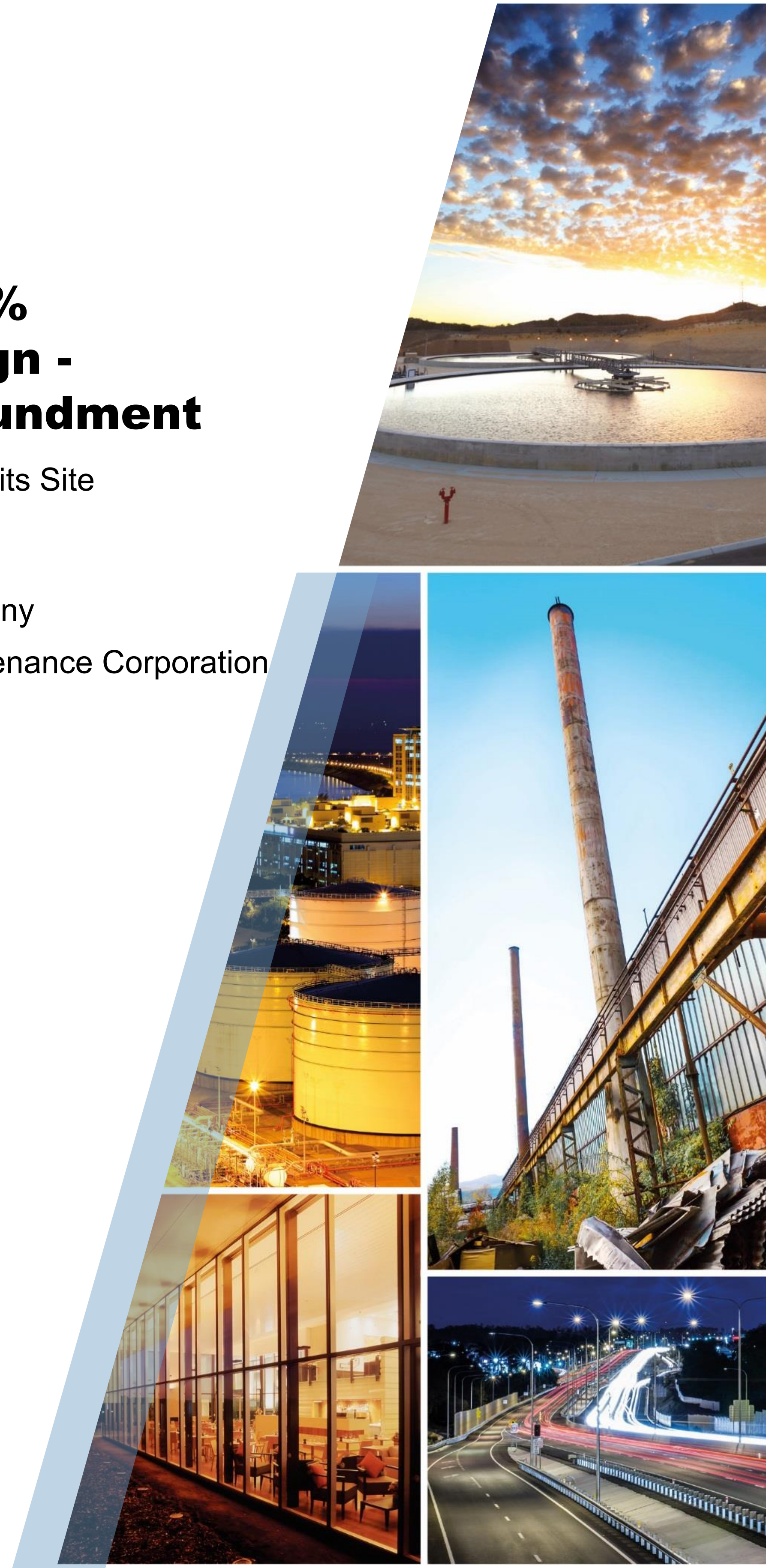
Preliminary 30% Remedial Design - Northern Impoundment

San Jacinto River Waste Pits Site
Harris County, Texas

International Paper Company
McGinnes Industrial Maintenance Corporation



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List of Acronyms

AOC	-	Administrative Settlement Agreement and Order on Consent for Remedial Design
ARAR	-	Applicable or Relevant and Appropriate Requirements
ASTM	-	American Society for Testing and Materials
BAZ	-	Biologically Active Zone
BHHRA	-	Baseline Human Health Risk Assessment
BMP	-	Best Management Practice
^{137}Cs	-	Cesium-137
CFR	-	Code of Federal Regulations
CFS	-	Cubic feet per Second
cm	-	Centimeter
CME	-	Central Mine Equipment
COD	-	Chemical Oxygen Demand
COPC	-	Constituent of Potential Concern
CQA/CQP	-	Construction Quality Assurance/Quality Control Plan
CU	-	Consolidated Undrained
CY	-	Cubic Yard
DI	-	Deionized
DPT	-	Direct Push Technology
EPA	-	Environmental Protection Agency
ERP	-	Emergency Response Plan
FSP	-	Field Sampling Plan
ft bgs	-	Feet Below Ground Surface
F_y	-	Yield
GAC	-	Granular Activated Carbon
GCV	-	Generalized Cross Validation
GHD	-	GHD Services Inc.
gpm	-	Gallons per Minute
GPS	-	Global Positioning System
HASP	-	Health and Safety Plan
HDPE	-	High-Density Polyethylene
I-10	-	Interstate Highway 10
IBC	-	Intermediate Bulk Containers
IC	-	Institutional Control
ICIAP	-	Institutional Controls Implementation and Assurance Plan
IPC	-	International Paper Company
ksi	-	Kilopound per Square Inch
kW	-	Kilowatts
MARS	-	Multivariate Adaptive Regression Splines
MIMC	-	McGinnes Industrial Maintenance Corporation
mg/L	-	Miligrams per Liter
ML	-	Minimum Level
MNR	-	Monitored Natural Recovery
mph	-	Miles per Hour
NAVD88	-	North American Vertical Datum of 1988
ng/kg	-	Nanogram per Kilogram

List of Acronyms

NTU	-	Nephelometric Turbidity Units
O&M	-	Operations and Maintenance
^{210}Pb	-	Lead-210
PBR	-	Permit By Rule
PCBs	-	Polychlorinated Biphenyls
pcf	-	Pounds per Cubic Foot
PCL	-	Protective Concentration Levels
PDI	-	Pre-Design Investigation
PDI-1	-	First Phase Pre-Design Investigation
PDI-2	-	Second Phase Pre-Design Investigation
pg/L	-	Picogram per Liter
QAPP	-	Quality Assurance Project Plan
RA	-	Remedial Action
RAO	-	Remedial Action Objective
RCRA	-	Resource Conservation and Recovery Act
RD	-	Remedial Design
RDWP	-	Remedial Design Work Plan
RI	-	Remedial Investigation
RI/FS	-	Remedial Investigation/Feasability Study
ROD	-	Record of Decision
ROW	-	Right of Way
SAA	-	Sand Separation Area
SAP	-	Sampling and Anlaysis Plan
SF	-	Safety Factor
SM	-	Standard Method
SOW	-	Statement of Work
SPT	-	Standard Penetration Test
SVOC	-	Semivolatile Organic Compound
SWMP	-	Site Wide Monitoring Plan
SWPPP	-	Storm Water 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

List of Acronyms

UCS	-	Unconfined Compressive Strength
USGS	-	United States Geological Survey
USACE	-	United States Army Corps of Engineers
UU	-	Unconsolidated Undrained
V	-	Volts
VOC	-	Volatile Organic Compound
WQBEL	-	Water Quality-Based Effluent Limitation
µm	-	Micron
µg/L	-	Nanogram 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 *Preliminary 30% Remedial Design - Northern Impoundment* (30% RD) for the San Jacinto River Waste Pits Site in Harris County, Texas (Site). This 30% 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 Preliminary 30% RD for the Northern Impoundment to be submitted to the EPA.

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 in 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 in Figure 1-1. The Northern Impoundment is located immediately north of the Interstate Highway 10 (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 (Anchor QEA, 2019).

The remedy selected by the EPA for the Northern Impoundment described in the *Record of Decision* (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 cleanup 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 cleanup 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 cleanup 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 cleanup 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 cleanup 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 cleanup 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) inadvertent ingestion and dermal contact of impacted sediment and through ingestion of fish/shellfish collected in areas with impacted sediment. The risk-based cleanup level for the Northern Impoundment was calculated to be 30 nanograms per kilogram (ng/kg) $TEQ_{DF,M}$.

1.2 Remedial Design Approach

In accordance with the AOC, the 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 investigations (PDIs), preliminary 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 ten times since the RD was initiated, including on April 30, 2018, May 14-15, 2018, May 30, 2018, June 13, 2018, May 3, 2019, December 17, 2019, January 27-28, 2020, February 19, 2020, March 25, 2020, and April 22, 2020.

In addition, representatives from GHD and EPA conduct 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 Preliminary 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 Preliminary 30% RD for both the Northern Impoundment and the Southern Impoundment.
- On April 13, 2020, the *Preliminary 30% Remedial Design - Southern Impoundment* was submitted to the EPA (GHD, 2020b).

1.3 Objective

The objective of this 30% RD is to present a summary of the 30% RD for the Northern Impoundment as required by the SOW. This 30% RD includes a summary of the results from the PDI-1, PDI-2, and the ongoing Treatability Study. This 30% 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 an engineered barrier using best management practices (referred to herein as the best management practice [BMP]), waste material removal methodology, and water treatment. Associated design drawings, specifications, and supplemental plans are also included in this 30% RD.

1.4 Document Organization and Supporting Deliverables

The remaining sections of this 30% RD are organized as follows:

- Section 2 includes descriptions of the phased PDIs 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 design, waste material removal and solidification methodology, transportation and disposal, and water treatment process elements of the Northern Impoundment design.
- Section 6 includes a description of the investigation activities conducted in the SSA during PDI-2 and the implications 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 Cleanups* (EPA, 2009).
- Section 8 includes a list of the drawings (in preliminary form) developed to date for the Northern Impoundment RD, along with the list of anticipated detailed technical specifications. Any additional drawings will be submitted in a future design deliverable.
- 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/CQP), Transportation and Off-site Disposal Plan (TODP), Institutional Controls Implementation and Assurance Plan (ICIAP), and Monitored Natural Recovery (MNR) Plan.
- Section 10 includes references to cited reports, correspondence and other documents.

- This 30% RD includes supporting figures and tables that are referenced throughout the document. This 30% RD also includes the following appendices:
  - Appendix A - PDI Supporting Documents (including analytical laboratory reports, data validation reports, aquifer test results, and a photographic log for the PDI-1 and analytical laboratory reports, data validation reports, and a photographic log for PDI-2)
  - Appendix B - Northern Impoundment Geotechnical Engineering Report
  - Appendix C - Treatability Study Supporting Documents (including water and waste material analytical laboratory reports, data validation reports, and a photographic log)
  - Appendix D - Northern Impoundment Prelinimary Vibration Analysis
  - Appendix E - Design Drawing Package

- Appendix F - Northern Impoundment BMP Wall-Type Analysis
- Appendix G - Supporting Deliverables (including drafts of HASP, ERP, FSP, QAPP, SWMP, CQA/CQP, TODP, ICIAP, and MNR Plan)
- Appendix H - SSA Supporting Documents (including analytical lab reports and data validation reports)

2. Pre-Design Investigation

In March 2011 and May 2012, the Respondents completed investigations at the Northern Impoundment as part of the RI. A summary and 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 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 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, 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 feet bgs for chemistry analysis, from the surface to 10 feet bgs for waste characterization analysis, and from the surface to the Beaumont clay (to a maximum depth of

62 feet 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), at which chemistry 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 chemistry, 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 chemistry borings. All chemistry 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 zero to two feet 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 to access to the boring location.

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

2.1.2 PDI-1 Chemistry 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 feet bgs, with three borings (SJSB036, SJSB037, and SJSB038) installed to maximum depth of 12 to 13 feet 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 assumed 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 feet 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

In order 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 feet 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 9034).

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 feet bgs and screened from 10 to 15 feet 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 three 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 seven to 11 feet 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 Chemistry Results

Of the 11 borings analyzed, five 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.

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 feet bgs. Boring locations SJSB032 and SJSB033 were installed to 18 feet 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 feet bgs, respectively. Borings SJSB036 and SJSB037 were installed to terminal depths of approximately 13 feet 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 feet bgs at both borings. Boring SJSB038 on the eastern side of the Northern Impoundment was installed to a depth of 12 feet bgs and showed concentrations above 30 ng/kg $TEQ_{DF,M}$ at a depth of 11 feet bgs.

PDI-1 chemistry 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 feet 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 5.2.3, 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 Northern Impoundment Treatability Study, conducted concurrently with PDI-2. See Section 3.3 for a summary of the Northern Impoundment Treatability Study 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 (*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 chemistry 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 feet bgs for chemistry borings, and to a maximum depth ranging from 20 to 100 feet 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 was 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 of them 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 drilled. 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 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 liner, and then installed a short surface casing (4 feet 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 through the extent of the impacted material (approximately 18 to 20 feet) 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 to the top, the casing was pushed to the mudline (for underwater borings), the geotextile liner was repaired, and the armored cap rock was replaced.

2.2.2 PDI-2 Chemistry Sampling

In accordance with the *Final Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d), the sampling program was designed to better define the placement of the outer BMP. To that end, 14 non-contingent, chemistry 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 chemistry 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 feet bgs and samples were collected for each 2-foot interval.

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 feet 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 feet 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 cleanup level, and the next interior boring location from that clean boring had results that exceeded the cleanup level at, or almost at, total depth. In order 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 feet 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 feet 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 feet bgs at three 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 feet bgs. Discrete samples were collected for every two-foot interval between 18 and 30 feet bgs, for a total of six samples per boring. The 18 to 20 feet 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 feet bgs depth interval for all three locations; thus, the remaining samples for subsequent depth intervals were not analyzed.

In summary, 25 chemistry 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 feet bgs. All others were drilled to 18 feet bgs.

All chemistry 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 *Final Second Phase Pre-Design Investigation 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 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 feet 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 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 feet, 1 to 2 feet, 2 to 4 feet, and 4 to 6 feet 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 centimeter (cm) (0.98 inches) from the sediment/surface water interface to a depth of 82.5 cm (32.5 inches) and analyzed for ^{137}Cs and ^{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 Chemistry Results

A total of 25 chemistry 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 feet bgs and the remaining borings were all below 30 ng/kg $TEQ_{DF,M}$ down to 18 feet 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 inform the alignment of the outer BMP. This is further discussed in Section 5.2.

All subsurface chemistry results from the RI, PDI-1, and PDI-2 are shown on Figure 2-6. The data bars in this Figure show the interval results as elevations, adjusted to account for the depth of water atop each boring location, giving an indication of the depths from which waste material will have 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. This is further discussed in Section 5.2.4 as it relates to the RD.

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 feet North American 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 feet NAVD88) to a minimum elevation of -60 feet NAVD88 on the western side of the Northern Impoundment and to approximately -50 feet 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 feet NAVD88 (an additional 20 feet of thickness) on the western side and at approximately -50 to -65 feet NAVD88 (up to an additional

15 feet 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 feet 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 PDI Conclusions and Recommendations

When the ROD was issued, only eight subsurface borings had been installed in the Northern Impoundment. As part of PDI activities, an additional 36 subsurface borings were installed, providing additional horizontal and vertical (as deep as -35 feet NAVD88) characterization. Analytical results from these samples indicated that the vertical impact of material with $TEQ_{DF,M}$ exceeding 30 ng/kg extended much deeper than initially determined. As shown on Figure 2-6, data from the PDIs indicate that the excavation elevations during the RA range up to an elevation of -25 feet NAVD88 with an average depth of -15 feet NAVD88. The average depth of waste referenced in the ROD was -9 feet NAVD88. The horizontal and vertical waste extents will be used during the RD to determine the type of BMP necessary to implement the selected remedy. The data from the PDIs will also be used to determine the area of the Northern Impoundment that will require remediation and the alignment of the BMP. In addition, final waste removal depths necessary to achieve compliance with the clean-up level will need to be determined in order to properly design the BMP. Data analysis and BMP design are further discussed in Section 5.4.

Understanding the geotechnical characteristics of the soils beneath the Northern Impoundment is also a critical component of the RD for the BMP. The presence of more cohesive (clay) materials identified during the PDI-2 has a direct correlation to the tip elevation (BMP depth) required for the BMP design. 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 5.2.3.

3. Treatability Study

3.1 Treatability Study Overview

As part of the PDI-2 field activities in October 2019, waste material, water, and armored cap material samples were collected 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 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 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 transportation and disposal.
- Evaluation of optimum solidification mix designs to meet requirements for 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 trearment 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 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 the Resource Conservation and Recovery Act (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.

3.3.1 Treatability Testing Sample Collection

As part of the Northern Impoundment PDI-2 activities conducted from September to December 2019, four approximately 20-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 quandrant). 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 - Standard Methods (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, results from the PDI-2 baseline characterization indicated that all waste material samples met disposal criteria for a Class II landfill. Based upon past experience on similar projects, many landfills require waste to meet a specified UCS. To account for this potential requirement, additional solidification testing is currently being performed. These results may or may not be utilized depending upon the requirements of the selected landfill later in the design process.

The results of the testing showed that all four samples from the Northern Impoundment had similar physical and chemical characteristics. The results from the waste material characterization are shown in Table 3-1. Analytical laboratory reports are included as part of Appendix C.

3.4 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 storm water and will require management. As discussed in the TSWP, water treatability testing was to be 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 storm water 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 Criteria

To ensure that discharge of treated water during the RA meets likely permit limits that would be assigned to similarly permitted outfalls, COPC discharge criteria were determined 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 likely 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 Segment 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 estimated location of the outfall and the type of water body, the following default dilution fractions were used, per TCEQ guidance: 30% for Zone of Initial Dilution (Acute), 8% for Aquatic Life Mixing Zone (Chronic), and 4% for Human Health Mixing Zone (Chronic). Since Segment 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 300-1,000 gallons per minute (0.432-1.44 million gallons per day). The default dilution factors are recommended for any discharge into a bay/tidal river greater than 400 feet wide with a flow rate less than 10 million gallons per day.

Using default dilution factors, river segment specific inputs, and expected TSS and discharge flow rates from the anticipated Northern Impoundment water treatment system discharge, preliminary discharge concentrations were determined. These preliminary calculated discharge criteria 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 email correspondence dated February 18, 2020 (EPA, 2020b),

> *EPA has determined that compliance with the TSWQS ARAR will be attained as follows:*
>
> *The state surface water quality standard for Dioxins/Furans is 7.97×10^{-8} µg/L[1] [0.0797 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 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 Minimum Level (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 cleanup 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.

If an effluent sample analyzed for dioxin is below the ML using the EPA approved method, the sample result will be identified as non-detect and the discharge will be determined to be in compliance with the ARAR.

[1] - microgram per liter

[2] - picogram per liter

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 feet by 20 feet and a depth of 10 feet. 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 liner 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. 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 with clarification only and one batch was treated with 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 treat and discharge technology through on-Site field and bench-scale testing, as described in the subsequent sections.

The 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 (NTU), 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 NTU for the clarifier, and at approximately one NTU for 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 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 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 a process flow diagram (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 and Dissolved Metals - EPA Method 6010C
- Total and Dissolved 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 - SM3500
- 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) - SM5310C
- TSS - SM2540D

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 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.

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. Figure 3-2 shows a visual depiction of 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 Sections 5.6 and 5.7.

Turbidity was monitored online at both the clarifier effluent and the filtered effluent. Turbidity results are presented in Figure 3-3. Clarifier turbidity was typically at 10 NTU or less, while filtered effluent turbidity was typically at one NTU or below. The clarifier effluent TSS concentration was 10 miligrams per liter (mg/L), while the filtered/clarified effluent TSS was 2 mg/L. Therefore, 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, TSS and turbidity levels can be used as an indication of the dioxin level based on these pilot testing results, as well as the bench-scale filtration results.

A turbidity spike occurred at 1930 hours 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, 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.

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 utilizes 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, but no clean effluent water stream. 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)).

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 treat and discharge option ranged from 300 to 1,000 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 many 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 (i.e., 1.6 million gallons) over a longer period of time as compared to the treat and discharge option. As a result, traditional treatment through clarification and filtration was selected for use in the Northern Impoundment 30% RD and thermal evaporation was not further evaluated. Thus, results of the thermal evaporation evaluation are not included in this 30% 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. Bench-scale testing was also performed on the clarified and filtered effluent from the pilot test 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 likely be disposed off-site as a separate waste stream. Because the sludge will have a very high moisture content, it will need to be solidified prior to off-Site transport. Treatability testing was performed to evaluate options for solidification of the sludge. In order to optimize the amount of reagent necessary for solidification, additional settling treatability testing was performed to evaluate the effectiveness prior to solidification.

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 seven -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/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) was presented and discussed with members of the TWG on January 27, 2020. Based upon the results and the TWG discussion, the EPA sent a correspondence 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.

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 may 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 sludge 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, 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 prepared by placing 300 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 are to be analyzed for UCS. The evaluation of the samples from the tests is currently ongoing.

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 30% 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 D.

