49 U	1.6 J	1.4 U	1.9 J	0.56 U	0.13 U	0.069 U	0.041 U	2000	390 J-	20
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	48	27	32	14	8.1	2.5 J	40	0.94 U	360	83	54
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.36 U	0.51 J	0.54 U	0.64 J	0.36 U	0.056 U	0.085 U	0.053 U	650	130 J-	7.4
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.20 U	5.5 J	5.3 J	5.1 J	2.0 J	0.25 U	0.066 U	0.056 U	6800	1000	73
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.93 U	0.38 J	0.45 U	0.26 J	0.28 U	0.24 J	0.61 J	0.24 J	4.8 J	0.84 J	0.68 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.13 U	1.5 J	1.2 J	1.4 J	0.48 J	0.050 J	0.065 U	0.054 U	1800	240 J-	18
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.6 J	0.65 J	0.89 J	0.35 J	0.24 U	0.098 J	1.2 J	0.060 U	25	4.0 J	1.5 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.17 U	0.16 U	0.14 U	0.11 U	0.032 U	0.13 U	0.039 U	110 J	9.6	1.4 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	1.5 J	1.8 J	0.81 J	0.53 U	0.21 U	4.4 J	0.12 U	9.5 J	2.4 J	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.14 J	4.9 J	3.0 J	2.6 J	1.2 J	0.15 J	0.076 U	0.055 U	5000	410 J-	57
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.35 J	0.34 J	0.44 J	0.34 J	0.20 J	0.069 U	0.29 J	0.075 U	320	35	5.3 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.060 U	0.22 U	0.18 U	0.14 U	0.11 U	0.033 U	0.048 U	0.040 U	200	18	2.1 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.090 J	2.1 J	1.7 J	1.3 J	0.68 J	0.050 U	0.079 U	0.057 U	2600	230 J-	34
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	2.7	100	84	70 J	38 J	3.7	1.1 J	0.60 J	110000 J	12000 J	2000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.0 J	39	32	25 J	14 J	1.5	0.60 J	0.24 J	49000 J	5100 J	700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.30 J	2.6 J	2.4 J	3.1 J	0.98 J	0.13 J	0.085 U	0.053 U	3100 J	610 J	36 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	90 J	98 J	49 J	28 J	8.9 J	160 J	3.0 J	740 J	190 J	120 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	8.3 J	7.6 J	7.6 J	3.0 J	0.30 J	0.13 J	0.056 U	9800 J	1400 J	100 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	43 J	21 J	27 J	13 J	7.5 J	3.1 J	47 J	1.5 J	180 J	40 J	26 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.23 J	11 J	7.2 J	5.9 J	2.8 J	0.15 J	0.090 U	0.060 U	12000 J	1000 J	140 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.7 J	4.1 J	4.6 J	1.9 J	1.2 J	0.64 J	9.1 J	0.25 U	330 J	39 J	8.5 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	4.7 J	200 J	160 J	140 J	64 J	7.2 J	2.0 J	0.89 J	220000 J	25000 J	3600 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	5.3 J	45 J	37 J	29 J	15 J	2.1 J	7.4 J	0.60 J	56000 J	5800 J	780 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	3.1 J	52 J	43 J	34 J	19 J	1.0 J	2.3 J	0.33 J	62000 J	6600 J	930 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	3.1 J	52 J	43 J	34 J	19 J	2.0 J	2.3 J	0.40 J	62000 J	6600 J	930 J

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Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB090 11215702-080221-BN-SJSB090(6-8) 08/02/2021 (6-8) ft bgs	SJSB090 11215702-080221-BN-DUP-11 08/02/2021 (6-8) ft bgs Field Duplicate	SJSB090 11215702-080221-BN-SJSB090(8-10) 08/02/2021 (8-10) ft bgs	SJSB090 11215702-080221-BN-SJSB090 (8-10)-R 08/02/2021 (8-10) ft bgs Lab Duplicate	SJSB090 11215702-080221-BN-SJSB090(10-12) 08/02/2021 (10-12) ft bgs	SJSB090 11215702-080221-BN-SJSB090(12-14) 08/02/2021 (12-14) ft bgs	SJSB090 11215702-080221-BN-SJSB090(14-16) 08/02/2021 (14-16) ft bgs	SJSB090 11215702-080221-BN-SJSB090(16-18) 08/02/2021 (16-18) ft bgs	SJSB091 11215702-080321-BN-SJSB091(0-2) 08/03/2021 (0-2) ft bgs	SJSB091 11215702-080321-BN-SJSB091(2-4) 08/03/2021 (2-4) ft bgs	SJSB091 11215702-080321-BN-SJSB091(4-6) 08/03/2021 (4-6) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.67 U	0.67 U	3.3 U	5.0 J	0.67 U	1.8 U	0.67 U	0.88 U	3.3 U	0.67 U	0.67 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	250	280	630	490	1400	890	780	780	4400	770	340
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.22 U	0.057 U	7.8	12	0.23 J	1.9 J	0.45 J	0.12 U	0.50 J	0.21 J	0.21 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	12	28	28	59	36	31	31	130	32	10
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.062 U	2.8 J	4.2 J	0.049 U	0.83 J	0.050 U	0.14 U	0.14 U	0.045 U	0.044 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.88 J	0.25 J	31	48	0.54 J	4.8 J	0.61 J	0.13 U	1.1 J	0.51 J	0.35 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.55 J	0.33 J	0.49 J	0.40 U	0.76 J	0.55 J	0.57 J	0.84 J	1.5 J	0.58 J	0.33 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.21 U	0.11 J	8.2	13	0.14 J	1.1 J	0.19 J	0.14 U	0.39 J	0.19 J	0.12 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.39 J	0.44 J	0.75 J	0.68 J	1.3 J	0.81 J	0.72 J	0.89 J	3.0 J	0.91 J	0.28 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.11 J	0.66 J	0.89 J	0.14 J	0.17 J	0.10 J	0.10 J	0.19 J	0.080 J	0.080 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.75 J	1.5 J	1.3 J	3.2 J	1.8 J	1.8 J	2.8 J	5.6 J	2.1 J	0.57 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.71 J	0.19 J	29	42	0.51 J	0.86 J	0.28 J	0.17 U	1.1 J	0.56 J	0.31 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.38 U	0.089 U	1.7 J	2.8 J	0.31 J	0.22 J	0.075 U	0.23 U	0.26 U	0.31 J	0.11 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.048 U	1.0 J	1.5 J	0.033 U	0.092 J	0.027 U	0.096 U	0.076 U	0.040 J	0.065 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.27 U	0.16 J	15	21	0.19 J	0.39 J	0.18 J	0.17 U	0.50 J	0.23 J	0.23 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	12	4.9	620 J	1200 J	7.5	16	7.4	2.9	31	11	14
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.5	1.9	190 J	420 J	2.5	5.5	2.3	0.87 J	8.6	4.2	3.2
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.25 U	0.062 U	13 J	20 J	0.23 J	3.3 J	0.45 J	0.14 U	0.50 J	0.21 J	0.21 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36 J	47 J	73 J	71 J	190 J	110 J	120 J	120 J	300 J	83 J	38 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.88 J	0.47 J	45 J	72 J	0.83 J	6.5 J	0.90 J	0.11 U	1.7 J	0.82 J	0.62 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	7.1 J	13 J	16 J	16 J	48 J	26 J	28 J	35 J	51 J	21 J	11 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.71 J	0.35 J	70 J	99 J	0.92 J	2.0 J	0.79 J	0.19 U	2.8 J	2.1 J	0.75 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.38 U	1.3 J	3.7 J	4.7 J	7.3 J	4.1 J	3.0 J	4.3 J	5.0 J	4.5 J	1.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	23 J	8.0 J	1100 J	2500 J	14 J	29 J	14 J	4.2 J	58 J	25 J	32 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.5 J	2.8 J	210 J	470 J	8.6 J	8.9 J	5.5 J	4.5 J	12 J	9.5 J	5.4 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.1 J	2.9 J	260 J	560 J	5.3 J	9.1 J	4.1 J	2.2 J	16 J	6.7 J	5.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.4 J	2.9 J	260 J	560 J	5.3 J	9.1 J	4.1 J	2.3 J	16 J	6.7 J	5.2 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB091 11215702-080321-BN-SJSB091(6-8) 08/03/2021 (6-8) ft bgs	SJSB091 11215702-080321-BN-DUP-18 08/03/2021 (6-8) ft bgs Field Duplicate	SJSB091 11215702-080321-BN-SJSB091(8-10) 08/03/2021 (8-10) ft bgs	SJSB091 11215702-080321-BN-SJSB091(10-12) 08/03/2021 (10-12) ft bgs	SJSB091 11215702-080321-BN-SJSB091(12-14) 08/03/2021 (12-14) ft bgs	SJSB091 11215702-080321-BN-SJSB091(14-16) 08/03/2021 (14-16) ft bgs	SJSB091 11215702-080321-BN-SJSB091(16-18) 08/03/2021 (16-18) ft bgs	SJSB092 11215702-072521-BN-SJSB092(0-2) 07/25/2021 (0-2) ft bgs	SJSB092 11215702-072521-BN-SJSB092(2-4) 07/25/2021 (2-4) ft bgs	SJSB092 11215702-072521-BN-SJSB092(4-6) 07/25/2021 (4-6) ft bgs	SJSB092 11215702-072521-BN-SJSB092(6-8) 07/25/2021 (6-8) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	0.67 U	450	250	1.6 U	0.075 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	930	1700	1400	1500	1100	1200	1900	1800	1200	640	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.057 U	0.12 J	0.038 U	0.20 J	0.049 U	0.063 J	0.042 U	910	540	1.9 J	0.050 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	39	63	55	62	47	59	82	110	72 J	28	43
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.065 U	0.062 U	0.043 U	0.068 U	0.055 U	0.046 U	0.046 U	330	170	1.0 J	0.048 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.096 J	0.15 J	0.076 J	0.071 U	0.048 U	0.048 U	0.040 U	3300	1800	11	0.036 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.66 J	0.77 J	0.71 J	1.0 J	0.75 J	0.81 J	0.84 J	1.9 U	1.1 U	0.15 U	0.31 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.068 J	0.047 U	0.033 U	0.071 U	0.050 U	0.049 U	0.039 U	880	500	2.8 J	0.039 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	1.4 J	1.3 J	1.7 J	1.3 J	1.5 J	2.2 J	9.4 J	7.0 J	0.16 U	0.35 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 J	0.20 J	0.14 J	0.14 J	0.086 J	0.087 J	0.14 J	46 J	28 J	0.11 U	0.037 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	3.3 J	3.1 J	2.4 J	2.6 J	3.2 J	4.5 J	6.3 U	1.1 U	0.14 U	0.30 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.16 J	0.099 J	0.058 U	0.057 U	0.051 U	0.048 U	2200	1400 J	9.9	0.058 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.29 J	0.30 J	0.082 U	0.27 J	0.30 J	0.12 U	0.12 U	290	200	0.19 U	0.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.043 J	0.035 U	0.023 U	0.054 U	0.036 U	0.037 U	0.030 U	82 J	57 J	0.12 U	0.036 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.057 U	0.059 U	0.048 J	0.062 U	0.057 U	0.054 U	0.049 U	1500	1100	6.6 J	0.066 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	3.1	1.3 U	1.4 U	0.91 U	1.3 U	0.93 U	0.51 U	210000	110000	340	7.4
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.72 J	0.56 J	0.50 J	0.51 J	0.74 J	0.53 J	0.39 J	21000 J	16000 J	93	3.1
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.065 U	0.27 J	0.043 U	0.20 J	0.055 U	0.063 J	0.046 U	1500 J	820 J	3.6 J	0.083 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	210 J	190 J	190 J	130 J	150 J	210 J	260 J	170 J	94 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.35 J	0.34 J	0.24 J	0.14 J	0.086 J	0.087 J	0.14 J	4800 J	2700 J	14 J	0.077 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	54 J	51 J	50 J	36 J	45 J	58 J	37 J	35 J	24 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.11 J	0.16 J	0.15 J	0.089 J	0.080 J	0.063 J	0.049 U	5700 J	3800 J	24 J	0.066 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	7.3 J	10 J	8.5 J	9.5 J	9.2 J	11 J	13 J	290 J	200 J	1.9 U	2.9 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	4.3 J	2.5 J	2.6 J	1.6 J	2.9 J	1.9 J	1.3 J	160000 J	130000 J	670 J	13 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.4 J	7.4 J	6.2 J	9.0 J	7.3 J	8.6 J	9.2 J	23000 J	17000 J	93 J	3.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.5 J	2.6 J	2.0 J	2.4 J	2.3 J	2.0 J	2.6 J	43000 J	28000 J	130 J	4.6
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.5 J	2.7 J	2.1 J	2.4 J	2.4 J	2.2 J	2.7 J	43000 J	28000 J	130 J	4.8

Notes:
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J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB092	SJSB092	SJSB092	SJSB092	SJSB092	SJSB093	SJSB093	SJSB093	SJSB093	SJSB093	SJSB093
Sample Identification:		11215702-072521-BN-SJSB092(8-10)	11215702-072521-BN-SJSB092(10-12)	11215702-072521-BN-SJSB092(12-14)	11215702-072521-BN-SJSB092(14-16)	11215702-072521-BN-SJSB092(16-18)	11215702-082421-BN-SJSB093(0-2)	11215702-082421-BN-SJSB093(2-4)	11215702-082421-BN-SJSB093(4-6)	11215702-082421-BN-SJSB093(6-8)	11215702-082421-BN-SJSB093(8-10)	11215702-082421-BN-SJSB093(10-12)
Sample Date:		07/25/2021	07/25/2021	07/25/2021	07/25/2021	07/25/2021	08/24/2021	08/24/2021	08/24/2021	08/24/2021	08/24/2021	08/24/2021
Sample Depth:		(8-10) ft bgs	(10-12) ft bgs	(12-14) ft bgs	(14-16) ft bgs	(16-18) ft bgs	(0-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs	(6-8) ft bgs	(8-10) ft bgs	(10-12) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.9 J	0.11 U	110	0.55 U	0.067 U	650 J	580 J	7.9 U	0.051 U	30 J	9.2 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	870	1100	1300	340	450	920 J	680 J	460	420	810	480
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.66 U	0.87 U	200	0.40 U	0.44 U	1500	1200	16 J	0.62 U	63 J	19 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	46	52	55	12	20	110 J	99 J	22 J	22 J	51 J	31 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.66 J	0.046 U	69	0.20 U	0.047 U	520 J	350 J	5.7 J	0.36 U	22 J	8.7 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.4 J	2.0 J	660	0.78 J	0.66 J	3900	3000	53 J	0.53 U	180	86
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.20 U	0.16 U	0.86 U	0.35 U	0.33 U	1.2 U	0.29 U	2.1 U	0.22 U	0.056 U	1.3 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.47 J	0.51 J	180	0.29 J	0.029 U	1000	760	13 J	0.040 U	46 J	22 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.23 U	0.17 U	0.98 U	0.32 J	0.61 J	33 J	10 J	0.098 U	0.22 U	2.2 J	2.4 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.053 U	0.38 U	11 J	0.18 U	0.41 U	5.7 U	2.4 U	4.6 U	0.75 U	0.20 U	0.23 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	2.6 J	0.85 U	0.77 J	1.6 J	13 J	11 J	2.5 J	0.22 U	2.1 J	2.3 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.9 J	1.4 J	550	0.54 J	0.063 U	2900	2500	43 J	0.084 U	140	91
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.20 U	0.22 U	82	0.24 J	0.11 U	390 J	430 J	6.0 J	0.19 U	20 J	13 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.055 U	0.084 U	22 J	0.12 J	0.028 U	190 J	160 J	4.0 U	0.035 U	8.0 J	5.6 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.92 J	0.97 J	420	0.42 J	0.065 U	2900	2400	40 J	0.30 U	120	82
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	70	71	33000	27	20	120000 J	110000 J	1600	0.11 U	5000	4200
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	18	17 J	6800 J	7.2	4.5	27000	29000	450	0.17 U	1300	1000
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.3 J	0.87 J	310 J	0.68 J	0.44 J	2300 J	1700 J	25 J	0.97 J	98 J	33 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	150 J	150 J	38 J	64 J	240 J	180 J	67 J	87 J	140 J	91 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.9 J	2.9 J	990 J	1.4 J	1.1 J	5600 J	4300 J	81 J	1.5 J	260 J	130 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	42 J	39 J	26 J	8.6 J	16 J	120 J	86 J	19 J	31 J	36 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	3.6 J	2.4 J	1500 J	1.3 J	0.24 U	8600 J	7300 J	120 J	0.84 J	400 J	270 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.1 U	3.3 U	82 J	1.3 J	1.7 U	620 J	490 J	9.0 J	5.1 J	36 J	33 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	130 J	150 J	50000 J	47 J	33 J	260000 J	240000 J	3700 J	1.7 J	11000 J	9500 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	18 J	17 J	7400 J	8.3 J	4.5 J	30000 J	31000 J	500 J	1.3 J	1400 J	1100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	27 J	26 J	10000 J	11 J	7.1 J	41000 J	42000 J	640 J	0.35 J	1900 J	1500 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	27 J	26 J	10000 J	11 J	7.2 J	41000 J	42000 J	640 J	0.68 J	1900 J	1500 J

Notes:
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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB093 11215702-082421-BN-SJSB093(12-14) 08/24/2021 (12-14) ft bgs	SJSB093 11215702-082421-BN-SJSB093(14-16) 08/24/2021 (14-16) ft bgs	SJSB093 11215702-082421-BN-SJSB093(16-18) 08/24/2021 (16-18) ft bgs	SJSB094 11215702-072621-BN-SJSB094(0-2) 07/26/2021 (0-2) ft bgs	SJSB094 11215702-072621-BN-SJSB094(2-4) 07/26/2021 (2-4) ft bgs	SJSB094 11215702-072621-BN-SJSB094(4-6) 07/26/2021 (4-6) ft bgs	SJSB094 11215702-072621-BN-SJSB094(6-8) 07/26/2021 (6-8) ft bgs	SJSB094 11215702-072621-BN-SJSB094 (6-8)-R 07/26/2021 (6-8) ft bgs Lab Duplicate	SJSB094 11215702-072621-BN-DUP-8 07/26/2021 (6-8) ft bgs Field Duplicate	SJSB094 11215702-072621-BN-DUP-8-R 07/26/2021 (6-8) ft bgs Lab Duplicate	SJSB094 11215702-072621-BN-SJSB094(8-10) 07/26/2021 (8-10) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	4.7 U	1.1 U	1.2 U	460 J	530	570	180 J	130	12 J	9.5 J	56 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	340	170	220	720 J	750	1700	680 J	1200 J	1200	1100	620
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	7.7 J	0.72 U	0.60 U	1100	1100	1300	290 J	300	19 J	21	110
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	19 J	12 J	13 J	68 J	70 J	140	42 J	61	48	42	32 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	3.9 U	0.48 U	0.41 U	280	360	360	110	100	5.9 J	5.9 J	39
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	35 J	1.2 U	0.81 U	3200	3600	4400	1300 J	1100	62 J	61	430
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 U	1.2 U	0.70 U	3.6 J	0.97 U	1.5 UJ	1.2 U	3.5 U	1.0 J	0.65 U	0.45 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	8.8 J	0.50 U	0.78 U	740	960	1100	330 J	230	16 J	16	130
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.69 U	1.4 U	1.0 U	7.0 J	0.93 U	9.1 J	1.2 U	3.9 J	1.2 J	1.1 J	0.52 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 U	0.55 U	0.87 U	42 J	57 J	45 J	16 J	16 J	0.99 J	1.1 J	5.5 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.2 U	1.6 U	1.5 U	5.6 J	0.88 U	7.0 J	1.1 U	4.1 U	2.7 J	2.5 J	0.45 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	30 J	1.5 U	1.4 U	2200	2700	2900	920 J	740	51 J	50	320
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	4.4 U	2.8 U	0.96 U	290	370	340	100 J	110	7.1	6.3 J	41
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.2 U	0.49 U	0.61 U	100	130	140	32 J	27 J	2.6 J	1.9 J	13 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	26 J	1.4 U	0.079 U	1600	2000	2000	700 J	700	47 J	36	240
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1100	45	10 J	110000 J	140000 J	130000 J	47000 J	45000 J	2300 J	2400 J	16000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	300	10 J	2.4 J	24000 J	23000 J	26000 J	10000 J	12000 J	570 J	720 J	3700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	14 J	1.4 J	1.2 J	1500 J	1700 J	1900 J	480 J	470 J	30 J	31 J	180 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	77 J	47 J	58 J	130 J	140 J	320 J	89 J	150 J	160 J	140 J	87 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	52 J	2.7 J	3.1 J	4600 J	5400 J	6500 J	1900 J	1500 J	92 J	91 J	650 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	27 J	28 J	48 J	17 J	37 J	9.9 J	43 J	42 J	37 J	16 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	83 J	4.5 J	1.4 J	6200 J	7500 J	7800 J	2600 J	2300 J	150 J	140 J	860 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	15 J	13 J	10 J	290 J	370 J	340 J	100 J	120 J	12 J	12 J	41 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2300 J	120 J	18 J	210000 J	210000 J	220000 J	87000 J	80000 J	4400 J	5000 J	26000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	340 J	16 J	7.8 J	26000 J	26000 J	28000 J	11000 J	14000 J	620 J	790 J	4100 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	420 J	15 J	3.6 J	36000 J	39000 J	41000 J	15000 J	17000 J	830 J	990 J	5500 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	430 J	17 J	4.4 J	36000 J	39000 J	41000 J	15000 J	17000 J	830 J	990 J	5500 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB094 11215702-072621-BN-SJSB094(10-12) 07/26/2021 (10-12) ft bgs	SJSB094 11215702-072621-BN-SJSB094(12-14) 07/26/2021 (12-14) ft bgs	SJSB094 11215702-072621-BN-SJSB094(14-16) 07/26/2021 (14-16) ft bgs	SJSB094 11215702-072621-BN-SJSB094(16-18) 07/26/2021 (16-18) ft bgs	SJSB095 11215702-072821-BN-SJSB095(0-2) 07/28/2021 (0-2) ft bgs	SJSB095 11215702-072821-BN-SJSB095(2-4) 07/28/2021 (2-4) ft bgs	SJSB095 11215702-072821-BN-SJSB095(4-6) 07/28/2021 (4-6) ft bgs	SJSB095 11215702-072821-BN-SJSB095(6-8) 07/28/2021 (6-8) ft bgs	SJSB095 11215702-072821-BN-DUP-10 07/28/2021 (6-8) ft bgs Field Duplicate	SJSB095 11215702-072821-BN-SJSB095(8-10) 07/28/2021 (8-10) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (8-10)-R 07/28/2021 (8-10) ft bgs Lab Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.17 U	0.15 U	0.11 U	0.11 U	340 J	18 J	0.17 U	0.12 U	0.61 J	25	13
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	840	1400	1300	45	1400	1700	240	190	240	1300 J	550 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.1 U	0.086 U	0.079 U	0.33 U	790	4.4 J	0.26 U	0.060 U	0.34 U	33	24
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	65	60	2.6 J	88 J	60	12	10 J	11	38 J	18 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.091 U	0.080 U	0.077 U	0.058 U	250	2.0 J	0.068 U	0.057 U	0.054 U	10	6.5
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.7 J	0.047 U	0.046 U	0.029 U	2800	7.0	0.045 U	0.029 U	1.2 J	100	62
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.27 U	0.37 U	0.91 J	0.097 U	1.2 U	0.33 U	0.13 U	0.080 U	0.14 U	0.71 J	0.36 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.62 J	0.047 U	0.045 U	0.030 U	740	1.6 J	0.044 U	0.027 U	0.42 J	28	17
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.31 U	0.41 U	1.6 J	0.11 U	1.3 U	0.40 U	0.15 U	0.091 U	0.15 U	1.3 J	0.63 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.047 U	0.046 U	0.029 U	40 J	0.36 U	0.045 U	0.026 U	0.040 U	1.3 J	0.98 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.4 J	4.8 J	4.4 J	0.096 U	4.8 J	0.33 U	0.74 J	0.50 J	1.0 J	1.7 J	0.99 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.7 J	0.066 U	0.063 U	0.047 U	2100	0.54 U	0.078 U	0.044 U	0.55 J	74	50
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.32 U	0.24 U	0.23 U	0.11 U	290	0.50 U	0.17 U	0.099 U	0.13 U	9.3	6.3
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.11 U	0.048 U	0.046 U	0.028 U	88 J	0.36 U	0.041 U	0.027 U	0.038 U	3.6 J	1.9 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.3 J	0.068 U	0.069 U	0.047 U	1700	0.57 U	0.085 U	0.051 U	0.48 J	55	37
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	83	4.3 U	2.4 U	6.4 U	110000 J	140	11 U	5.5 UJ	27 J	3500 J	2400 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	22	0.13 U	1.3 J	1.4 J	23000 J	42	0.16 U	1.7 J	6.3 J	810 J	710 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.086 U	0.23 U	0.33 J	1200 J	8.3 J	0.26 J	0.060 U	0.34 J	50 J	35 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	190 J	190 J	8.1 J	200 J	150 J	45 J	38 J	44 J	100 J	58 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	0.074 U	0.11 U	0.036 U	4100 J	8.6 J	0.078 U	0.036 U	1.6 J	160 J	92 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	32 J	52 J	50 J	2.0 J	32 J	18 J	9.1 J	8.9 J	11 J	20 J	14 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.0 J	0.068 U	0.069 U	0.14 U	6200 J	2.6 J	0.27 U	0.094 U	1.0 J	190 J	130 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.2 J	8.8 J	8.4 J	0.26 U	290 J	1.3 U	1.2 U	0.48 U	0.90 J	10 J	7.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	160 J	8.1 J	3.0 J	9.8 J	200000 J	240 J	19 J	8.9 J	49 J	6400 J	4900 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	22 J	1.1 J	4.1 J	1.4 J	25000 J	42 J	0.45 U	1.7 J	6.3 J	880 J	780 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	32 J	1.6 J	3.0 J	1.4 J	35000 J	58 J	0.27 J	1.9 J	9.6 J	1200 J	980 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	32 J	2.0 J	3.2 J	1.9 J	35000 J	59 J	1.0 J	2.3 J	9.7 J	1200 J	980 J

Notes:
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- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB095 11215702-072821-BN-SJSB095(10-12) 07/28/2021 (10-12) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (10-12)-R 07/28/2021 (10-12) ft bgs Lab Duplicate	SJSB095 11215702-072821-BN-SJSB095(12-14) 07/28/2021 (12-14) ft bgs	SJSB095 11215702-072821-BN-SJSB095(14-16) 07/28/2021 (14-16) ft bgs	SJSB095 11215702-072821-BN-SJSB095 (14-16)-R 07/28/2021 (14-16) ft bgs Lab Duplicate	SJSB095 11215702-072821-BN-SJSB095(16-18) 07/28/2021 (16-18) ft bgs	SJSB096 11215702-072721-BN-SJSB096(0-2) 07/27/2021 (0-2) ft bgs	SJSB096 11215702-072721-BN-SJSB096(2-4) 07/27/2021 (2-4) ft bgs	SJSB096 11215702-072721-BN-SJSB096(4-6) 07/27/2021 (4-6) ft bgs	SJSB096 11215702-072721-BN-SJSB096(6-8) 07/27/2021 (6-8) ft bgs	SJSB096 11215702-072721-BN-DUP-9 07/27/2021 (6-8) ft bgs Field Duplicate
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.10 U	0.92 U	0.12 U	0.70 J	1.1 U	0.12 U	700	290	3.8 J	0.51 J	0.13 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	200 J	500 J	130	170 J	400 J	260	1100	610	950	980	820
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.62 U	0.52 U	0.29 U	0.66 U	1.6 U	0.28 U	1500	650	7.6	0.18 J	0.071 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	11	19	6.5	7.7	17	15	130	43 J	36	39	34
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.35 J	0.26 U	0.043 U	0.28 J	0.51 U	0.061 U	450	200	2.6 J	0.041 U	0.072 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.8 J	0.69 J	0.032 U	2.1 J	4.0 J	0.019 U	4400	2000	25	0.74 J	0.29 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.097 U	0.34 U	0.057 U	0.33 J	0.39 U	0.28 U	5.9 J	2.1 J	0.26 U	0.59 J	0.23 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 J	0.30 J	0.032 U	0.64 J	1.3 J	0.018 U	1200	500	6.4 J	0.25 J	0.033 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.53 J	0.060 U	0.20 J	0.38 J	0.29 U	13	4.0 J	0.27 U	0.81 J	0.82 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.17 J	0.15 U	0.030 U	0.17 J	0.15 U	0.018 U	89	23 J	0.26 U	0.12 J	0.034 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 J	1.5 J	0.054 U	0.78 J	1.4 J	0.26 U	10	2.6 J	2.1 J	2.9 J	0.23 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.9 J	0.58 J	0.071 U	2.7 J	3.2 J	0.052 U	3500	1300	18	0.86 J	0.042 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.14 U	0.22 J	0.10 U	0.43 J	0.47 J	0.15 U	550	130	2.6 J	0.29 J	0.15 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 J	0.089 J	0.029 U	0.13 J	0.16 J	0.017 U	150	47 J	0.73 J	0.043 J	0.032 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2.1 J	0.41 J	0.078 U	2.7 J	2.2 J	0.056 U	3200	930	13	0.35 J	0.041 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	150 J	27 J	17	170	150	3.6 U	250000 J	61000 J	910 J	8.8	8.6
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	40 J	7.0 J	4.1	35	38	0.13 U	60000 J	15000 J	210	2.4	2.5
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.82 J	0.29 J	1.1 J	2.5 J	0.28 J	2200 J	980 J	12 J	0.18 J	0.072 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	44 J	78 J	25 J	32 J	72 J	66 J	230 J	88 J	120 J	150 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	5.0 J	1.2 J	0.075 U	3.3 J	5.6 J	0.052 U	6200 J	2900 J	32 J	1.3 J	0.29 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	13 J	18 J	6.2 J	9.3 J	18 J	17 J	99 J	27 J	25 J	38 J	30 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	7.0 J	1.2 J	0.078 U	7.6 J	8.3 J	0.056 U	9300 J	3400 J	48 J	1.9 J	0.057 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.42 U	2.9 J	0.69 U	1.5 J	3.6 J	5.9 J	590 J	150 J	5.7 J	5.9 J	5.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	300 J	48 J	25 J	300 J	280 J	6.1 J	390000 J	110000 J	1500 J	15 J	14 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	40 J	9.3 J	4.1 J	40 J	43 J	1.2 J	70000 J	16000 J	230 J	7.9 J	4.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	57 J	11 J	5.9	54 J	55 J	0.23	87000 J	22000 J	310 J	4.9 J	4.1 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	57 J	11 J	6.0	54 J	55 J	0.60	87000 J	22000 J	310 J	4.9 J	4.2 J

Notes:
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J- - Estimated concentration, result may be biased low
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TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth:	Units	SJSB096 11215702-072721-BN-SJSB096(8-10) 07/27/2021 (8-10) ft bgs	SJSB096 11215702-072721-BN-SJSB096 (8-10)-R 07/27/2021 (8-10) ft bgs Lab Duplicate	SJSB096 11215702-072721-BN-SJSB096(10-12) 07/27/2021 (10-12) ft bgs	SJSB096 11215702-072721-BN-SJSB096 (10-12)-R 07/27/2021 (10-12) ft bgs Lab Duplicate	SJSB096 11215702-072721-BN-SJSB096(12-14) 07/27/2021 (12-14) ft bgs	SJSB096 11215702-072721-BN-SJSB096(14-16) 07/27/2021 (14-16) ft bgs	SJSB096 11215702-072721-BN-SJSB096(16-18) 07/27/2021 (16-18) ft bgs	SJSB097 11215702-082221-BN-SJSB097(0-2) 08/22/2021 (0-2) ft bgs	SJSB097 11215702-082221-BN-SJSB097(2-4) 08/22/2021 (2-4) ft bgs	SJSB097 11215702-082221-BN-SJSB097(4-6) 08/22/2021 (4-6) ft bgs	SJSB097 11215702-082221-BN-SJSB097(6-8) 08/22/2021 (6-8) ft bgs
Parameters												
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	37	63	0.74 J	0.66 U	0.095 U	0.74 J	0.60 J	58 J	0.71 U	0.76 U	0.98 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1000	610	1200	940	460	360	600	2500	350	430	320
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	68 J	160 J	1.4 J	1.2 U	0.050 U	0.039 U	0.40 J	9.0 J	0.021 U	0.57 U	0.31 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	41	31	51	40	24	18	27	73 J	23 J	25 J	17 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	22 J	60 J	0.39 J	0.45 U	0.048 U	0.036 U	0.059 U	0.84 U	0.025 U	0.039 U	0.27 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	200 J	630 J	4.9 J	3.7 J	0.038 U	0.024 U	0.91 J	2.3 U	0.024 U	0.42 U	0.31 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.79 J	1.1 U	0.49 J	0.68 U	0.19 U	0.29 J	0.29 U	1.7 U	0.52 U	0.59 U	0.48 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	51 J	140 J	1.2 J	1.1 J	0.038 U	0.025 U	0.036 U	1.0 U	0.24 U	0.44 U	0.23 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.8 J	1.3 J	1.1 J	0.21 U	0.54 J	0.33 U	2.0 J	0.048 U	0.093 U	1.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	8.5	0.25 J	0.17 U	0.037 U	0.024 U	0.036 U	0.79 U	0.21 U	0.53 U	0.69 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	1.3 U	3.3 J	2.9 J	2.3 J	1.6 J	2.5 J	2.7 U	1.2 U	1.6 J	1.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	150 J	410 J	3.6 J	3.7 J	0.26 J	0.037 U	0.53 J	1.5 J	0.51 J	0.17 U	0.65 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	24 J	62 J	0.16 U	0.73 J	0.10 U	0.11 U	0.15 U	0.095 U	0.15 U	0.12 U	0.10 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	6.5 J	15	0.066 U	0.14 J	0.038 U	0.024 U	0.034 U	0.86 U	0.20 U	0.57 U	0.32 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	120 J	380 J	2.6 J	2.7 J	0.16 J	0.040 U	0.12 U	1.6 U	0.52 U	0.58 U	0.038 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	8000 J	25000 J	190	230	11	3.9	32	26	0.067 U	3.8 J	2.3 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1900 J	5700 J	45	58	3.3	0.95 J	8.7	0.062 U	0.54 J	1.1 U	0.95 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	100 J	260 J	1.8 J	2.0 J	0.050 U	0.039 U	0.40 J	20 J	0.42 J	1.3 J	0.71 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	140 J	95 J	160 J	140 J	100 J	71 J	130 J	230 J	94 J	110 J	66 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	290 J	880 J	6.4 J	6.0 J	0.038 U	0.027 U	0.91 J	9.7 J	0.65 J	2.2 J	1.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	32 J	41 J	42 J	28 J	24 J	42 J	47 J	28 J	31 J	22 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	400 J	1200 J	8.5 J	9.8 J	0.43 J	0.040 U	0.53 J	9.1 J	1.5 J	1.1 J	1.3 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	24 J	75 J	7.7 J	8.4 J	3.9 J	4.8 J	9.2 J	7.4 J	6.1 J	11 J	4.0 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	14000 J	44000 J	360 J	440 J	17 J	5.6 J	60 J	52 J	0.94 J	4.3 J	2.9 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	2100 J	6300 J	45 J	68 J	3.3 J	2.2 J	8.7 J	3.5 J	3.5 J	1.1 J	2.3 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2800 J	8500 J	67 J	84 J	5.1 J	1.9 J	13 J	4.4 J	0.89 J	0.92 J	0.78 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2800 J	8500 J	67 J	84 J	5.2 J	1.9 J	13 J	5.2 J	1.2 J	1.8 J	1.4 J

Notes:
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- J - Estimated concentration
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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB097 11215702-082221-BN-DUP-20 08/22/2021 (6-8) ft bgs Field Duplicate	SJSB097 11215702-082221-BN-SJSB097(8-10) 08/22/2021 (8-10) ft bgs	SJSB097 11215702-082221-BN-SJSB097(10-12) 08/22/2021 (10-12) ft bgs	SJSB097 11215702-082221-BN-SJSB097(12-14) 08/22/2021 (12-14) ft bgs	SJSB097 11215702-082221-BN-SJSB097(14-16) 08/22/2021 (14-16) ft bgs	SJSB098 11215702-082021-BN-SJSB098(0-2) 08/20/2021 (0-2) ft bgs	SJSB098 11215702-082021-BN-SJSB098(2-4) 08/20/2021 (2-4) ft bgs	SJSB098 11215702-082021-BN-SJSB098(4-6) 08/20/2021 (4-6) ft bgs	SJSB098 11215702-082021-BN-SJSB098(6-8) 08/20/2021 (6-8) ft bgs	SJSB098 11215702-082021-BN-SJSB098(8-10) 08/20/2021 (8-10) ft bgs	SJSB098 11215702-082021-BN-SJSB098(10-12) 08/20/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.3 J	1.0 U	0.089 U	0.089 U	0.089 U	39 J	73 J	120 J	57 J	130 J	82
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	420	66 J	22	26	26	1800	1800	3000	1900	1700	1600
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.5 J	0.62 U	0.082 U	0.064 U	0.064 U	8.3 J	31 J	38 J	13 J	250	150
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	24 J	3.6 U	1.1 J	1.6 J	1.7 J	58 J	71 J	120	77	95	71
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.082 U	0.29 U	0.079 U	0.047 U	0.0030 U	1.3 U	9.9 J	12 J	3.0 J	80	48
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.86 U	0.69 U	0.064 U	0.067 U	0.063 U	8.5 J	120	130	24 J	790	450
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.17 U	0.76 U	0.055 J	0.10 J	0.069 J	0.76 U	1.6 J	0.18 U	2.2 U	2.0 U	0.94 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.84 U	0.92 U	0.056 U	0.050 U	0.047 U	2.3 J	29 J	31 J	6.5 J	200	110
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.18 U	0.74 J	0.098 U	0.16 J	0.12 U	2.5 J	6.3 J	3.7 J	2.7 J	7.8 J	4.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.52 J	0.94 U	0.016 U	0.083 U	0.083 U	1.5 U	15 J	13 J	0.10 U	0.62 U	39
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.52 U	0.96 J	0.21 U	0.25 U	0.17 U	2.7 U	3.8 J	5.0 J	1.6 J	3.7 J	1.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	1.2 J	0.10 U	0.14 U	0.074 U	4.7 J	120	130	16 J	620	340
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.14 U	0.15 U	0.15 J	0.16 J	0.16 J	2.1 J	14 J	16 J	2.8 J	76	48
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.63 U	0.44 U	0.014 U	0.085 U	0.085 U	1.1 U	9.2 J	8.6 U	1.5 U	40 J	23
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.68 U	0.096 U	0.096 U	0.096 U	4.5 J	100	110	12 J	530	280
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1.4 J	9.3 J	1.2 J	1.1	0.11 U	180	5500	4500	360	21000	10000
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.095 U	2.1 U	0.44 J	1.0 J	0.050 J	47	1300	1300	110	7100 J	2700 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	1.1 J	0.22 J	0.086 J	0.12 J	18 J	59 J	72 J	28 J	430 J	260 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	93 J	11 J	3.9 J	6.5 J	5.4 J	190 J	240 J	370 J	77 J	230 J	190 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	3.2 J	0.12 J	0.20 J	0.23 J	20 J	200 J	210 J	42 J	1100 J	690 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	25 J	7.3 J	1.9 J	2.0 J	2.1 J	34 J	81 J	93 J	50 J	50 J	38 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.8 J	3.0 J	0.24 J	0.23 J	0.36 J	19 J	350 J	370 J	50 J	1800 J	1200 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	3.0 J	2.4 J	0.41 J	0.34 J	0.86 J	9.7 J	21 J	46 J	13 J	96 J	56 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	2.4 J	14 J	1.8 J	8.0 J	0.11 J	360 J	10000 J	10000 J	480 J	46000 J	34000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.4 J	3.7 J	0.81 J	1.1 J	0.32 J	51 J	1400 J	1500 J	130 J	7900 J	7300 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.97 J	1.2 J	0.73 J	1.3 J	0.24 J	71 J	1900 J	1800 J	160 J	9600 J	3900 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.3 J	2.6 J	0.77 J	1.4 J	0.29 J	71 J	1900 J	1800 J	160 J	9600 J	3900 J

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- ft bgs - Feet below ground surface
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Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB098 11215702-082021-BN-SJSB098(12-14) 08/20/2021 (12-14) ft bgs	SJSB098 11215702-082021-BN-SJSB098(14-16) 08/20/2021 (14-16) ft bgs	SJSB098 11215702-082021-BN-SJSB098(16-18) 08/20/2021 (16-18) ft bgs	SJSB099 11215702-072421-SS-SJSB099(0-2) 07/24/2021 (0-2) ft bgs	SJSB099 11215702-072421-SS-SJSB099(2-4) 07/24/2021 (2-4) ft bgs	SJSB099 11215702-072421-SS-SJSB099(4-6) 07/24/2021 (4-6) ft bgs	SJSB099 11215702-072421-SS-SJSB099(6-8) 07/24/2021 (6-8) ft bgs	SJSB099 11215702-072421-SS-SJSB099(8-10) 07/24/2021 (8-10) ft bgs	SJSB099 11215702-072421-SS-SJSB099(10-12) 07/24/2021 (10-12) ft bgs	SJSB099 11215702-072421-SS-SJSB099 (10-12)-R 07/25/2021 (10-12) ft bgs Lab Duplicate	SJSB099 11215702-072421-SS-SJSB099(12-14) 07/24/2021 (12-14) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	9.8 J	0.39 U	0.22 U	1700	1300 J+	2.9 J	0.53 J	0.063 U	5.4 J	4.3 U	0.094 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	610	610	19	11000	11000	160	110	120	440	360	220
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	19	0.38 U	0.14 U	2800	2100	3.1 J	0.45 J	0.61 J	6.5 J	6.1 J	0.057 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	36	37	1.2 J	670	640	6.3	3.4 J	4.8 J	28	22	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	6.5 J	0.20 U	0.057 U	790	620	1.0 J	0.055 U	0.20 J	2.5 J	2.5 J	0.055 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	61	1.3 J	0.051 U	6600	6000	11	1.2 J	1.6 J	21	22	0.021 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.83 J	0.60 J	0.044 U	6.3 J	8.2 J	0.30 J	0.32 J	0.058 U	0.52 J	0.73 U	0.31 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	15	0.43 J	0.064 U	1500	1700	2.9 J	0.31 J	0.43 J	5.8 J	4.9 J	0.022 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	1.1 J	0.088 U	49 J	41 J	0.41 J	0.069 U	0.068 U	1.1 J	0.91 J	0.51 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.051 U	0.15 U	0.082 U	84 J	100 J	0.071 U	0.028 U	0.049 U	0.52 J	0.51 J	0.30 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.3 J	2.2 J	0.099 U	12 J	8.3 J	0.067 U	0.23 J	0.058 U	1.8 J	1.7 U	0.82 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	48	0.93 J	0.11 U	4000	4300	9.4	1.0 J	1.2 J	13	12	0.26 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.4 J	0.47 J	0.015 U	390	430	1.0 J	0.068 U	0.064 U	0.16 U	1.4 J	0.092 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.1 J	0.16 U	0.064 U	170	220	0.27 J	0.028 U	0.046 U	0.81 J	0.63 J	0.021 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	40	0.53 U	0.073 U	2500	2700	5.5 J	0.51 J	0.71 J	8.0	8.9	0.037 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	1600	20	0.44 J	160000 J	120000 J	290	27	34	390	480	2.8 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	490	6.8	0.10 U	35000 J	40000 J	94	10	11	130	150	1.3 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	31 J	0.93 J	0.29 J	4500 J	3600 J	5.4 J	0.74 J	1.0 J	11 J	11 J	0.057 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	150 J	160 J	4.0 J	1500 J	1400 J	22 J	13 J	19 J	94 J	74 J	41 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	87 J	2.2 J	0.31 J	9400 J	9100 J	16 J	1.5 J	2.0 J	32 J	31 J	0.30 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	54 J	48 J	1.6 J	190 J	180 J	4.5 J	2.9 J	3.9 J	28 J	21 J	13 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	130 J	2.5 J	0.40 J	10000 J	11000 J	23 J	2.0 J	2.3 J	34 J	34 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	19 J	7.0 J	0.86 J	390 J	430 J	1.0 J	0.068 U	0.064 U	0.16 U	4.8 J	0.86 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	3300 J	52 J	0.99 J	250000 J	280000 J	590 J	59 J	70 J	830 J	870 J	4.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	540 J	14 J	0.20 J	38000 J	43000 J	100 J	10 J	11 J	140 J	170 J	1.3 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	680 J	10 J	0.062 J	53000 J	54000 J	130 J	13 J	15 J	180 J	210 J	1.7 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	680 J	11 J	0.16 J	53000 J	54000 J	130 J	13 J	15 J	180 J	210 J	1.9 J

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Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB099 11215702-072421-SS-SJSB099(14-16) 07/24/2021 (14-16) ft bgs	SJSB099 11215702-072421-SS-SJSB099(16-18) 07/24/2021 (16-18) ft bgs	SJSB099 11215702-072421-DUP-6 07/24/2021 (16-18) ft bgs Field Duplicate	SJSB100 11215702-082321-BN-SJSB100(0-2) 08/23/2021 (0-2) ft bgs	SJSB100 11215702-082321-BN-SJSB100(2-4) 08/23/2021 (2-4) ft bgs	SJSB100 11215702-082321-BN-SJSB100(4-6) 08/23/2021 (4-6) ft bgs	SJSB100 11215702-082321-BN-SJSB100(6-8) 08/23/2021 (6-8) ft bgs	SJSB100 11215702-082321-BN-SJSB100(8-10) 08/23/2021 (8-10) ft bgs	SJSB100 11215702-082321-BN-SJSB100(10-12) 08/23/2021 (10-12) ft bgs	SJSB100 11215702-082321-BN-SJSB100(12-14) 08/23/2021 (12-14) ft bgs	SJSB100 11215702-082321-BN-SJSB100(14-16) 08/23/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1.0 J	0.59 J	1.1 J	170 J	2.9 J	4.2 U	0.82 U	2.2 U	0.16 U	0.092 U	0.16 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	350	280	360	4600	380	220	340	200	52	15	49
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.90 J	0.50 J	0.90 J	23 J	0.83 J	1.3 U	1.6 U	0.61 U	0.22 U	0.14 U	0.24 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	17	13	17	170	18 J	15 J	25 J	8.8 J	2.8 J	1.1 J	2.9 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.24 J	0.15 J	0.058 U	5.1 J	0.50 J	0.63 U	0.036 U	0.61 U	0.12 U	0.052 U	0.073 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.5 J	0.76 J	1.4 J	15 J	0.82 J	1.7 U	1.7 U	1.4 U	0.26 U	0.14 U	0.29 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.14 U	0.48 J	5.0 J	0.67 J	0.84 U	0.051 U	0.48 U	0.28 J	0.18 J	0.14 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	0.30 J	0.54 J	7.9 J	0.63 J	0.41 U	1.3 U	0.48 U	0.28 J	0.22 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.12 U	0.15 U	0.50 J	6.3 J	0.69 J	1.2 J	1.3 J	0.76 J	0.23 J	0.17 J	0.18 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.050 U	0.032 U	0.045 U	5.0 J	0.44 J	1.2 U	0.055 U	0.43 U	0.13 U	0.11 U	0.098 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.3 J	0.72 J	1.3 J	8.6 J	1.3 J	2.2 J	0.052 U	1.3 J	0.43 J	0.21 U	0.21 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.8 J	0.47 J	1.1 J	12 J	1.2 J	1.5 J	0.082 U	0.15 U	0.31 U	0.22 U	0.28 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.11 U	0.089 U	0.11 U	5.7 J	0.64 J	1.3 J	0.13 U	1.2 J	0.32 J	0.29 J	0.23 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.050 U	0.035 U	0.044 U	4.4 J	0.13 J	0.45 U	0.65 U	0.64 U	0.14 U	0.18 U	0.085 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	0.36 J	0.67 J	10 J	1.1 J	1.2 U	0.066 U	0.90 U	0.26 U	0.25 U	0.012 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	55	14	27	230	7.3 J	15	0.076 U	3.4 J	0.33 U	0.28 U	0.54 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	19	5.0	10	66	1.2 J	5.4 J	0.10 U	0.14 U	0.0048 U	0.13 J	0.13 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.1 J	0.65 J	1.3 J	52 J	2.1 J	3.1 J	1.6 J	1.6 J	0.46 J	0.23 J	0.48 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	64 J	55 J	66 J	530 J	63 J	54 J	95 J	32 J	8.0 J	3.3 J	9.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.1 J	1.1 J	1.9 J	50 J	2.3 J	5.1 J	4.3 J	3.1 J	0.80 J	0.70 J	0.91 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	18 J	16 J	21 J	120 J	18 J	22 J	28 J	11 J	3.3 J	1.7 J	2.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.1 J	0.84 J	1.7 J	38 J	4.2 J	5.2 J	2.9 J	4.9 J	0.58 J	0.55 J	0.73 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	1.4 J	1.5 J	1.5 J	15 J	2.7 J	3.3 J	6.2 J	1.2 J	1.1 J	0.68 J	0.36 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	100 J	23 J	48 J	420 J	9.6 J	24 J	2.8 J	6.2 J	0.33 J	0.28 J	1.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	19 J	5.0 J	10 J	78 J	3.7 J	9.5 J	1.5 J	0.85 J	0.66 J	0.30 J	0.36 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	26 J	6.9 J	14 J	110 J	3.7 J	8.8 J	0.48 J	1.9 J	0.49 J	0.47 J	0.44 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	26 J	7.0 J	14 J	110 J	3.7 J	9.2 J	0.81 J	2.3 J	0.58 J	0.57 J	0.51 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB101 11215702-072521-SS-SJSB101(0-2) 07/25/2021 (0-2) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(0-2)-WC 07/25/21 (0-2) ft bgs	SJSB101 11215702-072521-SS-SJSB101(2-4) 07/25/2021 (2-4) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(2-4)-WC 07/25/21 (2-4) ft bgs	SJSB101 11215702-072521-SS-SJSB101(4-6) 07/25/2021 (4-6) ft bgs	SJSB101 11215702-072521-SS-SJSB101(6-8) 07/25/2021 (6-8) ft bgs	SJSB101 11215702-072521-SS-SJSB101(8-10) 07/25/2021 (8-10) ft bgs	SJSB101 11215702-072521-SS-SJSB101(10-12) 07/25/2021 (10-12) ft bgs	SJSB101 11215702-072521-SS-SJSB101 (10-12)-R 07/25/2021 (10-12) ft bgs Lab Duplicate	SJSB101 11215702-072521-SS-SJSB101(12-14) 07/25/2021 (12-14) ft bgs	SJSB101 11215702-072521-SS-SJSB101(14-16) 07/25/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	1700	1400	1400	1200	640	0.61 J	0.095 U	5.0 J	3.5 U	1.7 J	0.66 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	10000	10000	9700	5800	4500	110	88	170	150	180	95
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3100	2500	2300	2800	1100	0.72 J	0.20 J	7.5	6.6	0.94 J	0.24 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	540	670	610	470	280	3.9 J	3.2 J	7.0	7.1	11	5.1 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1000	890	700	860	370	0.26 J	0.034 U	2.5 J	4.2 J	0.060 U	0.044 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10000	8500	7300	10000	3400	2.3 J	0.56 J	26	36	0.72 J	0.029 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	6.1 J	4.5 J	7.5 J	7.1 J	2.4 J	0.24 J	0.20 J	0.073 U	0.33 U	0.13 U	0.085 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2800	2200	1800	2600	1000	0.57 J	0.14 J	6.7	7.6	0.038 U	0.030 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	36 J	40 J	44 J	30 J	18 J	0.19 J	0.23 J	0.076 U	0.23 J	0.14 U	0.095 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	180	120	110 J	140 J	65 J	0.36 U	0.025 U	0.74 U	0.69 J	0.28 U	0.25 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	18 J	16 J	11 J	15 J	6.9 J	0.26 J	0.059 U	0.37 J	0.45 U	1.1 J	0.083 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7000	5500	4700	5500	2200	1.7 J	0.31 J	18	11	0.045 U	0.035 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	400 J	370	380	280	160	0.079 U	0.080 U	1.6 J	0.77 J	0.11 U	0.083 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	340	250	220	260	120	0.046 U	0.028 U	0.52 J	0.76 J	0.035 U	0.029 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	3400	2900	2700	2400	1300	0.83 J	0.051 U	11	6.0	0.045 U	0.038 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	160000 J	140000 J	150000 J	100000 J	62000 J	42	6.9	540 J	290 J	1.1 J	0.71 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	44000 J	35000 J	42000 J	34000 J	18000 J	13	1.8	170 J	92 J	0.11 U	0.077 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	4900 J	4300 J	3800 J	4300 J	1900 J	1.3 J	0.20 J	13 J	14 J	0.94 J	0.24 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1100 J	1400 J	1300 J	970 J	590 J	12 J	13 J	20 J	19 J	35 J	18 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	15000 J	13000 J	11000 J	15000 J	5200 J	3.2 J	0.70 J	39 J	51 J	1.0 J	0.25 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	190 J	190 J	190 J	150 J	82 J	3.2 J	3.1 J	5.5 J	7.2 J	12 J	5.5 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	16000 J	14000 J	12000 J	12000 J	5300 J	3.7 J	0.31 J	40 J	27 J	0.17 U	0.038 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	400 J	370 J	380 J	280 J	160 J	0.079 U	0.080 U	1.6 J	2.4 J	1.2 J	0.083 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	260000 J	230000 J	250000 J	170000 J	100000 J	72 J	9.6 J	1100 J	530 J	1.6 J	0.71 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	48000 J	38000 J	46000 J	37000 J	19000 J	13 J	1.8 J	190 J	100 J	1.0 J	0.15 U
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	63000 J	52000 J	59000 J	47000 J	25000 J	18 J	2.7 J	230 J	130 J	0.47 J	0.15 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	63000 J	52000 J	59000 J	47000 J	25000 J	18 J	2.7 J	230 J	130 J	0.62 J	0.27 J

Notes:
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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB101 11215702-072521-SS-SJSB101(16-18) 07/25/2021 (16-18) ft bgs	SJSB101 11215702-072521-SS-SJSB101(18-20) 07/25/2021 (18-20) ft bgs	SJSB102 11215702-081921-BN-SJSB102(0-2) 08/19/2021 (0-2) ft bgs	SJSB102 11215702-081921-BN-SJSB102(2-4) 08/19/2021 (2-4) ft bgs	SJSB102 11215702-081921-BN-SJSB102(4-6) 08/19/2021 (4-6) ft bgs	SJSB102 11215702-081921-BN-SJSB102(6-8) 08/19/2021 (6-8) ft bgs	SJSB102 11215702-081921-BN-SJSB102(8-10) 08/19/2021 (8-10) ft bgs	SJSB102 11215702-081921-BN-SJSB102(10-12) 08/19/2021 (10-12) ft bgs	SJSB102 11215702-081921-BN-SJSB102(12-14) 08/19/2021 (12-14) ft bgs	SJSB102 11215702-081921-BN-SJSB102 (12-14)-R 08/19/2021 (12-14) ft bgs Lab Duplicate	SJSB102 11215702-081921-BN-SJSB102(14-16) 08/19/2021 (14-16) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	19	0.38 U	150 J	12 U	13 J	1.4 U	1.1 U	0.26 U	1.9 J	2.7 J	0.0043 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	180	150	2900	160	710	580	590	890	590	620	800
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	0.15 U	120 J	3.0 U	12 J	0.63 U	0.34 U	0.13 U	1.0 J	5.9 J	0.11 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	9.3	7.3	180 J	14 J	34 J	49 J	27 J	39	25	28	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.088 U	0.074 U	15 J	1.1 U	3.9 J	0.044 U	0.22 U	0.0079 U	0.34 J	2.9 J	0.0058 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.3 J	0.38 J	120 J	1.1 U	28 J	3.1 U	2.0 U	0.24 U	3.3 J	45 J	0.093 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.097 U	0.26 J	7.0 J	0.099 U	1.4 U	0.90 U	0.091 U	0.58 J	0.43 J	0.37 U	0.44 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.052 U	0.18 U	37 J	0.23 U	8.1 J	0.87 U	0.041 U	0.21 U	0.88 J	10	0.0039 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.11 U	0.21 U	13 J	1.3 U	2.8 J	0.14 U	0.63 J	1.2 J	0.63 J	0.65 J	0.94 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.29 U	0.092 U	1.0 U	1.2 U	0.13 U	0.31 U	0.35 U	0.0084 U	0.0093 U	5.6 J	0.15 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.096 U	0.34 J	11 J	1.1 U	1.4 J	3.7 J	1.9 J	1.2 J	1.1 J	1.5 J	1.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.0 J	0.33 J	98 J	1.6 U	23 J	1.5 J	3.4 J	0.35 U	2.9 J	28 J	0.20 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	0.19 U	20 J	1.0 U	3.8 J	1.4 J	0.31 U	0.50 J	0.43 J	0.39 J	0.15 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.049 U	0.074 U	13 J	0.80 U	2.2 U	0.038 U	0.037 U	0.22 U	0.24 U	2.5 J	0.0037 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.077 U	0.25 U	95 J	1.2 U	23 J	1.8 U	1.9 U	0.0070 U	2.3 J	9.5	0.096 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	24	6.6	3900	17	960	54	41	3.1	87	55	3.5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.5	2.1	960	3.0 J	230	16	0.16 U	0.71 J	23	14	0.014 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.0 J	0.38 J	220 J	10 J	20 J	0.63 J	0.56 J	0.20 J	1.9 J	11 J	0.18 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	34 J	29 J	450 J	25 J	91 J	100 J	82 J	120 J	84 J	86 J	110 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	1.6 J	0.74 J	250 J	5.0 J	41 J	4.6 J	2.4 J	0.67 J	5.0 J	68 J	0.25 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	9.6 J	13 J	120 J	7.6 J	33 J	22 J	31 J	43 J	26 J	23 J	33 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	1.0 J	19 J	380 J	4.5 J	66 J	3.9 J	5.8 J	0.72 J	7.8 J	53 J	0.47 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.16 U	4.2 J	30 J	2.1 J	11 J	4.7 J	4.0 J	8.3 J	5.1 J	3.7 J	6.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	42 J	13 J	8900 J	20 J	2400 J	110 J	57 J	4.6 J	190 J	120 J	9.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.5 J	4.9 J	1100 J	3.8 J	270 J	17 J	0.16 U	6.9 J	27 J	18 J	4.1 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	11 J	3.0 J	1400 J	4.9 J	340 J	24 J	4.9 J	2.5 J	34 J	31 J	1.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	11 J	3.2 J	1400 J	5.9 J	340 J	24 J	5.6 J	2.5 J	34 J	31 J	1.4 J

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Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Parameters	Units	SJSB102 11215702-081921-BN-SJSB102(16-18) 08/19/2021 (16-18) ft bgs	SJSB102 11215702-081921-BN-SJSB102 (16-18)-R 08/19/2021 (16-18) ft bgs Lab Duplicate	SJSB102 11215702-081921-BN-SJSB102(18-20) 08/19/2021 (18-20) ft bgs	SJSB102 11215702-081921-BN-SJSB102(20-22) 08/19/2021 (20-22) ft bgs	SJSB102 11215702-081921-BN-SJSB102(22-24) 08/19/2021 (22-24) ft bgs	SJSB103 11215702-082121-BN-SJSB103(0-2) 08/21/2021 (0-2) ft bgs	SJSB103 11215702-082121-BN-SJSB103(2-4) 08/21/2021 (2-4) ft bgs	SJSB103 11215702-082121-BN-SJSB103(4-6) 08/21/2021 (4-6) ft bgs	SJSB103 11215702-082121-BN-SJSB103(6-8) 08/21/2021 (6-8) ft bgs	SJSB103 11215702-082121-BN-SJSB103(8-10) 08/21/2021 (8-10) ft bgs	SJSB103 11215702-082121-BN-SJSB103(10-12) 08/21/2021 (10-12) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	7.6 U	8.5 J	2.0 U	1.4 U	0.69 U	1.6 U	0.10 U	2.5 U	1.4 U	0.76 U	0.089 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	900	760	810	790	730	35 U	35 U	220	14 J	8.4 U	28
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	3.5 U	3.7 J	1.4 U	0.51 U	0.93 U	0.67 U	1.3 U	1.1 U	0.88 U	0.55 U	0.064 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	40 J	38 J	52 J	40 J	40 J	2.6 U	0.14 U	11 J	2.1 U	1.9 U	1.0 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.7 U	0.70 U	1.3 U	0.57 U	0.69 U	0.057 U	0.39 U	0.60 U	0.62 U	0.53 U	0.047 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	10 J	5.6 J	2.9 U	1.2 U	0.87 U	0.29 U	0.81 U	1.7 U	1.3 U	1.3 U	0.063 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.1 U	0.64 U	2.6 U	3.3 U	1.5 U	0.062 U	0.46 U	0.40 U	0.82 U	1.0 U	0.043 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	3.0 U	2.4 J	1.4 U	0.68 U	0.48 U	0.38 U	0.83 U	0.91 U	1.5 U	1.2 U	0.051 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 U	0.76 U	4.1 U	3.9 U	2.7 U	0.27 U	0.14 U	1.0 J	0.62 J	1.4 J	0.055 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	1.6 U	0.22 U	2.6 U	1.2 U	0.57 U	0.47 U	0.13 U	0.62 U	0.72 U	1.3 U	0.083 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.6 J	1.2 J	5.1 U	2.7 U	3.2 U	0.55 U	0.14 U	1.0 J	0.86 J	1.7 J	0.12 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.9 J	4.5 J	1.6 U	1.9 U	1.4 U	0.36 J	0.18 U	1.2 J	2.8 J	2.6 J	0.074 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.3 U	0.15 U	4.1 U	3.6 U	3.9 U	1.4 J	1.0 U	0.46 J	2.0 J	1.8 J	0.043 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 U	0.13 U	1.5 U	0.64 U	0.59 U	0.48 U	0.41 U	0.39 U	0.88 U	0.85 U	0.085 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	7.7 J	3.4 J	3.2 U	1.3 U	0.48 U	0.11 U	0.53 U	1.3 U	2.1 U	1.6 U	0.096 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	290 J	140 J	16	1.4 U	0.50 U	5.6 J	2.1 J	13	7.4 J	5.2 J	0.96 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	72 J	38 J	6.0 U	0.98 U	1.7 U	0.12 U	0.34 U	11	2.4 U	1.2 U	0.29 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	7.7 J	5.6 J	2.6 J	1.1 J	1.6 J	1.6 J	2.7 J	2.3 J	2.1 J	1.4 J	0.12 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	120 J	120 J	130 J	95 J	100 J	5.5 J	4.3 J	42 J	4.3 J	4.0 J	4.0 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	19 J	10 J	8.8 J	4.0 J	2.8 J	3.7 J	2.7 J	4.1 J	4.6 J	4.8 J	0.21 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	33 J	27 J	55 J	40 J	40 J	1.9 J	1.3 J	12 J	3.4 J	5.8 J	1.7 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	26 J	13 J	6.5 J	7.8 J	4.5 J	4.0 J	6.0 J	2.8 J	5.5 J	5.0 J	0.26 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.6 J	4.1 J	15 J	10 J	15 J	1.4 J	4.1 J	5.5 J	3.4 J	3.9 J	0.61 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	600 J	270 J	28 J	2.6 J	1.7 J	11 J	5.3 J	64 J	8.7 J	6.8 J	2.7 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	84 J	48 J	7.6 J	6.2 J	4.1 J	0.12 U	0.34 U	11 J	2.4 J	1.2 J	0.56 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	110 J	55 J	2.4 J	0.64 J	0.62 J	1.0 J	0.21 J	13 J	3.0 J	2.7 J	0.45 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	110 J	55 J	8.9 J	3.9 J	4.0 J	2.2 J	1.1 J	14 J	4.8 J	3.9 J	0.49 J

Notes:
U - Not detected at the associated reporting limit
J - Estimated concentration
UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB103 11215702-082121-BN-SJSB103(12-14) 08/21/2021 (12-14) ft bgs	SJSB104 11215702-072421-BN-SJSB104(0-2) 07/24/2021 (0-2) ft bgs	SJSB104 11215702-072421-BN-SJSB104(2-4) 07/24/2021 (2-4) ft bgs	SJSB104 11215702-072421-BN-SJSB104(4-6) 07/24/2021 (4-6) ft bgs	SJSB104 11215702-072421-BN-SJSB104(6-8) 07/24/2021 (6-8) ft bgs	SJSB104 11215702-072421-BN-SJSB104(8-10) 07/24/2021 (8-10) ft bgs	SJSB104 11215702-072421-BN-SJSB104(10-12) 07/24/2021 (10-12) ft bgs	SJSB104 11215702-072421-BN-SJSB104(12-14) 07/24/2021 (12-14) ft bgs	SJSB104 11215702-072421-BN-SJSB104(14-16) 07/24/2021 (14-16) ft bgs	SJSB104 11215702-072421-BN-SJSB104(16-18) 07/24/2021 (16-18) ft bgs	SJSB105 11215702-072321-BN-SJSB105(0-2) 07/23/2021 (0-2) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.099 U	1.5 U	0.25 U	0.54 U	0.86 U	1.7 U	0.075 U	1.7 U	0.042 U	0.092 U	470
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	49	1300	1100	710	1300	770	1400	430	80	130	3200
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.064 U	0.48 U	0.14 U	0.33 U	0.14 U	0.59 U	0.043 U	0.021 U	0.030 U	0.038 U	800
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	3.0 J	41	46	29	48	32	56	17	2.4 J	3.6 J	180
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.047 U	0.10 J	0.028 U	0.089 J	0.040 U	0.068 J	0.041 U	0.021 U	0.029 U	0.036 U	240
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.063 U	0.90 J	0.12 J	0.76 J	0.10 J	0.33 J	0.049 U	0.024 U	0.019 U	0.042 U	2500
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.13 J	0.56 U	0.66 U	0.45 U	0.58 U	0.59 U	0.33 U	0.11 U	0.060 U	0.058 U	3.0 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.041 U	0.30 J	0.080 J	0.25 J	0.049 J	0.087 J	0.051 U	0.026 U	0.021 U	0.046 U	710
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.21 J	0.84 J	0.87 J	0.66 J	0.81 J	0.73 J	0.37 U	0.12 U	0.076 U	0.065 U	11
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.083 U	0.22 U	0.35 U	0.27 U	0.29 U	0.28 U	0.36 U	0.026 U	0.27 U	0.35 U	40
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 U	1.7 J	2.4 J	1.4 J	2.2 J	2.1 J	3.6 J	0.11 U	0.062 U	0.056 U	6.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.088 U	0.91 J	0.30 J	0.75 J	0.26 J	0.24 J	0.074 U	0.046 U	0.046 U	0.056 U	2000
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.25 J	0.31 J	0.23 J	0.22 J	0.20 J	0.21 J	0.21 U	0.082 U	0.068 U	0.083 U	240
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.047 J	0.032 J	0.055 J	0.017 U	0.019 U	0.049 U	0.025 U	0.020 U	0.045 U	80
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.096 U	0.54 J	0.12 J	0.43 J	0.095 J	0.034 U	0.074 U	0.049 U	0.046 U	0.055 U	1400
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.28 U	38	3.2	24	2.6	1.2 J	2.2	1.3	0.91 J	0.063 U	83000 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.075 J	9.9	1.0 J	7.0	0.91 J	0.38 J	0.11 U	0.051 U	0.081 U	0.071 U	27000 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.11 J	0.78 J	0.11 J	0.57 J	0.12 J	0.77 J	0.13 U	0.20 U	0.030 U	0.038 U	1200 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	8.5 J	140 J	160 J	110 J	160 J	100 J	160 J	46 J	8.5 J	12 J	420 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.28 J	1.5 J	0.59 J	1.3 J	0.44 J	0.78 J	0.36 J	0.051 U	0.27 J	0.35 J	3700 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.7 J	28 J	43 J	26 J	40 J	30 J	47 J	8.7 J	3.2 J	1.1 J	110 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.36 J	2.1 J	0.54 J	1.7 J	0.47 J	0.36 J	0.11 U	0.13 U	0.083 U	0.056 U	5400 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	5.2 J	9.8 J	5.4 J	8.0 J	6.9 J	4.5 U	1.1 U	0.92 U	0.35 U	260 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.43 J	68 J	5.9 J	43 J	5.1 J	2.6 J	2.4 J	1.7 J	0.91 J	0.18 U	160000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.39 J	14 J	7.2 J	10 J	5.5 J	5.1 J	1.3 U	0.60 U	2.1 J	0.22 U	30000 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.40 J	15 J	2.7 J	11 J	2.6 J	1.6 J	1.7 J	0.43	0.14 J	0.075 J	36000 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.46 J	15 J	2.8 J	11 J	2.6 J	1.7 J	1.8 J	0.53	0.25 J	0.20 J	36000 J

Notes:
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UJ - Not detected; associated reporting limit is estimated
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high
TEQ - Toxicity Equivalent Quotient
ft bgs - Feet below ground surface
pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB105 11215702-072321-BN-SJSB105(2-4) 07/23/2021 (2-4) ft bgs	SJSB105 11215702-072321-BN-SJSB105(4-6) 07/23/2021 (4-6) ft bgs	SJSB105 11215702-072321-BN-SJSB105(6-8) 07/23/2021 (6-8) ft bgs	SJSB105 11215702-072321-BN-SJSB105(8-10) 07/23/2021 (8-10) ft bgs	SJSB105 11215702-072321-BN-SJSB105(10-12) 07/23/2021 (10-12) ft bgs	SJSB105 11215702-072321-BN-SJSB105(12-14) 07/23/2021 (12-14) ft bgs	SJSB105 11215702-072321-BN-SJSB105 (12-14)-R 07/23/2021 (12-14) ft bgs Lab Duplicate	SJSB105 11215702-072321-BN-SJSB105(14-16) 07/23/2021 (14-16) ft bgs	SJSB105 11215702-072321-BN-SJSB105 (14-16)-R 07/23/2021 (14-16) ft bgs Lab Duplicate	SJSB105 11215702-072321-BN-SJSB105(16-18) 07/23/2021 (16-18) ft bgs	SJSB106 11215702-080821-BN-SJSB106(0-2) 08/08/2021 (0-2) ft bgs
Dioxins/Furans												
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	480	3.9 J	0.47 U	0.49 U	0.39 U	4.3 J	13 J	2.9 J	0.87 U	0.32 U	31
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	1600	1500	1800	1600	1100	1600	1300	1400	1600	1400	4400
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1200	5.0 J	0.52 U	0.15 U	0.32 U	7.0 J	25 J	1.3 J	1.1 U	0.20 U	4.7 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	110	49	68	64	37	64	49	57	70	57	130
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	440	1.6 J	0.18 U	0.080 U	0.062 U	2.1 J	9.0	0.68 U	0.41 U	0.049 U	0.78 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	4200	17	1.8 J	0.55 J	1.0 J	24 J	98 J	3.3 J	3.6 J	0.38 J	2.2 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.4 J	0.54 U	0.50 U	0.92 U	0.63 U	0.58 U	0.77 U	0.62 U	1.1 U	0.76 U	2.5 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1100	5.2 J	0.53 J	0.22 U	0.29 J	6.8 J	22	1.0 J	0.96 J	0.14 U	1.1 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	8.4 J	0.90 J	1.9 J	1.4 J	0.89 J	1.2 J	1.4 J	1.2 J	1.8 J	1.3 J	3.0 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	54 J	0.38 U	0.053 U	0.046 U	0.040 U	0.41 U	1.4 J	0.21 U	0.22 U	0.11 U	0.18 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.1 J	2.1 J	3.2 J	3.1 J	1.8 J	2.8 J	2.0 J	2.6 J	3.1 J	3.6 J	6.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	2600	12	1.2 J	0.44 J	0.86 J	18 J	68 J	2.9 J	2.6 J	0.39 J	2.0 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	300	1.9 J	0.15 U	0.16 U	0.27 J	2.6 J	7.9	0.59 J	0.71 J	0.32 J	0.58 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	110	0.53 J	0.051 U	0.044 U	0.039 U	0.79 J	2.8 J	0.12 J	0.16 U	0.029 U	0.18 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1900	9.2	1.0 J	0.39 J	0.54 J	13 J	58 J	2.1 J	2.3 J	0.18 J	1.1 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	130000 J	610 J	71	33	39	900 J	3700 J	160	150	14	71 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	33000 J	170	20	8.1	11	250 J	970 J	41	41	4.3	27 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	1900 J	8.0 J	0.70 J	0.15 J	0.32 J	11 J	42 J	2.2 J	1.9 J	0.20 J	8.9 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	230 J	170 J	190 J	200 J	110 J	200 J	150 J	180 J	210 J	200 J	310 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	6000 J	24 J	2.3 J	0.78 J	1.3 J	36 J	140 J	5.3 J	5.6 J	0.62 J	6.6 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	59 J	33 J	40 J	51 J	26 J	45 J	39 J	42 J	54 J	51 J	65 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	6800 J	34 J	3.4 J	0.83 J	1.7 J	48 J	200 J	7.9 J	8.0 J	0.72 J	6.1 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	320 J	7.7 J	8.3 J	13 J	6.0 J	12 J	14 J	8.6 J	11 J	11 J	0.58 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	210000 J	1100 J	120 J	57 J	70 J	1600 J	6300 J	290 J	280 J	27 J	110 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	37000 J	190 J	26 J	16 J	18 J	270 J	1100 J	50 J	51 J	11 J	27 J
TEQ												
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	48000 J	240 J	29 J	13 J	17 J	350 J	1400 J	60 J	60 J	7.6 J	39 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	48000 J	240 J	29 J	13 J	17 J	350 J	1400 J	60 J	60 J	7.7 J	39 J

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- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-4

Supplemental Design Investigation Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Parameters	Units	SJSB106 11215702-080821-BN-SJSB106 (0-2)-R 08/08/2021 (0-2) ft bgs Lab Duplicate	SJSB106 11215702-080821-BN-SJSB106(2-4) 08/08/2021 (2-4) ft bgs	SJSB106 11215702-080821-BN-SJSB106(4-6) 08/08/2021 (4-6) ft bgs	SJSB106 11215702-080821-BN-SJSB106(6-8) 08/08/2021 (6-8) ft bgs	SJSB106 11215702-080821-BN-DUP-15 08/08/2021 (6-8) ft bgs Field Duplicate	SJSB106 11215702-080821-BN-SJSB106(8-10) 08/08/2021 (8-10) ft bgs	SJSB106 11215702-080821-BN-SJSB106(10-12) 08/08/2021 (10-12) ft bgs	SJSB106 11215702-080821-BN-SJSB106(12-14) 08/08/2021 (12-14) ft bgs	SJSB106 11215702-080821-BN-SJSB106(14-16) 08/08/2021 (14-16) ft bgs	SJSB106 11215702-080821-BN-SJSB106(16-18) 08/08/2021 (16-18) ft bgs
Dioxins/Furans											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.6 U	0.69 J	3.1 J	0.65 J	0.078 U	0.65 J	0.77 J	0.61 J	0.80 J	0.80 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	3600	950 J	2700	1400	810	1000	1900	1300	990	1100
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 U	0.39 U	1.0 U	0.37 U	0.084 U	0.47 U	0.45 U	0.37 U	0.51 U	0.37 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	100	36	73	58	35	47	85	61	46	53
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.093 U	0.12 U	0.26 J	0.076 U	0.076 U	0.092 U	0.13 U	0.097 U	0.11 U	0.095 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.67 U	0.42 J	0.92 J	0.037 U	0.030 U	0.065 U	0.046 U	0.058 U	0.078 U	0.057 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 U	0.79 J	0.77 J	0.94 J	0.25 U	0.68 J	0.75 J	1.0 J	0.38 U	0.87 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.069 U	0.46 J	0.037 U	0.029 U	0.063 U	0.047 U	0.054 U	0.078 U	0.057 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.8 J	1.0 J	1.5 J	1.3 J	0.27 U	1.4 J	2.1 J	1.9 J	0.44 U	1.4 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.12 U	0.27 J	0.21 J	0.036 U	0.024 U	0.056 U	0.044 U	0.055 U	0.071 U	0.15 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.6 J	2.7 J	3.1 J	3.3 J	2.8 J	3.3 J	5.2 J	3.8 J	3.9 J	3.8 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.50 J	0.69 J	0.13 U	0.072 U	0.053 U	0.37 J	0.076 U	0.076 U	0.10 U	0.093 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.39 J	0.29 U	0.32 U	0.25 U	0.23 U	0.38 U	0.35 U	0.30 U	0.24 U	0.28 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	0.18 J	0.073 U	0.037 U	0.026 U	0.058 U	0.045 U	0.054 U	0.076 U	0.053 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.41 J	0.17 U	0.13 U	0.075 U	0.062 U	0.080 U	0.076 U	0.078 U	0.11 U	0.11 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	22 J	4.5	17	2.7	0.79 U	3.5	0.77 U	0.99 U	2.3 U	3.2
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	6.6 J	1.8	5.3	0.90 J	0.098 U	1.5 J	0.19 U	0.69 J	0.18 U	1.4 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.0 J	0.39 J	1.3 J	0.57 J	0.084 U	0.47 J	0.45 J	0.27 J	0.51 J	0.28 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	100 J	190 J	190 J	110 J	130 J	240 J	180 J	140 J	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.0 J	0.87 J	1.6 J	0.037 U	0.030 U	0.065 U	0.047 U	0.058 U	0.14 U	0.15 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	42 J	24 J	35 J	55 J	38 J	38 J	64 J	54 J	43 J	48 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.7 J	3.8 J	0.51 U	0.075 U	0.062 U	0.75 J	0.076 U	0.078 U	0.11 U	0.14 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	8.0 J	0.29 U	0.32 U	0.25 U	0.23 U	0.38 U	0.35 U	0.30 U	0.24 U	0.28 U
Total tetrachlorodibenzofuran (TCDF)	pg/g	39 J	6.4 J	27 J	2.4 J	0.79 J	5.7 J	0.77 J	0.99 J	1.6 J	2.8 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	12 J	4.6 J	5.3 J	5.6 J	2.4 J	4.4 J	1.8 J	4.9 J	2.3 J	1.4 J
TEQ											
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	12 J	3.4 J	9.2 J	2.7 J	0.87 J	3.2 J	2.2 J	2.4 J	1.2 J	3.2 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	12 J	3.6 J	9.4 J	2.9 J	1.1 J	3.4 J	2.6 J	2.6 J	1.6 J	3.4 J