For the raw clarifier underflow solidification tests where 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 showing that the water had not been incorporated in the solidified material.

In order to eliminate standing water, 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 with a sample of waste material composite. 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 solidifying solids. The minimum reagent doses to achieve a pocket penetrometer hardness of >64 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 evaluation of the clarifier underflow solidification samples is currently ongoing, and the samples will be analyzed for UCS.

3.5 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 cleanup level. These data are shown in Table 3-5. Analytical laboratory reports are included as part of Appendix C.

3.6 Preliminary Treatability Study Conclusions

Waste Material

- Characterization results for the Northern Impoundment waste material treatability samples were consistent with results obtained during PDI-1, indicating that the waste material can be classified as non-hazardous. In addition, the characterization results indicate that the waste material meets criteria for disposal in a Texas Class II landfill.
- Testing is ongoing for the waste material solidification samples; however, the results suggest that an addition of a low dose of Portland cement would allow the removed waste material to meet landfill 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 level of TSS in the water. TSS and turbidity demonstrated potential to serve as an indicator parameter for dioxins and furans that can be measured real-time in the field.
- The results of the 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.
- Treatment of simulated contact water by clarification and filtration resulted in an effluent that meets the discharge criteria established by the EPA and the success of the treatment process and methodology was corroborated through the implementation of parallel tests. This technology has been selected to advance forward in the RD for water treatment. The treatment process will be designed in accordance with EPA correspondence received 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.”
- Solids in the clarifier underflow will likely require settlement to produce a concentrated stream for solidification. The settled solids from the clarifier can be solidified with doses as low as 20% 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 $TEQ_{DF, M}$ cleanup level. These results support the proposed reuse of the existing armored cap material as part of final Northern Impoundment site restoration during and at the conclusion of the RA.

3.7 Additional Treatability Testing

As discussed further in Section 5, the preliminary 30% RD provides for removal of waste material in the Northern Impoundment using two different methodologies. Approach A would be implemented in two out of the five planned remedial Cells (see embedded Figure 5-A in Section 5.1) and would include installation of a BMP, removal of all water in the cell, and excavation of the waste material inside the BMP. Under this approach, the water treatment process would include removal, treatment, and discharge of all water from the cell as it accumulates throughout the removal period. Accumulated water would be pumped from the cell to a storage vessel, treated through clarification and filtration, and would then be discharged to the river.

Three out of the five Cells would be remediated using Approach B, which would include installation of a BMP, and removal of the waste material through a column of water. Under this approach, the water treatment process would utilize similar treatment technology to that of Approach A; however, water would be treated in-situ in the cell via a recirculation and filtration process. For these Cells , water treatment would occur only once, after the waste removal through the water column is completed.

Treatability activities performed to date, and summarized in this 30% RD, were designed to evaluate the water treatment process for Approach A. Although the treatment technology would be similar for both approaches, the processes will be different. Additional treatability testing will be conducted during the summer of 2020, as described in a letter to the EPA dated April 16, 2020 (GHD, 2020c), and currently under revision to address the EPA's comments, to evaluate the water treatment process for Approach B. Results of this treatability testing, and some additional planned filtration confirmation testing, will be presented in the 90% RD for the Northern Impoundment.

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 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 waste.

The 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.

5. Remedial Design

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

- Engineered Barrier BMP
- Excavation
- Transportation and Disposal
- Water Management
- Monitoring and Controls

- Certain technical challenges associated with construction and implementability of the remedy as selected in the ROD - based in large part on data collected as part of the PDIs - are described throughout Section 5 and summarized in Section 5.9.

5.1 Remedial Approach

The remedy selected for the Northern Impoundment, as outlined in the ROD, includes excavation and off-site disposal of waste material located beneath the armored cap installed as part of the TCRA that exceeds the prescribed clean-up level of 30 ng/kg $TEQ_{DF,M}$. As described in the ROD, the selected remedy is to utilize a BMP such as a cofferdam.

At the time that remedial alternative was selected, subsurface data collected during the RI in 2011 and 2012 was available. At the time the ROD was issued, eight soil borings taken from depths ranging from -7.6 feet to -18.5 feet NAVD88 had been collected. As part of the RD process, 34 additional subsurface soil borings were installed in the Northern Impoundment at deeper elevations up to -35 feet NAVD88. Analytical results from these borings have further defined the vertical depths of material located beneath the armored cap that exceeded 30 ng/kg $TEQ_{DF,M}$ within the Northern Impoundment, and have significantly increased the volume of waste material to be excavated from the volume estimated in the ROD.

The selected remedial alternative in the ROD was based on an expected excavation with an average depth of approximately -9 feet NAVD88. However, results from the PDIs indicate that the actual excavations necessary to remove materials exceeding 30 ng/kg $TEQ_{DF,M}$. are significantly deeper, ranging up to an elevation of -25 feet NAVD88 with an average depth of approximately -15 feet NAVD88. Furthermore, based on geotechnical data collected during PDI-2 and not available at the time the ROD was selected, the geotechnical characteristics of the soils for the Northern Impoundment raise significant concerns about the technical feasibility of installing a BMP as contemplated by the ROD.

The BMPs outlined in the ROD were conceptual in nature and not based on site-specific information, such as site-specific geotechnical data or information about the currently known depths of waste material. Based on the results of the PDIs, the selected remedy now requires the removal of material down to elevations of -25 feet NAVD88, approximately 30 feet beneath the surface of the San Jacinto River. This would require the engineering and construction of a BMP that can withstand an approximately 35-foot wall of water during storm events outside the hurricane season and during BMP construction within the hurricane season.

The BMP design is still in its initial stages, but based upon review of PDI-2 geotechnical data (received March 2020), the large scale of the design elements outlined in this 30% RD associated with the BMP border on what is infeasible to construct, and likely make the use of such a structure technically impracticable. In addition, due to the size of these structural BMP elements, there would be risks to worker health and safety. There would also be an inherent risk of a release of waste material in the Northern Impoundment to the river during pile driving to install the BMP, due to the forces that would be required to install the pile walls to the depths required. Further discussion of the technical impracticability associated with the BMP is provided in Section 5.9.

Notwithstanding the above, GHD has, as directed by EPA, developed a preliminary design for the remedy as it is outlined in the ROD in order to meet the approved schedule for submission of the 30% design package for the Northern Impoundment. An overall remedial approach has been developed, in coordination with members of the TWG, and includes several fundamental elements. These elements are discussed in the Section below. Further detailed evaluation of the constructability and risks associated with this remedial approach will be required once comments on this design package are received and analyzed.

BMP Alignment and Excavation Extent

The lateral extent of the excavation for purposes of the RD would be defined by the presence of waste material above the 30 ng/kg $TEQ_{DF,M}$ dioxin cleanup level underneath the armored cap. This approach was outlined in the *Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d), and further agreed upon during the December 17, 2019 TWG meeting. The lateral extent of the planned removal is shown on Figure 5-A below. The lateral limits of the planned removal area also define the corresponding outer alignment of a BMP. The depth of removal was determined based upon the vertical limits of waste material above the 30 ng/kg $TEQ_{DF,M}$ dioxin clean-up level. The total estimated volume of waste material for removal is approximately 212,000 CY which is significantly more than the estimated volume of 162,000 CY provided in the ROD. The current estimate of the waste volume could likely further increase based upon the final depths of the excavations required to achieve compliance with the 30 ng/kg $TEQ_{DF,M}$ dioxin clean-up level.

Multi-cell BMP, Seasonal Excavation, and Top of Wall Elevation

The ROD stated that performing the removal of the waste material using BMPs would reduce the 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 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.

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 historical data, since 1996 there were no high water events that exceeded an elevation of +9 feet NAVD88 during the period of November to April. This information is contained in Figure 5-1. Therefore, for design purposes, the top of pile elevation for the BMP was established as +9 feet NAVD88.

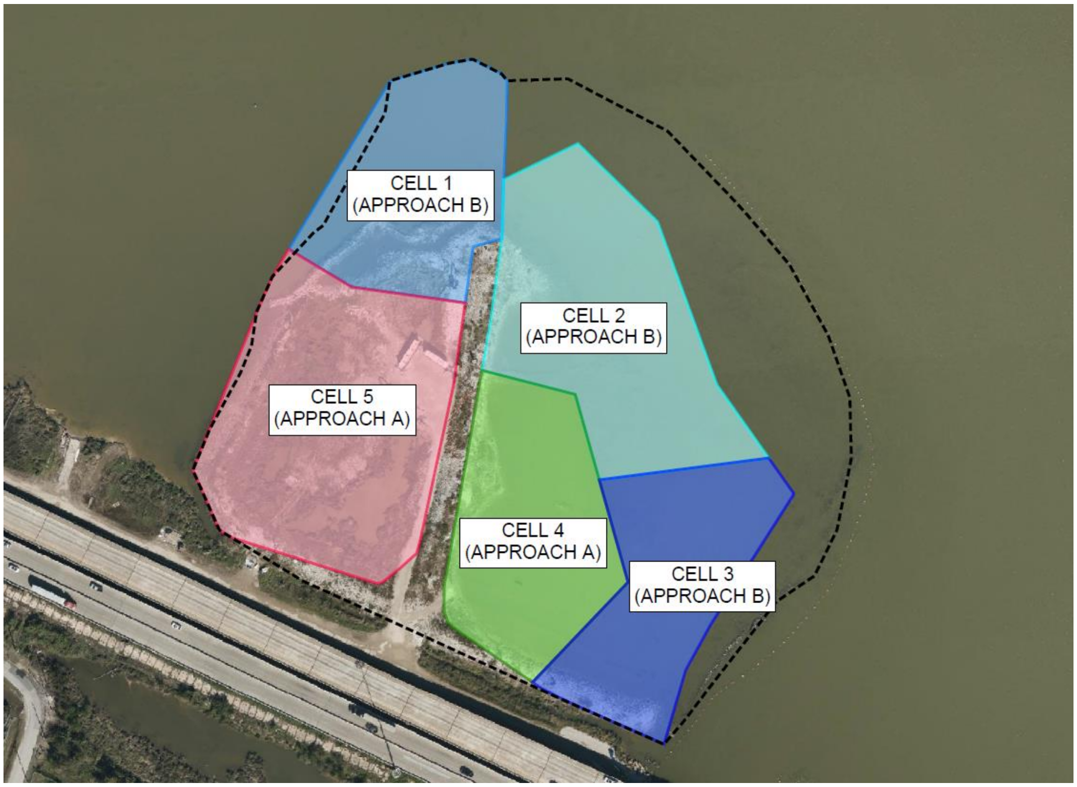
As discussed in Section 5.9, information has come to light regarding Coastal Water Authority (CWA) plans for installation of additional gates at Lake Houston. The operation of those additional gates could impact water level elevations at the Northern Impoundment during future storm events and may require reassessment of the applicability of the historical record in evaluating impacts of future storm events on river heights.

With the excavation period being limited to November through April, the Northern Impoundment would be subdivided into five Cells - with a single cell being excavated each excavation season (as defined in Section 5.2.2). The preliminary number, size, and configuration of the Cells was based upon the following factors, and will continue to be analyzed/optimized throughout the RD:

- Volume and removal rates -The cell sizes were established to ensure the volume of planned removal from within each cell could be achieved within the excavation period of November through April.
- Excavation depth - The configuration of the Cells was established based on similar required depths of excavation, allowing for the use of similar approaches to remove waste within a cell.
- Access and implementability - The Cells were established to allow for access with necessary equipment, and provide an area for loading into trucks for transportation.
- Transportation and disposal - The cell volumes were established based on total number of available hauling days to transport waste material during each excavation season.
- Water treatment - The remedial approach selected for each cell will determine the water treatment process that will be utilized. Cells that will be completed utilizing Approach B have lower target waste material removal volumes to allow time for water treatment at the end of the cell excavation.

The preliminary cell alignment is shown on Figure 5-A, below.

Figure 5-A: Preliminary Cell Alignment



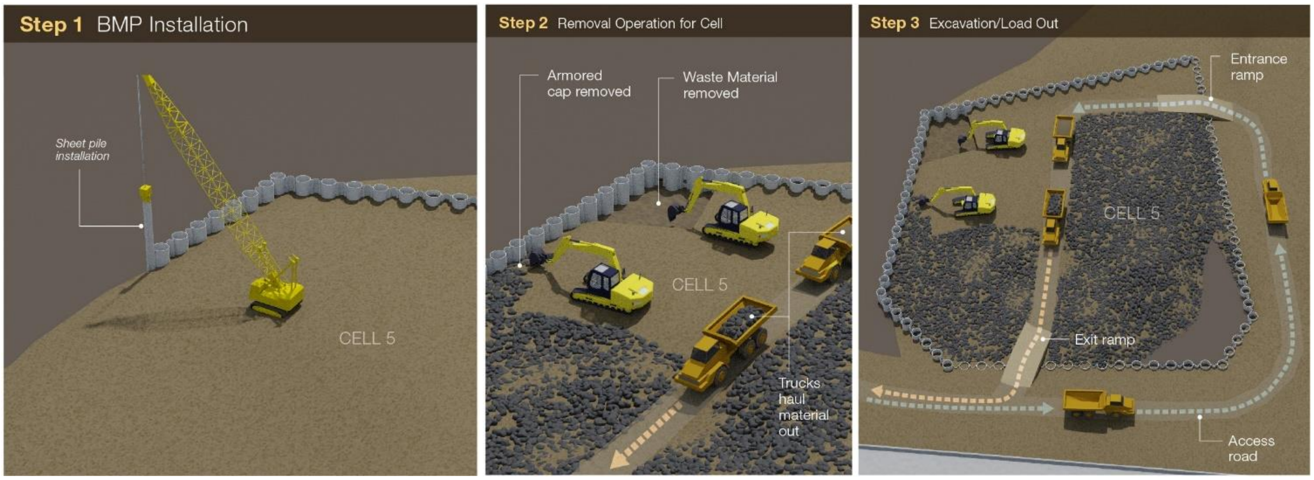
Optimized Removal Approach

As discussed above, results from the PDI indicate that the extent of waste material above the 30 ng/kg $TEQ_{DF,M}$ dioxin clean-up level is significantly deeper in many parts of the Northern Impoundment than was anticipated at the time the ROD was issued. In order to design a BMP structure capable of withstanding the force of the San Jacinto River during excavation activities, two approaches for removal of the waste material were developed based on depth of excavation. The two approaches for removal are outlined below.

Approach A - Removal from a dewatered cell with a physical BMP in place

For Cells 4 and 5 of the Northern Impoundment, the approach would include (1) installation of a physical BMP around a cell, (2) return of any river water present within the cell back to the river prior to removal of the armored cap, and (3) removal of the waste material with excavation equipment working within the cell. Any groundwater seepage or rainfall that comes into contact with the waste material would be treated and discharged to the river in compliance with the TSWQS ARAR. A preliminary conceptual illustration of "Approach A" is shown on Figure 5-B below.

Figure 5-B: Approach A Conceptual Removal Method

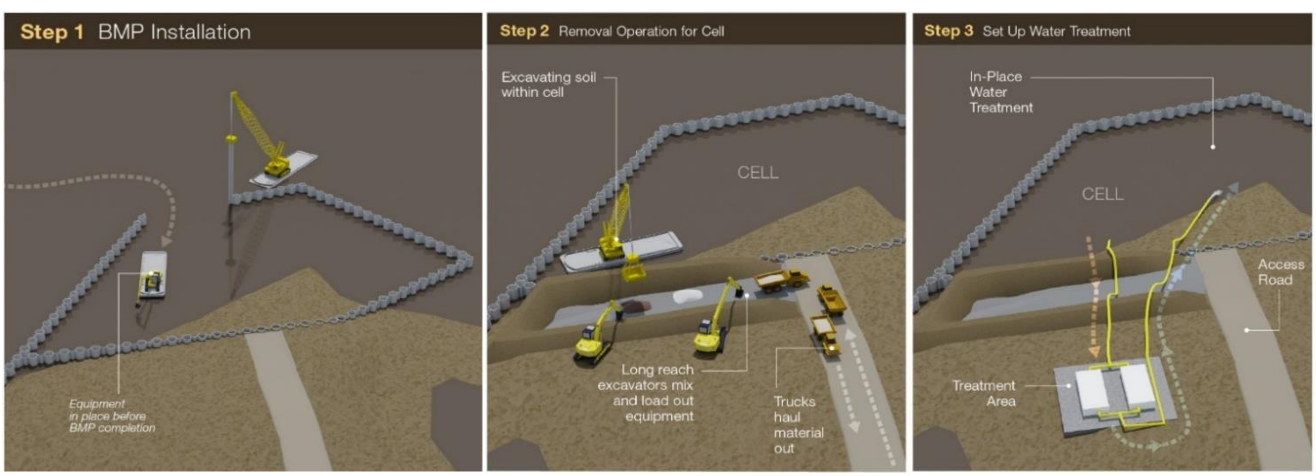


Approach B - Removal through the water column with a physical BMP in place

For Cells 1, 2, and 3 of the Northern Impoundment, Approach A is technically impracticable due to the engineering limitations of the BMP. An alternative approach was developed during the design process and reviewed with members of the TWG. The alternative approach, referenced herein as "Approach B", would include (1) installation of a physical BMP around a cell, (2) return of a limited amount of river water present within the cell back to the river prior to waste removal, and (3) the removal of waste material through the water column using barge-mounted excavation equipment. Following removal of the waste material, the water within the BMP would be re-circulated through a treatment system until the water within the BMP meets the TSWQS ARAR, allowing return of the treated water to the river. The water treatment component of Approach B remains conceptual and treatability testing is currently planned to determine if *in-situ* water treatment, as required under this approach, is technically feasible.

A preliminary conceptual visualization of Approach B is shown in Figure 5-C below.

Figure 5-C: Approach B Conceptual Removal Method



Water Treatment

The two different waste removal approaches, “Approach A” and “Approach B”, require different water treatment processes. For Approach A, the water treatment process would remove, treat, and discharge all water from the cell as water accumulates throughout an excavation season. Accumulated water would be pumped from the cell to a storage vessel, treated through clarification and filtration until it meets the TSWQS ARAR, and then discharged to the river.

For Approach B, the process would utilize similar treatment technology; however, water would be treated in-situ in the cell via a recirculation and filtration process to achieve the applicable ARAR. For these Cells , water treatment would occur after waste removal through the water column has been completed.

Re-use of Armored Cap

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 described in Section 3.5, treatability testing was performed on the 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 3.4.1.1) or the clean-up level of 30 ng/kg $TEQ_{DF,M}$ dioxin.

Prior to removal of the waste material, the armored cap rock would be removed. The armored cap rock that is sitting upon the geosynthetic barrier, is easily accessible, and can effectively be removed without disturbing the barrier and underlying waste material. The armored rock material will be considered for re-use. Once removed, the armored cap rock would be stockpiled at or near the Northern Impoundment for potential reuse during or after execution of the project. The location of the rock planned for re-use is 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 would require a period of approximately seven years to complete. Following EPA approval of the RD, it would take one year to procure a contractor (the RA contractor) and the materials necessary to construct the BMP, followed by five years of BMP installation and waste removal (one cell per excavation season), and concluding with an additional and final year for project demobilization.

5.2 Basis of Design

5.2.1 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.

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. The Multivariate Adaptive Regression Splines (MARS) algorithm was used to correlate Northern Impoundment data with the Sheldon gage. 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:

$$GCV = RSS/(N \times (1-N_e)/N^2)$$

Where RSS is the residual sum of squares of the model, N is the number of observations, and N_e 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:

$$WSE_{SJ,t} = WSE_{SH,t} \times L_{SH,t}$$

Where, $WSE_{SJ,t}$ is the water surface elevation at the Northern Impoundment at time *t*, $WSE_{SH,t}$ is the water surface elevation at the Sheldon gage at time *t*, and $L_{SH,t}$ is the either rising or falling limb of the hydrograph at the Sheldon gage at time *t*. The model selected three first order terms (or correlations), and also found an interaction with limb, indicating that the water level at the Northern Impoundment scales differently with the Sheldon gage depending on whether the hydrographic limb is rising or falling.

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 time period (the “excavation season,” as defined below in Section 5.2.2) and also agreed on the proposed design elevation for the top of the BMP. Both of these topics as they relate to the 30% RD for the Northern Impoundment are further discussed below.

As noted above, the use of historic surface water elevations for purposes of the RD will have to be reassessed once more information is available about impacts of CWA plans for the installation of additional gates at the Lake Houston dam.

5.2.2 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 RD. To allow for the removal of waste material during the low water season (between November and April), 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 months (May to October) of the RA, work will be conducted to prepare for the upcoming excavation season (procurement, BMP installation, work area staging and access, etc.).

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. High water events have historically occurred between the months of May and October, as shown in 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 feet NAVD88 at the Northern Impoundment. More recently, Tropical Storm Imelda caused significant flooding in September 2019, with water surface elevation peaking at 8.9 feet NAVD88 at the Northern Impoundment. For reference, the typical river stage for September at the Northern Impoundment fluctuates between 1 to 3 feet NAVD 88.

Comparison of the Sheldon and Northern Impoundment hydrographs for both the full year (shown on Figure 5-2) and for the November to April 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 2019 show that there were no high water events that exceeded an elevation of +9 feet 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 feet 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.

5.2.3 Geotechnical Conditions

A primary objective of the PDI-2 was to collect additional geotechnical data to evaluate slope stability and BMP design. To achieve BMPs with adequate factors of safety (FS), a thorough understanding of the geotechnical properties of the soils in and underlying the Northern Impoundment is necessary. The additional geotechnical testing provided a better understanding of the geotechnical properties to evaluate slope stability and design strength parameters that were used for the 30% RD.

Prior to the PDI-2, the Northern Impoundment soil lithology was characterized as being comprised of interbedded Recent Alluvial Sediments (silts, sands, and clays) to an approximate depth of -30 feet NAVD88, which was confirmed during the PDI-2. The previous investigations, based on information available at the time, determined that the Beaumont Clay formation extended below this reference elevation (-30 feet NAVD88) to a minimum elevation of -60 feet NAVD88 on the western side of the Northern Impoundment and to approximately -50 feet NAVD88 on the eastern side of the Northern Impoundment. Additional geotechnical borings installed during the PDI-2 (specifically boring SJSB057) determined however, that the Beaumont Clay formation extends to approximately -80 feet NAVD88 (an additional 20 feet of thickness), and on the eastern side, clays were encountered between approximately -50 to -65 feet NAVD88 (up to an additional 15 feet of thickness). Additionally, prior to the PDI-2, it was believed that there was a sand formation extending below the clay formation across the Northern Impoundment to approximately -80 feet NAVD88. These sands, although encountered in the PDI-2 were not found to be as consistent across the Northern Impoundment as initially understood.

A geotechnical analysis and design recommendations were prepared by Ardaman and Associates and are presented in Appendix B. The Northern Impoundment characteristics vary across the impoundment and will necessitate multiple design sections and analyses prior to completing the design. A general characterization of the Northern Impoundment indicates that all Cells are underlain by a combination of cohesive clay layers intermixed with granular sandy layers. The presence of cohesive materials that behave in a drained or undrained state, require consideration of quick and slow loading cases, Q and S cases respectively.

An analysis of the geotechnical data indicates poor soil conditions exist relative to BMP design. As further described in Appendix B, the presence of more cohesive (clay) materials identified during the PDI-2 has a direct correlation to the tip depth, which is the required bottom elevation of the BMP design. A series of stability analyses were performed to estimate the minimum required embedment depth of the BMPs. The various soils information for each cell are presented in Appendix B. Section 6 of Appendix B includes results of the analysis, whereas Tables 7 through 11 of Appendix B provide soil strength parameters for each cell under consideration.

Additionally, given the depth of embedment required for stability of the proposed BMPs, there is a possibility that during the installation of the BMP, vibrations caused by pile driving could induce localized instability of the near-surface soils. There is potential for the release of waste material into the environment during installation since slopes in the topography exist in the northwestern and southeastern portions of the Northern Impoundment. As a result, there is an inherent risk that during installation of the pilings associated with the BMP a slope failure could occur resulting in a release of waste material. The forces exhorted into the pilings to drive them may transfer into the surrounding soil and potentially cause a sloughing of waste material from the slope into the San Jacinto River. To evaluate the effects of pile driving on slope stability, GHD performed a preliminary vibration analysis that is further discussed in Section 5.4.4 and summarized in Appendix D. The effects of pile driving on slope stability will be further evaluated in the design process.

5.2.4 Cell Alignment

The selected remedy described in the ROD requires the removal of material that meets two criteria: (1) it has $TEQ_{DF,M}$ concentrations above 30 ng/kg; and (2) it is located beneath the armored cap. In addition, the ROD requires the use of BMP(s) to perform the removal (i.e., sheet pile walls, cofferdams, berms, etc.). Analytical data obtained from the RI and the PDIs 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 *Second Phase Pre-Design Investigation Work Plan* (GHD, 2019x), the alignment of the outer BMP will be based on analytical data, such that the placement of the BMP will only encapsulate waste material with dioxin $TEQ_{DF,M}$ levels above the clean-up level of 30 ng/kg. Areas with $TEQ_{DF,M}$ levels below the clean-up level of 30 ng/kg will not require excavation and will be excluded from containment within the BMP(s) (i.e. the center berm and portions of the eastern side of the Northern Impoundment). Analytical data from the RI and PDIs is shown on Figure 2-6. An evaluation of the combined RI and PDI data was presented to members of the TWG at the December 17, 2019 TWG meeting. At that TWG meeting, there was direction that the outer BMP should be placed at boring locations with dioxin $TEQ_{DF,M}$ levels below the clean-up level of 30 ng/kg, as shown on Figure 5-A.

Vertical Extent

Analytical data from the RI and PDIs were also utilized to determine the vertical extent of the waste material requiring removal. As previously mentioned, results from the PDIs indicated that the excavations will need to be significantly deeper than what was anticipated at the time the ROD was issued. The elevation of waste material in the Northern Impoundment is found as deep as -25 feet NAVD88 with an average depth of -15 feet NAVD88.

The elevation of the sample interval in each boring with a dioxin concentration below 30 ng/kg $TEQ_{DF,M}$ was used as the design basis for the excavation bottom contours presented on the design drawings (Appendix E). However, four boring locations (borings SJGB010, SJGB012, SJSB046-C1, and SJSB071) had samples above 30 ng/kg $TEQ_{DF,M}$ in the deepest sample interval collected, as seen on Figure 2-6. At these locations, the design considered the adjacent borings to determine the appropriate excavation elevations to complete the preliminary excavation bottom contours. The excavation bottom contours for each cell can be seen in design drawings C-08, C-13, C-17, C-21, and C-27 in Appendix E. Having a defined bottom excavation elevation is critical for the design of the BMP type and determining the tip depth. The identification of a defined bottom excavation is a major uncertainty in the RD, as further discussed in Section 5.9.

Based on the updated excavation limits, the approximate volume of waste material in the Northern Impoundment is estimated at 212,000 CY as opposed to the 162,000 CY estimated in the ROD. 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.

5.3 Preliminary Excavation Procedures

5.3.1 Property Access

To implement the RA, it will be necessary to have access to approximately 10 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 during implementation of the RA to avoid conveying water requiring treatment for long distances. Property access will also need to be secured for the duration of the RA, which could take up to seven years. Currently, several properties in the vicinity of the Northern Impoundment are being evaluated. The layouts of the water treatment systems are depicted in Drawings P-04 and P-08. These layouts will be updated with site-specific detail in future design submittals when a property for staging has been selected. Implementation of the Northern Impoundment RA will also require access to and use of the Texas Department of Transportation (TxDOT) right-of-way (ROW) that runs parallel to I-10, which is the only route that provides land access to the Northern Impoundment. Implementing the Northern Impoundment RA will require that an agreement be reached with TxDOT to allow for use of the TxDOT ROW. In addition, and as is discussed in more detail in Section 5.9, TxDOT plans to replace the I-10 bridge beginning in the next four to five years. It is unknown as to how TxDOT's plans may impact its ability to allow access to its ROW for purposes of the Northern Impoundment RA.

Certain parts of the BMPs will be located in areas below the mean high tide line which are owned by the Port of Houston Authority (POHA). POHA's acceptance will be required both to construct and later remove the BMPs and, to the extent they cannot be removed, abandon them in place, as is further discussed below in Section 5.3.8.1. Similarly, the presence of a +9 foot NAVD88 impermeable barrier in the San Jacinto River will need to be discussed with the Harris County Flood Control District (HCFCD) since it will likely have an affect on floodwaters in the vicinity of the Northern Impoundment.

5.3.2 Northern Impoundment Preparation and Layout

In order to facilitate waste material removal, solidification, and water treatment, the RA contractor would have to complete several preparation activities at the Northern Impoundment.

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 may need to be widened in order to make Northern Impoundment RA operations more 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. Furthermore, the area immediately north of the TxDOT ROW is owned by a third-party landowner and access to it would be required to improve the access road. This will be evaluated further as a part of the 90% RD.

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 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 tide. 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 refined as a part of the 90% RD.

Staging and laydown pads may need to be constructed for water treatment equipment. The exact location of the water treatment equipment may vary from excavation season to excavation season as the Northern Impoundment RA advances and the Northern Impoundment shrinks in size proportionately. Therefore, these construction activities may have to take place several times. The RA contractor will also prepare power, communications, and water utilities for the water treatment equipment, as necessary.

The RA contractor may also need to construct mixing areas for soil solidification. Similar to the water treatment staging and laydown pads, the exact location of the mixing areas may vary from excavation season to excavation season. It is likely that these mixing areas will be constructed in areas adjacent to active Cells to mitigate excessive handling and transport of wet material.

5.3.3 Selection of Excavation Approach

Cell dimensions are based upon the volume of waste material that can be excavated within an excavation season and the factors detailed in Section 5.3.6.6. The preliminary cell configuration includes five Cells, as depicted in Figure 5-A shown in Section 5.1. Two approaches for excavation methodology have been developed, as described in Sections 5.3.5 and 5.3.6, based on the conditions and limitations of each cell. The following factors were evaluated to determine the appropriate approach to utilize for each cell:

- Anticipated excavation bottom elevations based on PDI data.
- Presence and/or depth of standing water and the resulting hydrostatic conditions.
- Geotechnical data.
- Logistics and accessibility of excavation equipment.

A preliminary evaluation indicates that Cells 4 and 5 should be implementable using Approach A. For Cells 1, 2, and 3, the excavation depths combined with the water depths in these areas would result in the need for an engineered BMP to withstand up to 35 feet of hydrostatic pressure. The BMP types and BMP tip elevations that would be needed to account for these conditions are not feasible for Approach A, as was discussed with members of the TWG at the January 27, 2020 TWG Meeting. In these Cells, Approach B may be more implementable.

5.3.4 Excavation Sequencing

To allow for the removal of waste material during the excavation season (between November and April), 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 months (May to October), preparation activities will be conducted, and the BMP will be installed around the cell that will be remediated in the coming excavation season. Sections of the BMP would be reused from cell to cell as possible. The exact sequencing of the remediation of the Cells will be optimized further in the design process, but the order will likely include a sequence that allows cell containing the upland working area of the Northern Impoundment to be excavated last.

5.3.5 Excavation Methodology - Approach A

Excavation in Cells 4 and 5 is proposed to be performed using Approach A. Typically, this approach to waste material removal would utilize a standard track-mounted excavator located on dry land (i.e., an area outside the excavation that is above the water table). The excavator would be positioned where it can reach into the excavation and swing around to load trucks. Where required, the excavator could track down to a ledge or bench in order to reach deeper or further, but generally, the excavator would operate from upland locations. Approach A methodology is shown conceptually in Figure 5-B (as shown in Section 5.1 above) and is detailed below.

5.3.5.1 BMP Installation

The BMP will likely be installed during the non-excavation season months (May to October) so that it is in place prior to the start of the excavation season in November. BMP type and tip depth (bottom elevation of the BMP) would vary between Cells based upon methodology and excavation depths. The details and basis of the BMP design are discussed in Section 5.4.

5.3.5.2 Cell Dewatering

Following the installation of the BMP around the cell, river water will become trapped in the cell and behind the BMP. Prior to removal of the armored cap, the river water trapped behind the BMP would be pumped back into the river to allow waste material removal activities within the cell to be conducted using land-based equipment in relatively dry conditions.

5.3.5.3 Armored Cap Removal

After the BMP is installed and the cell is dewatered, the armored cap will be removed to expose the waste material for excavation. It is anticipated that only the waste material in the area in which excavation activities are being conducted will be exposed at any given time. The rock that is readily accessible and can be segregated without disturbing the underlying liner may be salvaged for re-use during or after the RA. Depending on the space available on the Northern Impoundment each excavation season, the rock may be stockpiled on the impoundment itself or at a nearby location. The geotextile and geomembrane barrier of the armored cap may be disposed of off-Site.

5.3.5.4 Excavation Procedures

For each area in which the armored cap has been removed, excavation of the delineated waste material would take place using excavators. Any waste material that does not contain free liquids and/or requires 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 below.

As excavation activities advance below the water table, dewatering sumps may be required to remove water in advance so the 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) 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 may be constructed over the lip of the BMP to allow truck traffic into and out of the cell. Any storm water or seepage water that accumulates in the cell during the excavation season will be pumped out of the cell, as needed to maintain excavation operations, to a water treatment system where it will be treated and discharged to the river, as described in Section 5.6.

5.3.6 Solidification and Load-Out

If the waste material is not dry enough 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 fly ash or Portland cement. Solidification activities will likely be conducted in a designated mixing pad inside the confines of the BMP prior to load out in the haul trucks.

5.3.7 Excavation Methodology - Approach B

As previously described, excavation activities in Cells 1, 2, and 3 would not be feasible using Approach A due to the depths of excavation, limitations of the BMP, and challenges to access using land-based equipment. The alternative approach (Approach B) includes installation of a BMP around the cell, and return to the river of only a limited amount of water to the river so that the designed hydraulic head is maintained inside the cell. Waste material would be removed through a column of water using barge-mounted excavation equipment. Approach B methodology is shown conceptually in Figure 5-C (shown in Section 5.1) and is detailed below.

5.3.7.1 BMP Installation

Similar to Approach A, a BMP would be installed around the cell during the non-excavation season. The barge-mounted excavation equipment will likely be floated into the cell prior to installing the last piles of the BMP.

5.3.7.2 Armored Cap Removal

Similar to Cells 4 and 5, the initial phase will be removal of the armored cap rock covering the existing waste material. It is anticipated that only the cap material in the area in which excavation activities are being conducted would be removed at any given time. The rock that is readily accessible and can be segregated without disturbing the underlying liner may be salvaged for re-use during or after the RA. Depending on the space available on the Northern Impoundment in each removal season, the rock may be stockpiled on the impoundment itself or at a nearby location. The geomembrane and geotextile liner will likely be disposed of off-site.

5.3.7.3 Excavation Procedures

After the armored cap material, liner and/or ACBM are removed in each area, removal of the delineated waste material may be completed using a crane and clamshell bucket mounted on the barge that was floated into the cell prior to beginning work. The crane and clamshell bucket would be equipped with positioning software and wireless marine grade control units, which will aid in execution and precision of excavation activities. The grade control equipment would be used consistently throughout the excavation activities so that design excavation elevations can be achieved in each cell.

As the material is removed, it may be loaded onto carrier barges located inside the cell. The carrier barges would be moved around by tugs or work boats, ultimately pushing them to an area adjacent to the interior BMP where a land-based excavator would transfer the wet material to a mixing pad for dewatering/solidification. The grade control equipment may be used to verify that the design excavation elevations have been achieved.

Following initial excavation of material, residuals will be managed using one of the methods described in Section 5.3.7.5.

Unlike with Approach A, water treatment for Approach B will be conducted at the end of the excavation season. Upon completion of excavation and residual management activities, the volume of water inside the cell will be pumped out of the cell, and through a water treatment system, and then pumped back into the cell. The water would be recirculated through the treatment system until it meets the discharge criteria, at which time, the BMP would be removed and the water in the cell will be allowed to return to the river. Water treatment may take more than two weeks of constant treatment. The volume of waste material that can be removed in during an excavation season using Approach B is consequently less than the volume that can be removed using Approach A because of the time required for water treatment. Water treatment is further discussed in Section 5.7.

5.3.7.4 Solidification and Load-Out

The wet material from the carrier barges located within the cell will be transferred onto a mixing pad in an area adjacent to the interior BMP for solidification. Treatability testing has been conducted to evaluate reagents and dosages for material solidification, as described in Section 3.3. Quality control procedures, such as paint filter testing and pocket penetrometer testing, may be implemented to verify that the wet material placed in the mixing pad has been sufficiently solidified prior to loading into haul trucks for transport to an off-site disposal facility.

5.3.7.5 Management of Residuals

Approach B may include mechanical excavation from barge-mounted equipment. A residual layer consisting of a thin layer of waste residual that precipitates from the water column may form after excavation. These residuals would typically be generated from suspension of materials during the excavation process, limitations on complete removal with bucket excavation, and the potential for fallback (material dropping from the bucket) as the bucket is brought up through the water column.

Two options are being considered for removal of the residual layer. One option would be to employ another removal step, or a “cleanup pass”, to specifically target the residual layer using either mechanical excavation equipment or a suction pump or similar device. With this additional cleanup pass option, a flocculant or other chemical treatment method would be used to promote settling after the initial excavation activities are complete, and prior to the cleanup pass. The use of a flocculant is being evaluated in planned additional treatability testing (as described in Section 3.7), with the results to be incorporated into the 90% RD. Another option would be to use mixing equipment such as aerators to cause the residual layer to remain in suspension where it can be treated with the recirculation wastewater treatment system described in Section 5.7.

A combination of the two options may be used, in which the bulk of the residual layer would be removed with the cleanup pass and the remainder put in suspension for removal with the recirculation wastewater treatment system.

These options will be further developed for the 90% RD. Additional treatability testing is planned to provide information on the amount and condition of the residuals as well as the chemical additives and rates to promote settling, as described in Section 3.7.

5.3.7.6 Excavation Season Production Rates

The approximate volume of waste material in the Northern Impoundment is estimated at 212,000 CY. To facilitate a seasonal excavation approach, the total volume of material would be divided into multiple Cells - with a single cell excavated each excavation season. The preliminary number, size, and configuration of the Cells along with the amount of waste that can be removed, transported, and disposed during an excavation season (i.e. production rate) is based upon the following factors, and will continue to be analyzed/optimized throughout the RD:

- Volume and removal rates - The cell sizes were established to ensure the volume of planned removal from within each cell could be achieved within the excavation period of November through April.
- Excavation depth - The configuration of the Cells was established based on similar required depths of excavation, allowing for the use of similar approaches to remove waste within a cell.
- Access and implementability - The Cells were established to allow for access with necessary equipment, and provide an area for loading into trucks for transportation.
- Transportation and disposal - The cell volumes were established based on total number of available hauling days to transport waste material during each excavation season.
- Water treatment - The approach selected for each cell will determine the water treatment process that will be utilized. As such, Cells to be completed utilizing Approach B must have lower waste material removal volumes since time during the excavation season must be set aside to treat the water within the BMP following removal of the waste material.

For Approach A, the design volumes for Cells 4 and 5 are approximately 55,000 CY per cell. For Approach B, the design volumes for Cells 1, 2, and 3 are approximately 35,000 CY per cell. The design volumes for Approach B take into account a shorter duration of excavation time to allow for water treatment at the end of the excavation season, as described in Section 5.7. The assumptions and limitations of waste transport and disposal as a basis of the design are further discussed in Section 5.5.2.

5.3.8 Confirmation Sampling

It is unknown at this time whether post-excavation confirmation sampling can be implemented due to the following factors:

- Design constraints of the BMP if further excavation is required - Once the BMP is designed and constructed, excavation to deeper elevations in an attempt to reach a clean-up level cannot exceed the design excavation elevations for the BMP, as doing so has the potential to put more hydraulic force on the BMP and presents a risk of a significant BMP failure.

- Schedule extension into non-excavation season - It is vital that all excavation activities are completed during the excavation season to avoid the risks of overtopping the cell. Traditional confirmation sampling requires that excavations are left open while waiting for analytical results. If results come back above the clean-up level, additional excavation will be conducted. If multiple rounds of sampling and excavation are required, the schedule could be significantly extended beyond the excavation season.
- Volume increase - The volumes for each cell will be carefully defined to ensure that that amount of waste material can be excavated and transported to a disposal facility during an excavation season. If it is necessary to excavate deeper due to unfavorable confirmation sample results, the volumes will increase such that it may be too great to handle in an excavation season.
- Delays to water treatment - Water treatment for Approach B Cells will not occur until all material in the cell has been excavated. If the time to complete excavation is extended, water treatment will be delayed and could be extended beyond the excavation season.

Methods of confirmation sampling have been discussed with the members of the TWG and will continue to be discussed and developed during the RD.

5.3.9 Excavation Area Restoration

Voluntary post-excavation restoration measures are being considered. Restoration activities may include placement of a cover that consists of recycled armored cap rock and/or clean imported sand. After cover placement in a cell, the BMPs would then be removed, if practical, or abandoned in place.

5.3.9.1 Abandonment of the BMP

After completion of excavation in a cell and possible placement of cover materials, the BMP for that cell (unless planned for re-use as part of a future cell) will either be removed or abandoned in place. The AZ-type piles that may be used for the shallower installations can be removed and reused, as feasible. Any piles that extend beyond the depth of the Beaumont clay (approximately -80 feet NAVD88) and any of the shallower piles that cannot be removed, may have to be abandoned in place due to the size of the piles and the embedment depths. Due to the size and types of piles under consideration for the BMP, it is unlikely that it will be technically feasible to remove them. Therefore, it is anticipated that most of the piles will have to be left in place following the completion of the RA.

As noted, certain parts of the BMPs will be located in areas below the mean high tide line which are owned by the POHA. POHA's acceptance would be required to install, maintain, and remove the BMPs and, if removal is not feasible, approval to leave the BMPs in place. POHA consent for such activities and in particular, for the abandonment in place of some of the piles, is an uncertainty associated with the Northern Impoundment RD and is addressed in Section 5.9.

5.4 BMP

5.4.1.1 Corrosion Protection & Maintenance

Design of Northern Impoundment BMP structures is expected to be for temporary, short-term use. Effects of corrosion on steel will be negligible during these time frames. No special considerations for corrosion protection will be considered in the structural design of steel elements.