Notes:
- U - Not detected at the associated reporting limit
- J - Estimated concentration
- UJ - Not detected; associated reporting limit is estimated
- J- - Estimated concentration, result may be biased low
- J+ - Estimated concentration, result may be biased high
- TEQ - Toxicity Equivalent Quotient
- ft bgs - Feet below ground surface
- pg/g - picogram per grams

Table 2-5

Supplemental Design Investigation Waste Characterization Results
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: Sample Identification: Sample Date: Sample Depth: Sample Type:	Regulatory Limits[1]	Units	SJSB101-Waste 11215702-072521-SS-SJSB101(0-2)-WC 07/25/21 (0-2) ft bgs	SJSB101-Waste 11215702-072521-SS-SJSB101(2-4)-WC 07/25/21 (2-4) ft bgs	SJSB102-Waste 11215702-081921-BN-SJSB102(8-10)-WC 08/19/21 (8-10) ft bgs	SJSB102-Waste 11215702-081921-BN-SJSB102(10-12)-WC 08/19/21 (10-12) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(8-10)-WC 07/22/21 (8-10) ft bgs	SJSB083-Waste 11215702-072221-BN-SJSB083(10-12)-WC 07/22/21 (10-12) ft bgs
TCLP Herbicides								
2,4,5-TP (Silvex)	10	mg/L	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U	0.0064 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	1	mg/L	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
TCLP Metals								
Arsenic	1.8	mg/L	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U	0.041 U
Barium	100	mg/L	1.4 J	0.98 J	0.22 J	0.28 J	0.86 J	0.39 J
Cadmium	0.5	mg/L	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.0028 U	0.0028 U
Chromium	5	mg/L	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U	0.019 U
Lead	1.5	mg/L	0.033 J	0.029 U	0.029 U	0.029 U	0.029 U	0.029 U
Mercury	0.2	mg/L	0.00013 U	0.00016 J	0.00013 U	0.00013 U	0.00013 U	0.00013 U
Selenium	1	mg/L	0.036 U	0.036 U	0.036 U	0.036 U	0.50 U	0.036 U
Silver	5	mg/L	0.0085 U	0.0085 U	0.0085 U	0.0085 U	0.0085 U	0.0085 U
Polychlorinated Biphenyls								
Aroclor-1016 (PCB-1016)	50000	ug/kg	13 U	10 U	7.2 U	8.5 U	11 U	8.0 U
Aroclor-1221 (PCB-1221)	50000	ug/kg	14 U	11 U	7.9 U	9.2 U	12 U	8.7 U
Aroclor-1232 (PCB-1232)	50000	ug/kg	9.5 U	7.7 U	5.4 U	6.4 U	8.2 U	6.0 U
Aroclor-1242 (PCB-1242)	50000	ug/kg	5.7 U	4.6 U	3.3 U	3.8 U	4.9 U	3.6 U
Aroclor-1248 (PCB-1248)	50000	ug/kg	9.3 U	7.6 U	5.3 U	6.3 U	8.1 U	5.9 U
Aroclor-1254 (PCB-1254)	50000	ug/kg	12 U	9.5 U	6.7 U	7.8 U	10 U	7.4 U
Aroclor-1260 (PCB-1260)	50000	ug/kg	1500	1900	6.3 U	7.4 U	670	7.0 U
TCLP Pesticides								
Chlordane, technical	0.03	mg/L	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Endrin	0.02	mg/L	0.000091 U	0.000091 U	0.000091 U	0.000091 U	0.000091 U	0.000091 U
gamma-BHC (lindane)	0.3	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Heptachlor	0.008	mg/L	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Heptachlor epoxide	0.04	mg/L	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Methoxychlor	10	mg/L	0.00031 U	0.00031 U	0.00031 U	0.00031 U	0.00031 U	0.00031 U
Toxaphene	0.3	mg/L	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U	0.020 U
TCLP Semi-Volatile Organic Compounds (SVOCs)								
1,4-Dichlorobenzene	7.5	mg/L	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	400	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2,4,6-Trichlorophenol	2	mg/L	0.0095 U	0.0095 U	0.0095 U	0.0095 U	0.0095 U	0.0095 U
2,4-Dinitrotoluene	0.13	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2-Methylphenol	200	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U
3&4-Methylphenol	200	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U	0.0079 U
Hexachlorobenzene	0.13	mg/L	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Hexachlorobutadiene	0.4	mg/L	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U	0.0084 U
Hexachloroethane	3	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U
Methylphenol (cresol)	200	mg/L	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Nitrobenzene	2	mg/L	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U	0.012 U
Pentachlorophenol	100	mg/L	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Pyridine	4	mg/L	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U	0.0082 U
TCLP Volatile Organic Compounds (VOCs)								
1,1-Dichloroethene	0.6	mg/L	0.057 U	0.057 U	0.11 U	0.11 U	0.057 U	0.057 U
1,2-Dichloroethane	0.5	mg/L	0.029 U	0.029 U	0.058 U	0.058 U	0.029 U	0.029 U
1,4-Dichlorobenzene	7.5	mg/L	0.020 U	0.020 U	0.041 U	0.041 U	0.020 U	0.020 U
2-Butanone (Methyl ethyl ketone) (MEK)	200	mg/L	0.058 U	0.058 U	0.12 U	0.12 U	0.058 U	0.058 U
Benzene	0.5	mg/L	0.039 U	0.039 U	0.079 U	0.079 U	0.039 U	0.039 U
Carbon tetrachloride	0.5	mg/L	0.066 U	0.066 U	0.13 U	0.13 U	0.066 U	0.066 U
Chlorobenzene	70	mg/L	0.032 U	0.032 U	0.063 U	0.063 U	0.032 U	0.032 U
Chloroform (Trichloromethane)	6	mg/L	0.042 U	0.042 U	0.085 U	0.085 U	0.042 U	0.042 U
Tetrachloroethene	0.7	mg/L	0.040 U	0.040 U	0.080 U	0.080 U	0.040 U	0.040 U
Trichloroethene	0.5	mg/L	0.030 U	0.030 U	0.060 U	0.060 U	0.030 U	0.030 U
Vinyl chloride	0.2	mg/L	0.073 U	0.073 U	0.15 U	0.15 U	0.073 U	0.073 U
General Chemistry								
Cyanide (total)		mg/kg	0.51 U	0.50 U	0.29 U	0.36 U	0.48 U	0.37 U
Free liquid		none	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CNF	0.10 CFL
Ignitability	140	Deg F	140	140	140	140	140	140
pH, lab	2, 12.5	s.u.	9.5 J-	8.0 J-	8.8 J-	8.4 J-	8.6 J-	8.9 J-
Reactive cyanide		mg/kg	0.011 U	0.011 U	0.012 U	0.011 U	0.011 U	0.012 U
Reactive sulfide		mg/kg	1.2 U	1.2 U	1.3 U	1.2 U	1.2 U	25
Sulfide		mg/kg	15 U	17 U	8.2 U	9.1 U	13 U	11 U

Notes:
[1] Regulatory limits listed in Title 30 of the Texas of the Texas Administrative Code (TAC) Chapter 335, Subchapter R (Waste Classification) Appendix 1, Table 1 for Class 1 Nonhazardous Industrial Waste.
U - Not detected at the associated reporting limit
J - Estimated concentration
J- - Estimated concentration, result may be biased low
CNL - Contains Free Liquid
CNF - Contains No Free Liquid
TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per liter
ug/kg - micrograms per kilogram
ft bgs - feet below ground surface
mg/kg - micrograms per kilogram
s.u. - standard units

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJGB010	SJGB011	SJGB012	SJGB013	SJGB014	SJGB015	SJGB016	SJGB017	SJSB028	DUP (28 8-10)	SJSB029	SJSB030	SJSB031	DUP (31 0-2)	SJSB032	DUP (32 4-6)	SJSB033	SJSB034	SJSB035	DUP (35 12-14)	SJSB036	SJSB037	SJSB038
																		5.12 J	1.32 J				
													2.46 J	1.72 J									
+5									59.2 J			5.54 J						1.17 J	0.585 J				
+4													0.77 J				95.6 J						
+3									2.4 J		14.9 J	1.9 J						3.04 J	0.995				
+2													0.666 J		3,410 J		1,050						
+1	4,720 J	12,700 J	4,050 J						35.9 J		2.95 J	0.735 J						0.988 J	0.896 J				
0													0.719 J		7,660 J		7,120 J				50,500 J		
-1	26,900 J	22,200 J	25,100 J		31,600 J			1.95 J	12.3 J		2.12 J	2.81 J						0.98 J	0.64 J				
-2							3,520 J						0.726 J		3,170 J	1,740 J	5,740 J					40,400	
-3	6,350 J	9,430 J	24,400 J		210 J			1.46 J	7.13 J	21.2 J	1.48 J	0.44 J						0.812 J	0.801 J		276 J		
-4							75.3 J						0.97 J		6.19 J		1,700					0.873 J	
-5	194 J	14,800 J	17,700 J		531 J	1.22 J		0.909 J	3.35 J		1.35 J	0.82 J						0.592 J	1.26 J	0.471 J			
-6							0.464 J						0.333 J		85.8 J		157 J						
-7		8,710 J			213 J	0.640 J		0.853 J	2.59 J		2.45 J	0.453 J						1.5 J	0.962 J		519 J		
-8				5,100 J			2.33 J						0.653 J		26.5 J		24 J				19 J	618 J	
-9		3.37 J			18.6 J	1.48 J		0.177 J	2.39 J		1.36 J	0.592						0.897 J	0.516 J		189 J	2.59 J	96,700
-10				1,740 J			6.15 J						0.362 J		15.9 J		17.6 J					11.5 J	364 J
-11					1.29 J	1.51 J			1.19 J		0.769 J	0.982 J											152 J
-12				338 J											2.13 J		12.5 J						4.71 J
-13						0.850 J					9.13 J												
-14				104 J											12.7 J								
-15																							
-16				25.2 J																			
-17																							
-18																							
-19																							
-20																							
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-34																							
-35																							

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB045	DUP (45 2-4)	DUP (45 6-8)	SJSB045-C1	SJSB046	DUP (46 12-14)	SJSB046-C1	DUP (46-C1 16-18)	SJSB047	SJSB047-C1	SJSB048	SJSB048-C1	SJSB049	SJSB050	DUP (50 2-4)	SJSB050-C1	DUP (50-C1 16-18)	SJSB051	DUP (51 16-18)	SJSB052	DUP (52 16-18)	SJSB052-C1	SJSB053
+5																							
+4																							
+3																							
+2																							
+1																							
0																							
-1				286 J																			
-2	10.3 J				636 J		1,550 J		1.19 J		1.7 J							3.02 J				9.22 J	
-3				190 J										7.41 J									
-4	3.42 J	5.26 J			2,660 J		3,350 J		1.35 J	7,470 J	1.02 J	623 J						4.98 J				1.2 J	
-5				286 J									23,600 J	3.05 J	3.13 J					2.07 J			
-6	5.58 J				8,610 J		2,820 J		1.53 J	6,310 J	1.72 J	55.1 J				2.27 J		2.48 J				0.493 J	
-7				46.8 J									6,640 J	1.33 J						1.94 J			
-8	2.16 J		4.88 J		28,500 J		11,700 J		2.73 J	139 J	2.46 J	592 J				1.97 J		2.64 J				1.47 J	
-9				54.6 J									2,350 J	1.48 J						1.99 J			1.79 J
-10	3.25 J				6,930 J		14,900 J		2.03 J	29.4 J	2.52 J	4.95 J				2.22 J		3.03 J				2.32 J	
-11				50.4 J									110 J	3.38 J						1.99 J			0.917 J
-12	0.717 J				111 J		55.1 J		1.41 J	769 J	1.77 J	323 J				3.1 J		1.71 J				1.39 J	
-13				3.79 J									251 J	2.71 J						2.01 J			1.44 J
-14	1.52 J				3,420 J	3,370 J	2,230 J		1.69 J	685 J	2.03 J	6.35 J				1.31 J		2.91 J				1.71 J	
-15				22.4 J									112 J	1.81 J						2.8 J			1.44 J
-16	2.36 J				1,710 J		205 J		1.98 J	821 J	1.66 J	147 J				1.54 J		2.35 J				1.79 J	
-17				5.81 J									117 J	1.77 J						2.24 J			1.28 J
-18	4.96 J				3,400 J		5,690 J	3,980 J	1.67 J	327 J	2.56 J	143 J				3.38 J		2.48 J	1.7 J			2.08 J	
-19													28.1 J	0.351 J						0.694 J			1.79 J
-20					4.82 J					7.35 J		219 J				2.88 J							
-21													5.87 J							12.1 J	10.1 J		0.22 J
-22												11.8 J				1.33 J	0.473 J						
-23																							3.33 J
-24												1.07 J											
-25																							0.35 J
-26																							
-27																							
-28																							
-29																							
-30																							
-31																							
-32																							
-33																							
-34																							
-35																							

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB053-C1	SJSB054	SJSB055	SJSB055-C1	SJSB056	SJSB056-C1	DUP (56-C1 14-16)	SJSB057	SJSB058	SJSB070	SJSB071	SJSB072	SJSB072-R	SJSB073	SJSB074	DUP-5 (74 2-4)	SJSB075	SJSB076	SJSB076-R	SJSB077	DUP-3 (77 6-8)	SJSB077-R
+5																						
+4															7,800 J							
+3																	NA	3,000 J				
+2												NA		9.6 J	70,000 J	59,000 J				NA		
+1									12 J								NA	49,000 J				
0											34,700 J	NA		31,000 J	30,000 J					NA		
-1									36,100 J	43,900 J							55,000 J	63,000 J				
-2											45,900 J	NA		26,000 J	87 J					NA		
-3									48,400 J	68,600 J							NA	210 J				
-4			1.36 J			0.792 J					26.8 J	NA		68,000 J	5.1 J					63,000 J	61,000 J	
-5									324 J	45,600 J							NA	11 J				
-6			1.07 J			1.14 J					2.24 J	12 J		83,000 J	3.1 J					77,000 J		
-7	0.806 J	16,600 J							1,160 J	24,300 J							270 J	150 J	110 J			
-8			0.814 J			0.26 J					1.03 J	340 J		41 J	0.37 J					50 J		150 J
-9	0.855 J	1,550 J		34.3 J					376 J	16,700 J							0.88 J	21 J				
-10			1.28 J			0.597 J					1.48 J	1.3 J		5.2 J	2.6 J					24 J		23 J
-11	1.34 J	6.43 J		31.1 J					9,890 J	1,000 J							1.8 J	5.2 J				
-12			2.53 J		3.35 J	1.4 J					0.523 J	1.7 J		15 J	0.84 J					350 J		330 J
-13	1.4 J	5.94 J		1.34 J					136 J	609 J							6.7 J	3.7 J				
-14			0.89 J		1.65 J	1.33 J					44.6 J	34 J		5.6 J						0.21 J		
-15	0.936 J	17.6 J		0.697 J					788 J	6.9 J												
-16			1.09 J		0.803 J	0.596 J					45.4 J	0.52 J										
-17	1.76 J	5.28 J		1.07 J					0.524 J	4.69 J												
-18			1.42 J		0.782 J	0.593 J	0.624 J	24,200 J				74 J	120 J									
-19	1.15 J	369 J		1.16 J																		
-20			0.92 J		3.76 J	0.962 J		37,600 J				0.81 J										
-21	2.2 J	32.7 J		0.671 J																		
-22					0.928 J			3,540 J														
-23		6.52 J		1.12 J																		
-24					2.91 J			372 J														
-25				5.49 J																		
-26					4.44 J			7.6 J														
-27																						
-28					0.457 J			2.93 J														
-29																						
-30								15.9 J														
-31																						
-32								1.59 J														
-33																						
-34								1.5 J														
-35																						

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB078	DUP-2 (78 14-16)	SJSB078-R	SJSB079	DUP-7 (79 8-10)	SJSB080	DUP-4 (80 16-18)	SJSB081	DUP-13 (81 6-8)	SJSB081-R	SJSB082	DUP-16 (82 6-8)	SJSB082-R	SJSB083	SJSB083 WC	SJSB084	SJSB085	SJSB085-R	SJSB086	DUP-12 (86 6-8)	SJSB087	DUP-17 (87 6-8)	SJSB087-R
+5																							
+4																							
+3																							
+2	33,000 J			32,000 J		23,000 J																	
+1																							
0	47,000 J			52,000 J		14,000 J																	
-1											15,000 J												
-2	86,000 J			28,000 J		9,200 J		2,300 J						46,000 J					5.0 J				
-3											670 J					12,000 J					4,600 J		
-4	32 J		140 J	50,000 J		3,200 J		47,000 J						2,200 J					2.3 J				
-5											2,000 J					3,200 J	42,000 J				25,000 J		
-6	64 J		100 J	45,000 J	50,000 J	1,500 J		47,000 J						9.8 J					1.3 J				
-7											7.7 J	5.4 J				45 J	720 J				2,300 J		
-8	91 J		110 J	190 J		12 J		5.3 J	2.1 J					14 J					1.2 J	1.1 J			
-9											120 J		42 J			23 J	27 J				10 J	2.4 J	
-10	16 J			3.1 J		1.5 J		19,000 J		11,000 J				15,000 J	4,400 J				2.2 J				
-11											4.1 J					6.1 J	44 J	7.4 J			570 J		
-12	7.3 J	12 J		16 J		0.44 J		280 J		200 J				200 J	47 J				2.3 J				
-13											1.1 J					7.8 J	25 J				3.5 J		
-14	120 J		140 J	0.64 J		13 J	3.0 J	2.8 J						24 J					3.2 J				
-15											3.7 J					6.1 J	4.3 J				110 J		110 J
-16	2.7 J							1.7 J						9.0 J					2.9 J				
-17											0.99 J					3.7 J	7.0 J				570 J		1,500 J
-18	260 J		200 J					0.87 J						0.72 J					1.6 J				
-19																3.9 J	11 J				3.0 J		
-20	0.42 J													4.8 J									
-21																	7.8 J						
-22																							
-23																							
-24																							
-25																							
-26																							
-27																							
-28																							
-29																							
-30																							
-31																							
-32																							
-33																							
-34																							
-35																							

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB088	DUP-14 (88 6-8)	SJSB088-R	SJSB089	SJSB089-R	DUP-19 (89 6-8)	SJSB089 (DUP-19)-R	SJSB090	DUP-11 (90 6-8)	SJSB090-R	SJSB091	DUP-18 (91 6-8)	SJSB092	SJSB093	SJSB094	SJSB094-R	DUP-8 (94 6-8)	SJSB094 (DUP-8)-R	SJSB095	DUP-10 (95 6-8)	SJSB095-R	SJSB096	DUP-9 (96 6-8)	SJSB096-R
+5																								
+4																								
+3																								
+2																								
+1																								
0																								
-1								62,000 J						41,000 J										
-2	39,000 J			820 J															35,000 J					
-3								6,600 J			16 J			42,000 J										
-4	43,000 J			53 J									43,000 J		36,000 J				59 J					
-5								930 J			6.7 J			640 J										
-6	50,000 J			18 J									28,000 J		39,000 J				1.0 J			87,000 J		
-7								6.4 J	2.9 J		5.2 J			0.68 J										
-8	54,000 J	63,000 J	71,000 J	2.5 J		3.5 J	3.1 J						130 J		41,000 J				2.3 J	9.7 J		22,000 J		
-9								260 J		560 J	2.5 J	2.7 J		1,900 J										
-10	51,000 J			52 J	43 J								4.8		15,000 J	17,000 J	830 J	990 J	1,200 J		980 J	310 J		
-11								5.3 J			2.1 J			1,500 J										
-12	5.3 J			34 J	19 J								27 J		5,500 J				57 J		11 J	4.9 J	4.2 J	
-13								9.1 J			2.4 J			430 J										
-14	0.68 J			2.0 J									26 J		32 J				6.0			2,800 J		8,500 J
-15								4.1 J			2.4 J			17 J										
-16	1.3 J			2.3 J									10,000 J		2.0 J				54 J		55 J	67 J		84 J
-17								2.3 J			2.2 J			4.4 J										
-18	520 J		1,800 J	0.40 J									11 J		3.2 J				0.60			5.2 J		
-19											2.7 J													
-20	2.5 J												7.2 J		1.9 J							1.9 J		
-21																								
-22	2.2 J																					13 J		
-23																								
-24	1.1 J																							
-25																								
-26																								
-27																								
-28																								
-29																								
-30																								
-31																								
-32																								
-33																								
-34																								
-35																								

Note:
J - Estimated concentration

Table 2-6

RI, PDI-1, PDI-2, and SDI Dioxins and Furans Results Summary - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

ELEVATION	SJSB097	DUP-20 (97 6-8)	SJSB098	SJSB099	DUP-6 (99 16-18)	SJSB099-R	SJSB100	SJSB101	SJSB101 WC	SJSB101-R	SJSB102	SJSB102-R	SJSB103	SJSB104	SJSB105	SJSB105-R	SJSB0106	DUP-15 (106 6-8)	SJSB106-R
+5																			
+4																			
+3																			
+2																			
+1																			
0				53,000 J				63,000 J	52,000 J										
-1																			
-2				54,000 J				59,000 J	47,000 J		1,400 J								
-3																	39 J		12 J
-4				130 J				25,000 J			5.9 J				36,000 J				
-5														15 J			3.6 J		
-6				13 J				18 J			340 J				48,000 J				
-7														2.8 J			9.4 J		
-8				15 J				2.7 J			24 J				240 J				
-9														11 J			2.9 J	1.1 J	
-10				180 J		210 J		230 J		130 J	5.6 J				29 J				
-11														2.6 J			3.4 J		
-12				1.9 J				0.62 J			2.5 J				13 J				
-13							110 J							1.7 J			2.6 J		
-14			71 J	26 J				0.27 J			34 J	31 J			17 J				
-15	5.2 J						3.7 J						2.2 J	1.8 J			2.6 J		
-16			1,900 J	7.0 J	14 J			11 J			1.4 J				350 J	1,400 J			
-17	1.2 J						9.2 J						1.1 J	0.53			1.6 J		
-18			1,800 J					3.2 J			110 J	55 J			60 J	60 J			
-19	1.8 J						0.81 J						14 J	0.25 J			3.4 J		
-20			160 J								8.9 J				7.7 J				
-21	1.4 J	1.3 J					2.3 J						4.8 J	0.20 J					
-22			9,600 J								3.9 J								
-23	2.6 J						0.58 J						3.9 J						
-24			3,900 J								4.0 J								
-25	0.77 J						0.57 J						0.49 J						
-26			680 J																
-27	1.4 J						0.51 J						0.46 J						
-28			11 J																
-29	0.29 J																		
-30			0.16 J																
-31																			
-32																			
-33																			
-34																			
-35																			

Note:
J - Estimated concentration

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: / Sample Location: / Sample Identification: / Sample Date: / Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest Initial 11187072-NORTH-IMPCT-INITIALS 10/15/2019 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest Area 2 11187072-N.TREATMENT AREA #2 12/18/2019 180-100205-1	Composite Sample 3 - Northeast Area 3 11187072-N.TREATMENT AREA #3 12/18/2019 180-100205-1	Composite Sample 4 - Southeast Area 4 11187072-N.TREATMENT AREA #4 12/18/2019 180-100205-1
General Chemistry					
Cyanide (total)	mg/kg	0.43 U	0.37 U	0.40 U	0.40 U
Free liquid	none	U	U	U	U
Ignitability	Deg F	> 140	> 140	> 140	> 140
Percent solids	%	--	71.4	67.4	66.7
pH, lab	s.u.	7.9 J	8.5 J	8.7 J	7.9 J
Sulfide	mg/kg	76 J	72	59	24 J
TCLP-Dioxins/Furans					
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	7.6 U	95 J	19 U	16 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	34 U	77 J	11 U	9.9 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	5.3 U	9.0 U	8.5 U	8.3 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	3.4 U	23 J	7.5 U	5.9 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	6.2 U	31 J	12 U	11 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	2.9 U	15 U	12 U	10 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.5 U	20 J	8.7 U	6.9 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	3.1 U	13 U	11 U	11 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.7 U	7.9 U	9.2 U	7.5 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	2.2 U	15 J	7.3 U	7.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.3 U	6.7 U	7.9 U	6.3 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	10 U	8.4 U	8.3 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	8.4 U	19 U	20 U	16 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	2.5 U	9.2 U	7.5 U	6.8 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	11 U	9.2 U	9.4 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	2.8 U	11 J	6.5 U	6.6 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	3.4 U	12 U	12 U	12 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	6.2 U	31 J	12 U	11 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	10 U	23 J	7.5 U	5.9 U
Total hexachlorodibenzofuran (HxCDF)	pg/L	3.1 U	15 J	12 U	11 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	4.7 U	20 J	9.2 U	7.5 U
Total pentachlorodibenzofuran (PeCDF)	pg/L	4.6 U	11 U	9.2 U	9.4 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	8.4 U	19 U	20 U	16 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	2.8 U	11 J	6.5 U	6.6 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	4.4 J	12 U	12 U	12 U
TCLP-Glycol					
2-Ethoxyethanol	mg/L	2.5 U	2.5 U	2.5 U	2.5 U
Ethylene glycol	mg/L	1.9 U	1.9 U	1.9 U	1.9 U
Ethylene glycol monomethyl ether (2-methyoxyethanol)	mg/L	2.4 U	2.4 U	2.4 U	2.4 U
TCLP-Herbicides					
2,4,5-TP (Silvex)	mg/L	0.0030 U	0.0030 U	0.0030 U	0.0030 U
2,4-Dichlorophenoxyacetic acid (2,4-D)	mg/L	0.020 U	0.020 U	0.020 U	0.020 U
Dinoseb	mg/L	0.038 U	0.038 U	0.038 U	0.038 U
TCLP-Metals					
Arsenic	mg/L	0.041 U	0.041 U	0.041 U	0.041 U
Barium	mg/L	1.1 J	0.53 J	0.44 J	0.48 J
Cadmium	mg/L	0.0028 U	0.0028 U	0.0028 U	0.0028 U
Chromium	mg/L	0.0078 U	0.0078 U	0.011 J	0.0078 U
Lead	mg/L	0.029 U	0.029 U	0.029 U	0.029 U
Mercury	mg/L	0.00010 U	0.00010 U	0.00010 U	0.00010 U
Selenium	mg/L	0.036 U	0.036 U	0.036 U	0.036 U
Silver	mg/L	0.0085 U	0.0085 U	0.0085 U	0.0085 U

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest Initial 11187072-NORTH-IMPCT-INITIALS 10/15/2019 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest Area 2 11187072-N.TREATMENT AREA #2 12/18/2019 180-100205-1	Composite Sample 3 - Northeast Area 3 11187072-N.TREATMENT AREA #3 12/18/2019 180-100205-1	Composite Sample 4 - Southeast Area 4 11187072-N.TREATMENT AREA #4 12/18/2019 180-100205-1
Misc					
Methomyl	ug/L	0.12 U	0.13 U	0.12 U	0.13 U
TCLP-PCBs					
Aroclor-1016 (PCB-1016)	mg/L	0.00018 U	0.00019 U	0.00019 U	0.00019 U
Aroclor-1221 (PCB-1221)	mg/L	0.00022 U	0.00022 U	0.00023 U	0.00023 U
Aroclor-1232 (PCB-1232)	mg/L	0.00020 U	0.00020 U	0.00021 U	0.00021 U
Aroclor-1242 (PCB-1242)	mg/L	0.00035 U	0.00036 U	0.00036 U	0.00036 U
Aroclor-1248 (PCB-1248)	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
Aroclor-1254 (PCB-1254)	mg/L	0.00037 U	0.00037 U	0.00038 U	0.00038 U
Aroclor-1260 (PCB-1260)	mg/L	0.00015 U	0.00015 U	0.00016 U	0.00016 U
TCLP-Pesticides					
4,4'-DDD	mg/L	0.00021 U	0.00021 U	0.00021 U	0.00021 U
4,4'-DDE	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
4,4'-DDT	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
alpha-Chlordane	mg/L	--	0.00015 U	0.00015 U	0.00015 U
Chlordane	mg/L	0.0029 U	0.0029 U	0.0029 U	0.0029 U
Dieldrin	mg/L	0.00011 U	0.00011 U	0.00011 U	0.00011 U
Endosulfan I	mg/L	0.00027 U	0.00027 U	0.00027 U	0.00027 U
Endosulfan II	mg/L	0.00013 U	0.00013 U	0.00013 U	0.00013 U
Endosulfan sulfate	mg/L	0.00026 U	0.00026 U	0.00026 U	0.00026 U
Endrin	mg/L	0.000091 U	0.000091 U	0.000091 U	0.000091 U
gamma-BHC (lindane)	mg/L	0.00012 U	0.00012 U	0.00012 U	0.00012 U
gamma-Chlordane	mg/L	--	0.00016 U	0.00016 U	0.00016 U
Heptachlor	mg/L	0.00018 U	0.00018 U	0.00018 U	0.00018 U
Heptachlor epoxide	mg/L	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Methoxychlor	mg/L	0.00031 U	0.00031 U	0.00031 U	0.00031 U
Mirex	mg/L	0.000084 U	0.000084 U	0.000084 U	0.000084 U
Toxaphene	mg/L	0.020 U	0.020 U	0.020 U	0.020 U
TCLP-Semi-Volatile Organic Compounds (SVOCs)					
1,4-Dichlorobenzene	mg/L	0.0045 U	0.0045 U	0.0045 U	0.0045 U
2,4,5-Trichlorophenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2,4,6-Trichlorophenol	mg/L	0.0095 U	0.0095 U	0.0095 U	0.0095 U
2,4-Dinitrotoluene	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
2-Methylphenol	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U
3&4-Methylphenol	mg/L	0.0079 U	0.0079 U	0.0079 U	0.0079 U
Hexachlorobenzene	mg/L	0.0055 U	0.0055 U	0.0055 U	0.0055 U
Hexachlorobutadiene	mg/L	0.0084 U	0.0084 U	0.0084 U	0.0084 U
Hexachloroethane	mg/L	0.0040 U	0.0040 U	0.0040 U	0.0040 U
Nitrobenzene	mg/L	0.012 U	0.012 U	0.012 U	0.012 U
Pentachlorophenol	mg/L	0.0075 U	0.0075 U	0.0075 U	0.0075 U
Pyridine	mg/L	0.0082 U	0.0082 U	0.0082 U	0.0082 U

Table 3-1

2019 Treatability Waste Material Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: / Sample Location: / Sample Identification: / Sample Date: / Report Sample Delivery Group (SDG):	Units	Initial Sample - Southwest / Initial / 11187072-NORTH-IMPCT-INITIALS / 10/15/2019 / 180-97287-1, 180-97287-2	Composite Sample 2 - Northwest / Area 2 / 11187072-N.TREATMENT AREA #2 / 12/18/2019 / 180-100205-1	Composite Sample 3 - Northeast / Area 3 / 11187072-N.TREATMENT AREA #3 / 12/18/2019 / 180-100205-1	Composite Sample 4 - Southeast / Area 4 / 11187072-N.TREATMENT AREA #4 / 12/18/2019 / 180-100205-1
TCLP-Volatile Organic Compounds (VOCs)					
1,1,1,2-Tetrachloroethane	mg/L	0.16 U	0.16 U	0.16 U	0.16 U
1,1,1-Trichloroethane	mg/L	0.10 U	0.10 U	0.10 U	0.10 U
1,1,2,2-Tetrachloroethane	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
1,1,2-Trichloroethane	mg/L	0.096 U	0.096 U	0.096 U	0.096 U
1,1-Dichloroethene	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2,3-Trichloropropane	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2-Dibromoethane (Ethylene dibromide)	mg/L	0.11 U	0.11 U	0.11 U	0.11 U
1,2-Dichloroethane	mg/L	0.058 U	0.058 U	0.058 U	0.058 U
1,3-Dichloropropene	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
1,4-Dichlorobenzene	mg/L	0.041 U	0.041 U	0.041 U	0.041 U
2-Butanone (Methyl ethyl ketone) (MEK)	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	mg/L	0.074 U	0.074 U	0.074 U	0.074 U
Acetone	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
Acetonitrile	mg/L	2.0 U	2.0 U	2.0 U	2.0 U
Acrylonitrile	mg/L	1.3 U	1.3 U	1.3 U	1.3 U
Benzene	mg/L	0.079 U	0.079 U	0.079 U	0.079 U
Bromodichloromethane	mg/L	0.094 U	0.094 U	0.094 U	0.094 U
Bromoform	mg/L	0.10 U	0.10 U	0.10 U	0.10 U
Bromomethane (Methyl bromide)	mg/L	0.18 U	0.18 U	0.18 U	0.18 U
Carbon disulfide	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
Carbon tetrachloride	mg/L	0.13 U	0.13 U	0.13 U	0.13 U
Chlorobenzene	mg/L	0.063 U	0.063 U	0.063 U	0.063 U
Chloroform (Trichloromethane)	mg/L	0.085 U	0.085 U	0.085 U	0.085 U
Dichlorodifluoromethane (CFC-12)	mg/L	0.12 U	0.12 U	0.12 U	0.12 U
Ethylbenzene	mg/L	0.086 U	0.086 U	0.086 U	0.086 U
Hexachlorobutadiene	mg/L	0.073 U	0.073 U	0.073 U	0.073 U
Isobutanol (isobutyl alcohol)	mg/L	3.6 U	3.6 U	3.6 U	3.6 U
Methyl acrylonitrile	mg/L	1.6 U	1.6 U	1.6 U	1.6 U
Methylene chloride	mg/L	0.15 U	0.15 U	0.15 U	0.15 U
Styrene	mg/L	0.053 U	0.053 U	0.053 U	0.053 U
Tetrachloroethene	mg/L	0.080 U	0.080 U	0.080 U	0.080 U
Toluene	mg/L	0.067 U	0.067 U	0.067 U	0.067 U
trans-1,3-Dichloropropene	mg/L	0.069 U	0.069 U	0.069 U	0.069 U
Trichloroethene	mg/L	0.060 U	0.060 U	0.060 U	0.060 U
Trichlorofluoromethane (CFC-11)	mg/L	0.058 U	0.058 U	0.058 U	0.058 U
Vinyl chloride	mg/L	0.15 U	0.15 U	0.15 U	0.15 U
Xylenes (total)	mg/L	0.17 U	0.17 U	0.17 U	0.17 U

Notes:
TCLP - Toxicity Characteristic Leaching Procedure
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
Deg F - Degrees in Fahrenheit
s.u. - standard unit
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- Data not available