5.4.1.2 Material

The BMP piles are assumed to be steel grade ASTM A572, Grade 50 (yield [F_y] = 50 kilopound per square inch [ksi]).

5.4.1.3 Design Loads

In Situ Soil

The soil parameters specific to the Northern Impoundment are discussed in depth in Appendix B. Both drained and undrained loading conditions will be considered. The designation for soil parameters are in accordance with Unified Soil Classification System.

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

Q-case loading refers to quick loading of clay materials that do not have time to drain, the undrained case. S-case referees to slow loading of clays after draining has occurred, the drained case.

River Water

The loading from the river water with a density of 62.4 pounds per cubic foot (pcf) would be applied as hydrostatic pressure to the exterior and interior BMP faces. Water elevations are described in Section 5.2.1.

River Flooding

Based on FEMA Flood Map (effective on January 16, 2017), the Northern Impoundment is designated a special flood hazard area Zone AE. Based on the anticipated project duration, and as the excavation will be completed in short duration outside the flooding event season (November to April), FEMA flood load was not considered for the design of the BMP. Refer to Section 5.2.1 for discussion of river elevations and selection of the design water level.

Wind

Pressure from wind loading corresponding to wind velocity of 115 miles per hour (mph) and Exposure Category C, as defined in American Society of Civil Engineers (ASCE) 7, will be applied on the exterior of the BMP. Wind load will only be applied to the exposed height of BMP above water level for Usual conditions. At the design water level for Unusual conditions; therefore, the BMP exterior would not be exposed to the wind. See Section 5.4.2 for usual and unusual design conditions.

5.4.1.4 Load Combinations

The design loads are considered to act in the following combinations, in accordance with Allowable Stress Design, as defined in ASCE 7 for the structural design.

(1) D + H + F

(5) D + H + F + 0.6W

(6A) D + H + F + 0.75(0.6W)

(7) 0.6D + H + F + 0.6W

WHERE,

D = DEAD LOAD

F = LOAD DUE TO FLUIDS (HYDROSTATIC PRESSURE)

H = LOAD DUE TO LATERAL EARTH PRESSURE

W = WIND LOAD

ASCE 7 load case (7) requires the load factor for resisting (passive) lateral earth pressure be reduced to 0.6. The intent of the reduction is to design the wall against overturning by reducing the resistance. Since the wall is being designed for overturning (rotational) stability with adequate embedment as described in Section 5.4.2.3, a reduction for lateral earth pressure would not be considered.

5.4.2 Design Criteria

For the 30% RD, the BMP is being designed as a rigid cantilever pile wall, in accordance with Engineer Manuals (EM) 1110-2-2504. Both the undrained and drained conditions are being evaluated to determine the pile Section that meets the criteria below.

5.4.2.1 Design Water Level

The BMP would be designed to consider two water elevations for differing conditions. One will be defined as the usual condition and one as the unusual condition. These terms are then used to select safety factors (SFs) from EM1110-2-2504.

The usual condition represents a more frequent expected water elevation that would be associated with the following:

Exterior Water Elevations

- Usual Water Elevation = +5 feet NAVD88
- Unusual Water Elevation = +9 feet NAVD88

Interior Water Elevation

- Lowest Dewatered Elevation = -8 feet NAVD88

5.4.2.2 Safety Factors

SFs are defined by EM1110-2-2504 for floodwalls and retaining walls as shown in Figure 5-D below. Pile walls for the Northern Impoundment RD will serve as both floodwalls and retaining walls. The SFs highlighted below have been selected for the Northern Impoundment RD.

Water elevation loading essentially drives the basis of the wall design. Therefore, SFs for floodwalls were chosen over the SFs for retaining walls. A minimum SF of 1.5 for Q-case loading and 1.25 for S-case loading has been selected for the Northern Impoundment RD.

Figure 5-D: Safety Factors from EM1110-2-2504

Minimum Safety Factors for Determining the Depth of Penetration Applied to the Passive Pressures

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

5.4.2.3 Rotational Stability

It is a standard design assumption that rotational stability is proportional to the embedment of a rigid cantilever wall. The total embedment of a pile is the maximum of the depths required for undrained and drained loading conditions.

The BMP would be designed with the SFs outlined in red on Figure 5-D above.

5.4.2.4 Steel Section Strength

The BMP would be designed and analyzed as a rigid cantilever wall for the loads described in Section 5.4.1.3.

The allowable stress in the pile for the usual design water elevation would be 0.5 F_y for bending and 0.33 F_y for shear. These values equate to SFs of 2.0 and 3.0 for bending and shear, respectively.

The allowable stress for the unusual design water elevation would be 0.66 F_y and 0.44 F_y for bending and shear, respectively. These values equate to SFs of 1.5 and 2.3 for bending and shear, respectively.

5.4.2.5 Deflection

Total system displacements comprised of structural steel deformation, rotation and translation of the entire BMP and soil system will need to be evaluated for the proposed BMP. Since the BMP is expected to be designed as a cantilever wall, maximum deflections occur at the top of the wall.

Neither EM 1110-22-504 nor ASCE 7 provide guidance on limiting system deflection. Structural steel can deform significantly before structural failure occurs; hence, structural steel deformation cannot be used as a limiting parameter for the design.

A professional practice rule of 0.01 times the wall height, measured from top of wall to bottom of an excavation, is typically applied to limit the total deflections. This limit is appropriate for retaining walls considering the activation of active and passive soil pressures. This limit would be used to evaluate deflection over the unbalanced depth of the excavation.

The following is an example of the maximum case:

WALL HEIGHT = +9FEET + (-28FEET) = 37 FEET

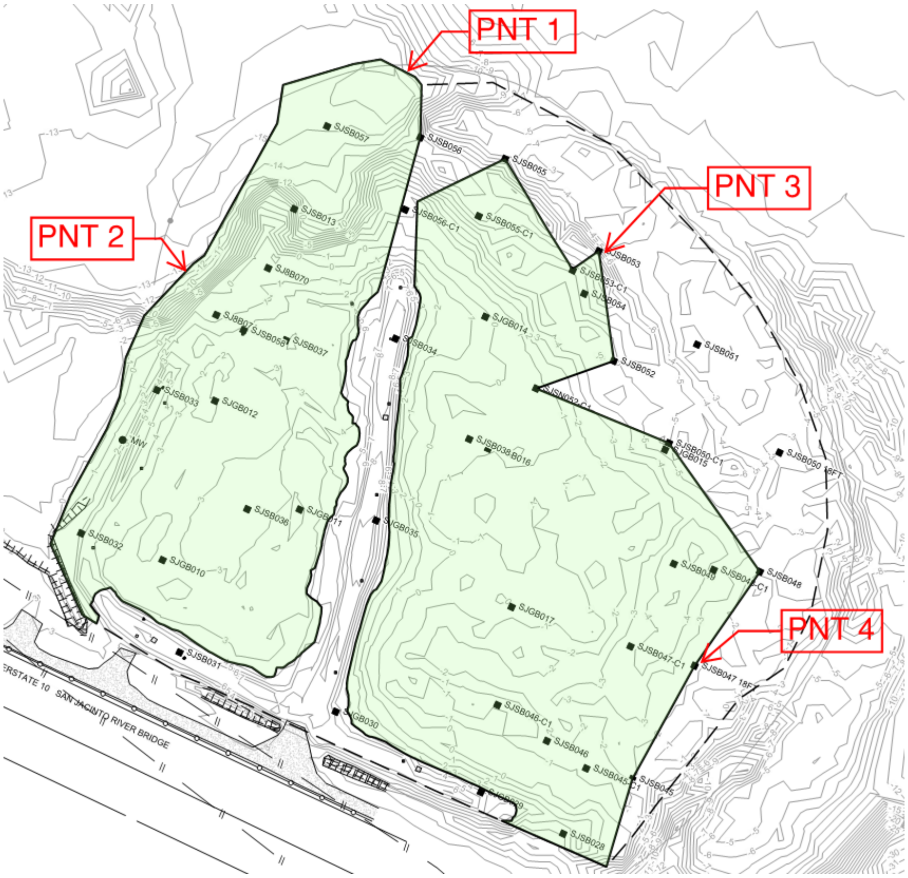
ALLOWABLE DEFLECTION = 0.01 X 37 FEET = 0.37 FEET = 4.4 INCHES.

An allowable deflection of 4.4 inches would be extremely difficult to meet for hydrostatic load of a cantilevered pile wall at this maximum height. The height varies along the length of the BMP wall; therefore, this represents the highest deflection allowed for the tallest wall location. In many cases the walls may be shorter. Where walls are shorter, the allowable deflection would be smaller. Deflection calculations are provided in Appendix F. Approaches for controlling deflection will have to be addressed as the design of the BMP is developed.

5.4.3 BMP Wall Analysis

For this 30% RD, four locations around the Northern Impoundment were selected for a preliminary pile analysis. These locations were selected based on an initial overview of the BMP layout in order to provide four wall designs representing four wall heights. Wall height is the critical parameter in determining the depth and size of the piles used to build the wall. Selecting four locations with heights generally ranging from short to tall is expected to provide a good preliminary overview of the range of wall sizes, depths, and related constructability challenges that will inform whether or not the selected options will be constructible. Figure 5-E below shows the approximate locations (Point [PNT] 1 through PNT 4) and Table 5-A below shows preliminary results. The locations are for four different mudline elevations on the exterior face of the BMP. These locations each have different anticipated bottom of excavation elevations for the inside face of the wall. As the design progresses, this process will need to be repeated for all points along the wall for each cell to complete the Northern Impoundment RD. This evaluation is further detailed in Appendix F.

Figure 5-E: Preliminary Pile Analysis Locations



Figures 5-F and 5-G show representative wall types being considered for use at the four locations shown in Figure 5-E above.

For this 30% RD, all of the wall analyses were performed by Ardaman and Associates using DeepEx pile analysis software with input elevations provided by GHD. Each analysis point represents a theoretical wall Section at that location with the respective mudline and excavation bottom elevations shown in Figure 5-E. Analysis of each point was performed assuming use of the same Section type (PAZ66) for comparison purposes. In this type of analysis, which computes static force equilibrium, stability and resulting pile embedment length are assumed to be the same regardless of the pile Section chosen. Stability calculations and the resulting pile embedment depth are not based on the size and Section properties of the wall. Balanced forces, hence, stability, are based on an assumption of a rigid pile element. Once the pile length for stability is known, the internal structural forces, shear and moment, are determined. Then the required steel Section size is selected. Because of the nature of this stability calculation, it was only necessary for DeepEx to be run using one pile Section in order to give preliminary results. Following this calculation, the required steel Section modulus for strength was calculated from the internal moments resulting from the stability analysis

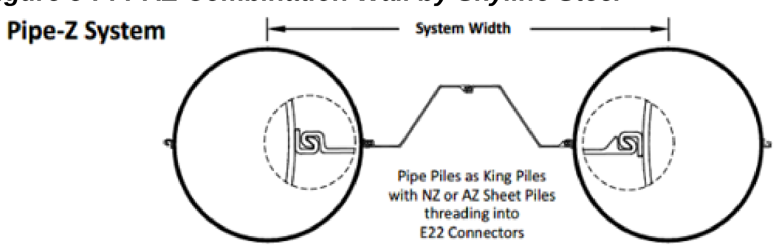
Accurate Section properties for the walls used in the design are required in order to calculate accurate wall deflections at the top of the wall. Once the preliminary steel Section is chosen, deflections can be estimated from the original DeepEx results by multiplying the original deflection result by the ratio of the moment of inertia for the revised pile Section dived by the moment of inertia for the original analysis section. Completion of a final design using cantilevered pile walls would include re-running all of the design wall location chosen with the final selected pile size included.

Results of the preliminary analysis show that the pile stability check is satisfied at the pile tip depths shown in Table 5-A. Supplemental evaluation of the Section properties required for the demand moment in each point was completed by spreadsheet. Spreadsheet analysis determined that the pile types for two analysis sections (PNT 1 and PNT 4) would need to be increased in size to HZ 1080M A pile types indicated in Table 5-B below. This is due to the fact that the internal moments within the piles at PNT 1 and PNT 4 exceed the Section capacity of the PAZ66 pile.

The DeepEx analysis results show that estimated deflections at the top of each of these representative wall sections would exceed the highest allowable limit of 4.4 inches. The deflection analysis was done with the SF set to 1.0. SFs are applied in order to evaluate the stability and internal strength of the wall in order to provide a margin of safety for selecting wall depth and Section strength. Because an understanding of the true deflection under the design loading is required, use of any SF other than 1.0 would distort the results. Table 5-B shows revised deflection estimates at the top of the pile walls, using different pile types that will meet the bending strength criteria for demand moments. While the Section strength increased by over 60 percent to meet the demand moment, the revised pile type would still have deflections ranging from 5.7 to 18.1 inches.

The largest PAZ pile type with an 84-inch diameter pile would reduce deflection at PNT 1 and PNT 4 to 11 inches, but would still not meet the moment demand requirement shown in Table 5-A.

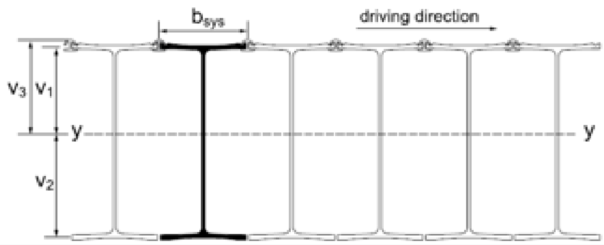
Figure 5-F: PAZ Combination Wall by Skyline Steel



Pipe-Z System Combination Sample	Sheet Pile Section	PROPERTIES OF PIPE PILE			PROPERTIES OF COMBINED WALL							COATING
		Outside Diameter in mm	Wall Thickness in mm	Pipe Weight lb/ft kg/m	System Width in mm	System Inertia in^4/ft cm^4/m	Section Modulus in^3/ft cm^3/m	WEIGHT (Sheet Pile Length/Pipe Length) 100% lb/ft^2 kg/m^2	80% lb/ft^2 kg/m^2	60% lb/ft^2 kg/m^2	Cross Sectional Area in^2/ft cm^2/m	Both Sides of Wall ft^2/ft m^2/m
PAZ60/AZ14-770	AZ 14-770	60.00 1524.00	0.625 15.9	396.70 590.37	122.98 3124	5098 696115	169.9 9136	50.5 246.7	48.2 235.1	45.8 223.6	14.85 314.2	28.84 8.79
PAZ60/NZ19	NZ 19	60.00 1524.00	0.750 19.1	475.04 706.95	117.48 2984	6391 872780	213.0 11454	61.2 298.9	58.7 286.5	56.1 274.1	17.99 380.7	28.99 8.84
PAZ60/AZ23-700	AZ 23-800	60.00 1524.00	0.875 22.2	553.04 823.03	125.35 3184	7004 956387	233.5 12551	66.5 324.6	63.8 311.4	61.1 298.1	19.53 413.5	30.48 9.29
PAZ60/AZ38-700N	AZ 38-700N	60.00 1524.00	1.000 25.4	630.71 938.62	117.48 2984	8567 1169817	285.6 15352	83.2 406.4	79.5 388.0	75.7 369.6	24.46 517.7	30.15 9.19
PAZ66/AZ14-770	AZ 14-770	66.00 1676.40	0.688 17.5	480.35 714.86	128.98 3276	7084 967362	214.7 11541	56.0 273.2	53.7 262.2	51.4 251.2	16.44 348.0	30.41 9.27
PAZ66/NZ19	NZ 19	66.00 1676.40	0.750 19.1	523.14 778.54	123.48 3136	8079 1103222	244.8 13162	62.9 307.2	60.5 295.4	58.1 283.6	18.49 391.3	30.56 9.32
PAZ66/AZ23-800	AZ 23-800	66.00 1676.40	0.875 22.2	609.16 906.56	131.35 3336	8866 1210754	268.7 14445	68.6 334.8	66.0 322.2	63.4 309.5	20.15 426.5	32.05 9.77
PAZ66/AZ38-700N	AZ 38-700N	66.00 1676.40	1.000 25.4	694.85 1034.08	123.48 3136	10793 1473880	327.1 17584	85.4 417.1	81.8 399.6	78.3 382.1	25.10 531.3	31.72 9.67

Figure 5-G: HZ-M Wall Type by Skyline Steel

Combination C 1



SECTION	Dimensions					PROPERTIES PER FOOT OF WALL					Coating Area	
	b_{sys} in mm	v_1 in mm	v_2 in mm	v_3 in mm	v_4 in mm	Sectional Area in^2/ft cm^2/m	Mass lb/ft^2 kg/m^2	Moment of Inertia in^4/ft cm^4/m	*Elastic Section Modulus in^3/ft cm^3/m	**Elastic Section Modulus in^3/ft cm^3/m	Waterside ft^2/ft m^2/m	Landside ft^2/ft m^2/m
HZ 880M A	18.70 47.5	14.96 379.9	16.67 423.5	16.31 414.3	–	31.28 662.1	106.46 519.8	5939.0 811010	356.2 19150	364.1 19575	1.81 0.551	9.85 3.001
HZ 880M B	18.70 47.5	15.13 384.3	16.66 423.1	16.41 416.7	–	34.37 727.6	116.98 571.1	6464.9 882820	388.1 20865	394.0 21185	1.82 0.554	9.85 3.003
HZ 880M C	18.70 47.5	15.24 387.1	16.71 424.3	16.44 417.5	–	35.81 758.1	121.88 595.1	6836.8 933600	409.2 22000	415.9 22360	1.82 0.554	9.85 3.002
HZ 1080M A	18.50 47.0	19.72 500.9	21.52 546.5	21.08 535.3	–	39.49 835.9	134.40 656.2	11736.7 1602720	545.5 29330	556.9 29940	1.79 0.547	11.26 3.431

Table 5-A: Preliminary Pile Results from DeepEx Analysis

Description	PNT 1	PNT 2	PNT 3	PNT 4
Governing Case	S	S	S	S
Stability SF[1]	1.25	1.25	1.25	1.25
Top of Wall Elevation (feet)	+9	+9	+9	+9
Interior Water Elevation (feet)	-8	-8	-8	-8
Mudline Elevation (feet)	-17	-15	-10	-2
Excavation Bottom Elevation (feet)	-28	-17	-15	-22
Pile Tip Depth Elevation (feet)	-93	-72	-80	-92
Demand Moment (k-feet/feet) at SF=1.0	1321	627	731	1413
Top Deflection (in) at SF=1.0	19.6	5.7	7.9	19.7
Required Section Modulus ($inch^3$ /feet)	473	225	262	506
DeepEx Analysis Section	PAZ66/ AZ38-700N	PAZ66/ AZ38-700N	PAZ66/ AZ38-700N	PAZ66/ AZ38-700N

[1] Safety Factor

Table 5-B: Preliminary BMP Sections

Description	PNT 1	PNT 2	PNT 3	PNT 4
Required Pile Section	HZ 1080M A	PAZ66/ AZ38-700N	PAZ66/ AZ38-700N	HZ 1080M A
Deflection (in) Revised Estimate	18.0	5.7	7.9	18.1

The results of this pile wall analysis demonstrate that extremely large pile sections for a cantilever wall and/or alternative wall types such as braced walls or double sheet pile walls must be considered for this RD. It is uncertain whether it is technically feasible to install pilings of this size and type into the soil conditions present at the Northern Impoundment. In addition, once these pilings are installed, due to their size and type, it is unlikely that some sections will be able to be removed. Additional analysis of wall types is included in Appendix F.

5.4.4 Preliminary 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. The evaluation was performed to consider slope stability and is detailed in Appendix D.

As discussed in Section 5.2.3, due to subsurface geology that contains dense sands, the impact hammer used to drive the piles may require up to 100 blows per foot (which is unconventionally high) to advance the piles through the 15-25 feet sand layer encountered between -70 and -100 feet NAVD88. The vibration resulting from these impacts could cause two types of slope failure along the Northern Impoundment- shallow slip surface or deep slip surface. The vibrations would be of specific concern in certain areas of the Northern Impoundment, because the steepness or length of slopes would be at greater risk for such a failure, particularly because even a relatively small failure (like shallow sloughing of material) could result in a release of waste material to the river.

A sensitivity analysis was performed to determine the seismic coefficient to be used to represent the vibration and the material thickness to be used to represent the expected amount of soft material that could be present on the slopes of the Northern Impoundment. The sensitivity analysis evaluated seismic coefficients ranging from 0.05 to 0.3 and thickness of soft material ranging from five to 15 feet. The value for the thickness of the soft material is an estimate, because soil data collected to date is not sufficient to characterize the thickness of this soft material on Northern Impoundment slopes. The material was assumed to be cohesive.

The following was the result of the sensitivity analysis:

- Without vibration added, the SF for the 5, 10, and 15 feet scenarios were 2.0, 1.52, and 1.30, respectively.
- For the 5-foot scenario, when seismic coefficients of 0.05, 0.10, and 0.15 were introduced, the SF decreased from 2.0 to 1.4, 1.05, and 0.83, respectively.

- For the 10-foot scenario, when seismic coefficients of 0.05 and 0.10 were applied, the SF decreased from 1.62 to 1.06 and 0.79, respectively.
- The 15-foot scenario was not considered since slope failure was reached using the 10-foot scenario.

It should be noted that if the material on the slope was changed from a cohesive material, as was used in the evaluation above, to a cohesionless material (i.e., sand), it would be much less stable and that would likely result in a shallow slip surface failure when vibration was applied. The vibration analysis is detailed in Appendix D.

The effects of vibration on settlement, liquefaction and cyclic mobility, and soil remolding are also in the preliminary evaluation stage.

Preliminary results from the slope stability analysis were presented during the April 22, 2020 TWG Meeting and are included in Appendix D. The level of uncertainty associated with slope stability during pile installation could be a major concern for the Northern Impoundment RA, as discussed in further in Section 5.9.

5.5 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, Appendix G Attachment 7 to this 30% RD. The TODP summarizes the regulatory requirements, characterization results, disposal facility profiling requirements, Northern Impoundment management and loading, transportation plans, and record keeping.

5.5.1 Waste Characterization

As summarized in Section 3.3, the waste material in the Northern Impoundment is not listed hazardous waste 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 was a characteristically hazardous waste. The results indicated that the material is not a characteristic hazardous waste under RCRA or TCEQ regulations.

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 and it 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. The results of the treatability testing supported the results from the PDI-1 characterization, indicating that the waste material from the Northern Impoundment is non-hazardous and was also determined to be eligible for disposal as a Class II non-hazardous waste per 30 TAC §335.505, 335.506, and 335.508.

Additional treatability testing is ongoing to evaluate solidification needs to increase the strength of the material so that it meets potential landfill requirements for UCS.

5.5.2 Loading, Transportation, and Disposal

The total volume of waste material anticipated to be removed and disposed of from the Northern Impoundment is approximately 212,000 CY. Removal will likely be completed over a minimum of five excavation seasons (November to April each year). Approximately 35,000 - 60,000 CY of impacted material would be excavated, transported, and disposed of off-site in each excavation season. The current five cell layout, shown on Figure 5-A, consists of two Cells (Cells 4 and 5) to be removed according to Approach A and three Cells (Cells 1, 2, and 3) to be removed according to Approach B. The Cells would be sized based on the amount of waste material that could reasonably be excavated, transported, and disposed of during one excavation season.

During waste material removal from Cells using Approach B methodology, the end of the excavation season will be dedicated to treating the water retained inside the cell. The additonal water treatment time limits the available timeframe to remove, transport, and dispose of excavated waste material during the November to April excavation season. Therefore, the sizes and volumes for Cells 1, 2, and 3 are assumed to be less than Cells 4 and 5. It is anticipated that Cells 4 and 5 may have 25% more hauling days per excavation season with an estimated 120 total hauling days, whereas Cells 1, 2, and 3 may only have approximately 96 hauling days per excavation season.

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 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 discussed in Section 5.3.2, is planning to replace the bridge within the next four to five years. The 30% 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, restricts the space available for truck staging, loading, and turnarounds. These factors will likely limit truck loadout and transportation efficiency, and may bottleneck excavation production rates.

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 from 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 this 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, TxDOT use of the shared access road that would impede ingress and egress, and other factors. Altogether, the RA may require over 15,000 truck trips. This will result in over 2.7 million miles traveled, which could lead to increased traffic accidents and greenhouse gas (GHG) emissions. 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

5.6 Water Management - Approach A

For Approach A, the water treatment process may include removal, treatment, and discharge of water from the cell as it accumulates throughout the excavation season to allow excavation activities to continue. Accumulated water will be pumped from the cell to a storage vessel, treated until it is below discharge criteria for dioxins and metals, then discharged to the river. This Section describes the basis of design and preliminary design elements for the water treatment system.

5.6.1 Basis of Design

5.6.1.1 Water Characterization

As described in Section 3.4, water treatability testing was performed in accordance with the TSWP (GHD, 2019a) to inform the RD of the water treatment system(s). The results from treatability testing indicated that the average TSS concentration for the simulated Northern Impoundment contact water sample was approximately 4,000 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 treatability.

During treatability testing, a contact water sample was filtered using a 0.45 µm filter and analyzed for dissolved dioxins and furans and metals to evaluate the fraction that are associated with the suspended solids versus dissolved in the water. Results indicated that the majority of the metals and dioxins were associated with the suspended solids and were not 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 cell during the RA.

5.6.1.2 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, suggesting that a treatment system that removes solids should reduce COPCs to levels below the discharge criteria.

5.6.1.3 Treatment Process

It is anticipated that Cells 4 and 5 may be remediated using Approach A. Under this remedial methodology, water that accumulates in the excavation, through storm water and/or seepage, will be pumped from the cell to a large, aboveground storage vessel. Water from the storage vessel will be processed through a modular water treatment system, which may consist of solids precipitation/flocculation, bulk solids removal, sand filtration, bag filtration, then GAC filtration, before it is discharged to the river. Based upon water treatability testing results, described in Section 3.4, the process described herein has proven effective in laboratory testing at reducing concentrations of COPCs in water to levels below their respective discharge limits.

5.6.1.4 Water Volume and Storage

To identify the volume of captured rainfall that may require treatment and/or storage during the Northern Impoundment RA, daily rainfall events from the Houston William P. Hobby Airport from 1930 to present (obtained from the National Centers for Environmental Information) were analyzed. Rainfall data for the anticipated excavation season (November to April) were used in the analysis. A cell size of 150,000 square feet and an open top storage tank area of 12,937 square feet were used with rainfall amounts to estimate the approximate volume expected to be captured. Each November to April excavation season was analyzed to estimate the total seasonal captured volume, the seasonal maximum daily volume, the seasonal maximum multi-day volume, and the seasonal maximum carried (i.e., running) volume, assuming treatment rates of 100 and 300 gpm. A treatment rate of 500 gpm was also evaluated, but resulted in no water being held from one day to the next. All analyses assumed rainfall capture inside both the excavation cell and the open-top water storage tank.

The maximum daily volume was the volume captured on the day with the greatest rainfall and the total seasonal captured volume was calculated as the cumulative sum volume of rainfall captured. Seasonal maximum multi-day volume was calculated as the total accumulated volume for a period of days with consecutive rainfall (i.e., these observations would be bounded by days with zero rainfall). Seasonal maximum running volume assumed a given treatment rate and for a given day was calculated as:

$$V_{r,i} = V_{p,i} + V_{d,i} - V_{t,i}$$

Where: $V_{r,i}$ is the carried or running volume on day *i*, $V_{p,i} = V_{r,i-1}$, $V_{d,i}$ is the volume captured on day *i*, and $V_{t,i}$ is the volume that can be treated on day *i* assuming a treatment rate of *t* (in gpm). Assuming a constant daily treatment rate gives $V_{t,i}=V_t$.

The maximum annual rainfall volume for the November to April period is 3.7 million gallons and occurred in 1948. This volume will be used as the basis of design for Approach A water treatment. This volume would be treated, as needed, depending on rainfall occurrence over the six-month period. The contribution of water from seepage has not been included in the design basis. Based on minimal seepage water observed during the pilot test, quantities of seepage are believed to be less than rainfall quantities, and unlikely to change the design flow rate or storage required.

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

- **Bulk Water Removal** - The treatment system may use suction pumps to rapidly remove accumulated contact water from the excavation and discharge the water to the storage tank.
- **Storage** - Depending on the final storage volume, either frac tanks (~20,000-gallons/tank) or lake tanks (~0.5 to 1.5 million gallons) may be used to store contact water prior to treatment.

Storage tanks will allow for contact water to be removed from the open cell and stored prior to treatment. The tanks may be mixed or agitated to maintain solids in suspension.

- **Chemical Addition** (coagulant, flocculant, and/or organosulfide, using metering pumps and mixing tanks). Polymer addition in the form of a coagulant can be used to neutralize the particle charge. When the charge is neutralized, particles will not be repelled and can be brought together or flocculated. A coagulant in the form of an inorganic salt of iron or aluminum can be added which form insoluble precipitates that entrap particles. A flocculating polymer can be added which is typically a high-molecular weight organic polymer. These polymers can increase floc size. An organosulfide is a long-chain polymer with sulfide functional groups. Soluble metals will precipitate by combining with the sulfide, which can then be removed from solution with the solids.
- **Bulk Solids Removal using an Inclined Plate Clarifier -** Conditioned solids may 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 are directed by gravity to the bottom of the clarifier, where the solids stream is continuously removed. Because of the high surface area due to the plates, an inclined plate clarifier requires a smaller footprint compared to a typical clarifier.
- **Gravity Thickening -** Conditioned solids from the inclined plate clarification may be pumped into a gravity thickener where solids will settle to the bottom of the thickener. The clarified liquid will be pumped back to the storage tank for reprocessing and the settled solids will be stabilized and disposed of with other solids from the excavation.
- **Multimedia Filtration** - With multimedia filtration, a pressure vessel is filled with three or more types of 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, the pressure across the filter increases, which requires backwashing to remove the collected particles. The media have varying densities so that when backwashed, anthracite is the least dense and remains on top, with sand remaining in the middle, and the most dense garnet settles to the bottom.
- **Bag/Cartridge Filtration -** Bag and cartridge filters use fabric to collect solids as water is pumped through the filter. The filter is designed to collect particles large than the specified opening in the filter.
- **GAC Filtration** - Granular activated carbon is a form of carbon that is processed to have small pores that increases the surface area available for adsorption. Dissolve organic compounds, including dioxins, will be removed with GAC.

Details of the basis of design of the temporary water treatment system are provided below.

5.6.2.1 Major Equipment List and Sizing Basis

The major water treatment system components and basis of sizing are detailed in Table 5-1. This includes sizing criteria assumptions, preliminary design value, and notes for each major equipment and process component.

5.6.2.2 Temporary Water Treatment Equipment Layout

An area of approximately 60 feet by 70 feet may be required for staging of the temporary water treatment system for Approach A. The design water storage volume is currently being finalized, so the estimated footprint does not include contact water storage at the front end of the water treatment system. The layout of temporary water treatment equipment is shown in Drawing P-04 and a PFD is shown on Drawings P-02 and P-03.

At the time of the 30% RD submittal, property access negotiations are ongoing, so the location of the water treatment system has not yet been determined. Since a significant amount of water storage will be necessary to store water on the front end of the treatment system for Approach A, the storage tanks may require several acres of land for staging.

5.6.2.3 Specification and Equipment Data Sheet List

As the design progresses for the Northern Impoundment, the detailed design drawings associated with the temporary water treatment system will be supplemented with technical specifications detailing the potential water treatment equipment, consumables, staging/sequencing, and operation. The technical specifications that are expected to accompany the detailed design drawings are listed in Section 8.2.

5.6.3 Operations and Maintenance Requirements

The temporary water treatment systems associated with the Northern Impoundment RA will operate intermittently primarily based on need to treat contact water resulting from precipitation. A preliminary discussion of the O&M requirements (including consumables and utilities) associated with the temporary water treatment system is provided below.

5.6.3.1 Consumables

Effective treatment of contact water may 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.

Organosulfide - Organosulfide is a flocculant that is a commonly used water treatment additive for removal of metals (via sulfide precipitation). Organosulfide may be added depending on influent soluble metals concentrations. Precipitated metals may be removed through the solids separation processes of the temporary water treatment system. It is anticipated that organosulfide would be delivered in intermediate bulk containers (IBC) totes (~300 gallons).

Coagulant - Coagulants (such as ferric chloride or polyaluminum chloride) may be dosed to facilitate enhanced removal of metals (through co-precipitation) and suspended solids in the clarification process of the temporary water treatment systems. It is anticipated that coagulant would be delivered in IBC totes (~300 gallons).

Acid/Caustic - Acid and/or caustic may be added to the contact water to adjust the water pH to optimize metals removal and enhance the effectiveness of the added coagulants. It is anticipated that acid/caustic would be delivered in IBC totes (~300 gallons).

Polymer - Liquid polymers may be utilized to enhance the settling of suspended solids and precipitated metals in the clarification step of the water treatment system. Polymer may also be required to enhance the settling/thickening of chemical sludge (clarifier option). Polymer would be activated/diluted prior to dosing into the water treatment process. It is anticipated that polymer would be delivered in drums or IBC totes.

Jar testing may be done on-site upon commissioning of the temporary treatment system in order to determine the type and dosage of chemicals needed.

Nominal Rated Filters - nominally rated filters (10 µm and 1 µm) may be utilized downstream of the multimedia filters. As the nominally rated filters are fouled (with captured solids), they will need to be removed and replaced.

Absolute Rated Filters - absolute rated filters (1 µm) may be utilized downstream of the nominally rated filters. As the absolute rated 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.

5.6.3.2 Power

The temporary water treatment system (as well as other facilities such as office trailers, etc.) in the Northern Impoundment will require electricity for operation. The initial estimated electrical load for the Northern Impoundment temporary water treatment system is 100 kilowatts (kW), 480 volts (V), 3 Phase. Actual power requirements will need to be confirmed by the selected RA contractor. The contractor that installs the water treatment system will have to obtain electricity from a local utility service connection or to use portable generators.

5.6.3.3 Labor

The temporary water treatment system will likely operate in a semi-automatic mode on an intermittent basis (i.e., after a rain event). The water treatment system will operate primarily at the initial phase of excavation for dewatering the cell and during precipitation events; thus, there may be periods of time in which the water treatment systems are idle and treatment system operators are not required. Key process decisions and operations will be executed with oversight by the contractor'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. The need for licensed wastewater treatment operators for the temporary water treatment system is currently being evaluated.

5.6.3.4 Residuals

The operation of the temporary water treatment systems may result in the generation of a number of residuals.

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 may be used to precipitate metals and removal of suspended solids from the treated water. The resulting sludge will be withdrawn as the underflow (i.e., settled solids) of the inclined plate clarifier. The settled solids will be directed to a gravity thickener tank where it is estimated that it may be thickened to a solids concentration of up to 6% (mass basis). Treatability testing showed that the clarifier underflow can be thickened easily. However, provisions for polymer addition are being included in the design, in the event that additional thickening is needed. During operation of the temporary water treatment system, it is estimated that thickened sludge may be generated at a maximum rate of 600 pounds per hour (dry solids basis). This thickened sludge will be directed to holding tanks prior to solidification and off-site disposal.

Spent Filter Elements: As previously noted, the nominally rated and absolute rated filter elements may become fouled with solids as the treatment system operates. These fouled filters will need to be removed and replaced. The spent filters will be disposed of in accordance with 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 discharge 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. The spent media will be disposed of in accordance with applicable federal and state requirements.

5.6.4 Monitoring

Routine effluent compliance monitoring requirements associated with the temporary water treatment systems are expected to include pH, TSS, metals, and dioxins/furans. Treated effluent samples from the temporary water treatment system may need to be collected as treated water is discharged to the San Jacinto River.

Process monitoring samples would also be collected within the treatment process to inform necessary operational adjustments, such as chemical dose refinement. Turbidity would be monitored through online and/or hand instrumentation to evaluate treatment system performance and adjust operations as needed. During pilot testing, clarifier effluent and filter effluent turbidity were measured to evaluate performance of the system and adjust chemical dosage rates. In addition, a direct correlation was established between turbidity, suspended solids, and $TEQ_{DF,M}$ concentrations. Therefore, it is anticipated that during the RA, real-time turbidity readings may be used to as an indicator for operational adjustments. TSS may also be used as a performance indicator. A detailed treatment system monitoring plan will be included in the 90% RD.

5.7 Water Management - Approach B

For Approach B, a low differential head must be maintained on the BMP. As a result, water must remain in the cell during waste material removal activities. For Approach B, the water treatment process may utilize similar treatment technology to that of Approach A; however, water will be treated *in-situ* in the cell via a recirculation and filtration process to achieve compliance with the applicable ARARs. For these Cells (Cells 1, 2, and 3), in-situ water treatment will likely occur once the waste material excavation activities are completed. At that time, the entire volume of water in the cell will be recirculated through a treatment system that may include solids removal using Geotubes® and filtration. This Section describes the basis of design and preliminary design elements for the Approach B water treatment system.

5.7.1 Basis of Design

5.7.1.1 Water Characterization

For Approach B, the contact water is assumed to be the same as that of Approach A as characterized in the treatability testing. Additional treatability testing to evaluate the methodology presented herein is planned, as discussed in Section 3.7, and the design basis may be updated in future design submittals based upon results of this testing.

5.7.1.2 Parameters Requiring Treatment

Parameters requiring treatment will be the same as those in Approach A. Discharge criteria will also be the same since the treated water in Approach B will also be returned to the river.

5.7.1.3 Water Volume and Treatment Process

It is anticipated that Cells 1, 2, and 3 would be remediated using Approach B. The maximum water volume expected based upon the area of the cell and amount of waste material removed in each cell would be approximately six million gallons. The water level is expected to drop as waste material is removed, and the water level is expected to increase with rainfall. River water may be added, if needed, to maintain the low differential head.

Based upon water treatability testing results, described in Section 3.4, when the TSS of the water was at a concentration of 2 mg/L, the concentrations of metals were below their discharge criteria and the concentrations of $TEQ_{DF,M}$ were below their MLs. In order to achieve this target TSS concentration in situ, water in the cell may be pumped from the cell, through an on-site treatment system consisting of polymer addition, bulk solids removal through Geotubes® or other bulk solids removal system, multimedia filtration, bag filtration, then GAC filtration and returned to the cell. The water will be recirculated in this fashion until the TSS in the cell reaches a concentration of 2 mg/L, as indicated using field turbidity measurements, and confirmed by TSS laboratory analysis. At that time, water samples from the excavation may be collected for laboratory analysis of metals and $TEQ_{DF,M}$ to determine if the water meets the discharge criteria. Based on a cell volume of six million gallons, and a treatment rate of 2,000 gpm, it is estimated that it may take approximately 14 days of constant recirculated treatment to achieve a TSS concentration of 2 mg/L.

5.7.2 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 water in the cell. The treatment process is anticipated to include the following unit processes:

- **Chemical Addition** - Polymer, flocculant, and/or organosulfide (See Section 5.6.2).

- **Bulk Solids Removal using Geotubes**® - A Geotube® container is a large bag-type filter made of a geotextile fabric. The solids material is pumped into the tube. Solids are collected inside the tube, while filtrate flows through the material. For this the Northern Impoundment RA, the Geotube® may be placed in a roll-off container. Filtrate will collect in the roll-off and be pumped out to downstream filtration processes. Solids will remain in the Geotube® and once it is full of solids, it will be removed from service and replaced with a new Geotube®.
- **Multimedia Filtration -** See Section 5.6.2
- **Bag/Cartridge Filtration -** See Section 5.6.2
- **GAC Filtration -** See Section 5.6.2

Details of the basis of design and preliminary process design elements for the Approach B temporary water treatment system are provided below.

5.7.2.1 Major Equipment List and Sizing Basis

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

5.7.2.2 Temporary Water Treatment Equipment Layout

In order to treat the water as quickly as possible, two treatment trains, each with 1,000 gpm treatment capacity, will likely operate in parallel during the Approach B water treatment process. Each treatment train may require an area of approximately 75 feet by 75 feet, thus a total area of approximately 75 feet by 150 feet may be required to accommodate both treatment trains. The layout of temporary water treatment equipment for the Approach B is shown in Drawing P-08 and a PFD is shown in Drawings P-06 and P-07. At the time of this 30% RD submittal, property access negotiations are ongoing, so the location of the water treatment system is yet to be determined. For Approach B, it is anticipated that the treatment system would be staged as close to the working cell as possible.

5.7.2.3 Potential Specification and Equipment Data Sheet List

As the detailed design progresses for the Northern Impoundment RA, the detailed design drawings associated with the temporary water treatment system will be supplemented with technical specifications detailing the potential water treatment equipment, consumables, staging/sequencing, and operation. The technical specifications that are expected to accompany the design drawings are listed in Section 8.2.

5.7.3 Operations and Maintenance Requirements

The temporary water treatment system associated with Approach B would need to begin operating near the end of each excavation season. A preliminary discussion of the O&M requirements (including consumables and utilities) associated with Approach B temporary water treatment is provided below.

5.7.3.1 Consumables

Effective treatment of contact water may require the use of several water treatment chemicals to facilitate solids separation, metals precipitation, and pH adjustment. The consumables necessary for Approach B are expected to be the same as those required for Approach A, described in Section 5.6.3.1, with the exception of Geotube® bags, which may only be necessary for Approach B. Geotube® bags will capture solids that are created by adding coagulant and polymer to the water for the removal of suspended solids.

5.7.3.2 Power

The temporary water treatment systems (as well as other facilities) in the Northern Impoundment will require electricity for operation. The initial estimated electrical load for the Northern Impoundment temporary water treatment systems is 200 kW, 480 V, 3 Phase. Actual power requirements will be confirmed by the selected RA contractor. The contractor executing the water treatment system installation will have to obtain electricity from a local utility service connection or use portable generators.

5.7.3.3 Labor

The temporary water treatment systems may operate in a semi-automatic mode of operation. Key process decisions and operations will be executed with the oversight by the RA contractor's treatment system operators. It is expected that operation of the temporary water treatment systems may require two to six operators, depending on the activities being performed. The need for licensed wastewater treatment operators for the temporary water treatment systems is currently being evaluated. The water treatment system for Approach B will likely operate only near the end of the excavation season.