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Dioxins/Furans											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	100	130	5.8 U	590	370 J-	--	6.4 U	5.5 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	100	3300	90 J	15000 J+	8800 J	--	44 U	44 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	50	160	6.9 U	880 J-	600 J-	--	2.9 U	1.9 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	50	150	4.1 U	840	540 J-	--	4.9 J	6.7 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	50	58	1.8 U	320	240 J-	--	1.4 U	1.3 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	410	19 J	3100	2500 J-	--	3.9 J	1.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	2.8 U	0.82 U	11 U	4.9 U	--	2.6 U	0.83 U	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	110	5.6 J	790	650 J-	--	1.7 J	0.77 U	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	4.1 U	0.83 U	30 J	20 J-	--	1.6 J	0.79 U	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	50	4.2 U	0.68 U	53	40 J-	--	2.0 U	0.52 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	50	1.8 U	0.74 U	18 J-	8.5 J-	--	1.4 U	0.73 U	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	50	200	11 J	2100	1900	--	2.5 J	1.5 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	50	18 U	1.1 U	160	130	--	0.94 U	0.99 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	50	12 U	0.73 U	93	73 J-	--	1.2 U	0.52 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	50	110	6.2 J	1200	1100	--	0.65 U	0.63 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	10	3900	220	50000	46000	--	37	7.1 J	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	10	1500	61	18000	15000	--	13	3.2 J	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/L	NL	280 J	11 J	1600 J	1100 J	--	4.3 J	1.9 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	NL	370 J	10 J	2000 J	1300 J	--	8.2 J	13 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/L	NL	620 J	25 J	4600 J	3800 J	--	8.8 J	1.6 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	NL	35 J	0.83 U	260 J	180 J	--	5.6 J	0.83 U	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/L	NL	490 J	26 J	5000 J	4600 J	--	2.5 J	1.5 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	NL	20 J	1.1 U	190 J	160 J	--	0.94 U	0.99 U	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/L	NL	8100 J	390 J	100000 J	100000 J	--	68 J	11 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	NL	1600 J	66 J	20000 J	16000 J	--	13 J	3.2 J	--	--
Dioxins/Furans (dissolved)											
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF) (dissolved)	pg/L	100	--	2.1 U	170	11 U	--	13 J	22 J	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD) (dissolved)	pg/L	100	--	17 UJ	5400 J+	280 J+	--	21 U	29 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	50	--	3.6 J	240	12 J	--	2.5 J	6.0 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD) (dissolved)	pg/L	50	--	1.1 U	250	27 J	--	2.4 J	6.4 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	50	--	2.8 J	88	4.9 U	--	1.1 U	4.9 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	7.6 J	750	31 J	--	0.91 U	3.1 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.2 U	4.6 U	3.1 U	--	2.9 J	4.9 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	2.7 J	190	9.8 J	--	0.89 U	3.5 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.2 U	6.7 J	2.1 J	--	1.1 U	4.4 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	2.0 U	14 J	4.8 U	--	1.9 J	3.8 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	50	--	1.1 U	5.7 J	1.7 U	--	0.97 U	4.8 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	50	--	3.4 U	450	20 J	--	1.2 U	3.2 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD) (dissolved)	pg/L	50	--	1.6 U	40 J	3.0 J	--	3.1 J	4.6 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	50	--	0.71 U	23 J	2.8 U	--	1.5 J	3.0 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	50	--	1.7 U	250	11 J	--	1.2 U	1.3 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF) (dissolved)	pg/L	10	--	21	11000	540 J	--	2.7 J	1.1 U	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD) (dissolved)	pg/L	10	--	7.1 J	3800	150 J	--	1.1 U	1.6 U	--	--
Total heptachlorodibenzofuran (HpCDF) (dissolved)	pg/L	NL	--	6.4 J	430 J	20 J	--	2.5 J	11 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD) (dissolved)	pg/L	NL	--	1.1 U	630 J	51 J	--	2.4 J	6.4 J	--	--
Total hexachlorodibenzofuran (HxCDF) (dissolved)	pg/L	NL	--	12 J	1100 J	48 J	--	3.4 J	13 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD) (dissolved)	pg/L	NL	--	1.2 U	74 J	6.9 J	--	2.9 J	14 J	--	--
Total pentachlorodibenzofuran (PeCDF) (dissolved)	pg/L	NL	--	3.4 J	1100 J	44 J	--	1.3 U	3.2 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD) (dissolved)	pg/L	NL	--	1.6 U	51 J	3.0 J	--	4.4 J	4.6 J	--	--
Total tetrachlorodibenzofuran (TCDF) (dissolved)	pg/L	NL	--	39 J	21000 J	920 J	--	2.7 J	1.1 U	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD) (dissolved)	pg/L	NL	--	7.1 J	4000 J	170 J	--	1.1 U	1.6 U	--	--
Herbicides											
2,4,5-TP (Silvex)	ug/L	NL	0.29 U	0.020 U	--	--	--	--	--	--	--
2,4-Dichlorophenoxyacetic acid (2,4-D)	ug/L	NL	1.9 U	0.040 U	--	--	--	--	--	--	--
Metals											
Aluminum	mg/L	NL	0.048 U	--	--	--	--	--	--	--	--
Antimony	mg/L	25.623	0.0098 U	0.0039 U	0.0039 U	0.0039 U	--	0.0039 U	0.0039 U	--	--
Arsenic	mg/L	0.164	0.012 U	0.089	0.026	0.023	--	0.0029 U	0.0029 U	--	--
Barium	mg/L	N/A	0.17	2.1	1.1	0.96	--	0.29	0.28	--	--
Beryllium	mg/L	NL	0.00037 J	0.00042 U	0.0074	0.0062	--	0.00042 U	0.00042 U	--	--
Boron	mg/L	NL	--	1.1	0.26	0.25	--	0.21	0.20	--	--
Cadmium	mg/L	0.0439	0.00050 U	0.00080 J	0.0028 J	0.0025 J	--	0.00040 J	0.00028 U	--	--
Calcium	mg/L	NL	35	250	130	120	--	55	53	--	--
Chromium	mg/L	0.389	0.0012 U	0.0017 J	0.12	0.11	--	0.0016 U	0.0016 U	--	--
Cobalt	mg/L	NL	0.0030 U	0.0066 J	0.051	0.043	--	0.00040 J	0.00031 U	--	--
Copper	mg/L	0.0167	0.011 U	0.0081 U	0.11	0.093	--	0.0081 U	0.0081 U	--	--
Iron	mg/L	NL	0.022 J	13	110	88	--	0.29 J	0.13 J	--	--
Lead	mg/L	0.107	0.0025 U	0.0022 U	0.12	0.098	--	0.0022 U	0.0022 U	--	--
Magnesium	mg/L	NL	22	250	58	54	--	33	31	--	--
Manganese	mg/L	NL	0.14	2.7	1.1	1.0	--	0.088	0.029	--	--
Mercury	mg/L	0.000598	0.00010 U	--	--	--	--	--	--	--	--
Mercury	ng/L	598	--	--	28 J	--	6.3 J	18 J	2.5 J	--	--
Mercury	ug/L	0.598	--	0.10 U	--	--	--	--	--	--	--
Molybdenum	mg/L	NL	0.0079 J	0.0068 J	0.0084 J	0.0090 J	--	0.010	0.010	--	--
Nickel	mg/L	0.103	0.0024 U	0.0036 J	0.095	0.081	--	0.0021 J	0.0020 J	--	--
Phosphorus	mg/L	NL	0.050 U	--	--	--	--	--	--	--	--
Potassium	mg/L	NL	12	27	25	23	--	12	12	--	--
Selenium	mg/L	0.619	0.013 U	0.0029 U	0.0029 U	0.0029 U	--	0.0029 U	0.0029 U	--	--
Silver	mg/L	0.00493	0.00084 U	0.0013 U	0.0013 U	0.0013 U	--	0.0013 U	0.0013 U	--	--
Sodium	mg/L	NL	250	2400	340	350	--	350	360	--	--
Strontium	mg/L	NL	0.31	2.5	0.84	0.79	--	0.48	0.46	--	--
Thallium	mg/L	0.5	0.0090 U	--	0.0042 U	0.0042 U	--	0.0042 U	0.026 U	--	--
Thallium	ug/L	500	--	0.14 U	--	--	--	--	--	--	--
Tin	mg/L	NL	--	0.00059 U	0.0048 J	0.0057 J	--	0.00059 U	0.00059 U	--	--
Titanium	mg/L	NL	--	0.0077 J	0.23	0.22	--	0.0011 J	0.00070 J	--	--
Vanadium	mg/L	NL	0.0019 U	0.00047 U	0.20	0.17	--	0.0036 J	0.0028 J	--	--
Zinc	mg/L	0.165	0.011 U	0.031	0.40	0.36	--	0.045	0.036	--	--

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Metals (dissolved)											
Aluminum (dissolved)	mg/L	NL	0.048 U	--	--	--	--	0.048 U	0.048 U	--	--
Antimony (dissolved)	mg/L	25.623	0.0098 U	0.0039 U	0.0039 U	0.0039 U	--	0.0098 U	0.0098 U	--	--
Arsenic (dissolved)	mg/L	0.164	0.012 U	0.037	0.014	0.0041 J	--	0.012 U	0.012 U	--	--
Barium (dissolved)	mg/L	N/A	0.18	1.9	0.55	0.30	--	0.30	0.32	--	--
Beryllium (dissolved)	mg/L	NL	0.00030 U	0.00042 U	0.0026 J	0.00042 U	--	0.00030 U	0.00030 U	--	--
Boron (dissolved)	mg/L	NL	--	1.1	0.22	0.20	--	--	--	--	--
Cadmium (dissolved)	mg/L	0.0439	0.00050 U	0.00080 J	0.0013 J	0.00040 J	--	0.00050 U	0.00050 U	--	--
Calcium (dissolved)	mg/L	NL	37	240	67	55	--	59	57	--	--
Chromium (dissolved)	mg/L	0.389	0.0012 U	0.0016 U	0.048	0.0039 J	--	0.0012 U	0.0012 U	--	--
Cobalt (dissolved)	mg/L	NL	0.0030 U	0.0064 J	0.017	0.0012 J	--	0.0030 U	0.0030 U	--	--
Copper (dissolved)	mg/L	0.0167	0.014	0.0081 U	0.036	0.0081 U	--	0.0072 J	0.0053 J	--	--
Iron (dissolved)	mg/L	NL	0.020 U	0.12 J	40	2.9	--	0.056 J	0.020 U	--	--
Lead (dissolved)	mg/L	0.107	0.0025 U	0.0022 U	0.037	0.0022 U	--	0.0025 U	0.0025 U	--	--
Magnesium (dissolved)	mg/L	NL	22	250	42	32	--	32	31	--	--
Manganese (dissolved)	mg/L	NL	0.15	2.6	0.34	0.035	--	0.064	0.028	--	--
Mercury (dissolved)	mg/L	0.000598	0.00037	--	--	--	--	--	--	--	--
Mercury (dissolved)	ng/L	598	--	--	--	22 J	--	1.7	1.7	--	--
Mercury (dissolved)	ug/L	0.598	--	0.10 U	--	--	--	--	--	--	--
Molybdenum (dissolved)	mg/L	NL	0.0076 J	0.011	0.0084 J	0.010	--	0.010 J	0.0096 J	--	--
Nickel (dissolved)	mg/L	0.103	0.0024 U	0.0050 J	0.033	0.0030 J	--	0.0024 U	0.0024 U	--	--
Phosphorus (dissolved)	mg/L	NL	0.066 J	--	--	--	--	0.050 U	0.050 U	--	--
Potassium (dissolved)	mg/L	NL	11	27	17	13	--	14	13	--	--
Selenium (dissolved)	mg/L	0.619	0.013 U	0.0029 U	0.0029 U	0.0029 U	--	0.013 U	0.013 U	--	--
Silver (dissolved)	mg/L	0.00493	0.00084 U	0.0013 U	0.0013 U	0.0013 U	--	0.00084 U	0.00084 U	--	--
Sodium (dissolved)	mg/L	NL	260	2400	340	350	--	330	330	--	--
Strontium (dissolved)	mg/L	NL	0.32	2.4	0.57	0.47	--	0.51	0.49	--	--
Thallium (dissolved)	mg/L	0.5	0.0090 U	--	0.0042 U	0.0042 U	--	0.0090 U	0.0090 U	--	--
Thallium (dissolved)	ug/L	500	--	0.14 J	--	--	--	--	--	--	--
Tin (dissolved)	mg/L	NL	--	0.0014 J	0.0012 J	0.00059 U	--	--	--	--	--
Titanium (dissolved)	mg/L	NL	--	0.0022 J	0.17	0.025	--	--	--	--	--
Vanadium (dissolved)	mg/L	NL	0.0019 U	0.00047 U	0.086	0.012	--	0.0038 J	0.0035 J	--	--
Zinc (dissolved)	mg/L	0.165	0.013 U	0.015 U	0.15	0.026 J	--	0.012	0.014	--	--
General Chemistry											
Alkalinity (as CaCO3 pH=4.5)	mg/L	NL	210	--	--	--	--	--	--	--	--
Alkalinity, bicarbonate	mg/L	NL	210	1000	190 J	170 J	--	160 J	140	--	--
Alkalinity, carbonate	mg/L	NL	5.0 U	20 U	20 UJ	20 UJ	--	20 UJ	20 U	--	--
Alkalinity, total (as CaCO3)	mg/L	NL	--	1000	190 J	170 J	--	160 J	140	--	--
Ammonia-N	mg/L	NL	2.7	7.1	0.073 J	0.23	--	0.067 U	0.067 U	--	--
Biochemical oxygen demand (BOD)	mg/L	NL	6.0 U	10 U	--	--	--	--	--	--	--
Bromide	mg/L	NL	1.5	9.9	0.12 J	0.15 J	--	0.20 J	0.30 J	--	--
Chemical oxygen demand (COD)	mg/L	NL	92	82	170	310	--	27	16	--	--
Chloride	mg/L	NL	400	4200	540	500	--	480	820	--	--
Cyanide (total)	mg/kg	NL	--	--	--	--	--	--	--	--	--
Cyanide (total)	ug/L	NL	--	3.1 U	--	--	--	--	--	--	--
Ferrous iron	mg/L	NL	--	0.016 UJ	--	--	--	--	--	--	--
Fluoride	mg/L	NL	--	--	1.2 U	0.26 J	--	0.34	0.060 UJ	--	--
Free liquid	none	NL	--	--	--	--	--	--	--	--	--
Hydrogen sulfide	mg/L	NL	--	0.048 U	--	--	--	--	--	--	--
Ignitability	Deg F	NL	--	--	--	--	--	--	--	--	--
Nitrate (as N)	mg/L	NL	--	0.025 U	R	R	--	R	R	--	--
Nitrite (as N)	mg/L	NL	--	0.030 U	R	R	--	R	R	--	--
Oil and grease (n-Hexane Extractable Material [HEM]), total	mg/L	NL	--	--	2.0 J	2.1 J	1.8 J	--	--	--	--
Oil and grease (Silica Gel Treated n-Hexane Extractable Material [SGT HEM]), non-polar material	mg/L	NL	--	--	1.0 U	1.0 U	1.0 U	--	--	--	--
Percent solids	%	NL	--	--	--	--	--	--	--	--	--
pH, lab	s.u.	NL	7.8 J	6.9 J	8.2 J	7.9 J	8.9 J	7.7 J	7.8 J	--	--
Phosphorus	mg/L	NL	--	0.031 J	1.1	0.25	--	0.066	0.095	--	--
Phosphorus, total (as PO4)	mg/L	NL	--	0.095 J	3.3	0.77	--	0.20	0.29	--	--
Sulfate	mg/L	NL	8.7	6.5	37	36	--	1.9 U	62	--	--
Sulfide	mg/kg	NL	--	--	--	--	--	--	--	--	--
Sulfide	mg/L	NL	--	0.045 U	0.57	0.061	0.19	0.0090 U	0.0090 U	--	--
TOC average duplicates	mg/L	NL	4.5	--	--	--	--	--	--	--	--
Total dissolved solids (TDS)	mg/L	NL	910	8800	980	1100	--	1300	1300	--	--
Total organic carbon (TOC)	mg/L	NL	--	24	17 J	9.2 J	--	5.0 J	4.3 J	--	--
Total suspended solids (TSS)	mg/L	NL	3400	240	3500	4600	--	11	2.2	16000	110000
PCBs											
Aroclor-1016 (PCB-1016)	ug/L	NL	0.18 U	0.56 U	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221)	ug/L	NL	0.22 U	0.46 U	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232)	ug/L	NL	0.20 U	0.13 U	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	ug/L	NL	0.34 U	0.17 U	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	ug/L	NL	0.11 U	0.21 U	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	ug/L	NL	0.36 U	0.15 U	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	ug/L	NL	0.15 U	0.35 U	--	--	--	--	--	--	--
PCBs (dissolved)											
Aroclor-1016 (PCB-1016) (dissolved)	ug/L	NL	--	0.64 U	--	--	--	--	--	--	--
Aroclor-1221 (PCB-1221) (dissolved)	ug/L	NL	--	0.52 U	--	--	--	--	--	--	--
Aroclor-1232 (PCB-1232) (dissolved)	ug/L	NL	--	0.14 U	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242) (dissolved)	ug/L	NL	--	0.19 U	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248) (dissolved)	ug/L	NL	--	0.24 U	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254) (dissolved)	ug/L	NL	--	0.17 U	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260) (dissolved)	ug/L	NL	--	0.40 U	--	--	--	--	--	--	--

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Pesticides											
alpha-Chlordane	ug/L	NL	--	0.10 U	--	--	--	--	--	--	--
Chlordane	ug/L	NL	0.27 U	0.13 U	--	--	--	--	--	--	--
Endrin	ug/L	NL	0.0086 U	0.015 U	--	--	--	--	--	--	--
gamma-BHC (lindane)	ug/L	NL	0.011 U	0.013 U	--	--	--	--	--	--	--
gamma-Chlordane	ug/L	NL	--	0.015 U	--	--	--	--	--	--	--
Heptachlor	ug/L	NL	0.017 U	0.013 U	--	--	--	--	--	--	--
Heptachlor epoxide	ug/L	NL	0.013 U	0.015 U	--	--	--	--	--	--	--
Hexachlorobenzene	ug/L	NL	0.016 U	--	--	--	--	--	--	--	--
Methoxychlor	ug/L	NL	0.029 U	0.019 U	--	--	--	--	--	--	--
Toxaphene	ug/L	NL	1.9 U	5.1 U	--	--	--	--	--	--	--
Semi-Volatile Organic Compounds (SVOCs)											
2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ug/L	NL	0.56 U	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	ug/L	NL	0.59 U	4.4 U	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	ug/L	NL	0.65 UJ	3.5 U	--	--	--	--	--	--	--
2,4-Dichlorophenol	ug/L	NL	0.49 UJ	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	ug/L	NL	0.39 UJ	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	ug/L	NL	15 U	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	ug/L	NL	0.49 U	2.2 U	--	--	--	--	--	--	--
2,6-Dinitrotoluene	ug/L	NL	0.58 U	2.9 U	--	--	--	--	--	--	--
2-Chloronaphthalene	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
2-Chlorophenol	ug/L	NL	0.62 UJ	--	--	--	--	--	--	--	--
2-Methylnaphthalene	ug/L	NL	0.60 UJ	--	--	--	--	--	--	--	--
2-Methylphenol	ug/L	NL	2.9 UJ	1.5 U	--	--	--	--	--	--	--
2-Nitroaniline	ug/L	NL	5.3 U	--	--	--	--	--	--	--	--
2-Nitrophenol	ug/L	NL	0.59 U	--	--	--	--	--	--	--	--
3&4-Methylphenol	ug/L	NL	3.6 UJ	1.4 U	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	ug/L	NL	5.6 U	--	--	--	--	--	--	--	--
3-Nitroaniline	ug/L	NL	0.64 U	--	--	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	ug/L	NL	14 U	--	--	--	--	--	--	--	--
4-Bromophenyl phenyl ether	ug/L	NL	0.61 U	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	ug/L	NL	0.59 U	--	--	--	--	--	--	--	--
4-Chloroaniline	ug/L	NL	0.42 UJ	--	--	--	--	--	--	--	--
4-Chlorophenyl phenyl ether	ug/L	NL	0.59 UJ	--	--	--	--	--	--	--	--
4-Nitroaniline	ug/L	NL	0.56 U	--	--	--	--	--	--	--	--
4-Nitrophenol	ug/L	NL	1.4 U	--	--	--	--	--	--	--	--
Acenaphthene	ug/L	NL	0.63 UJ	--	--	--	--	--	--	--	--
Acenaphthylene	ug/L	NL	0.63 UJ	--	--	--	--	--	--	--	--
Acetophenone	ug/L	NL	0.60 U	--	--	--	--	--	--	--	--
Anthracene	ug/L	NL	0.47 U	--	--	--	--	--	--	--	--
Atrazine	ug/L	NL	6.1 U	--	--	--	--	--	--	--	--
Benzaldehyde	ug/L	NL	1.1 U	--	--	--	--	--	--	--	--
Benzo(a)anthracene	ug/L	NL	0.72 U	--	--	--	--	--	--	--	--
Benzo(a)pyrene	ug/L	NL	0.51 U	--	--	--	--	--	--	--	--
Benzo(b)fluoranthene	ug/L	NL	0.93 U	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene	ug/L	NL	0.66 UJ	--	--	--	--	--	--	--	--
Benzo(k)fluoranthene	ug/L	NL	0.85 U	--	--	--	--	--	--	--	--
Biphenyl (1,1-Biphenyl)	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
bis(2-Chloroethoxy)methane	ug/L	NL	0.64 UJ	--	--	--	--	--	--	--	--
bis(2-Chloroethyl)ether	ug/L	NL	0.38 UJ	--	--	--	--	--	--	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	ug/L	NL	60 U	--	--	--	--	--	--	--	--
Butyl benzylphthalate (BBP)	ug/L	NL	4.4 U	--	--	--	--	--	--	--	--
Caprolactam	ug/L	NL	4.5 U	--	--	--	--	--	--	--	--
Carbazole	ug/L	NL	0.49 U	--	--	--	--	--	--	--	--
Chrysene	ug/L	NL	0.78 U	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	ug/L	NL	0.69 U	--	--	--	--	--	--	--	--
Dibenzofuran	ug/L	NL	0.70 UJ	--	--	--	--	--	--	--	--
Diethyl phthalate	ug/L	NL	5.5 U	--	--	--	--	--	--	--	--
Dimethyl phthalate	ug/L	NL	0.54 U	--	--	--	--	--	--	--	--
Di-n-butylphthalate (DBP)	ug/L	NL	7.1 U	--	--	--	--	--	--	--	--
Di-n-octyl phthalate (DnOP)	ug/L	NL	6.6 U	--	--	--	--	--	--	--	--
Fluoranthene	ug/L	NL	0.58 U	--	--	--	--	--	--	--	--
Fluorene	ug/L	NL	0.66 UJ	--	--	--	--	--	--	--	--
Hexachlorobenzene	ug/L	NL	0.54 U	3.4 U	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/L	NL	0.66 UJ	2.7 U	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	ug/L	NL	R	--	--	--	--	--	--	--	--
Hexachloroethane	ug/L	NL	0.60 UJ	3.4 U	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	ug/L	NL	0.82 U	--	--	--	--	--	--	--	--
Isophorone	ug/L	NL	0.52 U	--	--	--	--	--	--	--	--
Naphthalene	ug/L	NL	0.57 UJ	--	--	--	--	--	--	--	--
Nitrobenzene	ug/L	NL	4.8 U	2.7 U	--	--	--	--	--	--	--
N-Nitrosodi-n-propylamine	ug/L	NL	0.68 U	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	ug/L	NL	1.1 U	--	--	--	--	--	--	--	--
Pentachlorophenol	ug/L	NL	8.1 U	3.3 U	--	--	--	--	--	--	--
Phenanthrene	ug/L	NL	0.53 U	--	--	--	--	--	--	--	--
Phenol	ug/L	NL	4.7 UJ	--	--	--	--	--	--	--	--
Pyrene	ug/L	NL	0.52 U	--	--	--	--	--	--	--	--
Pyridine	ug/L	NL	5.2 UJ	2.3 U	--	--	--	--	--	--	--

Table 3-2

2019 Pilot Test Effluent Characterization Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Estimated Discharge Criteria [1,2]	Non-homogenized Contact Water	Excavation Seepage Water	Homogenized Contact Water - from tank feeding clarifier	Homogenized Contact Water - from tank feeding clarifier/filter	Equalized Contact Water - from tank feeding clarifier/filter	Clarified Effluent - from mix tank	Filter Effluent - from mix tank	Clarifier Underflow - composite	Settled Sludge - from bottom of cone bottom tank
Sample Location:			Contact-Initial	EXC-1	INF3	INF4	INF4	CEFF	FEFF	CUI	SS
Sample Identification:			11187072-CONTACT-INITIAL	11187072-091319-LL-EXC-1	INF 3	INF 4	DUP	1. CEFF, CEFF-Filtered	FEFF 1, FEFF-Filtered	CUI	SS
Sample Date:			9/24/2019	9/13/2019	10/25/2019	10/25/2019	10/25/2019	10/25/2019 , 11/5/2019	10/26/2019, 11/5/2019	10/26/2019	10/26/2019
Sample Type:							Duplicate				
Report Sample Delivery Group (SDG):			180-96144-1	600-191956-1, 600-191956-2	600-194690-1	600-194690-1	600-194690-1	600-194690-1, 320-56102-1	600-194690-1, 320-56102-1	600-194690-1	600-194690-1
Volatile Organic Compounds (VOCs)											
1,1,1-Trichloroethane	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
1,1,2-Trichloroethane	ug/L	NL	2.4 U	--	--	--	--	--	--	--	--
1,1-Dichloroethane	ug/L	NL	1.8 U	--	--	--	--	--	--	--	--
1,1-Dichloroethene	ug/L	NL	2.9 U	0.76 U	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	ug/L	NL	3.7 U	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	ug/L	NL	2.0 U	--	--	--	--	--	--	--	--
1,2-Dichloroethane	ug/L	NL	1.5 U	1.0 U	--	--	--	--	--	--	--
1,2-Dichloropropane	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
1,4-Dichlorobenzene	ug/L	NL	1.0 U	0.91 U	--	--	--	--	--	--	--
2-Butanone (Methyl ethyl ketone) (MEK)	ug/L	NL	2.9 U	1.6 U	--	--	--	--	--	--	--
Benzene	ug/L	NL	2.0 U	0.56 U	--	--	--	--	--	--	--
Bromodichloromethane	ug/L	NL	2.4 U	--	--	--	--	--	--	--	--
Bromoform	ug/L	NL	2.6 U	--	--	--	--	--	--	--	--
Carbon disulfide	ug/L	NL	--	1.7 U	--	--	--	--	--	--	--
Carbon tetrachloride	ug/L	NL	3.3 U	0.92 U	--	--	--	--	--	--	--
Chlorobenzene	ug/L	NL	1.6 U	0.82 U	--	--	--	--	--	--	--
Chloroethane	ug/L	NL	2.6 U	--	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	ug/L	NL	2.1 U	0.82 U	--	--	--	--	--	--	--
cis-1,2-Dichloroethene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
cis-1,3-Dichloropropene	ug/L	NL	1.6 U	--	--	--	--	--	--	--	--
Ethylbenzene	ug/L	NL	2.2 U	--	--	--	--	--	--	--	--
Hexachlorobutadiene	ug/L	NL	--	1.2 U	--	--	--	--	--	--	--
m&p-Xylenes	ug/L	NL	1.9 U	1.3 U	--	--	--	--	--	--	--
o-Xylene	ug/L	NL	2.4 U	0.93 U	--	--	--	--	--	--	--
Tetrachloroethene	ug/L	NL	2.0 U	1.2 U	--	--	--	--	--	--	--
Toluene	ug/L	NL	1.7 U	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethene	ug/L	NL	2.5 U	--	--	--	--	--	--	--	--
trans-1,3-Dichloropropene	ug/L	NL	1.7 U	--	--	--	--	--	--	--	--
Trichloroethene	ug/L	NL	1.5 U	1.6 U	--	--	--	--	--	--	--
Vinyl chloride	ug/L	NL	3.7 U	0.85 U	--	--	--	--	--	--	--
Xylenes (total)	ug/L	NL	4.3 U	2.0 U	--	--	--	--	--	--	--

Notes:

[1] Per an EPA email dated February 18, 2020, compliance with the Texas Surface Water Quality Standards will be determined using the minimum level from the EPA approved method (1613B), cited in 40 CFR Part 136, in sampling of dioxin concentrations for surface water discharges during the site remedial action.

[2] Estimated discharge criteria were calculated for all parameters except dioxins and furans utilizing the TCEQ model, TEXTOX MENU # 5 for bays or wide tidal rivers.

TCLP - Toxicity Characteristic Leaching Procedure
EPA - US Environmental Protection Agency
CFR - Code of Federal Regulations
TCEQ - Texas Commission on Environmental Quality
BHC - benzene hexachloride
PCB - polychlorinated biphenyl
mg/L - milligrams per Liter
ug/L - microgram per Liter
mg/kg - milligram per kilogram
pg/L - picograms per Liter

Deg F - Degrees in Fahrenheit
s.u. - standard unit
J - Estimated concentration.
J- - Estimated concentration, result may be biased low
J+ - Estimated concentration, result may be biased high.
U - Not detected at the associated reporting limit.
Dup - indicates the result from a duplicate sample
UJ - Not detected; associated reporting limit is estimated.
NL - No limit
-- Data not available

Table 3-3

2019 Bench-Scale Contact Water Filtration Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Report Sample Delivery Group (SDG): Filter Size:	Units	Non-homogenized contact water - effluent from 100 µm filter Filter Test 11187072-Filter Test-1 9/30/2019 320-54852-1 100 µm	Non-homogenized contact water - effluent from 10 µm filter Filter Test 11187072-Filter Test-3 9/30/2019 320-54852-1 10 µm	Non-homogenized contact water - effluent from 1 µm filter Filter Test 11187072-Filter Test-4 9/30/2019 320-54852-1 1 µm	Non-homogenized contact water - effluent from 0.45 µm filter Filter Test 11187072-Filter Test-5 9/30/2019 320-54852-1 0.45 µm	Non-homogenized contact water - effluent from 0.1 µm filter Filter Test 11187072-Filter Test-6 9/30/2019 320-54852-1 0.1 µm
Solids Collected on Filter						
	mg/L	9.53	4099	342	3.27	0.05
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	61 J	24 U	0.90 U	1.9 U	1.8 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	1900	850	12 U	4.0 U	4.6 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	84	30 J	0.75 U	1.1 U	1.2 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	75	30 J	1.7 U	0.53 U	1.4 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	28 J	11 J	0.87 U	0.47 U	0.47 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	210	74	1.1 U	0.60 U	1.2 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.7 U	1.7 U	2.0 U	1.9 U	1.9 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	53	20 J	0.44 U	1.2 U	0.86 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.7 U	0.84 U	0.45 U	0.62 U	1.3 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	4.5 U	2.1 U	0.67 U	0.75 U	1.1 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	2.3 U	0.60 U	0.71 U	0.57 U	1.5 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	100	39 J	0.53 U	0.60 U	0.64 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	9.4 J	4.2 J	0.92 U	1.0 U	1.2 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	7.0 J	2.8 U	0.36 U	0.94 U	0.47 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	59	22 J	0.56 U	0.57 U	0.66 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	2500	820	8.7 J	1.6 J	0.93 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	800	270	3.6 J	0.76 U	0.65 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	140 J	52 J	1.6 J	1.1 J	1.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	190 J	78 J	3.9 J	0.53 U	2.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	310 J	110 J	1.8 J	2.9 J	3.2 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	27 J	7.5 J	2.7 J	2.5 J	4.6 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	250 J	91 J	0.56 U	0.69 U	0.66 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	9.4 J	4.2 J	0.92 U	1.0 U	1.2 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	4200 J	1400 J	13 J	1.6 J	0.93 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	860 J	290 J	5.0 J	0.76 U	0.65 U

Notes:
- mg/L - milligrams per Liter
- pg/L - picograms per Liter
- µm - micron
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.

Table 3-4

2019 Focused Filtration Testing Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Pilot Test Filter Effluent - effluent from 1 um filter	Pilot Test Filter Effluent - effluent from 0.45 um filter	Pilot Test Filter Effluent - effluent from 0.1 um filter	Pilot Test Filter Effluent - effluent from 0.050 um filter	Pilot Test Filter Effluent - effluent from 0.025 um filter
Sample Location:		FEFF	FEFF	FEFF	FEFF	FEFF
Sample Identification:		11187072-FEFF-1um	11187072-FEFF-0.45um	11187072-FEFF-0.1um	11187072-FEFF-0.050um	11187072-FEFF-0.025um
Sample Date:		1/9/2020	1/9/2020	1/9/2020	1/13/2020	1/13/2020
Report Sample Delivery Group (SDG):		320-57624-1	320-57624-1	320-57624-1	320-57717-1	320-57717-1
Filter Size:		1 um	0.45 um	0.1um	0.05 um	0.025 um
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	1.5 J	1.0 J	2.1 J	1.3 J	0.93 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	9.3 U	3.6 U	14 U	3.7 U	14 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	0.51 U	0.52 U	0.95 U	0.67 U	0.84 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	1.1 U	0.722 U	1.7 U	0.73 J	1.3 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	0.29 U	0.20 U	0.27 U	0.80 U	0.96 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.40 U	0.41 U	0.50 U	0.65 U	0.72 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	1.8 U	1.6 U	1.8 U	1.6 J	1.8 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.41 U	0.42 U	0.50 U	0.63 U	0.71 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.30 U	0.30 U	0.33 U	0.66 J	0.85 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	0.29 U	0.30 U	0.50 J	0.96 U	0.68 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.26 U	0.50 J	0.29 U	0.44 U	0.52 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.25 U	0.33 U	0.32 U	0.59 U	0.78 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	0.40 U	0.40 U	0.35 U	1.1 U	1.2 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	0.30 U	0.31 U	0.34 U	0.41 U	0.48 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.26 U	0.33 U	0.35 U	0.62 U	0.80 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	0.22 U	0.21 U	0.24 U	0.34 U	0.41 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.40 U	0.41 U	0.48 U	0.62 U	0.70 U
Total heptachlorodibenzofuran (HpCDF)	pg/L	0.51 J	0.52 J	0.95 J	0.80 U	0.96 U
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	2.5 J	0.72 J	3.2 J	1.8 J	2.9 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	0.41 U	0.42 U	0.50 J	0.96 J	0.68 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	1.8 J	2.1 J	1.8 J	5.6 J	2.6 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	0.30 U	0.33 U	0.43 U	0.62 U	0.80 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	0.40 U	0.40 U	0.35 U	1.1 U	1.2 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	0.22 U	0.21 U	0.24 U	0.34 U	0.41 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.40 U	0.41 U	0.48 U	1.0 J	0.90 J

Notes:
pg/L - picograms per Liter
µm - micron
U - Not detected at the associated reporting limit.
J - Estimated concentration.

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Elutriate From Armored Cap Material	Elutriate From Armored Cap Material	Elutriate From Armored Cap Material
Sample Location:	Units	Berm	Eastern	Western
Sample Identification:		11187072-Berm-GW	11187072-Eastern-GW	11187072-Western-GW
Sample Date:		1/29/2020	1/29/2020	1/29/2020
Report Sample Delivery Group (SDG):		320-58170-1	320-58170-1	320-58170-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/L	21 U	14 U	13.8 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/L	83 U	94 U	51 U
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/L	7.54 U	7.54 U	7.54 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	9.52 U	9.52 U	9.52 U
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/L	5.85 U	5.85 U	0.71 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	5.92 U	5.92 U	0.79 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	7.72 U	7.72 U	7.72 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	6.14 U	0.81 U	0.70 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	0.48 U	0.52 U	0.48 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/L	6.25 U	6.25 U	0.53 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	6.10 U	6.10 U	6.10 U
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.46 U	0.48 U	0.42 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	6.12 U	6.12 U	0.47 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/L	5.39 U	0.55 U	0.49 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/L	0.51 U	0.55 U	0.46 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/L	0.28 U	0.36 U	0.35 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.60 U	0.44 U	3.4 J
Total heptachlorodibenzofuran (HpCDF)	pg/L	13 J	8.9 J	3.2 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/L	15 J	16 J	8.3 J
Total hexachlorodibenzofuran (HxCDF)	pg/L	6.8 J	3.9 J	0.79 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/L	5.0 J	3.4 J	4.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/L	0.51 U	0.55 U	0.46 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/L	1.1 J	0.62 J	0.47 U
Total tetrachlorodibenzofuran (TCDF)	pg/L	0.28 U	0.36 U	0.35 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/L	0.60 U	0.44 U	3.4 J

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Solids Washed From Armored Cap Material	Solids Washed From Armored Cap Material	Solids Washed From Armored Cap Material
Sample Location:	Units	Berm	Eastern	Western
Sample Identification:		11187072-Berm-Solids	11187072-Eastern-Solids	11187072-Western-Solids
Sample Date:		1/29/2020	1/29/2020	1/29/2020
Report Sample Delivery Group (SDG):		320-58170-1	320-58170-1	320-58170-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	5.0 J	4.0 J	12 J
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	320	280	540
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.9 J	0.75 U	3.2 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	0.61 U	12	26
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.30 U	0.24 U	0.29 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.18 J	0.21 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.48 U	0.46 U	0.69 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.23 U	0.14 U	0.17 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.86 J	0.38 J	0.67 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.18 U	0.24 J	0.11 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.62 J	0.48 J	0.68 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.12 U	0.12 J	0.13 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.17 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.095 U	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.13 U	0.12 U	0.17 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.73 J	2.2	2.5
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.56 J	0.98 J	1.0 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	3.8 J	2.0 J	9.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	20 J	33 J	62 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.69 J	1.2 J	1.9 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	5.0 J	4.9 J	7.9 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.69 J	0.12 J	1.4 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.20 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.73 J	3.6 J	5.0 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.56 J	0.98 J	1.0 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.898	1.54	1.84
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	1.06	1.68	2.02
Percent solids	%	99.6	99.6	99.7

Table 3-5

2019 Armored Cap Test Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Crushed Rock Armored Cap Material	Crushed Rock Armored Cap Material	Crushed Rock Armored Cap Material
Sample Location:	Units	Berm	Eastern	Western
Sample Identification:		11187072-Berm-Rock	11187072-Eastern Rock	11187072-Western-Rock
Sample Date:		2/11/2020	2/11/2020	2/11/2020
Report Sample Delivery Group (SDG):		320-58545-1	320-58545-1	320-58545-1
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	0.57 U	0.58 U	3.4 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	9.6 J	61	160
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	0.229 U	0.27 U	1.2 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	0.59 J	4.4 J	12
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.18 J	0.027 U	0.14 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.085 U	0.098 U	0.13 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 U	0.27 U	0.30 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.076 U	0.090 U	0.11 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.046 U	0.26 U	0.33 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.27 U	0.18 U	0.20 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.042 U	0.13 J	0.26 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.16 J	0.13 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.093 J	0.11 J	0.058 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.084 J	0.059 U	0.068 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.050 U	0.060 U	0.057 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	0.11 J	0.15 J	0.18 J
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.059 U	0.14 J	0.15 J
Total heptachlorodibenzofuran (HpCDF)	pg/g	0.46 J	0.38 J	3.7 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	1.3 J	12 J	26 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.35 J	0.18 J	0.98 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.24 J	1.1 J	2.1 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.17 J	0.16 J	0.13 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.093 J	0.11 J	0.24 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	0.23 J	0.15 J	0.18 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	0.059 U	0.14 J	0.15 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	0.128	0.345	0.379
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	0.204	0.404	0.474
Percent solids	%	99.7	94.4	94.2

Notes:
- pg/L - picograms per Liter
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- TEQ - toxic equivalency
- WHO - World Health Organization

Table 3-6

Analytical Results from 2020 Field Filtration Testing
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameter	Units	Influent - Sand-Filtered and Clarified Contact Water	1 µm Filtrate	0.5 µm Filtrate
TSS	mg/L	11	3.8	2.0 U
Total TCDD	pg/L	6.5 J	3.6 J	3.8 J
Total TCDF	pg/L	20 J	5.6 J	0.96 J
2,3,7,8-TCDD	pg/L	1.9 J	0.72 U	0.56 U
2,3,7,8-TCDF	pg/L	12	3.4 J	0.96 J

Notes:
mg/L - milligram per liter
pg/L - picogram per liter
µm - micrometer
TSS = total suspended solids
Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
Total TCDF = Total tetrachlorodibenzofuran
2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
J - Estimated concentration
U - Not detected at the associated reporting limit

Table 3-7

Results from Filtrate Generated from Particle Size Analysis - Approach B Filtration Testing
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Filter Size (µm)	With Chemical Addition						Without Chemical Addition					
	Solids on Filter (mg/L)	Solids Retained (%)	Total TCDD (pg/L)	Total TCDF (pg/L)	2,3,7,8-TCDD (pg/L)	2,3,7,8-TCDF (pg/L)	Solids on Filter (mg/L)	Solids Retained (%)	Total TCDD (pg/L)	Total TCDF (pg/L)	2,3,7,8-TCDD (pg/L)	2,3,7,8-TCDF (pg/L)
100	29.2	0.26	13,000 J	68,000 J	12,000	35,000	18	0.45	3,000 J	16,000 J	2,700	9,500
41	2,226	19.54	8,600 J	41,000 J	8,000	23,000	136.6	3.42	28,000 J	13,000 J	26,000	80,000
10	8,756	76.86	42 J	160 J	37	97	3,577	89.49	59 J	260 J	52	140
1	325.6	2.86	17 J	59 J	12	34	228.5	5.72	120 J	600 J	110	350
0.45	33.2	0.29	11 J	29 J	6.1 J	19	22.6	0.57	4.5 J	21 J	4.5 J	11
0.1	22.4	0.20	13 J	49 J	11	31	14.4	0.36	15 J	81 J	15	48

Notes:
mg/L - milligram per liter
pg/L - picogram per liter
µm - micrometer
Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
Total TCDF = Total tetrachlorodibenzofuran
2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
J - Estimated concentration

Table 3-8

Constituent Concentrations throughout Treatment Process - Additional WTS Treatability Testing
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Parameter	Units	Supernatant after Initial Setting	Supernatant after Chemical Addition and Settling	Chemical Addition Supernatant - 5-µm Filtrate	Chemical Addition Supernatant - 1-µm Filtrate
Total TCDD	pg/L	650 J	19 J	1.1 U	0.96 U
Total TCDF	pg/L	2,900 J	99 J	2.5 J	2.4 J
2,3,7,8-TCDD	pg/L	600	19	1.1 U	0.96 U
2,3,7,8-TCDF	pg/L	1,600	56	2.5 U	2.4 J
TSS	mg/L	1,050	5	2	2

Notes:
mg/L - milligram per liter
pg/L - picogram per liter
µm - micrometer
WTS - Water Treatment System
Total TCDD = Total tetrachlorinated dibenzo-p-dioxin
Total TCDF = Total tetrachlorodibenzofuran
2,3,7,8-TCDD = 2,3,7,8 tetrachlorinated dibenzo-p-dioxin
2,3,7,8-TCDF = 2,3,7,8 tetrachlorodibenzofuran
J - Estimated concentration
U - Not detected at the associated reporting limit

Table 4-1

Applicable or Relevant and Appropriate Requirements (ARAR)
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Item No.	Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
1.	Surface Water	Clean Water Act (CWA): Sections 303 and 304: Federal Water Quality Criteria.	33 U.S.C. §§1313 and 1314 (304(a))	Under §303 (33 U.S.C. §1313), individual states have established water quality standards to protect existing and attainable uses. CWA §301(b)(1)(C) requires that pollutants contained in direct discharges be controlled beyond BCT/BAT equivalents. Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) §121(d)(2)(B)(i) establishes conditions under which water quality criteria, which were developed by USEPA as guidance for states to establish location-specific water quality standards, are to be considered relevant and appropriate. Two kinds of water quality criteria have been developed under CWA §304 (33 U.S.C. §1314): one for protection of human health, and another for protection of aquatic life. These requirements include establishment of total maximum daily loads (TMDL).	A TMDL for dissolved nickel in the Houston Ship Channel System has been adopted and an implementation plan approved. Discharge criteria for the Northern Impoundment, including nickel, was determined by establishing Water Quality-Based Effluent Limitations (WQBELs) using TexTox Menus model provided by TCEQ; therefore, the use of the same model used to develop the TMDL ensures that the cumulative effects will not cause an exceedance of the water quality criteria for nickel. Per the 2020 Texas Integrated Report – Texas 303(d) list, San Jacinto River Segment 1005 is classified as impaired body of water for dioxin and polychlorinated biphenyls (PCBs) in edible tissues as category 5; therefore, it is suitable for development of a TMDL. A TMDL for dioxin and PCBs in edible tissues Segment 1005 has not been developed yet. The Texas Surface Water Quality Standard (TSWQS) for dioxins is applicable for surface water discharge from the Northern Impoundment, in accordance with the EPA's February 18, 2020, e-mail (included in Appendix D of this Northern Impoundment 90% RD Package), which stated: *EPA has determined that compliance with the TSWQS ARAR will be attained as follows:* *- The state surface water quality standard for Dioxins/Furans is 7.97 x 10-8 µg/L [0.0797 pg/L] (as TCDD equivalents);* *- Compliance with the TSWQS will be determined by using minimum level of the EPA approved method (1613B), cited in 40 CFR Part 136 (GUIDELINES ESTABLISHING TEST PROCEDURES FOR THE ANALYSIS OF POLLUTANTS), in sampling of surface water discharges during the Site remedial action.* *- If an effluent sample analyzed for dioxin is below the minimum level using the EPA approved method, the sample result would be identified as non-detect and the discharge would be determined to be in compliance with the ARAR.* *This approach is consistent with the state's guidance and other permits issued by TCEQ. EPA's determination is contingent on the water treatment facility using a 1 micron final filtration step in the water treatment process.*
2.	Surface Water	Clean Water Act (CWA): Criteria and standards for imposing technology -based treatment requirements under §402.	33 U.S.C. §1342; 40 CFR Part 125 Subpart A	Both on-site and off-site discharges from CERCLA Sites to surface waters are required to meet the substantive CWA (National Pollutant Discharge Elimination System) NPDES requirements.	On-site discharges to surface water must comply with the substantive technical requirements of the CWA but do not require a permit. Off-site discharges to a Publicly Owned Treatment Work (POTW) would be regulated under the conditions of a NPDES permit for the POTW. Water that is generated during removal activities in the Northern Impoundment will be treated and discharged to the San Jacinto River (Segment 1005). The discharge location(s) have yet to be determined but will be in close proximity to the Northern Impoundment, so only the substantive requirements of an NPDES permit, but not an NPDES permit, will be required. Water quality-based effluent limitations using TexTox menu # 5 for bay or wide tidal river were calculated and considered for the water treatment design. Development of the treatment system discharge limits are discussed further below.