5.7.3.4 Residuals

The operation of the temporary water treatment systems may result in the generation of a number of residuals. A discussion of the residuals resulting from temporary water treatment is provided below.

Chemical Sludge: The contact water is expected to contain solids from the waste material in the excavation. The addition of coagulants, organosulfide, and polymer may result in the precipitation of metals and removal of suspended solids. The resulting chemical sludge will be captured inside Geotubes®. For the mass balance purpose, it is assumed that Geotubes® will be allowed to dewater/consolidate until a 20% solids (mass basis) is achieved. However, additional treatability testing is planned, as described in Section 3.7. This assumption may be adjusted accordingly based upon the results of these tests. The dewatered sludge may then be solidified with the removed waste material and/or solidification reagents prior to off-site disposal.

Spent Filter Elements: As previously noted, the nominally rated and absolute rated filter elements may become fouled with solids as the treatment system operates. These fouled filters will need to be removed and replaced. The spent filters will be disposed of in accordance with 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 outlined in Approach A, the GAC vessels will be operated in a lead-lag configuration. The discharge 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 lead GAC vessel, the media in this vessel will be removed and replaced. Once back in service, this vessel will become the lag vessel. The spent filters will be disposed of in accordance with applicable federal and state requirements.

5.7.4 Monitoring

Monitoring may include periodic sampling of the following:

- Treatment system effluent, prior to returning to cell, to measure for TSS and COPC concentrations
- Water inside the cell, to determine when the TSS and COPCs in the cell are below discharge criteria, and the water can be returned to the river.

Initially turbidity and TSS may be used to evaluate treatment system performance. During pilot testing, when the filtered effluent had a turbidity of 1 NTU and TSS of 2 mg/L, the dioxins concentrations were non-detect below the ML. Turbidity and TSS values would be compared against these values (1 NTU and 2 mg/L, respectively) during the recirculation process. Once the cell contents are below these values, samples may be collected and analyzed for purposes of meeting discharge criteria for COPCs, at which point, treatment may be discontinued and the contents of the cell returned to the river.

Process monitoring samples may also be collected within the treatment process to inform necessary operational adjustments, such as chemical dose refinement. Turbidity would be monitored through inline and/or hand instrumentation to evaluate treatment system performance and adjust operations as needed. During pilot testing, clarifier effluent and filter effluent turbidity were successfully used to evaluate system performance and adjust chemical dosages. In addition, a direct correlation was established between turbidity, suspended solids, and dioxin concentrations. Therefore, it is anticipated that during the Northern Impoundment RA, real-time turbidity readings may be used to as an indicator for operational adjustments. TSS may also be used as a performance indicator.

5.8 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 RA contractor and will be included in the SWMP (Attachment 5 in Appendix G) and CQA/QCP (Attachment 6 in Appendix G). Erosion and sediment controls are also depicted in design drawings C-04 through C-06 (Appendix E). A summary is included in the following sections.

5.8.1 Control of Dust and Emissions

During implementation, the RA contractor will be required to use methods that minimize production of dust from construction operations. The RA contractor may be instructed to use potable water for potential misting operations to prevent airborne dust from dispersing into the atmosphere. Detailed specifications for perimeter dust monitoring and associated controls will be developed later in the design process.

5.8.2 Storm Water Pollution Prevention Plan and Controls

Prior to beginning construction activities on the Northern Impoundment, overall soil erosion and sediment controls may be implemented. These structures will remain in place and be maintained during each excavation season, for both Approaches A and B, throughout the implementation of the RA. Structures may differ for each cell and excavation season. These controls may consist of, but not be limited to, a combination of turbidity curtain, continuous non-absorbent boom, and absorbent oil boom.

Approach A

When removing waste material from a cell using Approach A, the cell will need to be maintained to be free of water as much as possible. Within the confines of the BMP around the cell, measures may be taken to keep water out of the open excavation, including grading and/or berm construction. There may also be areas located outside the confines of the BMP, including a possible waste material solidification and load-out area that may need to be protected using structures/controls such as berms and/or sloping.

In addition to surface water controls outside of the excavation limits, the RA contractor will provide, operate, and maintain necessary appropriately sized dewatering equipment to keep the excavation free of water, as much as possible. This will include both storm water and seepage water accumulating in the excavation. Requirements will be imposed on the RA contractor to ensure that the pumping equipment, machinery, and tankage are in good working condition for potential emergencies, including power outages, and that appropriately trained workers are employed to operate the pumping equipment. All water removed from any open excavation is to be contained, and transferred to the water treatment system storage tanks for treatment and discharge.

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 RA contractor will be required to use best management practices for the provision of all dewatering and water removal activities.

Approach B

When excavating a cell according to Approach B, a minimum water level must be maintained inside the cell to provide structural support to the BMP. In order to maintain a minimum water level, storm water may be captured or directed from other areas of the Northern Impoundment into the excavation area, as needed. Under these conditions, the contractor would install and manage similar structures/controls listed for Approach A, to intentionally divert and control non-impacted storm water into the excavation. In addition, the RA contractor would operate pumps and other water management equipment to maintain a minimum water level inside the cell. Similar to Approach A, there may also be areas located outside the confines of the BMP, including a possible waste material solidification and load-out area that may need to be protected using structures/controls like berms and/or sloping.

SWPPP

A Storm Water Pollution Prevention Plan (SWPPP) will be developed for the Northern Impoundment excavation program prior to commencement of any waste material removal work.

5.9 Uncertainties and 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, a limited amount of subsurface data had been collected from the Northern Impoundment. Analytical results from the PDIs now highlight that dioxins and furans exceeding 30 ng/kg $TEQ_{DF,M}$ are much deeper than had been assumed. Furthermore, the remedial alternatives considered in the FS and the ROD were not informed by the actual conditions that have since been determined to exist at the Northern Impoundment.

Given these newly identified conditions, there are significant technical challenges in developing an engineering design for the remedial alternative outlined in the ROD. Efforts have been made to address these technical challenges, as detailed in the preceding sections, but significant risks and uncertainties remain that could render the remedial alternative outlined in the ROD technically impracticable and not implementable. In addition, there are uncertainties associated with external factors, such as property access and planned TxDOT and CWA projects that are outside of the control of the RD process. The major elements of risk and uncertainties are summarized in the sections below.

5.9.1 Technical Challenges and Uncertainties

5.9.1.1 Excavation Limits

The absence of a pre-defined excavation bottom elevation remains a technical uncertainty in relation to the BMP design and the schedule.

Uncertainty of Excavation Depth and its Effect on the BMP

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. Simply put, the deeper the required excavation below the surface of the river, the more structurally robust the design and construction of the BMP must be, and will require, among other things, larger pilings and deeper tip elevations. Further, once a BMP is designed for a specific excavation depth, the depth of excavation cannot be extended below that depth during excavation activities, without risking a significant failure of the BMP.

In the absence of a pre-defined excavation elevation, the BMP will have to be designed to excavate to an assumed vertical elevation at the bottom elevation of those borings. In short, the BMP piling design will require the establishment of terminal vertical elevations for the excavation bottom, beyond which no further excavation can occur.

Traditional methodologies for confirmation sampling of excavations, if applied to the Northern Impoundment, will present a significant technical challenge. Once the BMP is designed and constructed, excavation to deeper elevations in an attempt to reach a clean-up level cannot exceed the design excavation elevations for the BMP, as doing so has the potential to put more hydraulic force on the BMP and presents a risk of a significant BMP failure. Therefore, terminal excavation depths need to be defined with a high level of confidence during the RD and cannot be subject to change (deeper excavations) during the RA. The pile types under consideration for use in the RD are not conventional, cannot be procured simply and will require manufacturing specifically for this project (likely overseas). Therefore, the option of installing an alternative BMP during the RA to accommodate deeper excavations is also not feasible.

Uncertainty of Excavation Depth and its Effect on the Schedule

During the RA, if excavation within a cell is required to a deeper depth (assuming that the BMP design could accommodate the additional excavation), that additional excavation work (and further confirmation sampling) will have the potential to extend the schedule for completing work in that cell beyond the excavation season. The designed cell dimensions are based on the volume of waste material that can be excavated within a defined excavation season. Increasing excavation depths would result in increased volumes. This could either require that work be suspended and resumed during the following excavation season, or require extending the excavation season into the high water season of the San Jacinto River. This would significantly increase the risk and likelihood of the BMP being overtopped and the cell being flooded during implementation.

The vertical elevation of the bottom of the excavation and any associated sampling attempting to define such remains a technical uncertainty in relation to the BMP design and the schedule. The BMP piling design will require the establishment of terminal vertical elevations for the excavation bottom, beyond which no further excavation can occur.

5.9.1.2 BMP

There are significant uncertainties related to the BMP including the effects of vibration during installation of the BMP on slope stability, the availability of materials, the risk of overtopping during high water events, and the ability to remove the BMP upon completion of the RA.

Effect Of Vibration On Slope Stability of the Northern Impoundment

The preliminary design of the BMP uses multiple piling types including PAZ66 (5.5 feet diameter pile and up to 100 feet long) and HZ 1080M (double I-beam piles and up to 100 feet long) with tip depths down to elevations of greater than -90 NAVD88. An analysis of geotechnical data from the Northern Impoundment indicates that poor soil conditions exist relative to the BMP design and will require the use of specialty pilings that can be installed to the required depths greater than 90 feet below the river surface. Due to the presence of dense sands that exist between approximately -70 and -100 feet NAVD88, an impact hammer will be required to install the pilings to their terminal depths. The soil conditions will require up to 100 blows per foot to advance the piles through the

15-25 foot thick sand layer. It is uncertain whether it is technically feasible to install pilings of this size and type into the soil conditions present at the Northern Impoundment.

Installation of these size and types of pilings will require a significant amount of force from both vibratory and impact hammers. Because of the presence of steep and/or long slopes in the Northwest and Southeast portions of the Northern Impoundment, there is an inherent risk that during installation of the pilings associated with the BMP, a slope failure could occur. The forces exerted onto the pilings to drive them may transfer into the surrounding soil and potentially cause a sloughing of waste material from the impoundment slope into the San Jacinto River. To evaluate the effects of pile driving on slope stability, GHD performed a preliminary vibration analysis, the results of which are summarized in Appendix E. The preliminary analysis suggests that seismic forces from the vibrations would have the potential to cause a slope failure, resulting in a release of waste material to the river. This issue will require further evaluation in the design process; however, due to the size and type of pilings required for the BMP, vibrations and the potential for a slope failure will remain an inherent risk associated with implementing the remedy selected in the ROD.

Availability and Schedule for Procurement of the BMP

The size and type of pilings being considered for the RA are specialty items that will have to be manufactured and fabricated, likely overseas, specifically for the Northern Impoundment RA. There is an uncertainty regarding (i) the availability of these types of piles, (ii) the extended time period that it will take to procure, fabricate and ship the piles to Texas, and (iii) the logistics of transporting the materials to the Northern Impoundment for installation. Variables such as international tariffs and steel prices will have significant effects on the availability, schedule and feasibility of acquiring the BMP materials.

BMP Removal

The BMP walls would in many instances be required to be installed in locations that are on POHA property, and the installation of pilings in those locations will require the acceptance and consent of POHA. In addition, once these pilings are installed, due to their size and type, there is significant uncertainty as to whether some sections can be removed; therefore, as part of the RD, the BMP in some areas may have to be designed to remain in place following completion of the RA. Thus, in addition to POHA consent required for the pilings to be installed and remain in place during the RA, POHA consent to allow such BMP structures to remain in the San Jacinto River would be required. The remaining BMP structures may also present an obstruction to the floodway and a potential hazard to navigational traffic, and further evaluation is needed with external stakeholders. This remains a large uncertainty with the feasibility of utilizing this BMP.

Risk Of Overtopping and Release During Excavation

The proposed top elevation of the BMP is +9 feet NAVD88, an elevation which exceeds historical water levels since 1996 during the excavation season. Even using this top elevation for the BMP, there is an inherent risk of a flooding event during excavation which could cause overtopping of the BMP, which would result in a release of waste material into the river. Simply put, when digging in and underneath a river, the dynamics of the weather and associated river levels create an inherent risk of releases to the river, and there is no guaranty that future river levels during the excavation season will not exceed historical levels. This is in addition to the risk and uncertainty created by the

CWA plans to add increased flow rate capacity (gates) to the Lake Houston control structure, as discussed below.

As the RD progresses, the design team will attempt to optimize the pile types, alignment, and tip depths; however, that optimization will still result in very significant marine piling structures that will have inherent challenges associated with their installation, use, and removal (which may not be technically possible).

5.9.1.3 Water Treatment

There are significant uncertainties with respect to water treatment, including the effectiveness of Approach B water treatment methodology to meet applicable ARARs and how well bench-scale treatability testing will translate to the RA for both Approach A and Approach B water treatment methodology.

Need For Treatability Testing for Approach B Water Treatment Methodology

As identified above, for each approach to waste material removal (Approach A and Approach B), different methods of water treatment are being considered. At this time, the treatability study related to Approach B has not been completed; the scope of work was submitted to EPA on April 16, 2020 and is currently under revision to address the EPA's comments. Results of the treatability testing are expected to be available in approximately 140 days from the EPA's approval of the scope of work. As such, until that treatability study is completed, it remains unknown whether or not the envisioned water treatment methodology for Approach B will be successful in meeting compliance with the applicable ARARs. It also remains unknown, if successful, how long Approach B water treatment would take to achieve concentrations that meet the applicable ARARs. For Approach B, water treatment is anticipated to occur after excavation of waste material within the cell has been completed. The longer the time required for water treatment, the shorter the time within an excavation season that is available for excavation activities. The length of time required for water treatment could change assumptions regarding the volume of waste that can be excavated during an excavation season.

Uncertainty with Translation of Laboratory Testing to Field Implementation

It remains uncertain how well the laboratory controlled treatability testing for water treatment (for both Approach A and Approach B) will translate to field-scale implementation during the RA. The planned laboratory treatability testing to evaluate Approach B methodology is being completed in a constructed reactor that is two feet by two feet by six feet in size; this is significantly smaller in scale and more controlled than the treatment system that would be required during the RA. Treatability testing performed to date (summarized in Section 3.4), has yielded favorable results, but, again, these tests were completed in much smaller, controlled settings that may not translate to full-scale implementation.

5.9.2 Other Challenges and Uncertainties

5.9.2.1 Transportation and Disposal

The RD is based on a fundamental assumption that waste material can be effectively transported from the Northern Impoundment to an off-site disposal facility. Currently there is only a single, unimproved road to and from the Northern Impoundment. This unpaved road is owned by TxDOT, and together with a paved frontage road, is used by TxDOT to access the I-10 bridge. Furthermore, a portion of the area immediately north of the TxDOT ROW is owned by a third-party landowner and access to it would be required to improve and widen the access road.

For purposes of the RD, it has been assumed that this TxDOT ROW road, the land to the immediate north, and the current I-10 frontage road will be available for use during the RA. During the course of the RA, over 15,000 truck round-trips will be required to transport excavated materials to an off-site disposal facility using the TxDOT ROW road and I-10 frontage road. This volume of increased traffic will require significant widening, strengthening and modifications to the existing roadways and the approval of TxDOT and a third-party for those activities. The consent of TxDOT for the use of its ROW over the course of the RA will also be required. In addition, the number of trucks that will be entering and exiting I-10 may require permitting with TxDOT, an issue that is currently being explored as part of the design process. At this point in the RD, it is uncertain whether the necessary agreement can be reached with TxDOT for the use of the TxDOT ROW for access to the Northern Impoundment and to make the necessary improvement to the roadway. It is also uncertain whether an agreement can be reached with the third-party landowner to allow for its property to be improved and used for the RA. TxDOT's plans for replacing the I-10 bridge, discussed in Section 5.9.2.2 below, create additional uncertainties related to land access to the Northern Impoundment.

An additional consideration is the impact on the schedule due to potential disruptions to the anticipated transportation route to the disposal facility. Over the last three years, the I-10 bridge at San Jacinto has been temporarily taken out of service twice due to barge strikes in the San Jacinto River and subjected to numerous traffic delays caused by miscellaneous accidents on the bridge. If a similar, or an even less significant, road closure occurs during the RA, the schedule for excavation (of the cell being completed that year) may be extended such that it cannot be completed during the excavation season.

5.9.2.2 Stakeholder Considerations

The proximity of the Northern Impoundment to the San Jacinto River and I-10 makes the schedule for completion of the RA, as identified in the ROD, subject to the activities of external stakeholders that are outside the control of the EPA. An example of this can be seen in the recent barge strikes that have occurred at the I-10 bridge over the last few years. Potential impacts from two upcoming planned external events and the need to address the flood impacts from the presence of the BMP are addressed below.

TxDOT Bridge Replacement Project

One major external event that is planned and has the potential to disrupt or delay execution of the RA at the Northern Impoundment is construction of a new I-10 bridge over the San Jacinto River. TxDOT is in the design phase of a planned bridge construction project to replace the existing I-10 bridge over the San Jacinto River with a new, longer span bridge. In developing the 30% RD , GHD and the EPA have engaged with TxDOT to understand the upcoming project and potential interSection with the RA at the Northern Impoundment. Based on that engagement, it appears that the TxDOT bridge construction is planned to occur during the seven year period during which the

Northern Impoundment RA, if implemented based on the preliminary RD presented in this Report, would take place.

It is currently unknown whether the two projects can proceed concurrently or if they did, what conflicts may arise between the two projects. These issues will have to be addressed as both projects move further into the design and planning process.

A significant uncertainty is the potential disruption that may occur during TxDOT's bridge replacement project to access to the existing I-10 frontage road and the entry and exit ramps for I-10 at Monmouth Street. As noted previously, the Northern Impoundment RD assumes the improvement of the I-10 frontage road and use of both the frontage road and the ramps over the project lifecycle; any disruption to such access could delay or lengthen the overall schedule for the RA.

Expansion of Lake Houston Control Structures

A second major external event that is planned and has the potential to impact both the RD and the RA for the Northern Impoundment is the planned expansion of the Lake Houston control structure at the headwaters of the San Jacinto River. CWA, which operates and maintains the Lake Houston control structure upriver of the Northern Impoundment, is currently in the planning and design stages of an expansion to the control structure. Once completed, the planned expansion will allow for the discharge of increased flow rates from Lake Houston and into the downstream San Jacinto River to allow for rapid decrease of water levels in Lake Houston in advance of storm events to prevent or reduce upstream flooding. The dam currently has two radial gates with a total capacity of 10,000 cubic feet per second (cfs) in addition to the spillway. The planned expansion project, which is currently planned for completion in 2022, would include the addition of 10 gates, each with the capacity of 3,600 cfs, for an increase in discharge capacity of approximately 36,000 cfs.

The CWA is currently completing hydraulic modeling for the watershed both upstream and downstream of the control structure; however, results from this modeling effort will not be available until the third or fourth quarter of 2020.

As detailed earlier in this Report, the top of wall elevation for the BMP is based upon extensive analysis of historic river elevation data dating back to 1994. A fundamental assumption in establishing the top elevation of the BMP was that historical river elevations can be used to predict river elevations during the RA. However, the planned CWA project has the potential to change the range of hydraulic conditions and river elevations that may be experienced at the Northern Impoundment, which in turn would greatly impact the BMP design. The uncertainty as to the impact of changes in discharges from the Lake Houston control structure means that it may be necessary to reconsider the wall height and BMP design and also presents a risk of an increased likelihood of BMP overtopping events and a resulting increased likelihood for releases to the river during the RA.

Given the impact of CWA's project on the RD, if the development of the design proceeds, the basis of the design in terms of wall height will have to be reevaluated based on CWA modeling of downstream impacts. The RD team will have to determine if historical water levels remain a reasonable basis of design for the top elevation of the BMP. In addition, if the CWA modeling shows that the increased flow rates from expanding the control structure are estimated to increase the water elevations in the San Jacinto River, that would require a reexamination and possible change in the current basis for design of the BMP.

Obstruction in the Floodway

As part of the RA, some configuration of a +9 foot NAVD88 BMP will be present in the San Jacinto River. The presence of an impermeable steel structure in the waterway could have an effect on the course of flood waters in the proximity of the Northern Impoundment. This will be discussed with the HCFCD as design progresses. Evaluation of the downstream modeling currently being performed by the CWA may help anticipate the behavior of the waterway during high water events.

5.9.2.3 Impacts on Community and Environment

Execution of a project of this magnitude and duration will have a significant impact on the surrounding community. The increase in the estimated volume of waste material for disposal (approximately 212,000 CY versus 162,000 CY estimated in the ROD) will result in an additional approximately 3,500 truck loads of waste material for transport from the Northern Impoundment to an off-site disposal facility over the course of the RA. This will result in an additional 630,000 miles traveled (for a total of over 2.7 million miles traveled). The increased truck traffic will not only have a significant effect on the traffic and congestion in the surrounding residential and commercial areas, but will have an impact on greenhouse gas emissions and the potential for traffic accidents as a result of the RA.

In addition to increased traffic and GHG emissions in the areas surrounding the Northern Impoundment, the RA will likely cause disruption to the surrounding community due to the noise associated with pile driving activities. Pile driving is projected to occur on a daily basis for much of the six months preceding each excavation season. The large pile types under consideration would require a very robust hammer to drive them to the depths under consideration. Also, as mentioned, due to unfavorable geotechnical conditions in the subsurface, there may be portions of the pile driving that require 1,500 to 2,500 blows from the hammer to advance a single pile to its terminal depth. As each cell will require hundreds of individual piles, this would result in tens of thousands of blows to install the BMP around a cell. The noise generated from the hammer impacting the pile will be significant and will need to be evaluated in further developing the RD, including (i) whether the pile driving operations and the associated noise could create a distraction hazard for drivers in passing vehicles on nearby I-10, and (ii) how the noise may carry and impact the surrounding community.

5.9.2.4 Access

Another uncertainty associated with the preliminary 30% RD is whether required access can be obtained. Efforts are underway to obtain necessary access, including access for a staging/construction laydown area and to use properties needed to facilitate truck access to the Northern Impoundment. There are also significant uncertainties associated with access and approvals that will be from POHA and TxDOT, as discussed above.

5.9.3 Cost of the Remedial Action

The design concepts presented in this 30% RD are preliminary. As detailed in this Section (Section 5.9), there are many remaining uncertainties that are being evaluated and the cost estimate included in the ROD did not take into account these uncertainties.

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 is 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. Modeling 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 *Final Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d), as part of the PDI-2 field activities, sediment samples were collected 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 lead-210 (^{210}Pb) and cesium-137 (^{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 *Final Second Phase Pre-Design Investigation Work Plan* (GHD, 2019d).

6.1.1 SSA Chemistry 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 feet, 2 to 4 feet, and 4 to 6 feet below the sediment/surface water interface. Eurofins TestAmerica analyzed the samples for dioxins and furans by EPA Method 8290 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 99 sediment samples for ^{137}Cs and ^{210}Pb by EPA Method 901.1.

6.1.3 SSA Investigation Results

6.1.3.1 SSA Chemistry Results

Concentrations of $TEQ_{DF, M}$ are below the risk-based protective level of 51 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 H.

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 feet) 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.

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

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 H.

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 51 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).

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 51 ng/kg. In summary, eight out of nine total sample locations at depths less than 24 inches have $TEQ_{DF, M}$ concentrations below 51 ng/kg. This is consistent with the results observed during the RI. Based upon these data, it can be concluded that eight out of the nine areas of the original extent of the SSA do not pose a threat to human and/or ecological receptors, so MNR activities moving forward will focus on the half acre surrounding sample SJSSA06.

The MNR Plan, which is provided as Attachment 9 in Appendix H, is conceptual at this time. The MNR Plan discusses the processes of MNR as related to dioxins and furans and site-specific characteristics to be considered in further development of that plan. The implementation of ICs will also be considered for the area around SJSSA06.

7. Environmental Footprint (Greener Cleanups)

EPA’s *Principals for Greener Cleanups* (EPA 2009) are being 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 cleanups. The framework focuses on five principals associated with a cleanup project's environmental footprint. These principals are listed below along with the potential methods by which they may be incorporated into the Northern Impoundment RD.

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. This principal may be incorporated into the RD by:

- Limiting traffic at the Northern Impoundment by requiring workers to carpool, as possible per appropriate social distancing guidance in the wake of the Covid 19 Pandemic.
- Requiring the contractor to use energy efficient equipment or vehicles where applicable.

Minimizing Air Pollutants and Greenhouse Gas Emissions. This includes reducing total air emissions, including emissions of air pollutants and greenhouse gases, throughout the clean-up. This principal may be incorporated into the Northern Impoundment RD by:

- Specifying that the contractor control dust emissions in and around the Northern Impoundment.
- Requiring air emission control devices on equipment that delivers 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 clean-up. This principal may be incorporated into the Northern Impoundment RD by:

- Employing BMPs for storm water, erosion, and sedimentation control.
- Managing the removal activities for Cells in which Approach B will be used to minimize the amount of added water in the cell.

Reduce, Reuse, and Recycle Materials and Waste. This includes minimizing the use of virgin materials and generation of waste throughout the clean-up as well as maximizing the use of recycled materials. This principal may be incorporated into the Northern Impoundment RD by:

- Using recycled rock from the armored cap for restoration of the Northern Impoundment area.
- Implementing a recycle program for workers.
- Requiring contractors to consider recycled material when purchasing material for the project.
- Reuse of BMPs, where possible.

Protect Land and the Environment. This includes reducing impacts to land and the environment throughout the clean-up. This principal may be incorporated into the Northern Impoundment RD by:

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

8. Preliminary Drawings and Specifications

8.1 Design Drawings

The Preliminary (30%) RD design drawings for the Northern Impoundment are presented in Appendix E and include the following preliminary drawings:

- 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 Cell 1
- Drawing C-09 - Excavation Section Cell 1 (1 of 2)
- Drawing C-10 - Excavation Section Cell 1 (2 of 2)

- Drawing C-11 - Pile Layout Plan Cell 1
- Drawing C-12 - Pile Profile Cell 1
- Drawing C-13 - Excavation Plan Cell 2
- Drawing C-14 - Excavation Section Cell 2
- Drawing C-15 - Pile Layout Plan Cell 2
- Drawing C-16 - Pile Profile Cell 2
- Drawing C-17 - Excavation Plan Cell 3
- Drawing C-18 - Excavation Section Cell 3
- Drawing C-19 - Pile Layout Plan Cell 3
- Drawing C-20 - Pile Profile Cell 3
- Drawing C-21 - Excavation Plan Cell 4
- Drawing C-22 - Excavation Section Cell 4
- Drawing C-23 - Pile Layout Plan Cell 4
- Drawing C-24 - Pile Profile Cell 4
- Drawing C-25 - Excavation Plan Cell 5
- Drawing C-26 - Excavation Section Cell 5
- Drawing C-27 - Pile Layout Plan Cell 5
- Drawing C-28 - Pile Profile Cell 5
- Drawing C-29 - Pile Details
- Drawing C-30 - Typical Details 1 of 3
- Drawing C-31 - Typical Details 2 of 3
- Drawing C-32 - Typical Details 3 of 3
- Drawing P-01 - Water Treatment System Approach A Process Flow Diagram/Mass Balance
- Drawing P-02 - Water Treatment System Approach A P&ID (1 of 2)
- Drawing P-03 - Water Treatment System Approach A P&ID (2 of 2)
- Drawing P-04 - Water Treatment System Approach A Plan
- Drawing P-05 - Water Treatment System Approach B Process Flow Diagram/Mass Balance
- Drawing P-06 - Water Treatment System Approach B P&ID (1 of 2)
- Drawing P-07 - Water Treatment System Approach B P&ID (2 of 2)
- Drawing P-08 - Water Treatment System Approach B Plan

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

8.2 Preliminary Technical Specifications

To supplement the Preliminary (30%) RD design drawings for the Northern Impoundment, a preliminary list of technical specifications has been identified. As the design progresses from Preliminary (30%) to Pre-Final (90%), these specifications will be further developed and determinations may be made that additional specifications are required.

- Section 01 00 00 - General Requirements
- Section 01 35 00 - Temporary Traffic Controls
- Section 01 35 29 - Health and Safety
- Section 01 50 00 - Temporary Facilities and Controls
- Section 01 57 13 - Temporary Soil Erosion and Sediment Controls
- Section 02 55 00 - Remedial Soil Solidification
- Section 22 05 01 - Mechanical General Requirements
- Section 31 10 00 - Site Clearing
- Section 31 23 16 - Excavation
- Section 31 23 23 - Fill
- Section 31 41 16 - Piles
- Section 32 31 13 - Chain Link Fences and Gates
- Section 32 92 19 - Seeding
- Section 40 05 13 - Common Work Results for Process Piping
- Section 40 05 51 - Common Requirements for Process Valves
- Section 46 05 01 - Process Equipment General Requirements
- Section 46 07 01 - Temporary Water Treatment System

9. Supporting Deliverables

Drafts of supporting deliverables have been prepared as part of the Northern Impoundment 30% RD. These deliverables will be updated as additional details of the RD are developed during the subsequent phases of the design.

9.1 Health and Safety Plan

The Construction HASP (Attachment 1 in Appendix G) has been prepared in accordance with CFR 1910 and 1926 to provide protection of human health and the environment during activities performed to implement the Northern Impoundment RA. As further developed, it will include 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 G) 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. The ERP also includes a High Water Preparedness Plan that describes the weather monitoring procedures and the emergency actions that will be taken during a potential high water event.

9.3 Field Sampling Plan

The FSP (Attachment 3 in Appendix G) describes the sampling activities for all media to be sampled during work to implement the Northern Impoundment RA. The FSP will detail the sample locations and describe the protocol for sample handling and analysis.

9.4 Quality Assurance Project Plan

The QAPP (Attachment 4 in Appendix G) 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 G) describes the procedures to obtain information on the material concentrations at 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 G) describes the planned and systematic activities that verify that the remedial construction to implement the the Northern Impoundment RA will meet requirements consistent with clean-up goals and performance requirements set forth in the ROD.

9.7 Transportation and Off-site Disposal Plan

The TODP (Attachment 7 in Appendix G) details, for the Northern Impoundment RA, waste characterization activities and the planned disposal facilities. It describes 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.

9.8 Institutional Controls Implementation and Assurance Plan

The ICIAP (Attachment 8 in Appendix G) describes the institutional controls applicable to the SSA. The ICIAP also provides the procedures to implement, maintain, and enforce the institutional controls.

9.9 Monitored Natural Recovery Plan (Operations & Maintenance Plan)

The MNR Plan (Attachment 9 in Appendix G), 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 will take the place of the O&M Plan, specified in the SOW.

9.10 Operations & Maintenance Manual

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

10. References

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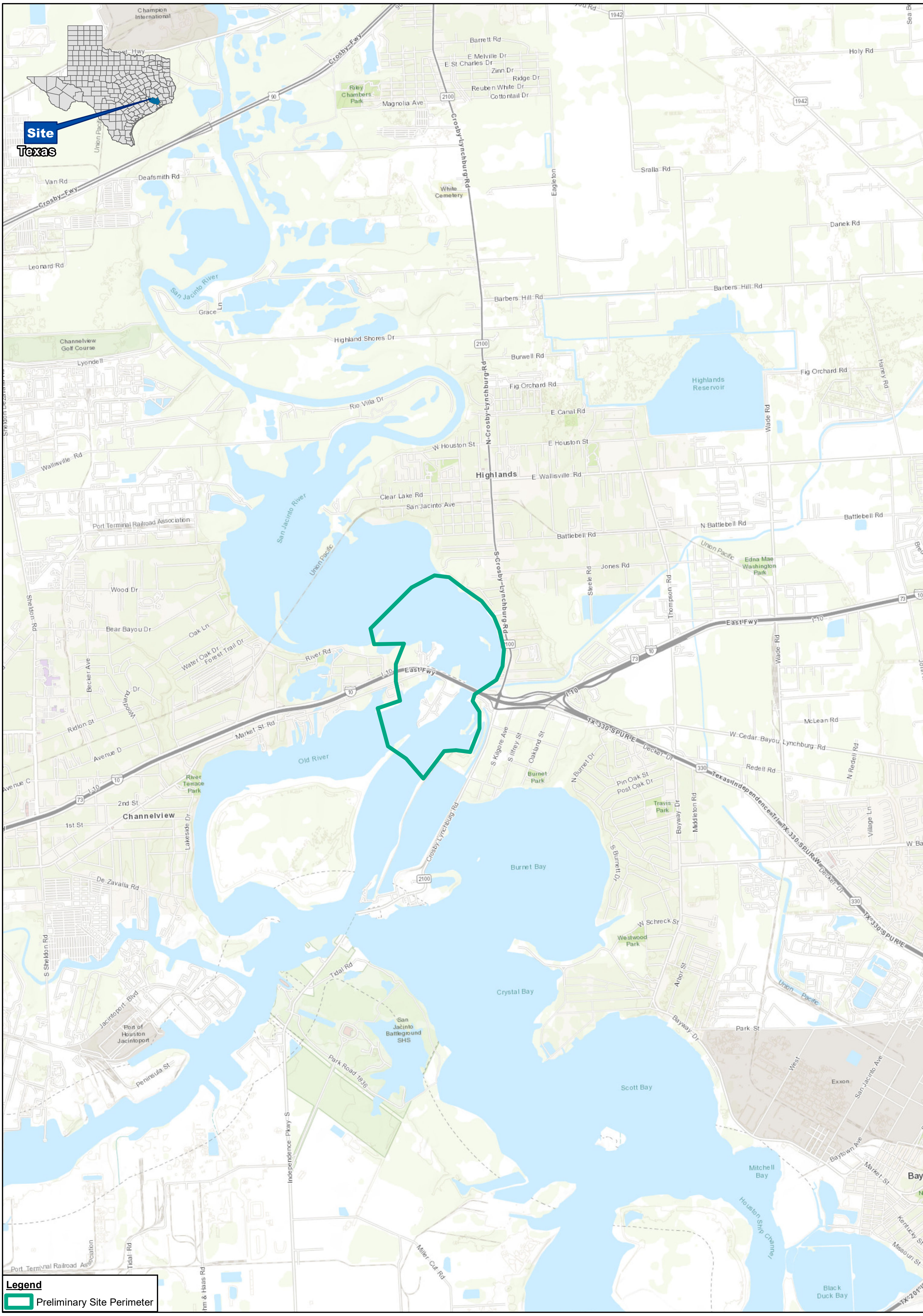

Source: ESRI World Topographic Maps.

0 0.5 1
Miles

Coordinate System:
NAD 1983 UTM Zone 14N

N

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

VICINITY MAP

11187072
May 26, 2020

FIGURE 1-1

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR001_Tabloid.mxd

Source: Image ©2020 Google, Imagery date: 10/28/2017

0 70 140
Feet

Coordinate System:
NAD 1983 StatePlane Texas South
Central FIPS 4204 Feet

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 19, 2020

NORTHERN IMPOUNDMENT AND SAND SEPARATION AREA

FIGURE 1-2

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR003.mxd

Source: Image ©2020 Google, Imagery date: 10/28/2017

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Feet

Coordinate System:
NAD 1983 StatePlane Texas South
Central FIPS 4204 Feet

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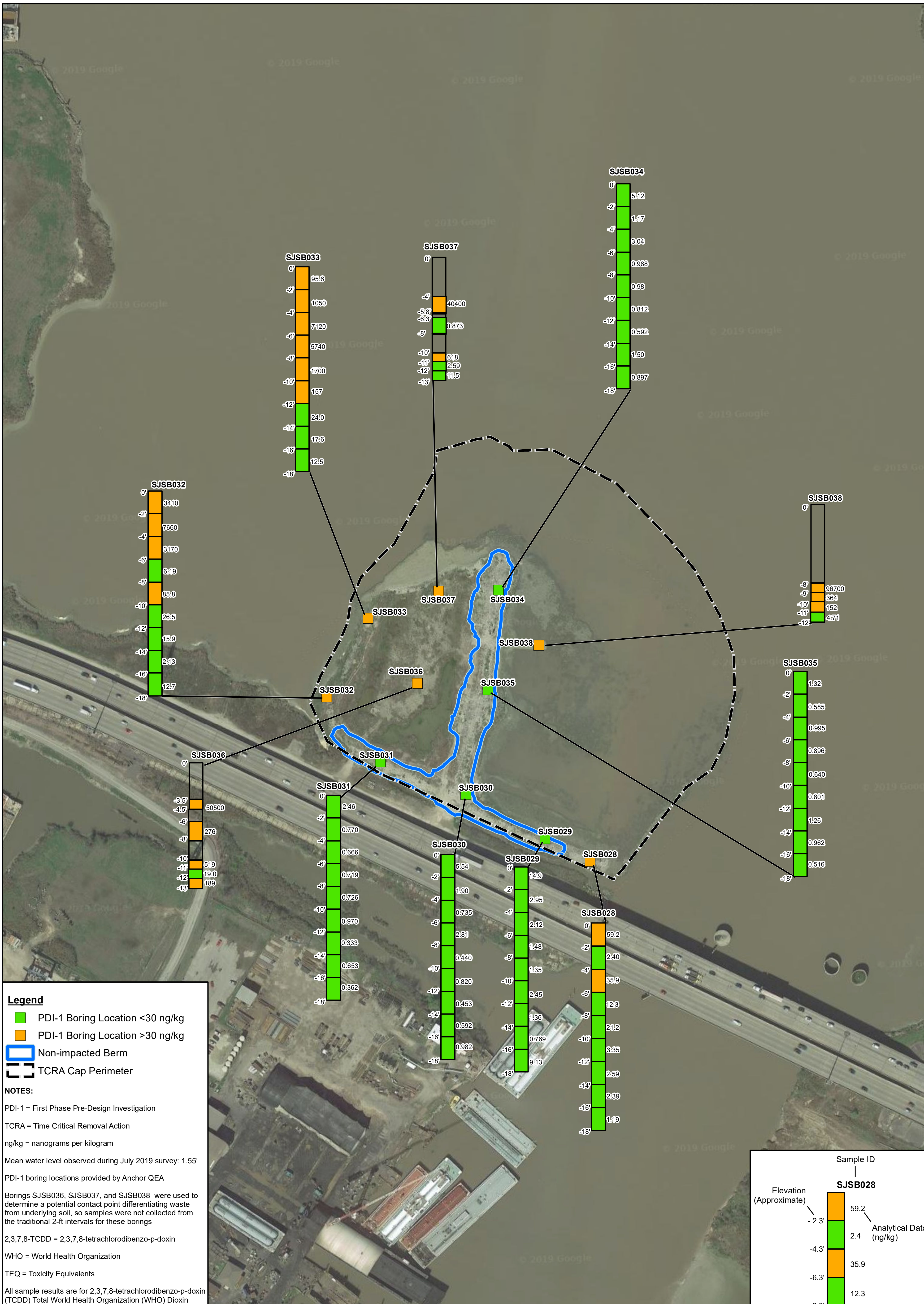
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

FIRST PHASE PRE-DESIGN INVESTIGATION BORING LOCATIONS

11187072
May 8, 2020

FIGURE 2-1

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR004.mxd



Source: Image ©2020 Google, Imagery date: 10/28/2017. Assumed limits of the TCRA cap. Extracted from 0557-RP001 (Buoy Anchors).dwg file received from the Anchor QEA April 2019.

0 50 100 150
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

FIRST PHASE PRE-DESIGN INVESTIGATION RESULTS

11187072
May 26, 2020

FIGURE 2-2

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR005_Shrink.mxd

Source: Image ©2020 Google, Imagery date: 10/28/2017

0 70 140
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

N

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

SECOND PHASE PRE-DESIGN INVESTIGATION
BORING LOCATIONS

11187072
May 12, 2020

FIGURE 2-3

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR006.mxd

Source: Image ©2020 Google, Imagery date: 10/28/2017. Assumed limits of the TCRA cap. Extracted from 0557-RP001 (Buoy Anchors).dwg file received from the Anchor QEA April 2019.

0 125 250
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

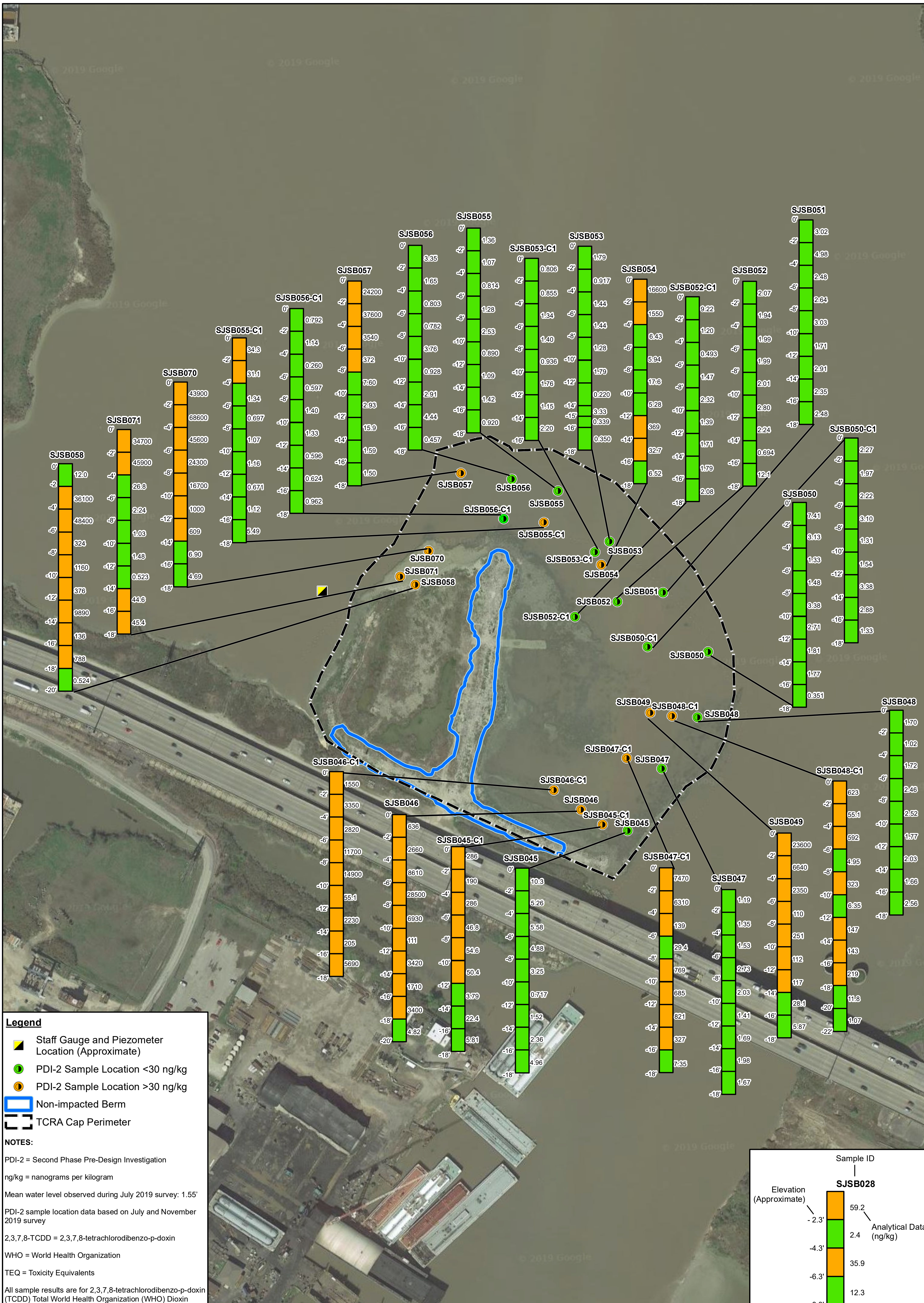
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 26, 2020

SAND SEPARATION AREA SAMPLE LOCATIONS

FIGURE 2-4

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR008.mxd



Source: Image ©2020 Google, Imagery date: 10/28/2017. Assumed limits of the TCRA cap. Extracted from 0557-RP001 (Buoy Anchors).dwg file received from the Anchor QEA April 2019.