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3.	Surface Water	Clean Water Act (CWA): Section 307(b): Pretreatment standards.	33 U.S.C. §1317(b)	CERCLA §121(e) states that no Federal, state, or local permit for direct discharges is required for the portion of any removal or remedial action conducted entirely on-site (the aerial extent of contamination and all suitable areas in close proximity to the contamination necessary for implementation of the response action) (USEPA, 1988).	If off-site discharges from a CERCLA response activity were to enter receiving waters directly or indirectly, through treatment at a POTW, the POTW must comply with applicable Federal, State, and Local substantive requirements and formal administrative permitting requirements. Per the RD as described in this Northern Impoundment 90% RD Package, contact water generated during excavation activities will not be discharged to a POTW; therefore this regulation does not apply.
4.	Surface Water	Clean Water Act (CWA).	Section 401: Water Quality Certification 33 U.S.C. §1341 30 TAC Chapter 279	Requires activities that involve a discharge into navigable waters of the U.S. to obtain certification from state or regional regulatory agencies that the proposed discharge will comply with CWA Sections 301, 302, 303, 306, and 307.	Water Quality Certification is a requirement of projects that involve discharge of dredge/fill or would impact waters of the U.S. or wetland. The cofferdam barrier wall to be installed at the Northern Impoundment is considered "fill material"; therefore, Section 401 would apply to the project. The project will comply with substantive requirements of Section 401.
5.	Surface Water	Clean Water Act (CWA).	CWA Section 404 and 404(b)(1): Dredge and Fill 33 U.S.C. §1344 (b)(1); 33 CFR 320 and 330; 40 CFR 230	Discharges of dredged and fill material into waters of the U.S. must comply with the CWA §404 (33 U.S.C. 1344) guidelines and demonstrate the public interest is served.	The San Jacinto River is a water of the U.S. These requirements are applicable to dredging, in-water disposal, capping, construction of berms or levees, stream channelization, excavation and/or dewatering within the river. Therefore, they would apply to the work in the Northern Impoundment. Under the 404(b)(1) guidelines, efforts should be made to avoid, minimize, and mitigate adverse effects on the waters of the U.S. and, where possible, select a practicable (engineering feasible) alternative with the least adverse effects. A permit for the on-site work will not be required; however, the substantive technical requirements of Section 404 will apply in the development, evaluation, and implementation of the remedial action to minimize adverse impacts to waters of the U.S. AA "Waters and Wetlands Delineation Report" will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
6.	Surface Water	Storm Water Discharge from Construction Activities.	40 CFR 450 30 TAC Chapter 205	Requires new construction project that will disturb 5 or more acres to request coverage under a Texas Commission on Environmental Quality (TCEQ) construction general permit (TX15000) and develop a storm water pollution prevention plan (SWPPP) to control discharges of storm water associated with construction activities in accordance with the NPDES program.	A permit is not required, however, the work must comply with the substantive technical requirements of these regulations. A SWPPP will be developed and implemented using best management practices to minimize erosion and entrainment of sediments in stormwater runoff.
7.	Surface Water	Texas Surface Water Quality Standards.	30 TAC §307.4-7, 10	These state regulations provide general narrative criteria, anti-degradation policy, numerical criteria for pollutants, numerical and narrative criteria for water-quality related uses (e.g., human use), and site-specific criteria for San Jacinto River basin.	The TSWQS for dioxins is applicable for surface water discharge from the Northern Impoundment, in accordance with EPA's February 18, 2020, e-mail quoted in Item No. 1, and included in Appendix D of this Northern Impoundment 90% RD Package.
8.	Surface Water	Texas Water Quality: Pollutant Discharge Elimination System (TPDES).	30 TAC §279.10	These state regulations require storm water discharge permits for either industrial discharge or construction-related discharge. The State of Texas was authorized by USEPA to administer the NPDES program in Texas on September 14, 1998.	No permit is required for on-site activities. A SWPPP will be developed and implemented using best management practices to minimize soil erosion and entrainment of sediments in stormwater runoff.

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9.	Surface Water	Texas Water Quality: Water Quality Certification.	30 TAC §279.10	These state regulations establish procedures and criteria for applying for, processing, and reviewing state certifications under CWA, §401. It is the purpose of this chapter, consistent with the Texas Water Code and the federal CWA, to maintain the chemical, physical, and biological integrity of the state's waters.	Water Quality Certification is a requirement for projects that involve discharge of dredge fill or would impact waters of the U.S. or wetlands. The cofferdam barrier wall that will be installed at the Northern Impoundment, as described in this 90% Northern Impoundment RD Package, is considered "fill material"; therefore, Section 401 would apply to the project. The BMP installation and removal activities will comply with substantive requirements of Section 401.
10.	Surface Water	Water Use.	TWC Sections 11.121 and 11.138; 30 TAC §297.11	Impoundment, diversion and storage, taking or use of state water with certain exemptions as provided in state law require obtaining a water rights permit. These exemptions are not applicable to the Northern Impoundment. These state regulations establish procedures for applying for, and obtaining the temporary diversion of surplus state water under a temporary water rights permit.	A temporary use permit is a requirement for projects that involve the use of state water and/or divert water for up to three years. Projects that would use more than 10 acre-feet of water and/or exceed one year term are subject to public notice and hearing. Hydrodynamic modeling was performed at the request of the Harris County Flood Control District (HCFCD) to evaluate the effect the cofferdam barrier wall planned for the Northern Impoundment may have on the water levels of the surrounding floodplain. Results of the evaluation suggest that the effect of the structure on the floodplain would be negligible under 2-year, 10-year, and 100-year flood event scenarios. This evaluation was summarized in a letter submitted to the HCFCD on March 30, 2022. A revised version of the letter was submitted on May 6, 2022, which addressed comments from the HCFCD that were received on April 8, 2022. The revised letter is included in Appendix D of this Northern Impoundment 90% RD package. At the request of the Texas Department of Transportation (TxDOT) the Respondents also evaluated the potential effect the cofferdam barrier would have on the river velocity and shear stress. The results of this evaluation were submitted to TxDOT on April 11, 2022. This submittal is also included in Appendix D.
11.	Waste	Resource Conservation And Recovery Act (RCRA): Hazardous Waste Management.	42 U.S.C. §§6921 et seq.; 40 CFR Parts 260 - 268	RCRA Subtitle C and its implementing regulations contain the federal requirements for the management of hazardous wastes.	This requirement would apply to certain activities if the waste materials or affected soils contain RCRA listed hazardous waste or exhibit a hazardous waste characteristic. Waste management in the Northern Impoundment would be required to comply with these regulations. Based on the results of the pre-design investigations (PDI-1, PDI-2) and supplemental design investigation (SDI), the Northern Impoundment waste materials sampled to date are not listed hazardous waste, do not contain listed hazardous waste above RCRA-thresholds, and are not classified as characteristic hazardous waste. The evaluation and designation of the material as non-hazardous was summarized in a letter to the EPA dated October 20, 2020. The EPA provided a response letter dated November 19, 2020, supporting the waste classification. These letters are included in Appendix D of this Northern Impoundment 90% RD Package. The results of the SDI confirmed the waste classification, as described in Section 3.3 of the main text of the Northern Impoundment 90% RD Package.
12.	Waste	Toxic Substances Control Act (TSCA).	15 USC §2601, et. seq.; 40 CFR 761.61 (c)	40 CFR 761.61 provides TSCA clean-up and disposal options for PCB remediation waste, which includes PCB-contaminated soil, sediment, sewage or industrial sludge, and building material. 761.61(c) is the risk-based option for PCB remediation waste.	Total PCB concentrations in the Northern Impoundment are below the regulatory threshold of 50 mg/kg, calculated as specified in 40 CFR 761 that could require management of any waste materials as a TSCA waste.
13.	Waste	RCRA: General Requirements for Solid Waste Management.	42 U.S.C. §§6941, et seq.; 40 CFR 258)	Requirements for construction for municipal solid waste landfills that receive RCRA Subtitle D wastes, including industrial solid waste. Requirements for run-on/run-off control systems, groundwater monitoring systems, surface water requirements, etc.	The Northern Impoundment remedial activities will not involve the construction of a municipal landfill; therefore, this regulation does not apply.

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14.	Waste	30 Texas Administrative Code (TAC) Part 1: Industrial Solid Waste and Municipal Hazardous Waste General Terms	30 TAC §§335.1 - 335.15	Substantive requirements for the transportation of industrial solid and hazardous wastes; requirements for the location, design, construction, operation, and closure of solid waste management facilities.	This regulation contains guidelines to promote the proper collection, handling, storage, processing, and disposal of industrial solid waste or municipal hazardous waste in a manner consistent with the purposes of Texas Health and Safety Code, Chapter 361. These regulations also define the classification of the Industrial Solid Waste from the Northern Impoundment. They are applicable and will be followed for waste materials from the Northern Impoundment that are transported to off-site landfills.
15.	Waste	30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Notification.	30 TAC Chapter 335 Subchapter P	Requires placement of warning signs in contaminated and hazardous areas if a determination is made by the executive director of the Texas Water Commission a potential hazard to public health and safety exists which will be eliminated or reduced by placing a warning sign on the contaminated property.	It is not expected that warning signs will be necessary based on this regulation. The Northern Impoundment will be protected with appropriate signage and other site controls as defined in the Health and Safety Plan. Any issues with respect to maintenance of current signage required pursuant to the Operations and Maintenance (O&M) Plan for the Time Critical Removal Action (TCRA) are expected to be addressed through modifications to the O&M Plan.
16.	Waste	30 TAC Part 1: Industrial Solid Waste and Municipal Hazardous Waste: Generators.	30 TAC Chapter 335, Subchapter C	Standards for hazardous waste generators either disposing of waste on-site or shipping off-site with the exception of conditionally exempt small quantity generators. The definition of hazardous involves state and federal standards.	Waste management with respect to RA activities associated with the Northern Impoundment would be required to comply with these regulations. Based on the results of the PDIs and SDI for the RD, the Northern Impoundment waste materials sampled to date are not listed hazardous waste, do not contain listed hazardous waste above RCRA -thresholds, and are not classified as characteristic hazardous waste. The evaluation and designation of the material as non-hazardous was summarized in a letter to the EPA dated October 20, 2020. The EPA provided a response letter dated November 19, 2020, supporting the waste classification. These letters are included in Appendix D of the Northern Impoundment 90% RD Package. The results of the SDI confirmed the waste classification, as described in Section 3.3 of the main text of the Northern Impoundment 90% RD Package.
17.	Waste	Hazardous Materials Transportation Act	49 U.S.C. §§1801, et seq.; 49 CFR Subchapter C	Establishes standards for packaging, documenting, and transporting hazardous materials.	These requirements would apply to all hazardous material transported to and from work sites for the Northern Impoundment RA. Based on the results of the PDIs and the SDI, it is not expected that the waste materials excavated from beneath the Northern Impoundment and transported off-site will be classified as hazardous material so these requirements would not apply.
18.	Air	Clean Air Act (CAA).	42 U.S.C. §§7401, et seq.	Authorization of potential emissions of dust, volatile organic compounds (VOCs), and/or hazardous air pollutants (HAP) resulting from the excavation, solidification and stabilization of the soil in the Northern Impoundment.	Any air discharges are required to be in compliance with the substantive technical requirements of the CAA and the work will be required to comply with any applicable TCEQ requirements regarding such emissions.
19.	Air	Texas Air Quality Rules.	30 TAC Chapter 116	Authorization of potential emissions of dust, VOCs, and/or HAP resulting from the excavation, solidification and stabilization of the soil in the Northern Impoundment.	TCEQ is the designated authority to issue air permits in Texas, so discharges must comply with the substantive technical requirements of this regulation. Emissions generated from equipment used to extract, handle, process, condition, reclaim or destroy contaminants for the purpose of remediation are covered by a TCEQ's permit by rule (PBR) as long as emissions are limited to 5 ton per year or 1 pound per hour for the site activities (30 TAC 106.533). Prior to commencing construction, emission calculations would be performed with respect to compliance with the PBR.
20.	Dredging/Floodplain	Rivers And Harbors Act of 1899: Obstruction of navigable waters (generally wharves, piers, etc.); excavation and fill.	33 U.S.C. §401	Controls the alteration of navigable waters (i.e., waters subject to ebb and flow of the tide shoreward to the mean high water mark). Activities controlled include construction of structures such as piers, berms, and installation of pilings as well as excavation and fill. Section 10 may be applicable for any action that may obstruct or alter a navigable waterway. No permit is required for on-site activities. However, substantive requirements might limit in-water construction activities.	The cofferdam barrier wall to be installed at the Northern Impoundment is considered "fill material"; therefore, Section 10 of the Rivers and Harbors Act of 1899 would apply to the BMP installation and removal activities and the work will be performed in a manner that complies with substantive requirements of Section 10.

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21.	Dredging/Floodplain	Coastal Zone Management Act.	16 USC §§1451, et seq.; 15 CFR 930	Federal activities must be consistent with, to the maximum extent practicable, state coastal zone management programs. Federal agencies must supply the state with a consistency determination.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). During the Remedial Investigation/Feasibility Study (RI/FS), an evaluation was made as to whether remedial alternatives may affect (adversely or not) the coastal zone and provides a technical basis for the lead agency (EPA) to determine whether the activity will be consistent with the state's TCMP. These requirements have been incorporated into the design as applicable.
22.	Dredging/Floodplain	FEMA (Federal Emergency Management Agency), Department of Homeland Security (Operating Regulations).	42 U.S.C. 4001, et seq.; 44 CFR Chapter 1	Prohibits alterations to river or floodplains that may increase potential for flooding.	The FEMA flood insurance rate map ID 48201C074M, effective on 1/6/2017, indicates that the Northern Impoundment is located within a designated coastal zone (Zone VE), which is within the Riverine Floodway. As stated in Item No. 10 above, hydrodynamic modeling was conducted as part of the RD to determine if the cofferdam structure, as described in the Northern Impoundment 90% RD Package, would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
23.	Dredging/Floodplain	National Flood Insurance Program (NFIP) Regulations.	42 U.S.C. Subchapter III, §§4101, et seq.	Provides federal flood insurance to local authorities and requires that the local authorities not allow fill in the river that would cause an increase in water levels associated with floods.	As stated in Item No. 10 above, hydrodynamic modeling was conducted to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
24.	Dredging/Floodplain	Floodplain Management and Wetlands Protection.	Executive Orders (EO) 11988 and 11990	Requires federal agencies to conduct their activities to avoid, if possible, adverse impacts associated with the destruction or modification of wetlands and occupation or modification of floodplains. Executive Orders 11988 and 11990 require federal projects to avoid adverse effects and minimize potential harm to wetlands and within flood plains. The EO 11990 requires federal agencies to avoid to the extent possible the long and short-term adverse impacts associated with the destruction or modification of wetlands and to avoid direct or indirect support of new construction in wetlands wherever there is a practicable alternative.	The Northern Impoundment is within a floodplain and the temporary structure (cofferdam barrier wall) will be constructed in the river. As stated in Item No. 10 above, hydrodynamic modeling was conducted to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible. The Respondents will be preparing and submitting to the USACE a “Waters and Wetlands Delineation Report” to address requirements under EO 11990.
25.	Dredging/Floodplain	Texas Coastal Coordination Council Policies for Development in Critical Areas.	31 TAC §501.23	Dredging in critical areas is prohibited if activities have adverse effects or degradation on shellfish and/or jeopardize the continued existence of endangered species or results in an adverse effect on a coastal natural resource area (CNRA) 5; prohibits the location of facilities in coastal natural resource areas unless adverse effects are prevented and/or no practicable alternative. Specifies compensatory mitigation.	Any removal (excavation) activities will occur within the cofferdam wall and footprint of the Northern Impoundment and do not currently involve dredging, and therefore will not impact critical areas. An updated Threatened and Endangered (T&E) Species Habitat Suitability Evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
26.	Dredging/Floodplain	Texas Coastal Management Plan (TCMP) Consistency.	31 TAC, §506.12	Specifies federal actions within the TCMP boundary that may adversely affect CNRAs, specifically, selection of remedial actions.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). During the RI/FS, an evaluation was made as to whether remedial alternatives may affect (adversely or not) the coastal zone and provides a technical basis for the lead agency (EPA) to determine whether the activity will be consistent with the state's TCMP. These requirements will be incorporated into the design as applicable.
27.	Dredging/Floodplain	Texas State Code - obstructions to navigation.	Natural Resources Code §51.302 Prohibition and Penalty	Prohibits construction or maintenance of any structure or facility on land owned by the state without an easement, lease, permit, or other instrument from the state.	Because this is a CERCLA action, a formal instrument should not be required; however, the work will be coordinated with the State.

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28.	Dredging/Floodplain	Floodplain Management of Harris County, Texas.	Texas Code Section 240.901 and TTC Sections 251.001-251.059 and Sections 254.001-254.019	Establishes construction requirements along the segment of the San Jacinto River at or near the Northern Impoundment.	The FEMA flood insurance rate map ID 48201C074M, effective on January 6, 2017, indicates that the Northern Impoundment is located within a designated coastal zone (Zone VE), which is within the Riverine Floodway. Much of the surrounding property that may be used for offices, laydown and staging areas are above an elevation with a 1 percent annual exceedance probability (AEP) for flooding Zone AE. Design of any temporary structure, including gas or liquid storage tanks, will comply with Harris County Texas floodplain management requirements. Additionally, at the request of HCFCD, as stated in Item No. 10 above, hydrodynamic modeling was conducted as part of the RD to determine if the cofferdam structure would have any adverse effect on the floodplain. The results of that evaluation suggest that the impacts would be negligible.
29.	Wildlife Protection	Endangered Species Act.	16 U.S.C. §§ 1531, et seq.	Federal agencies must ensure that actions they authorize, fund, or carry out are not likely to adversely modify or destroy critical habitat of endangered or threatened species. Actions authorized, funded, or carried out by federal agencies may not jeopardize the continued existence of endangered or threatened species as well as adversely modify or destroy their critical habitats.	During the RI/FS in 2010, a desktop review of photographs and U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) species and habitat maps was performed. Another evaluation was performed in 2021. Both evaluations concluded that there are no federally listed T&E or critical habitats present on the Northern Impoundment or in areas in the vicinity of the Northern Impoundment. An updated evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
30.	Wildlife Protection	Fish and Wildlife Coordination Act.	16 U.S.C. §§661, et seq., 16 U.S.C. §742a, 16 U.S.C. § 2901	Requires adequate provision for protection of fish and wildlife resources. This title has been expanded to include requests for consultation with USFWS for water resources development projects (Mueller, 1980). Any modifications to rivers and channels require consultation with the USFWS, Department of Interior, and state wildlife resources agency. Project-related losses (including discharge of pollutants to water bodies) may require mitigation or compensation.	Depending on the site conditions after final restoration of the Northern Impoundment after remedial activities are completed, consultation with the USFWS, Department of Interior, and state wildlife resources agency may be required to address adequate protection of fish and wildlife resources.
31.	Wildlife Protection	Bald and Golden Eagle Protection Act.	16 U.S.C. §668a-d	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any bald or golden eagle, nest, or egg. “Take” is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, trapping and collecting, molesting, or disturbing.	No readily available information suggests bald or golden eagles frequent the Northern Impoundment; however, if bald or golden eagles are identified prior to or during construction, activities will be designed to conserve the species and their habitat.
32.	Wildlife Protection	Migratory Bird Treaty Act.	16 U.S.C. §§703-712; 50 CFR §10.12	Makes it unlawful to take, import, export, possess, buy, sell, purchase, or barter any migratory bird. “Take” is defined as pursuing, hunting, shooting, poisoning, wounding, killing, capturing, and trapping and collecting.	The Northern Impoundment remedy will be carried out in a manner to avoid adversely affecting migratory bird species, including individual birds or their nests.

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33.	Wildlife Protection	State of Texas Threatened and Endangered (T&E) Species Regulations.	31 TAC 65.171 - 65.176	No person may take, possess, propagate, transport, export, sell or offer for sale, or ship any species of fish or wildlife listed as threatened or endangered.	During the RI/FS in 2010, a desktop review of photographs and USFWS and NMFS species and habitat maps was performed. Another evaluation was performed in 2021. Both evaluations concluded that there are no federally listed T&E or critical habitats present on the Northern Impoundment or in areas in the vicinity of the Northern Impoundment. An updated T&E Habitat Suitability Evaluation will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD.
34.	Historic Preservation	National Historic Preservation Act.	16 U.S.C. §§ 470, et seq.; 36 CFR 800	Section 106 of this statute requires federal agencies to consider effects of their undertakings on historic properties. Historic properties may include any district, Site, building, structure, or object included in or eligible for the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property.	According to the San Jacinto River Waste Pits RI/FS cultural resources assessment, no NRHP-eligible properties are documented in the area of concern. This was further confirmed by a cultural resources assessment completed in December 2021. This assessment will be included in a submittal to the USACE following submittal of the 90% RD. This requirement is therefore not applicable.
35.	Historic Preservation	Natural Resources Code, Antiquities Code of Texas.	Texas Parks and Wildlife Commission Regulations 191.092-171	Requires that the Texas Historical Commission staff review any action that has the potential to disturb historic and archeological Sites on public land. Actions that need review include any construction program that takes place on land owned or controlled by a state agency or a state political subdivision, such as a city or a county. Without local control, this requirement does not apply.	According to the San Jacinto River Waste Pits RI/FS cultural resources assessment, no NRHP-eligible properties are documented in the area of concern. This was further confirmed by a cultural resources assessment completed in December 2021. This assessment will be included in a submittal to the USACE following submittal of the Northern Impoundment 90% RD. This requirement is therefore not applicable.
36.	Historic Preservation	Practice and Procedure, Administrative Code of Texas.	13 TAC Part 2, Chapter 26	Regulations implementing the Antiquities Code of Texas. Describes criteria for evaluating archaeological Sites and permit requirements for archaeological excavation.	This requirement is only applicable if an archaeological site is found; based on evaluations during the RI/FS, it is unlikely that archaeological resources would be found on the Northern Impoundment. This was further confirmed by a cultural resources assessment completed in December 2021. This requirement is therefore not expected to be applicable.
37.	Noise	Noise Control Act.	42 U.S.C. §§4901, et seq.; 40 CFR Subchapter G §201, et seq.	Noise Control Act remains in effect but unfunded.	Noise is regulated at the state level.
38.	Noise	Noise Regulations.	Texas Penal Code Chapter 42, Section 42.01	The Texas Penal Code regulates any noise that exceeds 85 decibels after the noise is identified as a public nuisance.	A noise is presumed to be unreasonable if the noise exceeds a decibel level of 85 at the point of potential human exposure after the person making the noise receives notice from a magistrate or peace officer that the noise is a public nuisance. Activities associated with the Northern Impoundment RA, as described in the Northern Impoundment 90% RD Package, are not likely to exceed the 85-decibel level beyond the immediate work area. The activities are not anticipated to constitute a public nuisance due to the isolation of the work, its location adjacent to a freeway with high volumes of traffic during normal working hours, and the industrial nature of activities on the Northern Impoundment. As indicated in the Site-Wide Monitoring Plan (Appendix J), noise impacts from pile driving will be assessed and monitored by the remedial contractor at the start of work.

Table 5-1

Excavation Removal Elevations
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	SJSB073	SJSB058	SJSB101[1]	SJSB071[1]	SJSB037	SJSB070	SJSB099	SJGB013	SJSB100	SJSB098[1]	SJSB057[1]	SJSB103	SJSB097	SJSB056	SJSB056-C1	SJSB095	SJSB055-C1	SJSB055	SJSB096	SJGB014
Starting Elevation (Mud-line)	1.29	0.62	-0.15	-0.80	1.43	-1.17	-0.61	-8.04	-13.36	-14.36	-18.39	-15.36	-15.64	-12.40	-4.29	-2.07	-9.54	-4.90	-6.55	-1.22
ELEVATION (feet NAVD88)																				
+7																				
+6																				
+5																				
+4																				
+3																				
+2																				
+1	9.6	12			NA															
0	9.6	12	**63000**		NA															
-1	**31000**	**36100**	**63000**	**34700**	NA	**43900**	**53000**													**31625**
-2	**31000**	**36100**	**59000**	**34700**	NA	**43900**	**53000**									**35000**				**31625**
-3	**26000**	**48400**	**59000**	**45900**	**40400**	**68600**	**54000**									**35000**				**210.4**
-4	**26000**	**48400**	**25000**	**45900**	**40400**	**68600**	**54000**								0.79	**59**				**210.4**
-5	**68000**	**324**	**25000**	26.8	0.87	**45600**	**130**								0.79	**59**		1.36		**531.3**
-6	**68000**	**324**	18	26.8	0.87	**45600**	**130**								1.14	1.0		1.36		**531.3**
-7	**83000**	**1160**	18	2.24		**24300**	13								1.14	1.0		1.07	**87000**	**213.3**
-8	**83000**	**1160**	2.7	2.24		**24300**	13	**5100**							0.26	9.7		1.07	**87000**	**213.3**
-9	**41.0**	**376**	2.7	1.03	**618**	**16700**	15	**5100**							0.26	9.7		0.81	**22000**	18.6
-10	**41.0**	**376**	**230**	1.03	2.59	**16700**	15	**1740**							0.60	**1200**	**34.3**	0.81	**22000**	18.6
-11	5.2	**9890**	**230**	1.48	11.5	**1000**	**210**	**1740**							0.60	**1200**	**34.3**	1.28	**310**	1.29
-12	5.2	**9890**	0.62	1.48		**1000**	**210**	**338**						3.35	1.4	**57**	**31.1**	1.28	**310**	1.29
-13	15	**136**	0.62	0.52		**609**	1.9	**338**	**110**					3.35	1.4	**57**	**31.1**	2.53	4.9	
-14	15	**136**	0.27	0.52		**609**	1.9	**104**	**110**	**71**				1.65	1.33	6.0	1.34	2.53	4.9	
-15	5.6	**788**	0.27	**44.6**		6.9	26	**104**	3.7	**71**		2.2		1.65	1.33	6.0	1.34	0.89	**8500**	
-16	5.6	**788**	11	**44.6**		6.9	26	25.2	3.7	**1900**		2.2	5.2	0.80	0.60	**55**	0.70	0.89	**8500**	
-17		0.52	11	**45.4**		4.69	14	25.2	9.2	**1900**		1.1	5.2	0.80	0.60	**55**	0.70	1.09	**84.0**	
-18		0.52	3.2	**45.4**		4.69	14		9.2	**1800**	**24200**	1.1	1.2	0.78	0.62	0.60	1.07	1.09	**84.0**	
-19			3.2						0.81	**1800**	**24200**	14	1.2	0.78	0.62	0.60	1.07	1.42	5.2	
-20									0.81	**160**	**37600**	14	1.8	3.76	0.96		1.16	1.42	5.2	
-21									2.3	**160**	**37600**	4.8	1.8	3.76	0.96		1.16	0.92	1.9	
-22									2.3	**9600**	**3540**	4.8	1.4	0.93			0.67	0.92	1.9	
-23									0.58	**9600**	**3540**	3.9	1.4	0.93			0.67		13	
-24									0.58	**3900**	**372**	3.9	2.6	2.91			1.12		13	
-25									0.57	**3900**	**372**	0.49	2.6	2.91			1.12			
-26									0.57	**680**	7.6	0.49	0.77	4.44			5.49			
-27									0.51	**680**	7.6	0.46	0.77	4.44			5.49			
-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 Exc. Elev.	-10.71	-17.38	-17.65	-18.80	-9.57	-15.17	-12.61	-16.04	-15.36	-28.36	-26.39	-16.99	-15.64	-12.40	-21.92	-18.07	-13.54	-4.90	-18.55	-9.22
Calculated Exc. Depth	12	18	17.50	18	11	14	12	8	2	14	8	1.63	0	0	17.63	16	4	0	12	8
Hydraulic Heave Elevation	-20.00	-19.02	-18.38	-18.48	-20.02	-20.07	-22.27	-21.70	-20.41	-24.53	-15.65	-23.14	-26.20	-27.27	-28.24	-29.19	-31.84	-23.28	-28.55	-26.44
Hydraulic Heave Depth	21.29	19.64	18.23	17.68	21.45	18.90	21.66	13.66	7.05	10.17	-2.74	7.78	10.56	14.87	23.95	27.12	22.30	18.38	22.00	25.22

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.
- Black line indicates the target removal and hydraulic heave elevations are essentially identical.
- Dark grey shading indicates soil borings in the northwest corner.

[1] Excavation to the deepest elevation of dioxins concentrations >30 ng/kg TEQ would be at risk of hydraulic heave.

Notes:

Table 5-1

Excavation Removal Elevations
Final 100% Remedial Design – Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

	SJSB053-C1	SJSB053	SJSB054	SJSB094	SJSB052-C1	SJSB052	SJSB051	SJSB092	SJSB093	SJSB038	SJGB016	SJSB104	SJSB088	SJSB090	SJGB015	SJSB050-C1	SJSB033	SJGB012[1]	SJSB072[1]	SJSB074
Starting Elevation (Mud-line)	-7.40	-9.70	-7.40	-4.22	-2.20	-5.70	-2.70	-4.93	-1.53	-1.98	-2.07	-5.49	-2.12	-1.50	-5.94	-6.30	3.12	0.43	1.42	3.34
ELEVATION (feet NAVD88)																				
+7																				
+6																				
+5																				
+4																				
+3																	**95.6**			**7800**
+2																	**95.6**			**7800**
+1																	**1050**		NA	**70000**
0																	**1050**	**4050.5**	NA	**70000**
-1																	**7120**	**4050.5**	NA	**30000**
-2					9.22				**41000**	NA	**3517.8**		**39000**	**62000**			**7120**	**25065.3**	NA	**30000**
-3					9.22		3.02		**41000**	NA	**3517.8**		**39000**	**62000**			**5740**	**25065.3**	NA	**87**
-4				**36000**	1.2		3.02		**42000**	NA	**75.3**		**43000**	**6600**			**5740**	**24424.6**	NA	**87**
-5				**36000**	1.2		4.98	**43000**	**42000**	NA	**75.3**	15	**43000**	**6600**			**1700**	**24424.6**	NA	5.1
-6				**39000**	0.49	2.07	4.98	**43000**	**640**	NA	0.46	15	**50000**	**930**	1.22	2.27	**1700**	**17740**	NA	5.1
-7	0.806		**16600**	**39000**	0.49	2.07	2.48	**28000**	**640**	NA	0.46	2.8	**50000**	**930**	1.22	2.27	**157**	**17740**	12	3.1
-8	0.806		**16600**	**41000**	1.47	1.94	2.48	**28000**	0.68	NA	2.33	2.8	**71000**	6.4	0.64	1.97	**157**		12	3.1
-9	0.855		**1550**	**41000**	1.47	1.94	2.64	**130**	0.68	NA	2.33	11	**71000**	6.4	0.64	1.97	24		**340**	0.37
-10	0.855	1.79	**1550**	**17000**	2.32	1.99	2.64	**130**	**1900**	**96700**	6.15	11	**51000**	**260**	1.48	2.22	24		**340**	0.37
-11	1.34	1.79	6.43	**17000**	2.32	1.99	3.03	4.8	**1900**	**364**	6.15	2.6	**51000**	**260**	1.48	2.22	17.6		1.3	2.6
-12	1.34	0.92	6.43	**5500**	1.39	1.99	3.03	4.8	**1500**	**152**		2.6	5.3	5.3	1.51	3.1	17.6		1.3	2.6
-13	1.4	0.92	5.94	**5500**	1.39	1.99	1.71	27	**1500**	4.71		1.7	5.3	5.3	1.51	3.1	12.5		1.7	0.84
-14	1.4	1.44	5.94	**32**	1.71	2.01	1.71	27	**430**			1.7	0.68	9.1	0.85	1.31	12.5		1.7	0.84
-15	0.94	1.44	17.6	**32**	1.71	2.01	2.91	26	**430**			1.8	0.68	9.1	0.85	1.31			**34**	
-16	0.94	1.44	17.6	2.0	1.79	2.8	2.91	26	17			1.8	1.3	4.1		1.54			**34**	
-17	1.76	1.44	5.28	2.0	1.79	2.8	2.35	**10000**	17			0.53	1.3	4.1		1.54			0.52	
-18	1.76	1.28	5.28	3.2	2.08	2.24	2.35	**10000**	4.4			0.53	**1800**	2.3		3.38			0.52	
-19	1.15	1.28	**369**	3.2	2.08	2.24	2.48	11	4.4			0.25	**1800**	2.3		3.38			**120**	
-20	1.15	1.79	**369**	1.9		0.69	2.48	11				0.25	2.5			2.88			**120**	
-21	2.2	1.79	**32.7**	1.9		0.69		7.2				0.20	2.5			2.88			0.81	
-22	2.2	0.22	**32.7**			12.1		7.2				0.20	2.2			1.33			0.81	
-23		0.22	6.52			12.1							2.2			1.33				
-24		0.34	6.52										1.1							
-25		0.34											1.1							
-26		0.35																		
-27		0.35																		
-28																				
-29																				
-30																				
-31																				
-32																				
-33																				
-34																				
-35																				
Calculated Exc. Elev.	-11.93	-9.70	-23.40	-16.22	-16.91	-5.70	-2.70	-18.93	-15.53	-15.60	-14.16	-5.49	-20.12	-11.50	-9.57	-6.30	-8.88	-17.62	-20.58	-4.66
Calculated Exc. Depth	4.53	0	16	12	14.71	0	0	14	14	13.62	12.09	0	18	10	4	0	12	18.05	22	8
Hydraulic Heave Elevation	-24.37	-22.35	-23.73	-24.63	-24.11	-23.20	-22.01	-23.40	-22.91	-22.70	-22.84	-22.70	-21.98	-23.05	-22.82	-22.79	-18.68	-18.31	-18.35	-18.97
Hydraulic Heave Depth	16.97	12.65	16.33	20.41	21.91	17.50	19.31	18.47	21.38	20.72	20.77	17.21	19.86	21.55	16.88	16.49	21.80	18.74	19.77	22.31

Notes:
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- Red line indicates the elevation in each boring at which there is risk of hydraulic heave (Factor of Safety <1.25).
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- Black line indicates the target removal and hydraulic heave elevations are essentially identical.
- Dark grey shading indicates soil borings in the northwest corner.

[1] Excavation to the deepest elevation of dioxins concentrations >30 ng/kg TEQ would be at risk of hydraulic heave.

Table 5-1

Excavation Removal Elevations
Final 100% Remedial Design – Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

	SJSB076	SJSB075	SJSB036	SJGB011	SJSB032	SJSB077	SJGB010	SJSB078[1]	SJSB080	SJSB079	SJSB081	SJSB082	SJSB046-C1	SJSB083	SJSB102	SJSB028	SJSB045	SJSB045-C1	SJSB046	SJSB084
Starting Elevation (Mud-line)	2.26	2.28	2.25	0.41	1.71	1.42	0.88	1.82	1.77	1.05	-2.26	-1.75	-2.39	-2.93	-2.05	4.48	-2.10	-1.30	-2.00	-3.86
ELEVATION (feet NAVD88)																				
+7																				
+6																				
+5																				
+4																59.2				
+3																59.2				
+2	**3000**	NA	NA		**3410**			**33000**	**23000**							2.4				
+1	**3000**	NA	NA		**3410**	NA	**4723.8**	**33000**	**23000**	**32000**						2.4				
0	**49000**	NA	NA	**12724.8**	**7660**	NA	**4723.8**	**47000**	**14000**	**32000**						**35.9**				
-1	**49000**	NA	**50500**	**12724.8**	**7660**	NA	**30873.4**	**47000**	**14000**	**52000**						**35.9**		**286**		
-2	**63000**	**55000**	NA	**22222.8**	**3170**	NA	**30873.4**	**86000**	**9200**	**52000**	**2300**	**15000**	**1550**		**1400**	12.3	10.3	**286**	**636**	
-3	**63000**	**55000**	NA	**22222.8**	**3170**	NA	**6354**	**86000**	**9200**	**28000**	**2300**	**15000**	**1550**	**46000**	**1400**	12.3	10.3	**190**	**636**	
-4	**210**	NA	**276**	**9427.6**	6.19	NA	**6354**	**140**	**3200**	**28000**	**47000**	**670**	**3350**	**46000**	5.9	21.2	5.26	**190**	**2660**	**12000**
-5	**210**	NA	**276**	**9427.6**	6.19	**63000**	**194**	**140**	**3200**	**50000**	**47000**	**670**	**3350**	**2200**	5.9	21.2	5.26	**286**	**2660**	**12000**
-6	11	NA	NA	**14768.5**	**85.8**	**63000**	**194**	**100**	**1500**	**50000**	**47000**	**2000**	**2820**	**2200**	**340**	3.35	5.58	**286**	**8610**	**3200**
-7	11	NA	NA	**14768.5**	**85.8**	**77000**		**100**	**1500**	**50000**	**47000**	**2000**	**2820**	9.8	**340**	3.35	5.58	**46.8**	**8610**	**3200**
-8	**150**	**270**	**519**	**8707.4**	26.5	**77000**		**110**	12	**50000**	5.3	7.7	**11700**	9.8	24	2.59	4.88	**46.8**	**28500**	**45**
-9	**150**	**270**	19	**8707.4**	26.5	**150**		**110**	12	**190**	5.3	7.7	**11700**	14	24	2.59	4.88	**54.6**	**28500**	**45**
-10	21	0.88	**189**	3.37	15.9	**150**		16	1.5	**190**	**19000**	**120**	**14900**	14	5.6	2.39	3.25	**54.6**	**6930**	23
-11	21	0.88		3.37	15.9	24		16	1.5	3.1	**19000**	**120**	**14900**	**15000**	5.6	2.39	3.25	**50.4**	**6930**	23
-12	5.2	1.8			2.13	24		12	0.44	3.1	**280**	4.1	**55.1**	**15000**	2.5	1.19	0.72	**50.4**	**111**	6.1
-13	5.2	1.8			2.13	**350**		12	0.44	16	**280**	4.1	**55.1**	**200**	2.5	1.19	0.72	3.79	**111**	6.1
-14	3.7	6.7			12.7	**350**		**140**	13	16	2.8	1.1	**2230**	**200**	**34**		1.52	3.79	**3420**	7.8
-15	3.7	6.7			12.7	0.21		**140**	13	0.64	2.8	1.1	**2230**	24	**34**		1.52	22.4	**3420**	7.8
-16						0.21		2.7		0.64	1.7	3.7	**205**	24	1.4		2.36	22.4	**1710**	6.1
-17								2.7			1.7	3.7	**205**	9.0	1.4		2.36	5.81	**1710**	6.1
-18								**260**			0.87	0.99	**5690**	9.0	**110**		4.96	5.81	**3400**	3.7
-19								**260**			0.87	0.99	**5690**	0.72	**110**		4.96		**3400**	3.7
-20								0.42						0.72	8.9				4.82	3.9
-21								0.42						4.8	8.9				4.82	3.9
-22														4.8	3.9					
-23															3.9					
-24															4.0					
-25															4.0					
-26																				
-27																				
-28																				
-29																				
-30																				
-31																				
-32																				
-33																				
-34																				
-35																				
Calculated Exc. Elev.	**-9.74**	**-9.82**	**-10.75**	**-9.59**	**-8.29**	**-14.58**	**-15.21**	**-20.18**	**-8.23**	**-10.95**	**-14.26**	**-11.75**	**-20.39**	**-19.07**	**-20.05**	**-1.52**	**-2.10**	**-13.30**	**-20.00**	**-9.86**
Calculated Exc. Depth	**12**	**12.10**	**13**	**10**	**10**	**16**	**16**	**22**	**10**	**12**	**12**	**10**	**18**	**16.14**	**18**	**6**	**0**	**12**	**18**	**6**
Hydraulic Heave Elevation	**-18.86**	**-18.52**	**-18.64**	**-19.19**	**-19.02**	**-18.76**	**-18.73**	**-18.72**	**-19.00**	**-19.16**	**-20.47**	**-20.49**	**-21.13**	**-21.25**	**-20.91**	**-19.48**	**-19.65**	**-20.37**	**-20.90**	**-21.10**
Hydraulic Heave Depth	**21.12**	**20.80**	**20.89**	**19.60**	**20.73**	**20.18**	**19.61**	**20.54**	**20.77**	**20.21**	**18.21**	**18.74**	**18.74**	**18.32**	**18.86**	**23.96**	**17.55**	**19.07**	**18.90**	**17.24**

Notes:
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Table 5-1

Excavation Removal Elevations
Final 100% Remedial Design – Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

	SJSB087	SJGB017	SJSB086	SJSB047-C1	SJSB047	SJSB085	SJSB048	SJSB048-C1[1]	SJSB049	SJSB089	SJSB050	SJSB105	SJSB106	SJSB091	SJSB029	SJSB030	SJSB031	SJSB034	SJSB035
Starting Elevation (Mud-line)	**-3.01**	**-1.85**	**-2.72**	**-4.00**	**-2.10**	**-5.67**	**-2.40**	**-4.00**	**-5.10**	**-2.88**	**-3.40**	**-4.36**	**-3.10**	**-3.58**	**2.68**	**4.33**	**5.12**	**6.99**	**6.64**
ELEVATION (feet NAVD88)																			
+7																		5.12	1.32
+6																		5.12	1.32
+5																	2.46	1.17	0.59
+4																5.54	2.46	1.17	0.59
+3															14.90	5.54	0.77	3.04	1.00
+2															14.9	1.9	0.77	3.04	1.00
+1															2.95	1.9	0.67	0.99	0.90
0															2.95	0.74	0.67	0.99	0.90
-1															2.12	0.74	0.72	0.98	0.64
-2		1.95			1.19		1.7								2.12	2.81	0.72	0.98	0.64
-3	**4600**	1.95	5.0		1.19		1.7			**820**	7.41		**39**		1.48	2.81	0.73	0.81	0.80
-4	**4600**	1.46	5.0	**7470**	1.35		1.02	**623**		**820**	7.41	**36000**	**39**	16	1.48	0.44	0.73	0.81	0.80
-5	**25000**	1.46	2.3	**7470**	1.35		1.02	**623**	**23600**	**53**	3.13	**36000**	3.6	16	1.35	0.44	0.97	0.59	1.26
-6	**25000**	0.91	2.3	**6310**	1.53	**42000**	1.72	**55.1**	**23600**	**53**	3.13	**48000**	3.6	6.7	1.35	0.82	0.97	0.59	1.26
-7	**2300**	0.91	1.3	**6310**	1.53	**42000**	1.72	**55.1**	**6640**	18	1.33	**48000**	9.4	6.7	2.45	0.82	0.33	1.5	0.96
-8	**2300**	0.85	1.3	**139**	2.73	**720**	2.46	**592**	**6640**	18	1.33	**240**	9.4	5.2	2.45	0.45	0.33	1.5	0.96
-9	10	0.85	1.2	**139**	2.73	**720**	2.46	**592**	**2350**	3.5	1.48	**240**	2.9	5.2	1.36	0.45	0.65	0.897	0.52
-10	10	0.18	1.2	29.4	2.03	27	2.52	4.95	**2350**	3.5	1.48	29	2.9	2.7	1.36	0.59	0.65	0.897	0.52
-11	**570**	0.18	2.2	29.4	2.03	27	2.52	4.95	**110**	**52**	3.38	29	3.4	2.7	0.77	0.59	0.36		
-12	**570**		2.2	**769**	1.41	**44**	1.77	**323**	**110**	**52**	3.38	13	3.4	2.1	0.77	0.98	0.36		
-13	3.5		2.3	**769**	1.41	**44**	1.77	**323**	**251**	**34**	2.71	13	2.6	2.1	9.13	0.98			
-14	3.5		2.3	**685**	1.69	25	2.03	6.35	**251**	**34**	2.71	17	2.6	2.4	9.13				
-15	**110**		3.2	**685**	1.69	25	2.03	6.35	**112**	2.00	1.81	17	2.6	2.4					
-16	**110**		3.2	**821**	1.98	4.3	1.66	**147**	**112**	2.00	1.81	**1400**	2.6	2.4					
-17	**1500**		2.9	**821**	1.98	4.3	1.66	**147**	**117**	2.30	1.77	**1400**	1.6	2.4					
-18	**1500**		2.9	**327**	1.67	7.0	2.56	**143**	**117**	2.30	1.77	**60**	1.6	2.2					
-19	3.0		1.6	**327**	1.67	7.0	2.56	**143**	28.1	0.40	0.351	**60**	3.4	2.2					
-20	3.0		1.6	7.35		11		**219**	28.1	0.40	0.351	7.7	3.4	2.7					
-21				7.35		11		**219**	5.87			7.7		2.7					
-22						7.8		11.8	5.87										
-23						7.8		11.8											
-24								1.07											
-25								1.07											
-26																			
-27																			
-28																			
-29																			
-30																			
-31																			
-32																			
-33																			
-34																			
-35																			
Calculated Exc. Elev.	**-19.01**	**-17.04**	**-13.09**	**-20.00**	**-4.28**	**-13.67**	**-3.20**	**-22.00**	**-19.10**	**-14.88**	**-3.40**	**-20.36**	**-15.38**	**-18.10**	**2.68**	**4.33**	**5.12**	**-9.55**	**-14.71**
Calculated Exc. Depth	**16**	**15.19**	**10.37**	**16**	**2.18**	**8**	**1**	**18**	**14**	**12**	**0**	**16**	**12.28**	**14.52**	**0**	**0**	**0**	**16.54**	**21.35**
Hydraulic Heave Elevation	**-21.16**	**-22.02**	**-21.65**	**-21.35**	**-16.76**	**-22.55**	**-19.70**	**-21.87**	**-22.86**	**-22.73**	**-20.58**	**-21.95**	**-23.14**	**-22.79**	**-19.95**	**-19.64**	**-18.90**	**-23.99**	**-20.54**
Hydraulic Heave Depth	**18.15**	**20.17**	**18.93**	**17.35**	**14.66**	**16.88**	**17.30**	**17.87**	**17.76**	**19.85**	**17.18**	**17.59**	**20.04**	**19.21**	**22.63**	**23.97**	**24.02**	**30.98**	**27.18**

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.
- Black line indicates the target removal and hydraulic heave elevations are essentially identical.
- Dark grey shading indicates soil borings in the northwest corner.

[1] Excavation to the deepest elevation of dioxins concentrations >30 ng/kg TEQ would be at risk of hydraulic heave.

Table 5-2

Water Treatment Basis of Sizing
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Equipment/Process Description	Sizing/Selection Criteria	Bulk Water Design Value	Contact Water Design Value	Notes & Design Assumptions
Dewatering Pump(s)	Between the dewatering pump(s), influent tank(s), and effluent storage tanks, dewater the entire excavation (BMP) area from a 24-hour 9.3-inch (99.9th percentile during the anticipated construction season) rainfall event in under 5 days	4,000 gpm	2,000 gpm	- Pump(s) will shutdown on high level in influent tank(s) - See pump schedule for preliminary discharge head
Influent Tanks	See dewatering pump(s) criteria	~1 million gallons (working volume)	~2 million gallons (working volume)	- Rain for Rent LakeTank B-32 storage tank (~1.3 million-gallons) - 80% working volume per tank (~1 million gallons) - Minimum 12-inch freeboard - Minimum 24-inch water level to keep bottom liner in place
Effluent Storage Tanks	See dewatering pump(s) criteria	N/A	~4.8 million gallons (working volume)	- Rain for Rent LakeTank B-36 storage tank (~1.5 million-gallons) - 80% working volume per tank (~1.2 million gallons) - Minimum 12-inch freeboard - Minimum 24-inch water level to keep bottom liner in place
Containment Area Sump Pumps	Dewater the containment areas to allow work to resume as reasonably practicable	N/A	TBD by Contractor	- Contractor will select pump(s) to dewater the containment areas - Pumps will shutdown on low level in containment area sump(s) - Pumps will shutdown on high level in receiving tanks - See pump schedule for preliminary discharge head and flowrate
Frac Tanks	Provide flow equalization	N/A	18,000 gal (working volume)	
Transfer Pump (Effluent Storage Area Frac Tank)	Transfer containment water from the effluent storage area to the influent tanks	N/A	600 gpm	- Pump will shutdown on low level in effluent storage area frac tank - Pump will shutdown on high level in influent tanks - See Pump schedule for preliminary discharge head
Transfer Pump (Treatment Sytem (WTS) Area Frac Tank)	Transfer treated effluent from the WTS to the effluent storage tanks	N/A	1,000 gpm	- Pump will shutdown on low level in treatment system (WTS) area frac tank - Pump will shutdown on high level in effluent storage tanks (as relevant) - See pump schedule for preliminary discharge head
Transfer Pump (Effluent Storage)	Transfer water stored in the effluent storage tanks to the treatment system (WTS) area for retreatment or discharge to river	N/A	1,000 gpm	- Pump will shutdown on low level in effluent storage tanks (as relevant) - Pump will shutdown on high level in influent tanks (as relevant) - See pump schedule for preliminary discharge head
Treatment Feed Pump(s)	Base 300 gpm treatment rate with option to double to 600 gpm	N/A	300 gpm (base) 600 gpm (optional)	- Pump(s) will operate on VFD to adjust treatment rate, as required - Pump(s) will shutdown on low level in influent tanks - Pump(s) will shutdown on high level in rapid mix tank(s)
Rapid Mix Tank(s)	Minimum 7 minute retention time	N/A	Min. 2,100 gal (working volume)	- Mixer(s) will operate at high enough velocity to fully mix chemicals
Flocculation/Clarifier Feed Pump(s)	Base 300 gpm treatment rate with option to double to 600 gpm	N/A	300 gpm (base) 600 gpm (optional)	- Pump(s) will operate on VFD to adjust treatment rate, as required - Pump(s) will shutdown on low level in rapid mix tank(s) - Pump(s) will shutdown on high level in flocculation/clarifier tank(s)
Flocculation/Clarifier Tank(s) (Flocculation Section)	Minimum 7 minute retention time	N/A	Min. 2,100 gal (working volume)	- Tank(s) will include separate flocculation and inclined plate clarifier sections - Flocculation and clarification sections will flow by gravity - Flocculation section will include baffles to prevent vortexing - Flocculation section will be mixed by top entry variable speed mixer(s) - Mixer(s) will have paddle-type blades to prevent shearing solids

Table 5-2

Water Treatment Basis of Sizing
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Equipment/Process Description	Sizing/Selection Criteria	Bulk Water Design Value	Contact Water Design Value	Notes & Design Assumptions
Flocculation/Clarifier Tank(s) (Clarification Section)	Maximum 0.25 gpm/ft^2 hydraulic loading rate	N/A	Min. 1,200 ft^2	- Tank(s) will include separate flocculation and inclined plate clarifier sections - Flocculation and clarification sections will flow by gravity - Clarification section will include sludge hopper to allow for sludge withdrawal
Filter Feed Pump(s)	Base 300 gpm treatment rate with option to double to 600 gpm	4,000 gpm	300 gpm (base) 600 gpm (optional)	- Pump(s) will operate on VFD to adjust treatment rate, as required - Pump(s) will shutdown on low level in flocculation/clarifier tank(s) - Pump(s) will shutdown on high level in treatment system (WTS) area frac tank
Sand Filters	5-15 gpm/ft2 hydraulic loading rate	Min. 800 ft^2 (active filter area)	Min. 60 ft^2 (active filter area)	- Minimum of three vessels with forward-feed automated backwash
Bag or Cartridge Filtration System(s) (10 um)	300 gpm 10 micron filtration capacity with minimum 95% removal efficiency	Min. 4,000 gpm	Min. 300 gpm	- Rain for Rent BF2000 10-um Bag Filtration Units (2,000 gpm) (bulk water) - Rosedale Filter Cartridge Model PL-POMF-R1-10-P2
Bag or Cartridge Filtration System (1 um)	300 gpm 1 micron filtration capacity with minimum 95% removal efficiency	Min. 4,000 gpm	Min. 300 gpm	- Rain for Rent BF2000 1-um Bag Filtration Units (2,000 gpm) (bulk water) - Rosedale Filter Cartridge Model PL-POMF-R1-1-P2
Granular Activated Carbon (GAC) Adsorbers (Lead/Lag)	Two stage 20 minute total empty bed contact time with maximum 2-5 gpm/ft2 hydraulic loading rate	N/A	Min. 60 ft^2 (active bed area) Min. 800 ft^3 (bed volume)	- GAC vessels will be lead-lag with 10 minute contact time each
Flocculation/Clarifier Tank Sludge Pump(s)	At a rate sufficient to remove generated solids	N/A	TBD by Contractor	- Pump(s) will be positive displacement pump(s) (e.g., air diaphragm) - Flowrate will depend on solids accumulation rate - Flowrate will be adjusted during start-up and operations
Dewatering Boxes	Allow for dewatering of sludge from inclined plate clarifier in flocculatio/clarifier tank to 6-8 percent solids	N/A	25 cy Each	- Filter fabric over a false bottom box to trap solids and allow water to drain
Polymer Feed Pump(s)	Flow paced based upon treatment rate	TBD by Contractor	TBD by Contractor	- Use of chemical metering pumps (e.g., diaphragm, peristaltic) - Flowrate (dosing rate) will be adjusted during start-up and operations
Coagulant Feed Pump(s)	Flow paced based upon treatment rate	TBD by Contractor	TBD by Contractor	- Use of chemical metering pumps (e.g., diaphragm, peristaltic) - Flowrate (dosing rate) will be adjusted during start-up and operations
Caustic Feed Pump(s) (as needed)	Flow paced based upon measured pH of contact water leading to rapid mix tank	N/A	TBD by Contractor	- Use of chemical metering pumps (e.g., diaphragm, peristaltic) - Flowrate (dosing rate) will be adjusted during start-up and operations
Acid Feed Pump(s) (as needed)	Flow paced based upon measured pH of contact water leading to rapid mix tank	N/A	TBD by Contractor	- Use of chemical metering pumps (e.g., diaphragm, peristaltic) - Flowrate (dosing rate) will be adjusted during start-up and operations
Organosulfide Feed Pump(s) (as needed)	Flow paced based upon treatment rate	N/A	TBD by Contractor	- Use of chemical metering pumps (e.g., diaphragm, peristaltic) - Flowrate (dosing rate) will be adjusted during start-up and operations
Discharge Diffuser	Adequately diffuse discharge flows into the river to mitigate potential erosion and scouring issues	Min. 4,000 gpm	Min. 1,000 gpm	- Refer to civil details

Notes:
- The 100% process flow diagram (drawing P-001 & P-002) and piping and instrumentation diagrams (drawings P-003 through P-009) illustrate the major water treatment system equipment and components.
- The 100% pump schedule (drawing P-017) illustrate the pump criteria and preliminary selections
- The 100% civil details (drawing C-27) illustrate the design of the discharge diffuser

Abbreviations:
gpm - Gallons per Minute
VFD - Variable Frequency Drive
ft^2 - Square Feet
ft^3 - Cubic Feet
ppm - Parts per Million
gph - Gallons per Hour
cy - Cubic Yard

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (0-1) 12/7/2019 (0-1) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (0-2.5 CM) 12/7/2019 (0-2.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (1-2) 12/7/2019 (1-2) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (2-4) 12/7/2019 (2-4) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (4-6) 12/7/2019 (4-6) ft bgs	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (7.5-10 CM) 12/7/2019 (7.5-10) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (15-17.5 CM) 12/7/2019 (15-17.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	48	--	23	4.5 U	35	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2400	--	1100	330	1100	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	6.6 J	--	2.5 J	0.86 J	3.9 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	62	--	41	16	45	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.0 J	--	0.19 U	0.14 U	0.65 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.8 J	--	0.79 J	0.25 J	1.7 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.0 J	--	0.65 J	0.54 J	0.81 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.91 J	--	0.39 J	0.096 U	0.74 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	--	0.96 U	0.62 U	1.3 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.15 U	--	0.41 J	0.20 J	0.12 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.2 J	--	2.4 J	1.5 J	2.5 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.1 J	--	0.74 J	0.44 J	1.2 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.48 J	--	0.32 U	0.29 U	0.29 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.55 J	--	0.20 J	0.095 U	0.14 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.75 J	--	0.14 U	0.12 U	0.17 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	27	--	21	15	38	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	8.6	--	7.0	3.4	12	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	17 J	--	7.4 J	2.7 J	11 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	210 J	--	170 J	63 J	160 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	7.4 J	--	3.5 J	0.45 J	5.5 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	49 J	--	41 J	27 J	46 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	4.0 J	--	1.5 J	0.44 J	3.3 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	9.6 J	--	5.3 J	6.6 J	10 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	38 J	--	31 J	15 J	53 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	14 J	--	11 J	11 J	17 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	14.4	--	10.4	5.43	17.4	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	14.4	--	10.6	5.63	17.6	--	--
Radiochemistry								
Cesium-137	pCi/g	--	0.1323 U+/-0.08434	--	--	--	0.1896 U+/-0.1132	0.1845 U+/-0.09896
Lead-210	pCi/g	--	0.713 +/-0.0564	--	--	--	0.694 +/-0.0588	0.5 +/-0.0513
General Chemistry								
Percent solids	%	45.2	--	57.4	53.6	57.2	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area / Sample Location: / Sample Identification: / Sample Date: / Sample Depth:	Units	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (22.5-25 CM) 12/7/2019 (22.5-25) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (30-32.5 CM) 12/7/2019 (30-32.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (37.5-40 CM) 12/7/2019 (37.5-40) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (45-47.5 CM) 12/7/2019 (45-47.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (52.5-55 CM) 12/7/2019 (52.5-55) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (60-62.5 CM) 12/7/2019 (60-62.5) cm	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (70-72.5 CM) 12/7/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1497 U+/-0.08256	0.1376 U+/-0.08681	0.1214 U+/-0.07948	0.09617 U+/-0.07003	0.09826 U+/-0.06292	0.1139 U+/-0.07255	0.1443 U+/-0.07964
Lead-210	pCi/g	0.635 +/-0.0545	0.682 +/-0.0577	0.513 +/-0.059	0.538 +/-0.0583	0.599 +/-0.0532	0.465 +/-0.0503	0.456 +/-0.0478
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA01 11187072-120719-SS-SJSSA01 (80-82.5 CM) 12/7/2019 (80-82.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (0-2.5 CM) 12/7/2019 (0-2.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02(0-1) 12/7/2019 (0-1) ft bgs	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02(1-2) 12/7/2019 (1-2) ft bgs	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02(2-4) 12/7/2019 (2-4) ft bgs	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02(4-6) 12/7/2019 (4-6) ft bgs	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (7.5-10 CM) 12/7/2019 (7.5-10) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (15-17.5 CM) 12/7/2019 (15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	3.8 U	4.3 U	25	5.3 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	400	510	1000	450	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.67 U	2.6 J	4.2 J	0.90 U	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	14 J	21	44	22	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.083 U	0.52 U	0.77 U	0.062 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.094 U	1.1 J	2.3 J	0.42 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.14 U	0.33 J	0.39 J	0.39 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.092 U	0.35 J	0.73 J	0.23 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.32 J	0.42 J	1.1 J	0.54 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.13 U	0.12 U	0.20 U	0.11 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.80 J	1.4 J	2.3 J	1.0 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.095 U	0.063 U	1.3 J	0.10 U	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.062 U	0.17 J	0.42 J	0.080 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.097 U	0.084 U	0.25 J	0.081 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.092 U	0.061 U	1.2 J	0.26 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	3.6 J	3.2	18	2.0	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	1.1 J	1.1 J	6.8	0.62 J	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	1.5 J	4.8 J	11 J	2.3 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	48 J	77 J	150 J	70 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.85 J	3.1 J	8.7 J	2.2 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	18 J	34 J	51 J	26 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.095 U	1.1 J	6.1 J	0.88 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	4.3 J	8.8 J	11 J	4.6 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	7.7 J	6.8 J	49 J	5.0 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	7.0 J	11 J	20 J	5.2 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	1.83	2.34	10.9	1.51	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	1.91	2.36	10.9	1.57	--	--
Radiochemistry									
Cesium-137	pCi/g	0.1333 U+/-0.08375	0.1145 U+/-0.07314	--	--	--	--	0.114 U+/-0.06986	0.08665 U+/-0.05227
Lead-210	pCi/g	0.399 U+/-0.0504	0.657 +/-0.0547	--	--	--	--	0.552 +/-0.0573	0.346 +/-0.0448
General Chemistry									
Percent solids	%	--	--	71.2	75.2	76.0	79.7	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (22.5-25 CM) 12/7/2019 (22.5-25) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (30-32.5 CM) 12/7/2019 (30-32.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (37.5-40 CM) 12/7/2019 (37.5-40) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (45-47.5 CM) 12/7/2019 (45-47.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (52.5-55 CM) 12/7/2019 (52.5-55) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (60-62.5 CM) 12/7/2019 (60-62.5) cm	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (70-72.5 CM) 12/7/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.04357 U+/-0.02621	0.03245 U+/-0.02093	0.08767 U+/-0.0544	0.06205 U+/-0.04939	0.07463 U+/-0.046	0.0845 U+/-0.0547	0.06443 U+/-0.03829
Lead-210	pCi/g	0.28 +/-0.0495	0.226 +/-0.0474	0.245 +/-0.0566	0.342 +/-0.0461	0.326 +/-0.0472	0.331 +/-0.0483	0.38 +/-0.0497
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA02 11187072-120719-SS-SJSSA02 (80-82.5 CM) 12/7/2019 (80-82.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (0-2.5 CM) 12/6/2019 (0-2.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(0-1) 12/6/2019 (0-1) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(1-2) 12/6/2019 (1-2) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(2-4) 12/6/2019 (2-4) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03(4-6) 12/6/2019 (4-6) ft bgs	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (7.5-10 CM) 12/6/2019 (7.5-10) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (15-17.5 CM) 12/6/2019 (15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	10 U	5.5 U	1.6 U	120	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	980	810	700	2300	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	2.2 J	1.1 U	0.42 U	11	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	41	34	30	90	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.35 U	0.23 U	0.082 U	1.5 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	4.1 J	0.66 J	0.084 U	2.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.56 J	0.48 J	0.40 J	0.95 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	1.2 J	0.095 U	0.081 U	1.5 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.79 J	0.87 J	0.56 J	2.7 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.096 U	0.14 U	0.11 U	0.21 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	2.7 J	2.3 J	2.2 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	4.6 J	0.32 J	0.091 U	1.1 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.40 J	0.32 J	0.20 J	0.62 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.37 J	0.10 U	0.090 U	0.34 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	4.9 J	0.26 J	0.083 U	0.89 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	34	12	0.92 J	24	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	8.4	3.8	0.20 J	8.5	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	5.0 J	2.8 J	0.98 J	27 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	160 J	130 J	110 J	270 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	8.8 J	2.3 J	0.52 J	24 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	53 J	53 J	32 J	61 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	19 J	2.1 J	0.78 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	12 J	11 J	6.1 J	9.3 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	82 J	28 J	2.8 J	58 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	20 J	17 J	4.9 J	15 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	15.5	6.42	1.32	14.8	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	15.5	6.45	1.35	14.8	--	--
Radiochemistry									
Cesium-137	pCi/g	0.03835 U+/-0.02381	0.09548 U+/-0.05456	--	--	--	--	0.1187 U+/-0.07539	0.09875 U+/-0.06434
Lead-210	pCi/g	0.266 +/-0.0437	0.487 +/-0.0502	--	--	--	--	0.516 +/-0.0512	0.278 +/-0.0511
General Chemistry									
Percent solids	%	--	--	62.3	71.8	76.6	67.8	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area	Units	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA03	SJSSA03	SJSSA03	SJSSA03	SJSSA03	SJSSA03	SJSSA03
Sample Identification:		11187072-120619-SS-SJSSA03 (22.5-25 CM)	11187072-120619-SS-SJSSA03 (30-32.5 CM)	11187072-120619-SS-SJSSA03 (37.5-40 CM)	11187072-120619-SS-SJSSA03 (45-47.5 CM)	11187072-120619-SS-SJSSA03 (52.5-55 CM)	11187072-120619-SS-SJSSA03 (60-62.5 CM)	11187072-120619-SS-SJSSA03 (70-72.5 CM)
Sample Date:		12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019
Sample Depth:		(22.5-25) cm	(30-32.5) cm	(37.5-40) cm	(45-47.5) cm	(52.5-55) cm	(60-62.5) cm	(70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.07308 U+/-0.04441	0.06646 U+/-0.043	0.08151 U+/-0.04759	0.0821 U+/-0.05179	0.094 U+/-0.05404	0.06385 U+/-0.0392	0.05209 U+/-0.0324
Lead-210	pCi/g	0.302 +/-0.0498	0.447 +/-0.0471	0.261 +/-0.0447	0.452 +/-0.0469	0.286 +/-0.0498	0.0695 U+/-0.0435	0.402 +/-0.0489
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (80-82.5 CM) 12/6/2019 (80-82.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (0-2.5 CM) 12/9/2019 (0-2.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(0-1) 12/9/2019 (0-1) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(1-2) 12/9/2019 (1-2) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(2-4) 12/9/2019 (2-4) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04(4-6) 12/9/2019 (4-6) ft bgs	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (7.5-10 CM) 12/9/2019 (7.5-10) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (15-17.5 CM) 12/9/2019 (15-17.5) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	12 U	35 U	9.2 U	190	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	720	2100	750	4700	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	1.7 U	4.2 J	1.0 U	20	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	31	57	31	180	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	0.32 U	0.56 U	0.36 U	2.2 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	1.2 J	1.8 J	0.78 J	5.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.63 J	0.98 J	0.63 J	1.9 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.41 J	1.2 J	0.33 J	2.6 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	0.88 J	1.5 J	0.99 J	4.4 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.61 J	0.31 U	0.16 U	0.39 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	2.4 J	2.3 J	2.5 J	5.7 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	1.1 J	1.6 J	0.70 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	0.40 U	0.71 U	0.40 U	0.88 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	0.16 U	0.31 U	0.16 U	0.92 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	0.77 J	1.0 J	0.60 J	2.1 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	43	50	29	110	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	11	13	7.7	31	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	4.9 J	12 J	2.5 J	65 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	130 J	220 J	120 J	610 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	4.1 J	6.4 J	1.1 J	29 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	41 J	40 J	39 J	96 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	2.7 J	5.4 J	2.1 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	8.9 J	5.3 J	7.7 J	13 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	72 J	89 J	52 J	180 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	21 J	19 J	16 J	39 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	16.7	20.4	11.9	49.2	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	16.9	20.8	12.1	49.3	--	--
Radiochemistry									
Cesium-137	pCi/g	0.06432 U+/-0.04086	0.1421 U+/-0.08159	--	--	--	--	0.0665 U+/-0.03796	0.04764 U+/-0.02799
Lead-210	pCi/g	0.476 +/-0.055	1.11 +/-0.0613	--	--	--	--	1 +/-0.0639	0.93 +/-0.0592
General Chemistry									
Percent solids	%	--	--	41.6	50.8	46.1	42.6	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (22.5-25 CM) 12/9/2019 (22.5-25) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (30-32.5 CM) 12/9/2019 (30-32.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (37.5-40 CM) 12/9/2019 (37.5-40) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (45-47.5 CM) 12/9/2019 (45-47.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (52.5-55 CM) 12/9/2019 (52.5-55) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (60-62.5 CM) 12/9/2019 (60-62.5) cm	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (70-72.5 CM) 12/9/2019 (70-72.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1216 U+/-0.0706	0.1144 U+/-0.0658	0.09033 U+/-0.06255	0.128 U+/-0.07696	0.1268 U+/-0.07849	0.1293 U+/-0.07496	0.1496 U+/-0.08865
Lead-210	pCi/g	0.889 +/-0.0681	1.05 +/-0.0586	0.638 +/-0.0505	0.607 +/-0.0531	0.832 +/-0.0595	0.881 +/-0.0591	0.84 +/-0.052
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA04 11187072-120919-BN-SJSSA04 (80-82.5 CM) 12/9/2019 (80-82.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (0-1) 12/8/2019 (0-1) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (0-2.5 CM) 12/8/2019 (0-2.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (1-2) 12/8/2019 (1-2) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (2-4) 12/8/2019 (2-4) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-DUP2 12/8/2019 (4-6) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (4-6) 12/8/2019 (4-6) ft bgs	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (7.5-10 CM) 12/8/2019 (7.5-10) cm
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	10 J	--	3.4 U	4.3 U	4.4 U	2.4 U	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	550	--	190	140	380	160	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	1.5 J	--	0.49 J	0.63 J	0.77 J	0.43 J	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	18	--	8.0	7.2	15	6.6 J	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	0.27 J	--	0.23 J	0.39 J	0.066 U	0.071 U	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	2.1 J	--	0.26 J	0.21 J	0.28 J	0.13 U	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	0.37 J	--	0.36 J	0.31 J	0.45 J	0.29 J	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.49 J	--	0.090 U	0.12 U	0.12 U	0.14 U	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	0.56 U	--	0.29 U	0.41 U	0.38 U	0.31 U	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.10 U	--	0.31 J	0.20 J	0.17 J	0.18 J	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	1.4 J	--	0.71 J	0.76 J	1.1 J	0.54 J	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	1.8 J	--	0.33 J	0.24 J	0.38 J	0.27 J	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	0.18 U	--	0.15 U	0.13 U	0.16 U	0.20 U	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	0.11 U	--	0.071 U	0.094 U	0.088 U	0.11 U	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	1.0 J	--	0.094 U	0.10 U	0.086 U	0.13 U	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	78	--	6.0	2.9 J	9.9 J	4.5	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	18	--	1.5	0.76 J	2.7	1.3 J	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	3.7 J	--	1.4 J	1.9 J	1.8 J	1.0 J	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	70 J	--	29 J	25 J	65 J	24 J	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	3.5 J	--	0.57 J	0.41 J	0.45 J	0.18 J	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	20 J	--	11 J	12 J	28 J	10 J	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	4.5 J	--	0.33 J	0.24 J	0.85 J	0.27 J	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	3.3 J	--	2.4 J	3.3 J	7.6 J	3.0 J	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	130 J	--	9.1 J	4.1 J	16 J	6.4 J	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	22 J	--	4.0 J	4.1 J	14 J	4.5 J	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	27.0	--	2.42	1.33	4.17	1.98	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	27.1	--	2.53	1.44	4.30	2.13	--
Radiochemistry									
Cesium-137	pCi/g	0.1537 U+/-0.08935	--	0.1064 U+/-0.06604	--	--	--	--	0.1099 U+/-0.06103
Lead-210	pCi/g	0.749 +/-0.055	--	0.212 +/-0.052	--	--	--	--	0.259 +/-0.0486
General Chemistry									
Percent solids	%	--	64.1	--	71.3	75.8	76.5	68.5	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (15-17.5 CM) 12/8/2019 (15-17.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (22.5-25 CM) 12/8/2019 (22.5-25) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (30-32.5 CM) 12/8/2019 (30-32.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (37.5-40 CM) 12/8/2019 (37.5-40) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (45-47.5 CM) 12/8/2019 (45-47.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (52.5-55 CM) 12/8/2019 (52.5-55) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (60-62.5 CM) 12/8/2019 (60-62.5) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.1084 U+/-0.06582	0.07979 U+/-0.04556	0.09782 U+/-0.05617	0.07139 U+/-0.05011	0.06645 U+/-0.04037	0.09536 U+/-0.05946	0.08828 U+/-0.04935
Lead-210	pCi/g	0.35 +/-0.0423	0.119 +/-0.0422	0.181 +/-0.079	0.073 +/-0.0455	0.0704 U+/-0.0418	0.317 +/-0.0542	0.352 +/-0.0526
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:		Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area	Sand Separation Area
Sample Location:		SJSSA05	SJSSA05	SJSSA05	SJSSA06	SJSSA06	SJSSA06	SJSSA06	SJSSA06	SJSSA06
Sample Identification:	Units	11187072-120819-BN-DUP1	11187072-120819-BN-SJSSA05 (70-72.5 CM)	11187072-120819-BN-SJSSA05 (80-82.5 CM)	11187072-120619-SS-SJSSA06 (0-2.5 CM)	11187072-120619-SS-SJSSA06(0-1)	11187072-120619-SS-SJSSA06(1-2)	11187072-120619-SS-DUP1	11187072-120619-SS-SJSSA06(2-4)	11187072-120619-SS-SJSSA06(4-6)
Sample Date:		12/8/2019	12/8/2019	12/8/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019	12/6/2019
Sample Depth:		(60-62.5) cm	(70-72.5) cm	(80-82.5) cm	(0-2.5) cm	(0-1) ft bgs	(1-2) ft bgs	(1-2) ft bgs	(2-4) ft bgs	(4-6) ft bgs
Dioxins/Furans										
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	10 J	4.8 U	9.0 U	3.4 U	46 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	380	210	230	200	1300 J
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	3.1 J	2.7 J	19 J	2.8 J	100 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	16	9.9	12	9.3	75 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.79 U	1.0 U	9.3	0.93 U	41 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	9.6	9.2 J	120 J	9.7	420 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.20 J	0.20 J	0.71 J	0.16 J	0.65 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	2.3 J	2.4 J	31 J	2.3 J	110 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.45 J	0.24 J	0.91 J	0.42 J	0.64 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.24 J	0.17 J	2.8 J	0.15 J	7.3 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.87 J	0.72 J	1.2 J	0.58 J	4.0 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	6.6	6.2 J	160 J	6.2	250 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.69 J	0.70 J	7.7 J	0.68 J	25 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.35 J	0.32 J	9.5	0.37 J	11 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.7 J	5.1 J	190 J	5.4 J	170 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	270	300 J	1900 J	290	3900
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	74	83 J	360 J	82	2800
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	6.1 J	5.3 J	34 J	4.3 J	180 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	55 J	38 J	42 J	35 J	250 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	16 J	15 J	190 J	15 J	630 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	14 J	11 J	18 J	11 J	62 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	19 J	20 J	530 J	20 J	700 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	2.7 J	2.2 J	11 J	2.2 J	28 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	600 J	650 J	4500 J	640 J	17000 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	84 J	94 J	420 J	94 J	3100 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	105	117	637	115	3330
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	105	117	637	115	3330
Radiochemistry										
Cesium-137	pCi/g	0.1223 U+/-0.06922	0.1146 U+/-0.06916	0.06587 U+/-0.04211	0.06482 U+/-0.03688	--	--	--	--	--
Lead-210	pCi/g	0.333 +/-0.0544	0.442 +/-0.0572	0.365 +/-0.0568	0.221 +/-0.057	--	--	--	--	--
General Chemistry										
Percent solids	%	--	--	--	--	83.6	89.6	55.0	82.5	60.9

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (7.5-10 CM) 12/6/2019 (7.5-10) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (15-17.5 CM) 12/6/2019 (15-17.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (22.5-25 CM) 12/6/2019 (22.5-25) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (30-32.5 CM) 12/6/2019 (30-32.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (37.5-40 CM) 12/6/2019 (37.5-40) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (45-47.5 CM) 12/6/2019 (45-47.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (52.5-55 CM) 12/6/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.05367 U+/-0.03063	0.03911 U+/-0.02794	0.06255 U+/-0.03486	0.1076 U+/-0.06432	0.0544 U+/-0.0336	0.07865 U+/-0.04602	0.0497 U+/-0.03368
Lead-210	pCi/g	0.161 +/-0.0493	0.0939 +/-0.0491	0.215 +/-0.0476	0.113 +/-0.0522	0.0852 +/-0.0513	0.166 +/-0.0478	0.0697 U+/-0.0434
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (60-62.5 CM) 12/6/2019 (60-62.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (70-72.5 CM) 12/6/2019 (70-72.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (80-82.5 CM) 12/6/2019 (80-82.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (0-2.5 CM) 12/9/2019 (0-2.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(0-1) 12/9/2019 (0-1) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(1-2) 12/9/2019 (1-2) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(2-4) 12/9/2019 (2-4) ft bgs	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07(4-6) 12/9/2019 (4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	44	5.4 U	0.17 U	27 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	2400	430	36	890
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	4.8 J	0.64 U	0.15 U	0.52 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	61	16	1.4 U	39
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	1.3 U	0.21 U	0.17 U	0.70 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.3 J	0.12 U	0.092 U	0.33 U
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.1 J	0.40 J	0.19 J	0.51 U
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.1 J	0.15 J	0.088 U	0.31 U
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.9 J	0.59 J	0.11 U	0.54 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.78 J	0.097 U	0.071 U	0.26 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	2.7 J	1.3 J	0.096 U	2.6 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	1.1 J	0.16 U	0.11 U	0.39 U
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.51 U	0.28 U	0.15 U	0.66 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.60 J	0.093 U	0.070 U	0.24 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.74 J	0.16 U	0.12 U	0.41 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	28	2.7	0.073 U	0.25 U
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	8.6	1.1 J	0.10 U	0.34 U
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	15 J	1.5 J	0.17 U	5.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	220 J	75 J	5.7 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	8.8 J	0.15 J	0.092 U	0.33 U
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	38 J	20 J	1.9 J	28 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.8 J	0.17 U	0.12 U	0.43 U
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	3.7 J	4.2 J	0.28 J	5.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	47 J	3.1 J	0.073 U	0.25 U
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	11 J	3.8 J	0.40 J	0.57 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	14.0	1.90	0.030	0.917
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	14.3	2.09	0.213	1.62
Radiochemistry									
Cesium-137	pCi/g	0.03504 U+/-0.02395	0.05251 U+/-0.03429	0.04477 U+/-0.02713	0.112 U+/-0.06301	--	--	--	--
Lead-210	pCi/g	0.113 +/-0.0485	0.188 +/-0.054	0.0941 +/-0.0531	0.905 +/-0.062	--	--	--	--
General Chemistry									
Percent solids	%	--	--	--	--	43.4	64.4	81.7	56.0

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
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J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (7.5-10 CM) 12/9/2019 (7.5-10) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (15-17.5 CM) 12/9/2019 (15-17.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (22.5-25 CM) 12/9/2019 (22.5-25) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (30-32.5 CM) 12/9/2019 (30-32.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (37.5-40 CM) 12/9/2019 (37.5-40) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (45-47.5 CM) 12/9/2019 (45-47.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (52.5-55 CM) 12/9/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.05777 U+/-0.03325	0.1033 U+/-0.0658	0.0679 U+/-0.03908	0.1 U+/-0.05852	0.06529 U+/-0.04338	0.0502 U+/-0.03476	0.07514 U+/-0.04497
Lead-210	pCi/g	0.853 +/-0.0707	0.912 +/-0.0704	1.05 +/-0.0803	0.655 +/-0.0602	0.156 +/-0.0533	0.0682 U+/-0.0423	0.0808 U+/-0.0502
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
- U - Not detected at the associated reporting limit.
- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (60-62.5 CM) 12/9/2019 (60-62.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (70-72.5 CM) 12/9/2019 (70-72.5) cm	Sand Separation Area SJSSA07 11187072-120919-BN-SJSSA07 (80-82.5 CM) 12/9/2019 (80-82.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (0-2.5 CM) 12/4/2019 (0-2.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08(0-1) 12/4/2019 (0-1) ft bgs	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08(1-2) 12/4/2019 (1-2) ft bgs	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08(2-4) 12/4/2019 (2-4) ft bgs	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08(4-6) 12/4/2019 (4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	20	53	93	8.6 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	930	2600	3600	830
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	3.1 J	6.6 J	13	2.3 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	28	73	110	35
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.53 U	1.0 U	2.2 J	0.41 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.84 J	2.5 J	10	4.0 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.31 J	0.98 J	1.4 J	0.35 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.37 J	1.1 J	3.2 J	0.99 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.57 J	1.7 J	2.6 J	0.90 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.16 U	0.16 U	0.34 J	0.21 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.3 J	3.0 J	4.8 J	2.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.49 J	1.2 J	6.9 J	2.7 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.20 J	0.49 J	1.5 J	0.52 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.12 U	0.25 J	0.59 J	0.16 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.29 J	0.86 J	5.2 J	2.6 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	11	32	260	120
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	4.1	10	75	35
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	7.1 J	16 J	29 J	4.6 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	89 J	240 J	370 J	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	4.4 J	12 J	29 J	6.5 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	18 J	50 J	80 J	40 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	3.6 J	7.3 J	27 J	8.7 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	2.4 J	6.4 J	11 J	8.2 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	26 J	68 J	540 J	260 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	6.4 J	17 J	92 J	47 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	6.44	16.5	109	49.9
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	6.45	16.5	109	49.9
Radiochemistry									
Cesium-137	pCi/g	0.09191 U+/-0.05208	0.08917 U+/-0.05545	0.08095 U+/-0.04787	0.07898 U+/-0.0474	--	--	--	--
Lead-210	pCi/g	0.0815 +/-0.0467	0.0969 U+/-0.0587	0.198 +/-0.0468	0.076 U+/-0.0475	--	--	--	--
General Chemistry									
Percent solids	%	--	--	--	--	76.3	67.5	57.7	70.1

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (7.5-10 CM) 12/4/2019 (7.5-10) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (15-17.5 CM) 12/4/2019 (15-17.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (22.5-25 CM) 12/4/2019 (22.5-25) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (30-32.5 CM) 12/4/2019 (30-32.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (37.5-40 CM) 12/4/2019 (37.5-40) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (45-47.5 CM) 12/4/2019 (45-47.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (52.5-55 CM) 12/4/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.0429 U+/-0.02742	0.06693 U+/-0.04252	0.09049 U+/-0.04816	0.04994 U+/-0.02875	0.1452 U+/-0.07804	0.1771 U+/-0.1092	0.1565 U+/-0.08324
Lead-210	pCi/g	0.0758 U+/-0.045	0.0683 U+/-0.0422	0.083 U+/-0.0493	0.0681 U+/-0.0405	0.611 +/-0.0567	0.833 +/-0.0641	0.54 +/-0.0671
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (60-62.5 CM) 12/4/2019 (60-62.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (70-72.5 CM) 12/4/2019 (70-72.5) cm	Sand Separation Area SJSSA08 11187072-120419-SS-SJSSA08 (80-82.5 CM) 12/4/2019 (80-82.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (0-1) 12/8/2019 (0-1) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (0-2.5 CM) 12/8/2019 (0-2.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (1-2) 12/8/2019 (1-2) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (2-4) 12/8/2019 (2-4) ft bgs	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (4-6) 12/8/2019 (4-6) ft bgs
Dioxins/Furans									
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	4.4 U	--	3.6 U	4.1 U	7.3 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	300	--	180	180	130
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.83 J	--	1.2 J	1.1 J	1.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	7.4	--	6.2 J	6.1 J	5.5 J
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.087 U	--	0.35 J	0.56 J	0.32 J
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.33 J	--	0.78 J	3.3 J	0.64 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.087 U	--	0.096 U	0.24 J	0.27 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.073 U	--	0.32 J	0.82 J	0.28 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.31 U	--	0.50 U	0.21 U	0.19 U
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.13 J	--	0.28 J	0.46 J	0.23 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.34 J	--	0.58 J	0.44 J	0.36 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.35 J	--	0.64 J	1.2 J	0.40 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--	0.15 U	0.18 U	0.12 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.070 U	--	0.073 U	0.10 U	0.094 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.092 U	--	0.079 U	0.61 J	0.092 U
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	13	--	20	44	14
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0	--	4.4	9.7	3.0
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	2.3 J	--	4.0 J	2.5 J	3.0 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	27 J	--	18 J	22 J	16 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.83 J	--	3.3 J	4.6 J	1.2 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	3.3 J	--	4.3 J	5.0 J	3.3 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.76 J	--	0.74 J	2.7 J	0.40 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--	0.15 U	0.18 U	0.14 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	19 J	--	29 J	68 J	20 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0 J	--	4.4 J	11 J	3.3 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	4.56	--	6.75	15.0	4.70
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	4.67	--	6.87	15.1	4.79
Radiochemistry									
Cesium-137	pCi/g	0.1584 U+/-0.0959	0.1831 U+/-0.09753	0.183 U+/-0.1084	--	0.08415 U+/-0.05819	--	--	--
Lead-210	pCi/g	0.294 U+/-0.0491	0.596 +/-0.0531	0.524 +/-0.0536	--	0.095 +/-0.0428	--	--	--
General Chemistry									
Percent solids	%	--	--	--	71.0	--	75.2	78.4	75.4

Notes:
- pg/g - picogram per gram
- pCi/g - picocuries per gram
- DUP - indicates the result from a duplicate sample
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- J - Estimated concentration.
- -- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (7.5-10 CM) 12/8/2019 (7.5-10) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (15-17.5 CM) 12/8/2019 (15-17.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (22.5-25 CM) 12/8/2019 (22.5-25) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (30-32.5 CM) 12/8/2019 (30-32.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (37.5-40 CM) 12/8/2019 (37.5-40) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (45-47.5 CM) 12/8/2019 (45-47.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (52.5-55 CM) 12/8/2019 (52.5-55) cm
Dioxins/Furans								
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	--	--	--
Radiochemistry								
Cesium-137	pCi/g	0.09609 U+/-0.05366	0.08249 U+/-0.05073	0.1153 U+/-0.06196	0.09361 U+/-0.0574	0.0758 U+/-0.04698	0.06056 U+/-0.03959	0.08343 U+/-0.05239
Lead-210	pCi/g	0.0718 U+/-0.0451	0.0967 +/-0.0467	0.0732 U+/-0.0459	0.0755 +/-0.0432	0.0714 U+/-0.0446	0.12 +/-0.0473	0.08 U+/-0.0481
General Chemistry								
Percent solids	%	--	--	--	--	--	--	--

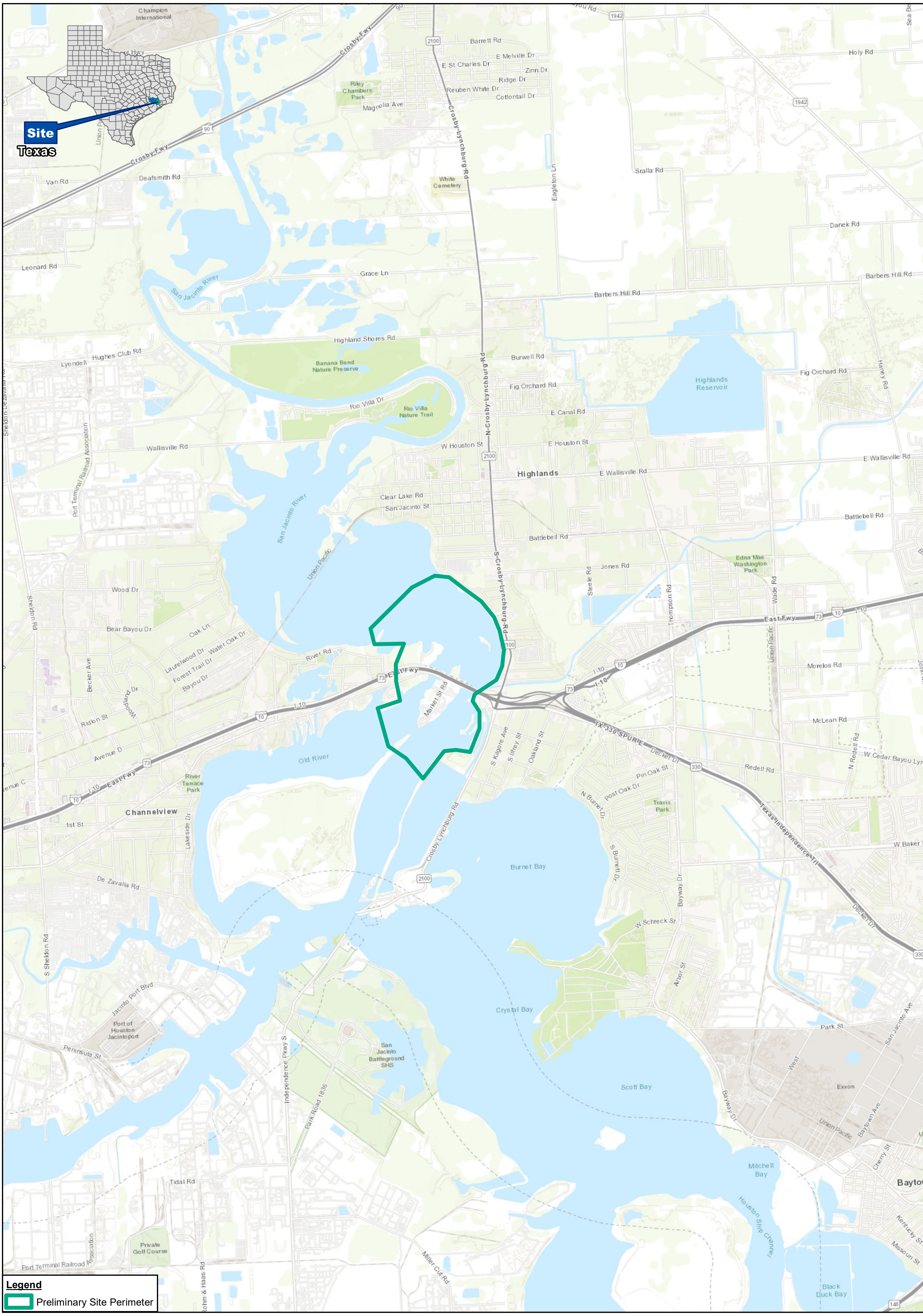
Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results - Northern Impoundment
Final 100% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area Sample Location: Sample Identification: Sample Date: Sample Depth:	Units	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (60-62.5 CM) 12/8/2019 (60-62.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (70-72.5 CM) 12/8/2019 (70-72.5) cm	Sand Separation Area SJSSA09 11187072-120819-BN-SJSSA09 (80-82.5 CM) 12/8/2019 (80-82.5) cm
Dioxins/Furans				
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--
Radiochemistry				
Cesium-137	pCi/g	0.09455 U+/-0.06032	0.1217 U+/-0.06699	0.05701 U+/-0.03507
Lead-210	pCi/g	0.0744 U+/-0.0461	0.0816 +/-0.0451	0.105 +/-0.0417
General Chemistry				
Percent solids	%	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed



Paper Size ANSI B

0 160 320 480 640

Miles

N

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

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

VICINITY MAP

Project No. **11215702**
Revision No. **-**
Date **May 11, 2022**

FIGURE 1-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS001-1.mxd

Data source: Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community.

Paper Size ANSI B
0 60 120 180 240
Feet

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

N

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

NORTHERN IMPOUNDMENT AND SAND SEPARATION AREA

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 1-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS001-2.mxd

Data source: Google Earth Imagery

Paper Size ANSI B

0 40 80 120 160

Feet

N

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

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

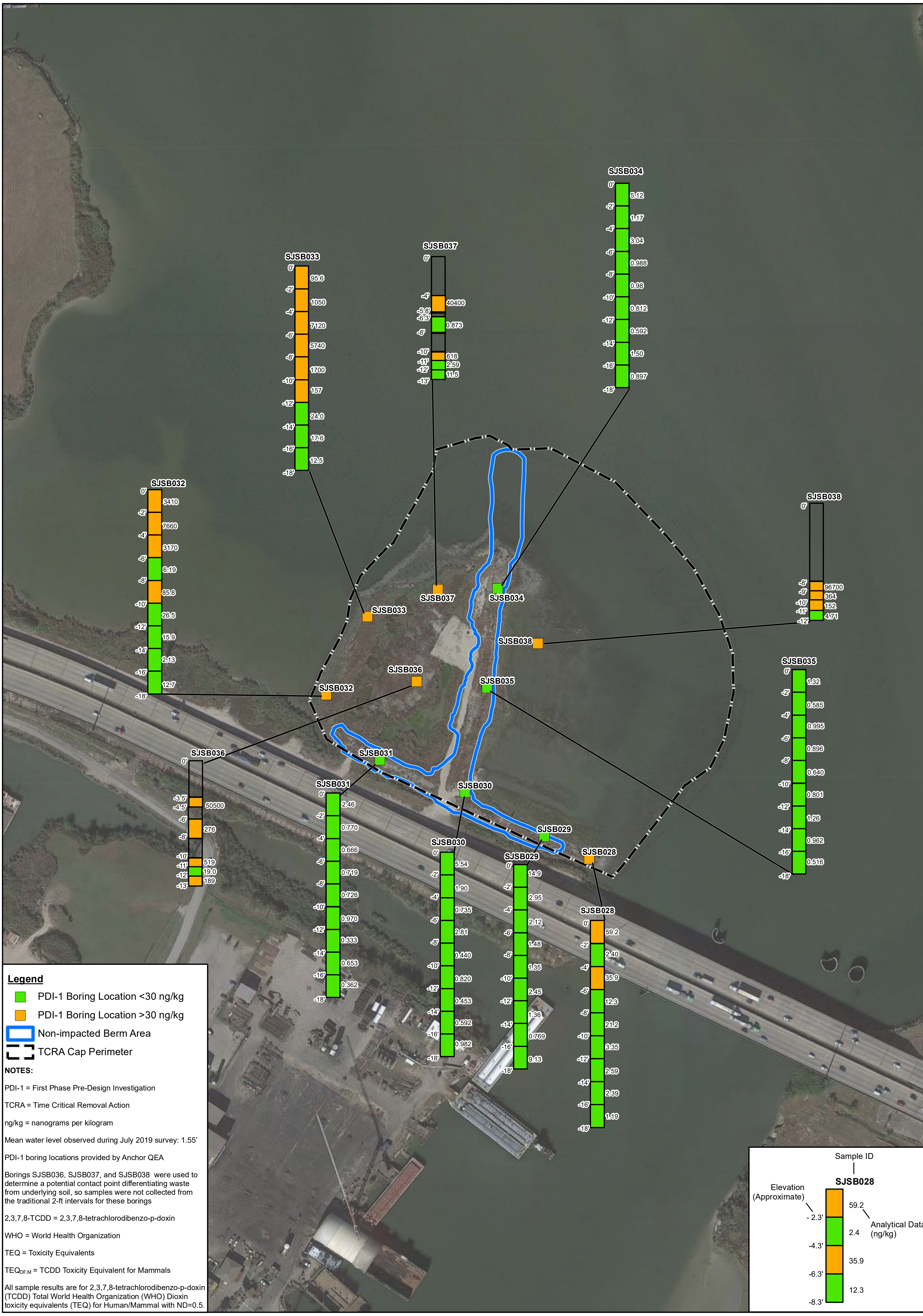
FIRST PHASE PRE-DESIGN
INVESTIGATION BORING LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-1.mxd

Data source: Google Earth Imagery



Paper Size ANSI B

0 60 120 180 240

Feet

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

N

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

FIRST PHASE PRE-DESIGN INVESTIGATION RESULTS

Project No. 11215702
Revision No. -
Date Jun 27, 2022

FIGURE 2-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-2.mxd

Data source: Google Earth Imagery

Paper Size ANSI B
0 40 80 120 160
Feet
N
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

SECOND PHASE PRE-DESIGN INVESTIGATION BORING LOCATIONS

Project No. 11215702
Revision No. -
Date Jun 10, 2022

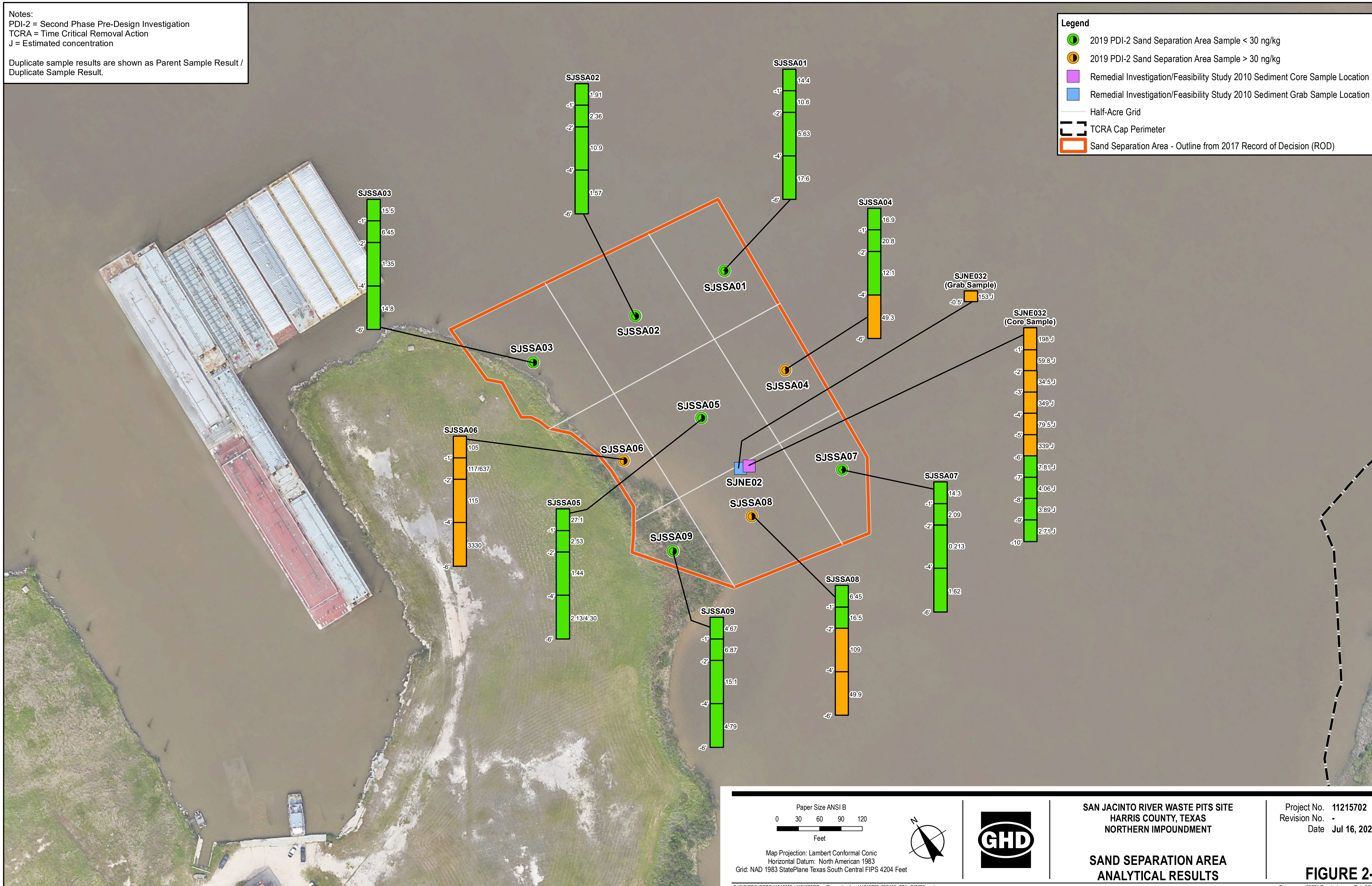
FIGURE 2-3

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-3.mxd

Data source: Google Earth Imagery

Notes:
PDI-2 = Second Phase Pre-Design Investigation
TCRA = Time Critical Removal Action
J = Estimated concentration

Duplicate sample results are shown as Parent Sample Result / Duplicate Sample Result.



SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
NORTHERN IMPOUNDMENT

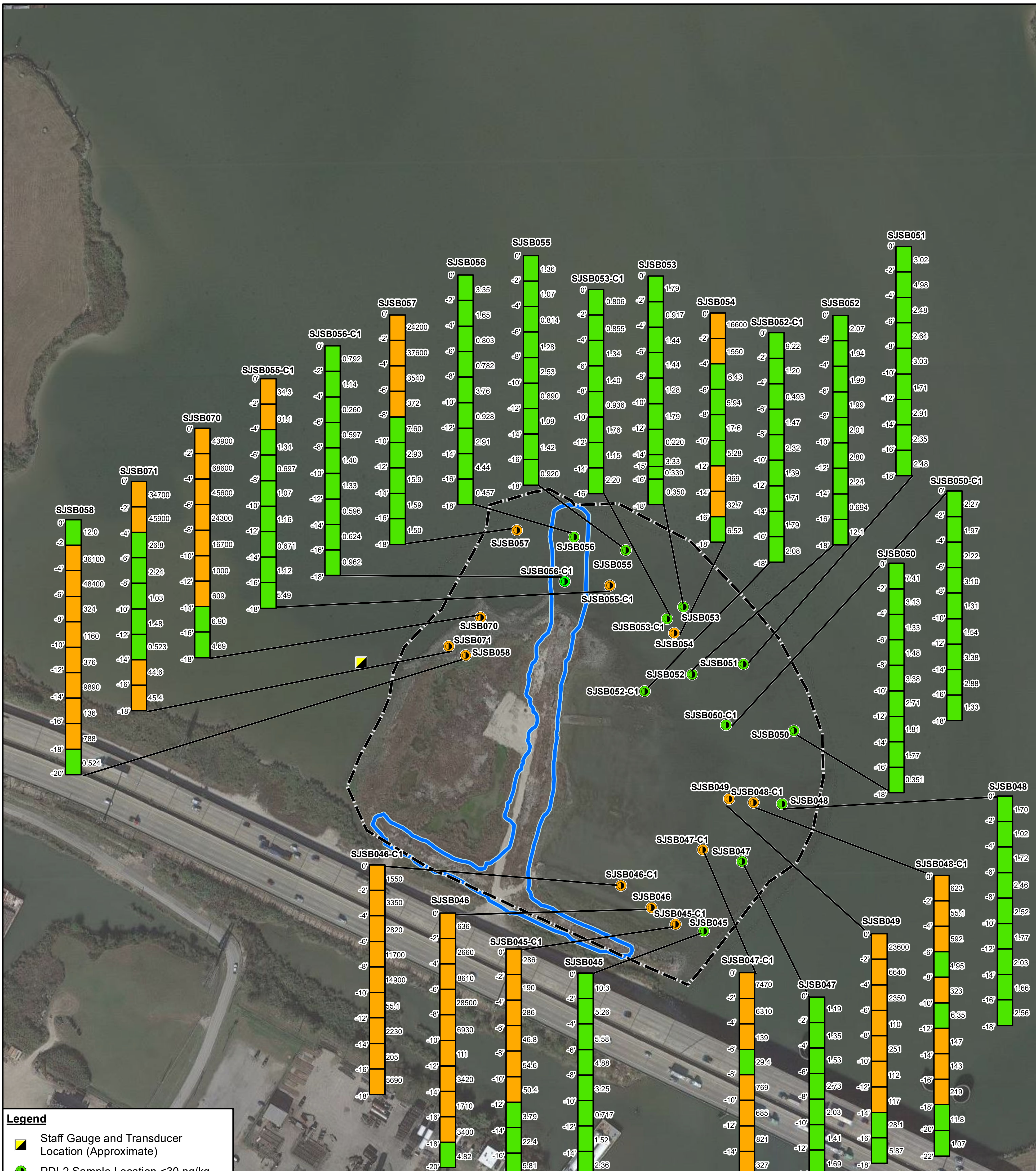
SAND SEPARATION AREA ANALYTICAL RESULTS

Project No. 11215702
Revision No. -
Date Jul 16, 2024

FIGURE 2-4

Q:\GIS\PROJECTS\11215000s\11215702\SandSeparationArea\11215702_202405_SSA_GIS002.mxd
Print date: 16 Jul 2024 - 11:56

Data source: ©2024 Google, Imagery Date 2/9/2023
Created by: yxiong2



NOTES:

PDI-2 = Second Phase Pre-Design Investigation

ng/kg = nanograms per kilogram

Mean water level observed during July 2019 survey: 1.55'

PDI-2 sample location data based on July and November 2019 survey

2,3,7,8-TCDD = 2,3,7,8-tetrachlorodibenzo-p-doxin

WHO = World Health Organization

TEQ = Toxicity Equivalents

$TEQ_{DF,M}$ = TCDD Toxicity Equivalent for Mammals

All sample results are for 2,3,7,8-tetrachlorodibenzo-p-doxin (TCDD) Total World Health Organization (WHO) Dioxin toxicity equivalents (TEQ) for Human/Mammal with ND=0.5.

Paper Size ANSI B

0 60 120 180 240

Feet

N

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

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

SECOND PHASE PRE-DESIGN INVESTIGATION RESULTS

Project No. 11215702
Revision No. -
Date Jun 27, 2022

FIGURE 2-5

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-5.mxd

Data source: Google Earth Imagery

Paper Size ANSI B

0 30 60 90 120

Feet

N

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

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

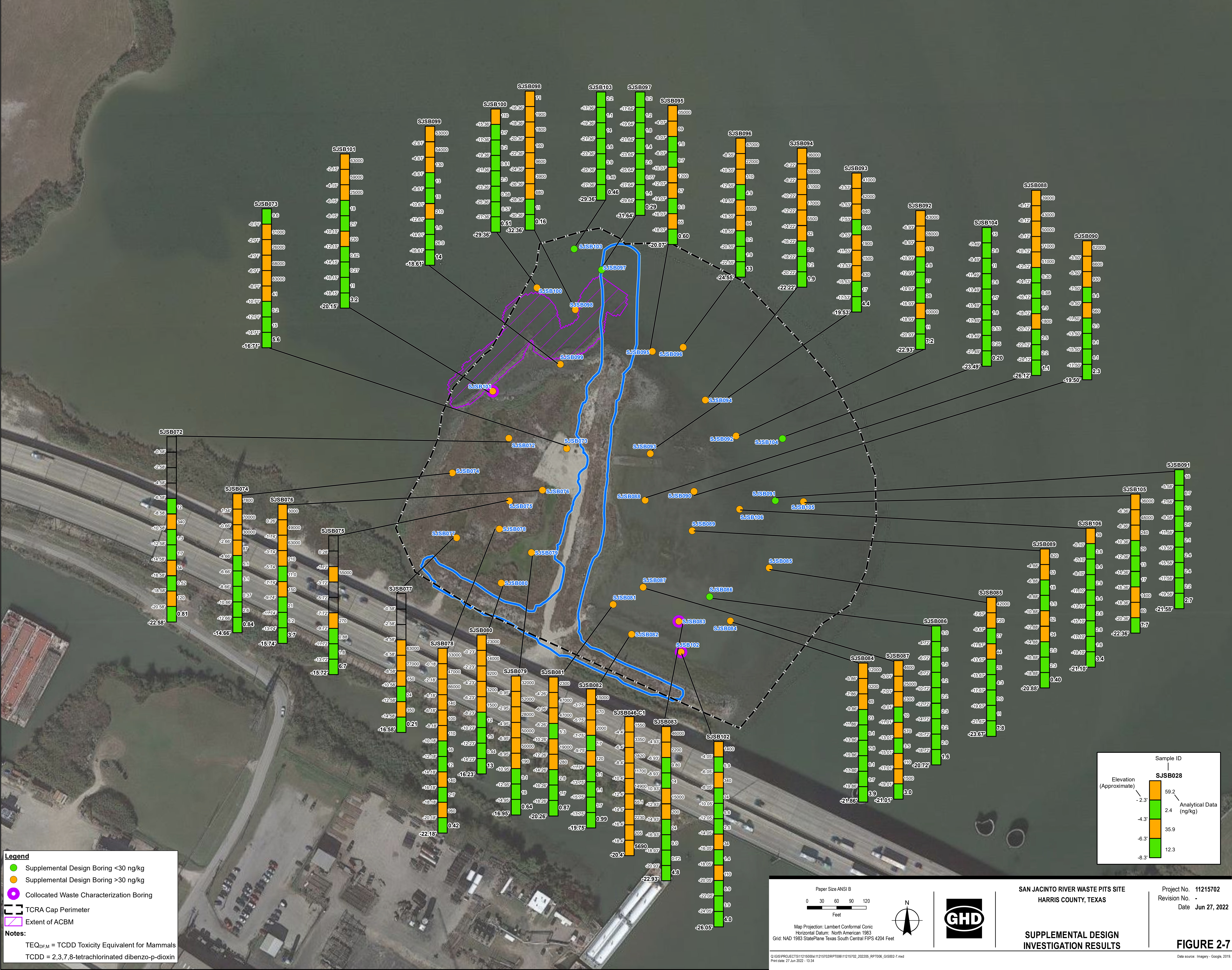
SUPPLEMENTAL DESIGN INVESTIGATION BORING LOCATIONS

Project No. **11215702**
Revision No. **-**
Date **May 11, 2022**

FIGURE 2-6

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-6.mxd
Print date: 11 May 2022 - 12:18

Data source: Imagery - Google, 2019.


Legend
Supplemental Design Boring <30 ng/kg
Supplemental Design Boring >30 ng/kg
Collocated Waste Characterization Boring
TCRA Cap Perimeter
Extent of ACBM
Notes:
TEQDF,M = TCDD Toxicity Equivalent for Mammals
TCDD = 2,3,7,8-tetrachlorinated dibenzo-p-dioxin
Sample ID
SJSB028
Elevation (Approximate)
Analytical Data (ng/kg)
Paper Size ANSI B
0 30 60 90 120
Feet
Map Projection: Lambert Conformal Conic
Horizontal Datum: North American 1983
Grid: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet
N
GHD
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
Project No. 11215702
Revision No. -
Date Jun 27, 2022
SUPPLEMENTAL DESIGN INVESTIGATION RESULTS
FIGURE 2-7
Data source: Imagery - Google, 2019.

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

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

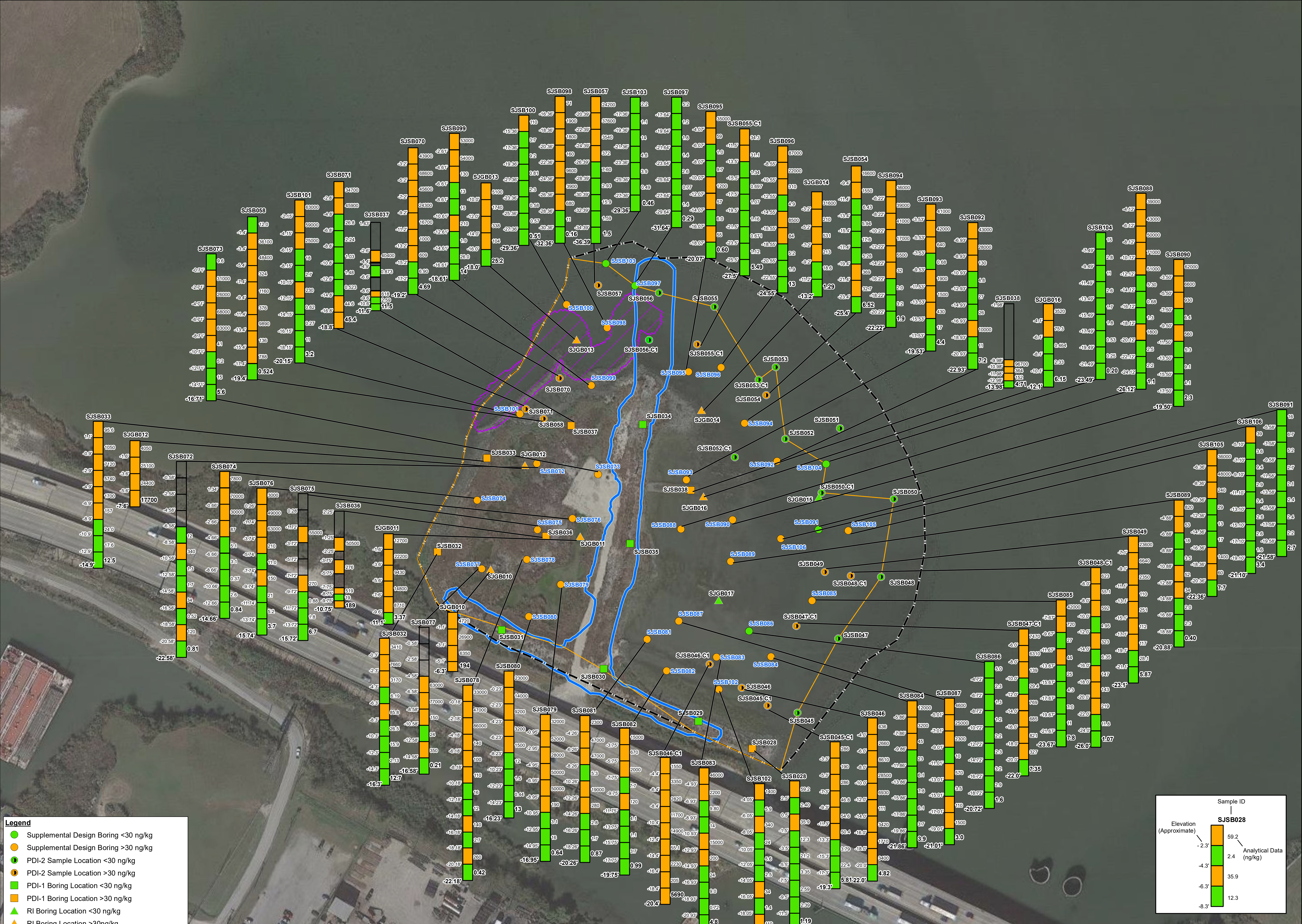
VELOCITY MONITORS AND AMBIENT TURBIDITY MEASUREMENT LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 2-8

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-8.mxd
Print date: 11 May 2022 - 12:29

Data source: Imagery - Google, 2019.



SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

Project No. 11215702
Revision No. -
Date Jun 27, 2022

RI, PDI 1, AND PDI 2, AND SDI RESULTS

FIGURE 2-9

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS002-9.mxd
Print date: 27 Jun 2022 - 13:36

Data source: Imagery - Google, 2019.

Paper Size ANSI B

0 40 80 120 160

Feet

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

N

GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

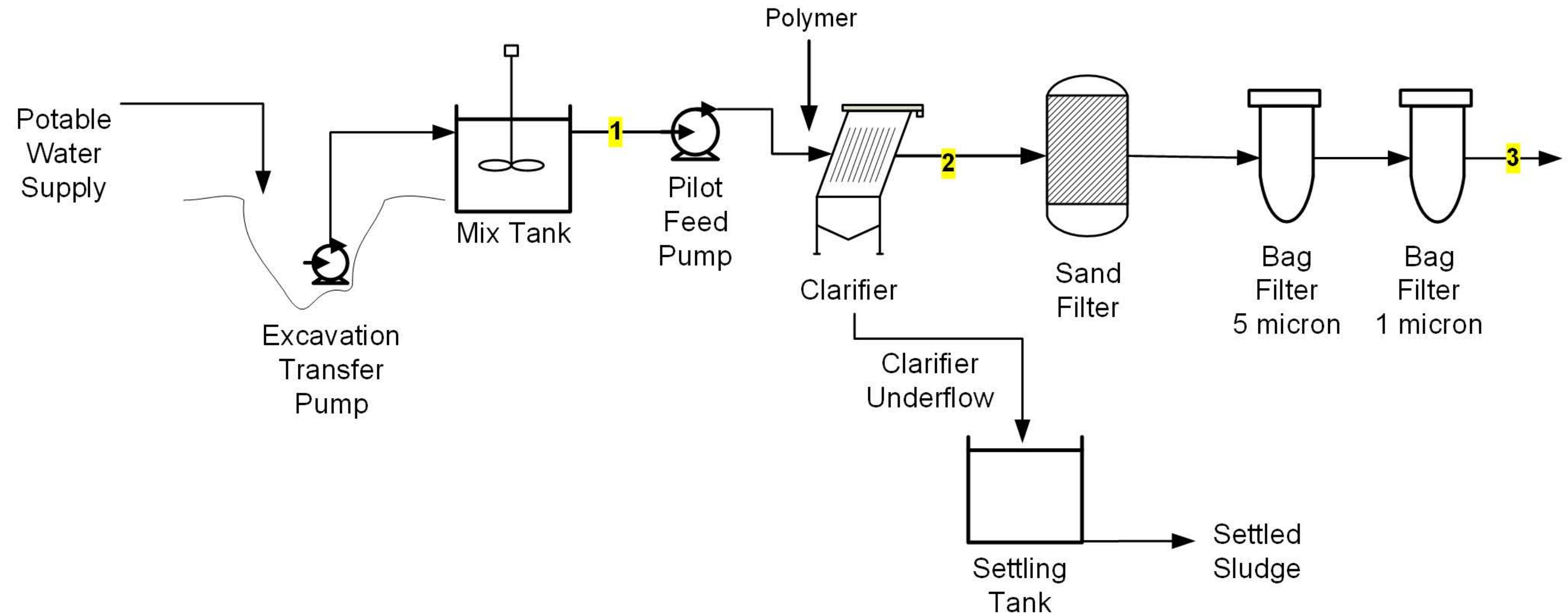
2019 TREATABILITY WASTE MATERIAL SAMPLE LOCATIONS

Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 3-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-1.mxd

Data source: Google Earth Imagery



Parameter		Sample Point 1 Contact Water (average)[2]	Sample Point 2 Clarifier Effluent[2]	Sample Point 3 Filter Effluent[2]
2,3,7,8 TCDD[1]	pg/L	16,500	13	<10
Copper	mg/L	0.10	0.0081 U	0.0081 U
Lead	mg/L	0.11	0.0022 U	0.0022 U
Zinc	mg/L	0.38	0.045	0.036
TSS	mg/L	4,050	11	2

Notes:
pg/L = picogram per liter
mg/L = milligram per liter
2,3,7,8 TCDD =Tetrachlorodibenzodioxin
TSS = total suspended solids
U = not detected at the associated reporting limit

1) The Minimum Level (ML) of EPA approved method 1613B is 10 pg/L.
2) Full analytical data set included in Table 3-2. Lab reports included in Appendix D.

Paper Size ANSI B

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

2019 PILOT TEST
PROCESS FLOW DIAGRAM

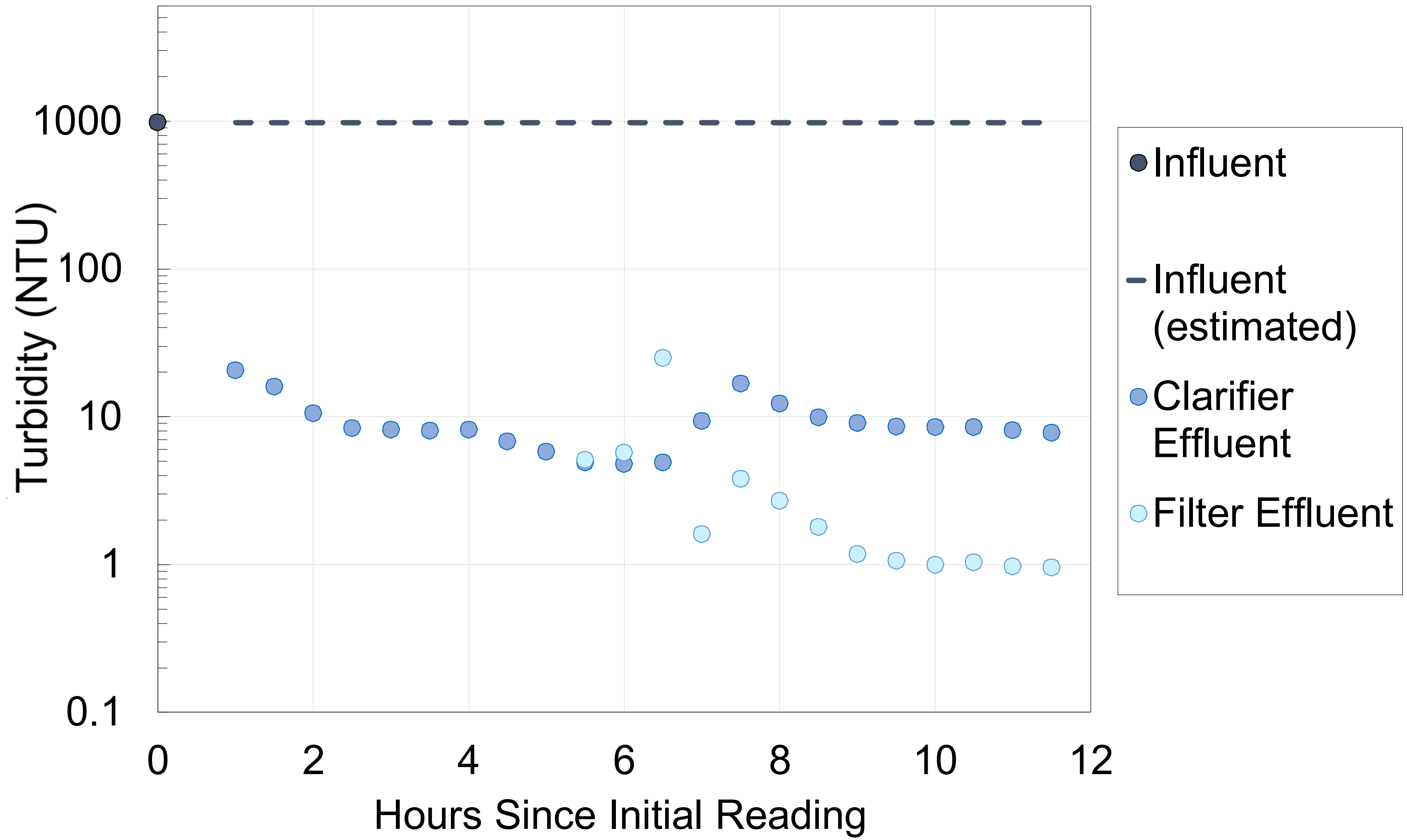
Project No. 11215702
Revision No. -
Date May 6, 2022

FIGURE 3-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-2.mxd

Notes:
NTU = Nephelometric Turbidity Unit

Turbidity was measured during the on-site water treatment pilot test. Real-time turbidity readings were taken for the influent, the post-clarification effluent, and the post-filtration effluent.



Paper Size ANSI B

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

2019 PILOT TEST
EFFLUENT TURBIDITY

Project No. 11215702
Revision No. -
Date May 6, 2022

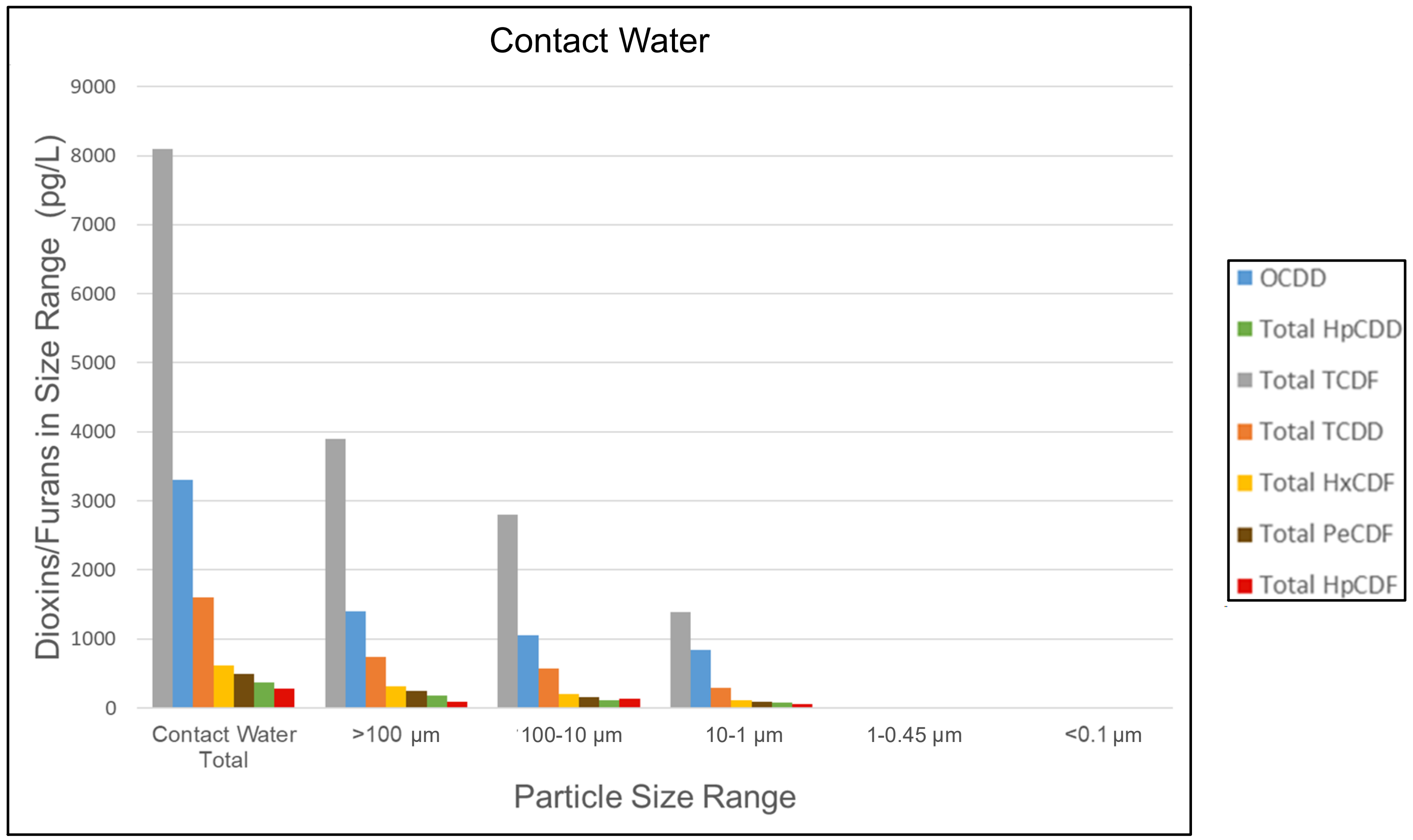
FIGURE 3-3

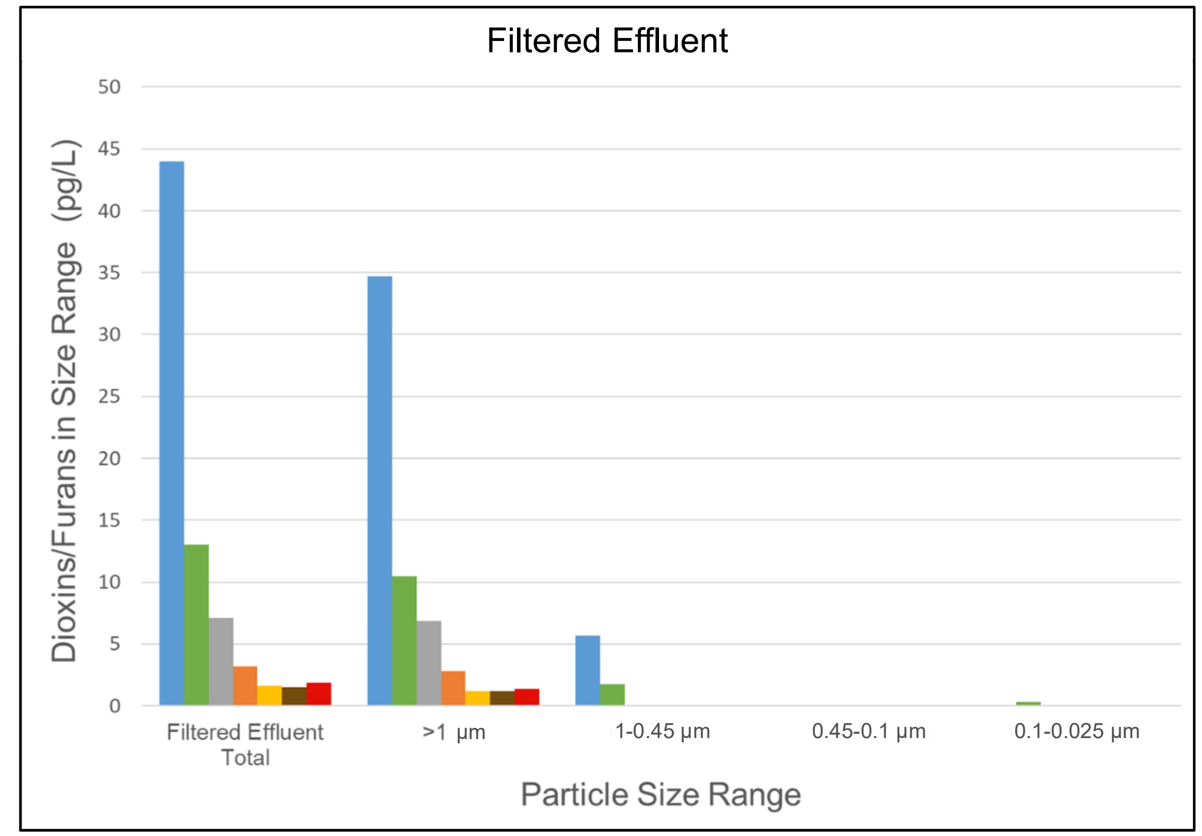
Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-3.mxd

Notes:
pg/L = picogram per liter
µm = micron
TCDF =Tetrachlorodibenzofuran
OCDD = Octachlorodibenzodioxin
TCDD = Tetrachlorodibenzodioxin
HxCDF = Hexachlorodibenzofuran
PeCDF = Pentachlorodibenzofuran
HpCDD = Heptachlorodibenzodioxin
HpCDF = Heptachlorodibenzofuran

The graph on the left shows dioxin/furan results after the raw contact water was filtered through 100 µm, 10 µm, 1 µm, 0.45 µm, and 0.1 µm filters.

The graph on the right shows dioxin/furan results after the clarified and filtered effluent from the on-site pilot test was then filtered through 1 µm, 0.45 µm, 0.1 µm, 0.05 µm, and 0.025 µm filters.





Paper Size ANSI B

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

Project No. 11215702
Revision No. -
Date May 6, 2022

2019 FILTRATION TESTING RESULTS

FIGURE 3-4

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-4.mxd

Paper Size ANSI B

0 40 80 120 160

Feet

N

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

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

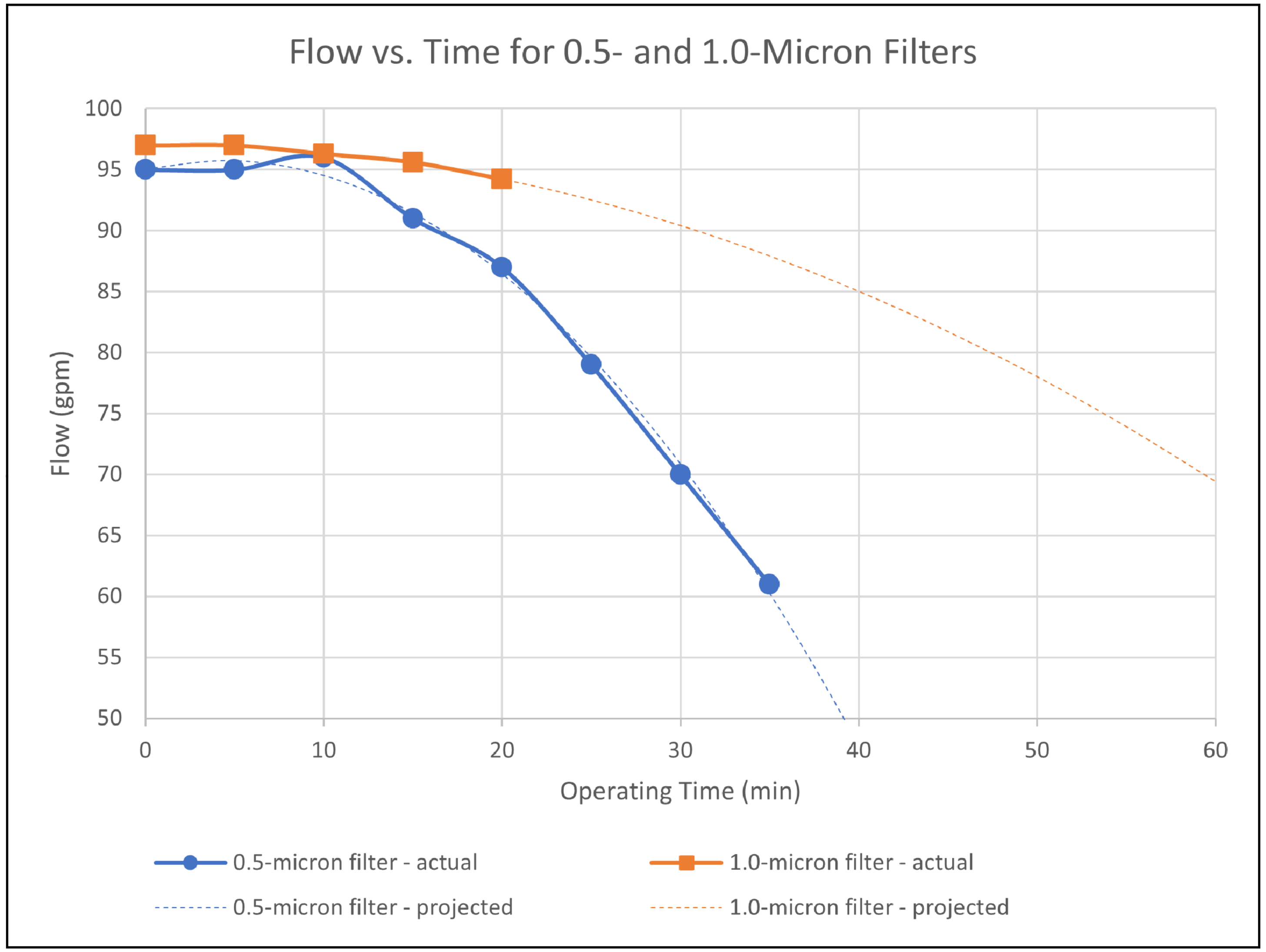
2019 ARMORED CAP MATERIAL SAMPLE LOCATIONS

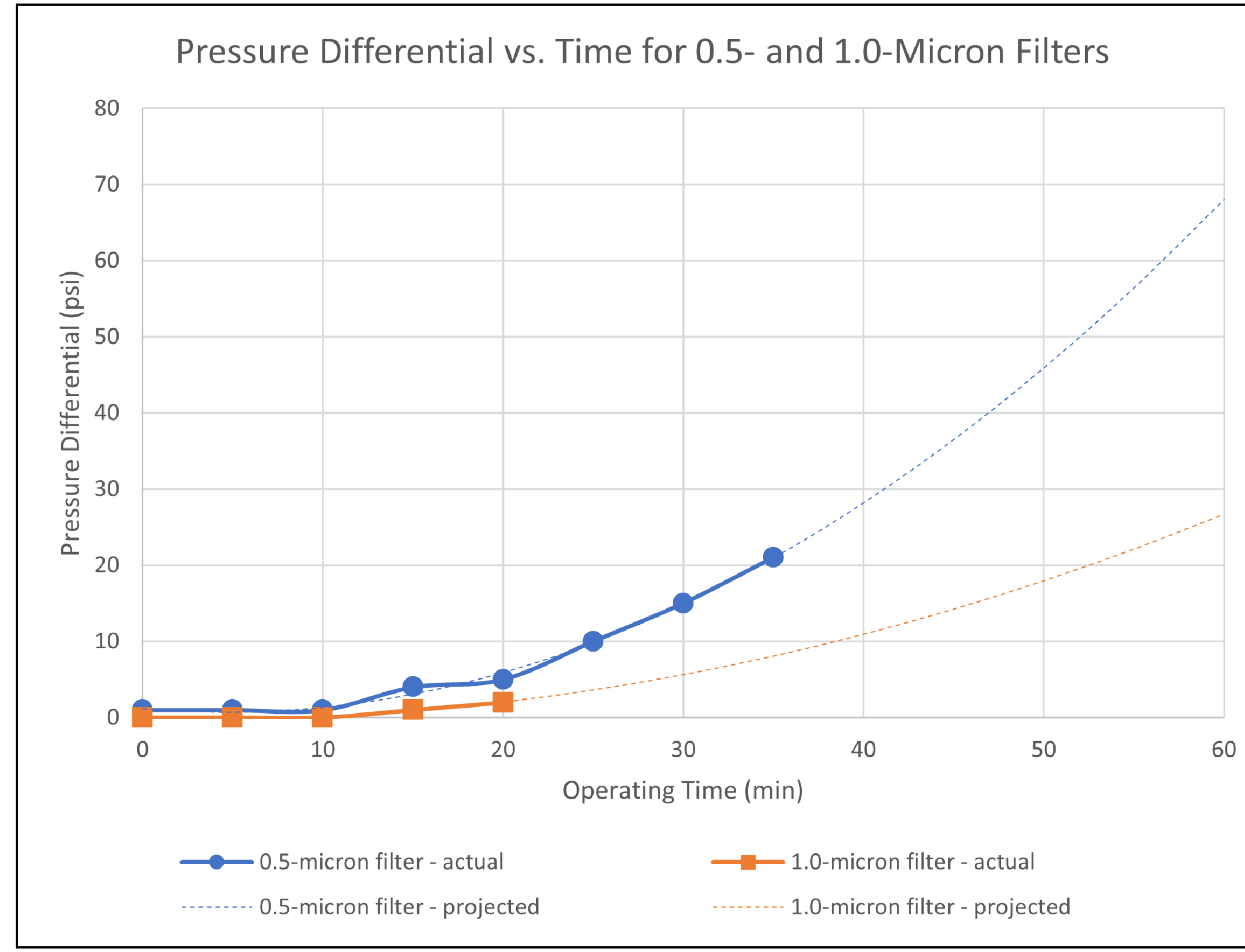
Project No. 11215702
Revision No. -
Date May 11, 2022

FIGURE 3-5

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-5.mxd

Data source: Google Earth Imagery





Notes:
- gpm = gallons per minute
- min = minutes
- psi = pounds per square inch

Paper Size ANSI B

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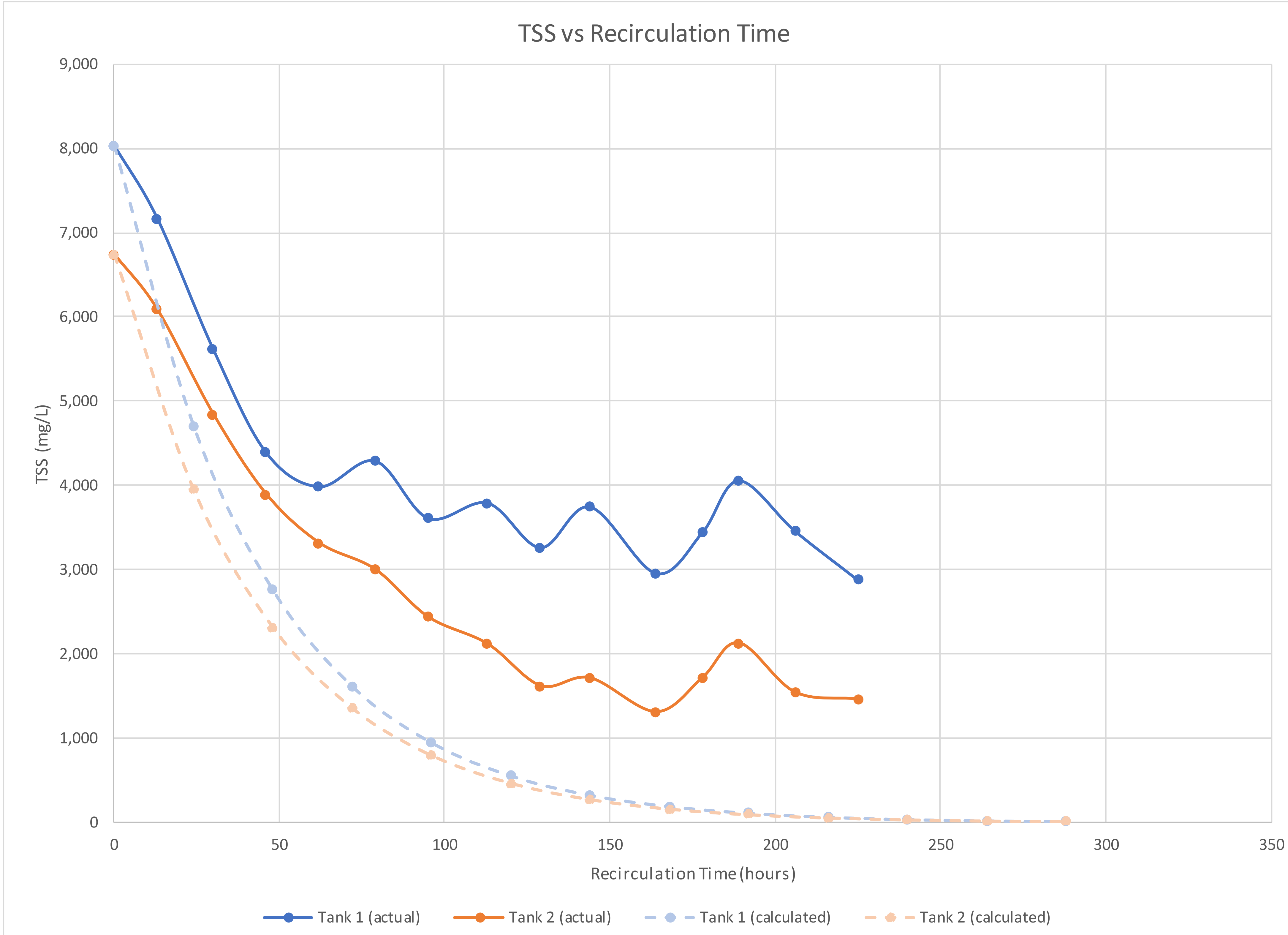
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

FLOW AND DIFFERENTIAL PRESSURE OVER TIME - FIELD FILTRATION TESTING

Project No. 11215702
Revision No. -
Date May 19, 2022

FIGURE 3-6

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-6.mxd



Notes:
- TSS = total suspended solids
- mg/L = milligrams per liter
- This graph shows the TSS values after recirculation. Expected TSS values for filtrate from Tank 1 and Tank 2 were calculated based on particle size distributions prior to recirculation versus filter pore sizes used during recirculation.

Paper Size ANSI B

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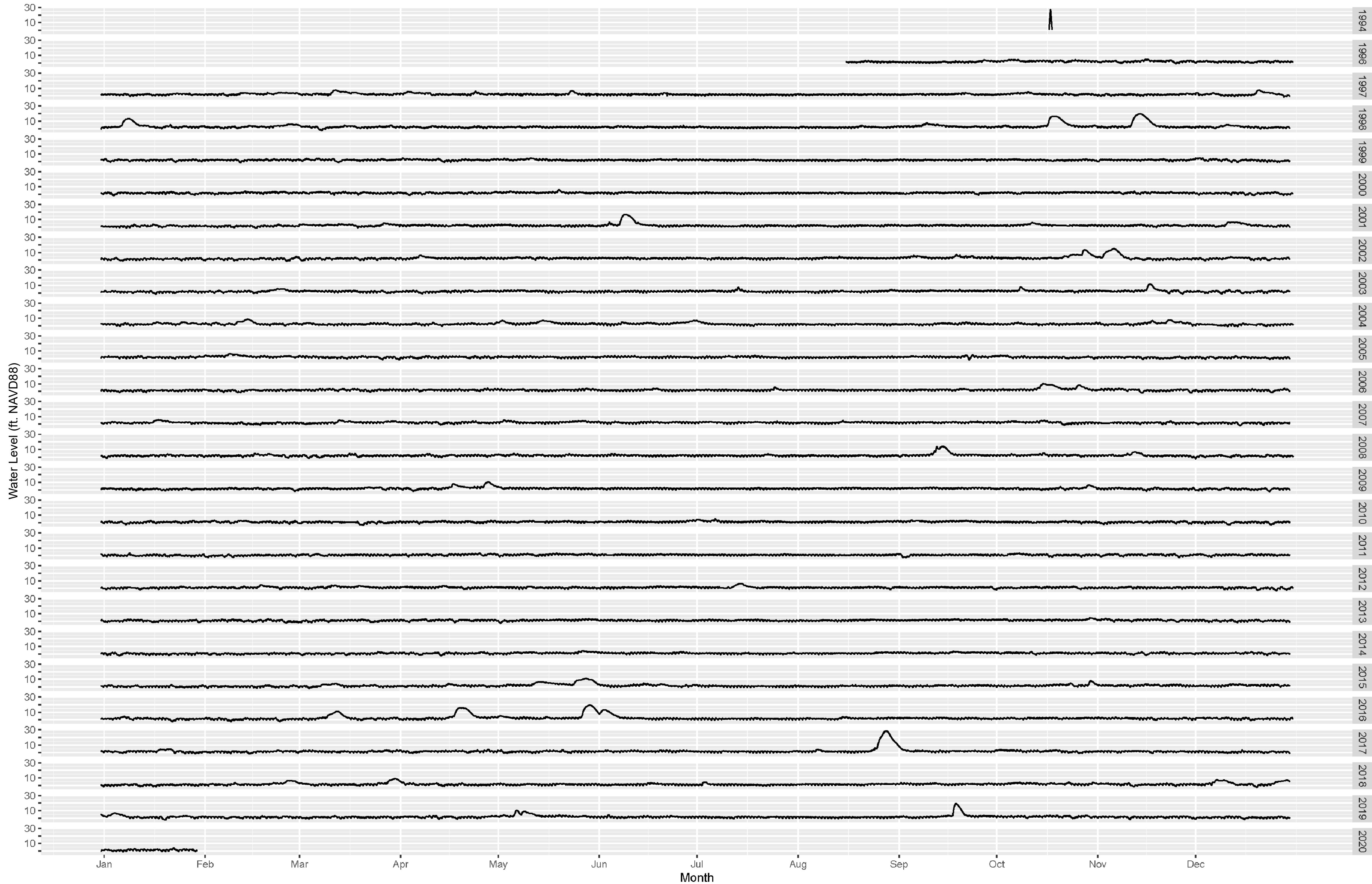
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

ACTUAL VERSUS EXPECTED (CALCULATED) TSS VALUES - APPROACH B FILTRATION TESTING

Project No. 11215702
Revision No. -
Date May 19, 2022

FIGURE 3-7

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS003-7.mxd



Legend

—— Water Surface Elevation (Feet NAVD88)

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

NAVD88 = North American Vertical Datum of 1988

Paper Size ANSI B

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

HISTORICAL RIVER ELEVATIONS - SHELDON GAGE

Project No. **11215702**
Revision No. **-**
Date **May 6, 2022**

FIGURE 5-1

Q:\GIS\PROJECTS\11215000s\11215702\RPT006\11215702_202205_RPT006_GIS005-1.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)

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 25, 2024

FIGURE 5-2

Q:\GIS\PROJECTS\11215000s\11215702\RPT012\11215702_202405_RPT012_GIS007.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)

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

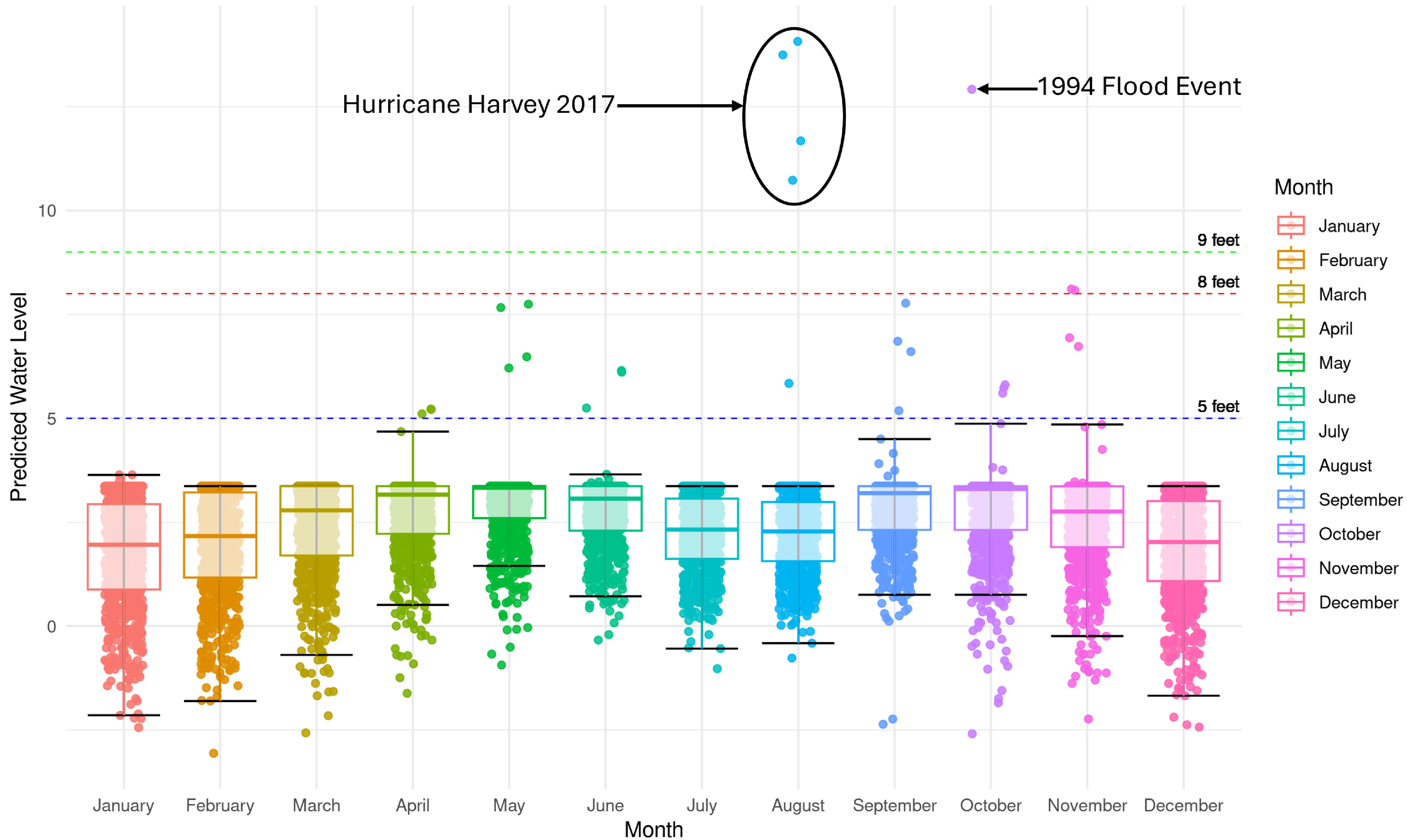
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

UPDATED HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

Project No. 11215702
Revision No. -
Date Jul 8, 2024

FIGURE 5-3

Q:\GIS\PROJECTS\11215000s\11215702\RPT012\11215702_202405_RPT012_GIS008.mxd



Boxplot interpretation:
The bold horizontal line inside the box represents the median.
The height of the box is the interquartile range (IQR), showing the middle 50% of the data.
*The whiskers extend to 1.5 * IQR or the maximum/minimum values within this range (black lines).*
Points lying outside the whiskers are typically considered as outliers

Note:
Points shown are based on the highest 1-day value.

Paper Size ANSI B

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS

MONTH-WISE BOXPLOTS
FOR DAILY MAXIMUM ELEVATIONS

Project No. 11215702
Revision No. -
Date Nov 19, 2024

FIGURE 5-4

Q:\GIS\PROJECTS\11215000s\11215702\RPT012\11215702_202405_RPT012_GIS009.mxd