0 50 100 150
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

GHD

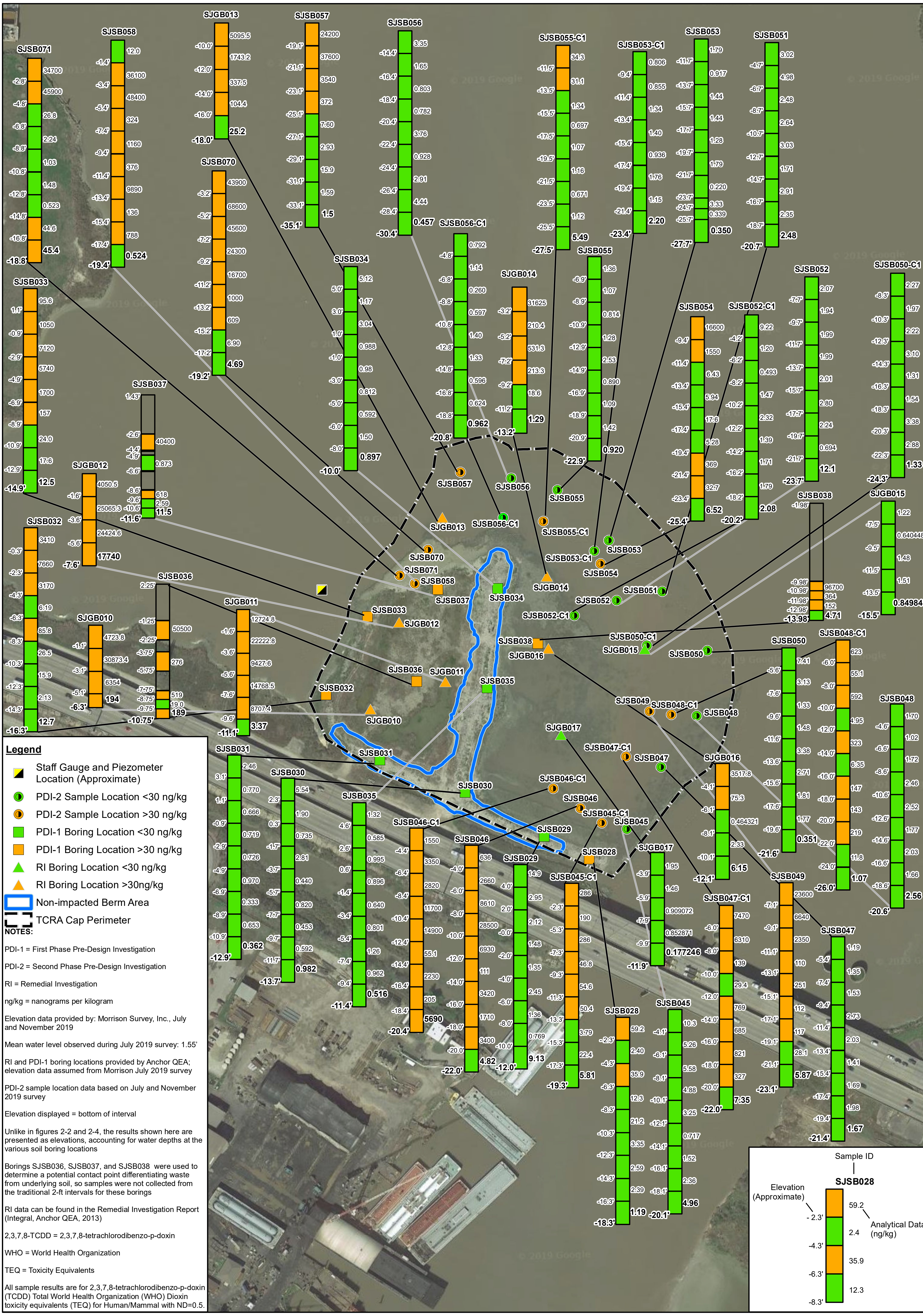
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 26, 2020

SECOND PHASE PRE-DESIGN INVESTIGATION RESULTS

FIGURE 2-5

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR007_shrink.mxd



Source: Image ©2020 Google, Imagery date: 10/28/2017. Assumed limits of the TCRA cap. Extracted from 0557-RP001 (Buoy Anchors).dwg file received from the Anchor QEA April 2019.

0 50 100 150
Feet
Coordinate System: NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 26, 2020

RI, PDI-1, AND PDI-2 RESULTS

FIGURE 2-6

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR009_shrink.mxd

Source: Image ©2020 Google, Imagery date: 10/28/2017

0 75 150
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

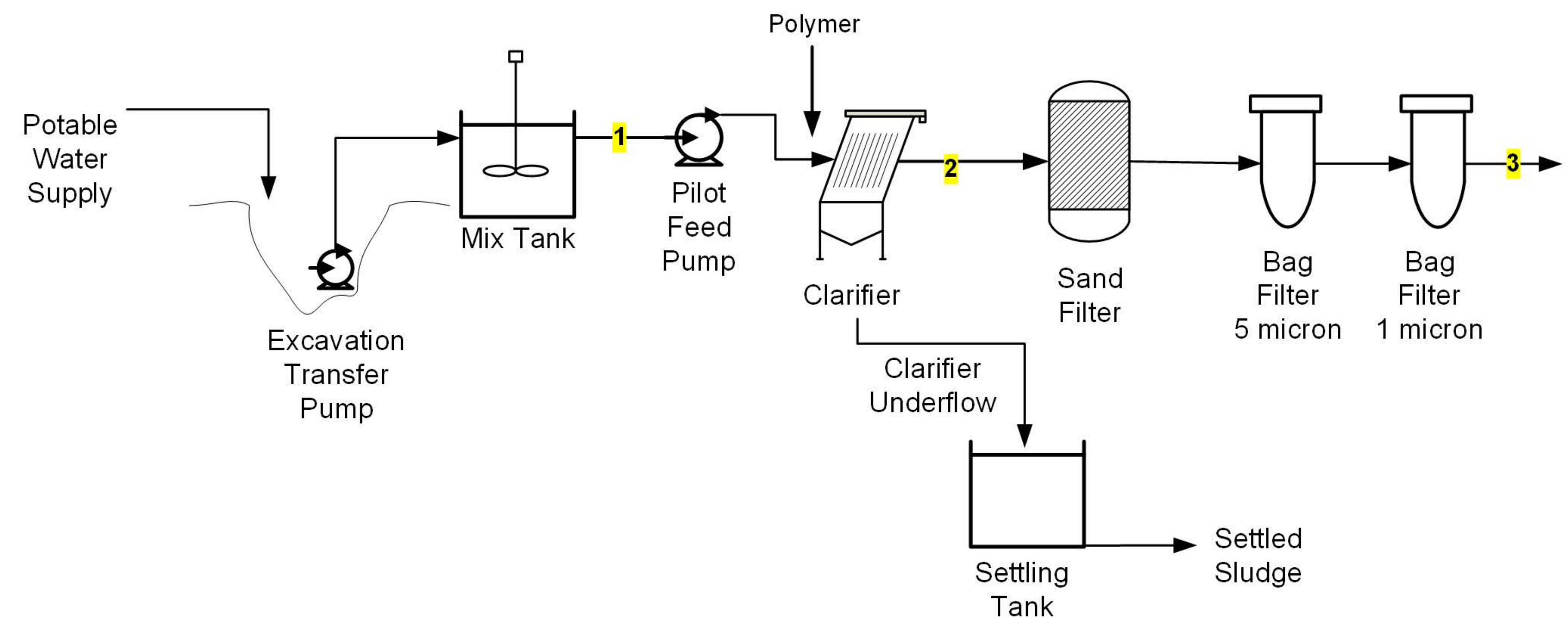
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

TREATABILITY WASTE MATERIAL SAMPLE LOCATIONS

11187072
May 13, 2020

FIGURE 3-1

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR010.mxd



Parameter		Sample Point		
		1	2	3
		Contact Water (average)[2]	Clarifier Effluent[2]	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 C.

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

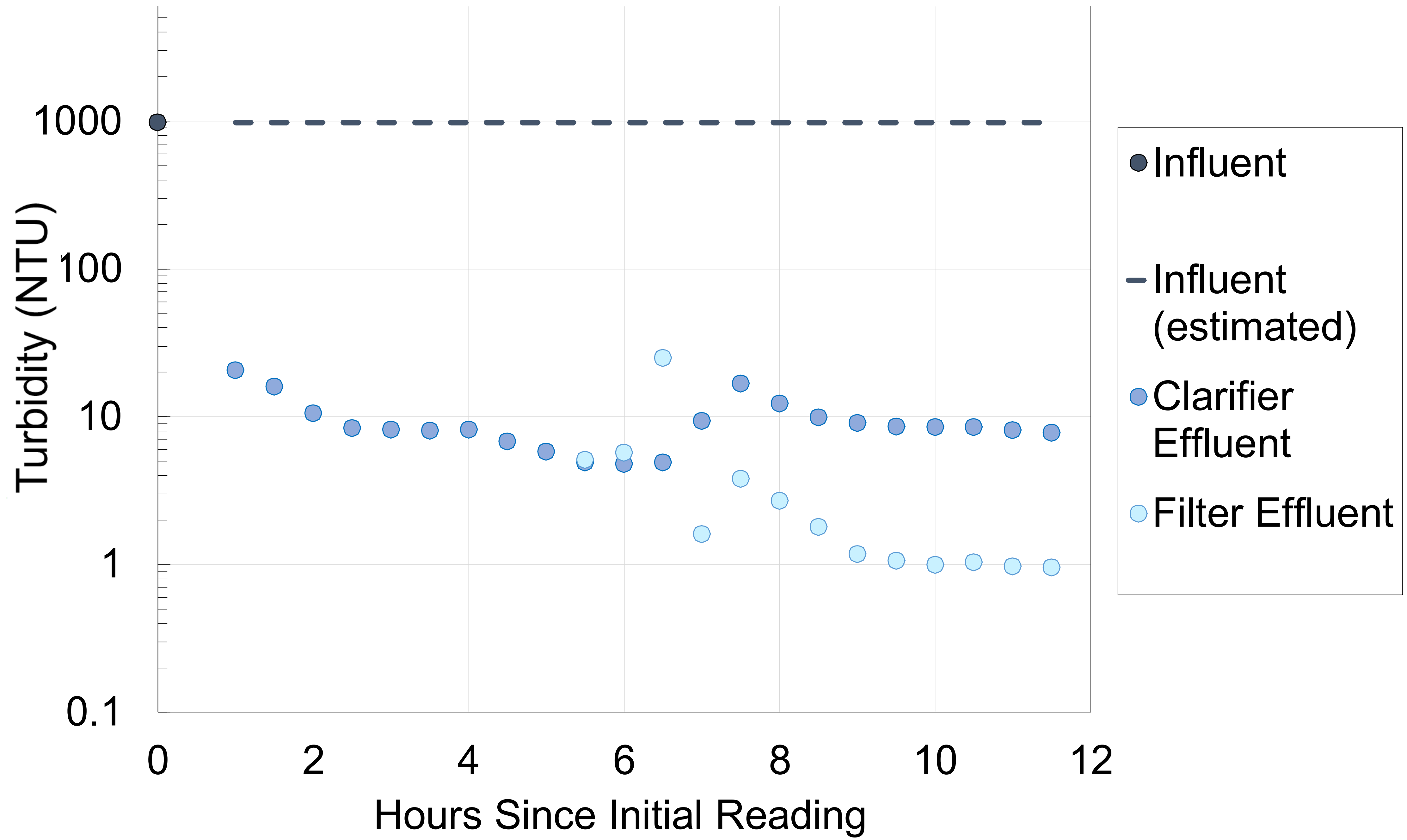
11187072
May 20, 2020

PILOT TEST PROCESS FLOW DIAGRAM

FIGURE 3-2

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.



SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 11, 2020

PILOT TEST EFFLUENT TURBIDITY

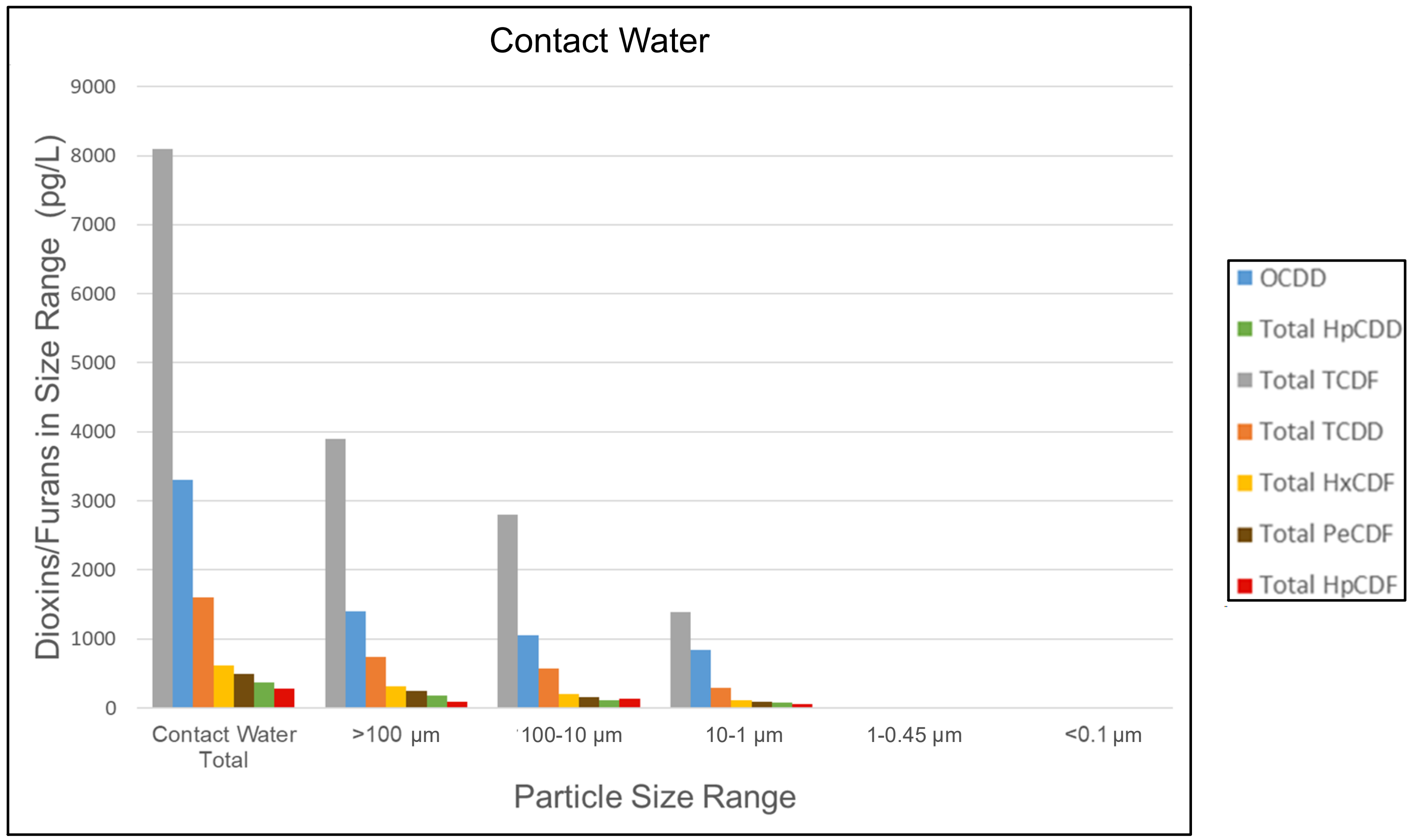
FIGURE 3-3

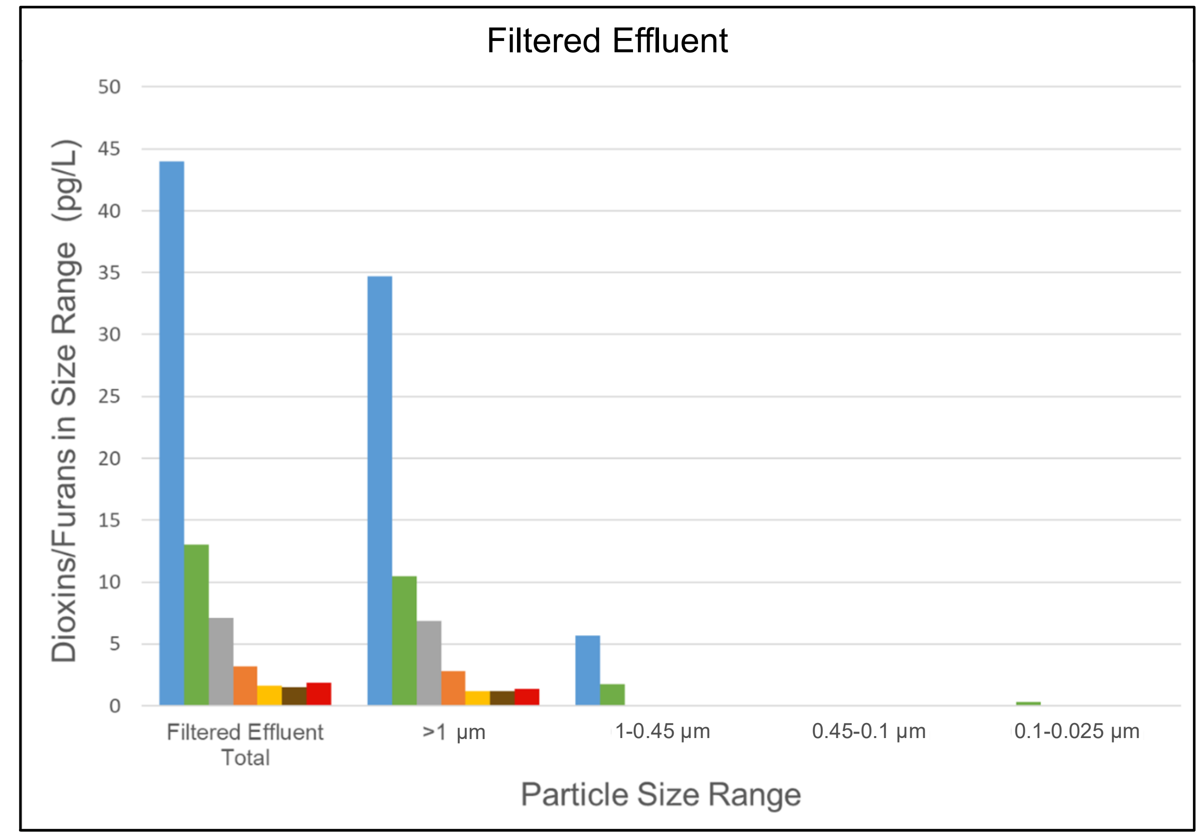
GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR013.mxd

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, and 0.025 µm filters.





SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 25, 2020

FILTRATION TESTING RESULTS

FIGURE 3-4

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR012.mxd

Notes:
1. Sample locations approximate.
2. Composite samples were collected from representative locations distributed across each area.
TCRA = Time Critical Removal Action

Legend
- Approximate Armored Cap Material Sample Locations
- Western Composite
- Berm Composite
- Eastern Composite
- Non-impacted Berm Area
- Approximate Area for Armored Cap Reuse
- TCRA Cap Perimeter

Source: Image ©2020 Google, Imagery date: 10/28/2017

0 70 140
Feet

Coordinate System:
NAD 1983 StatePlane Texas South Central FIPS 4204 Feet

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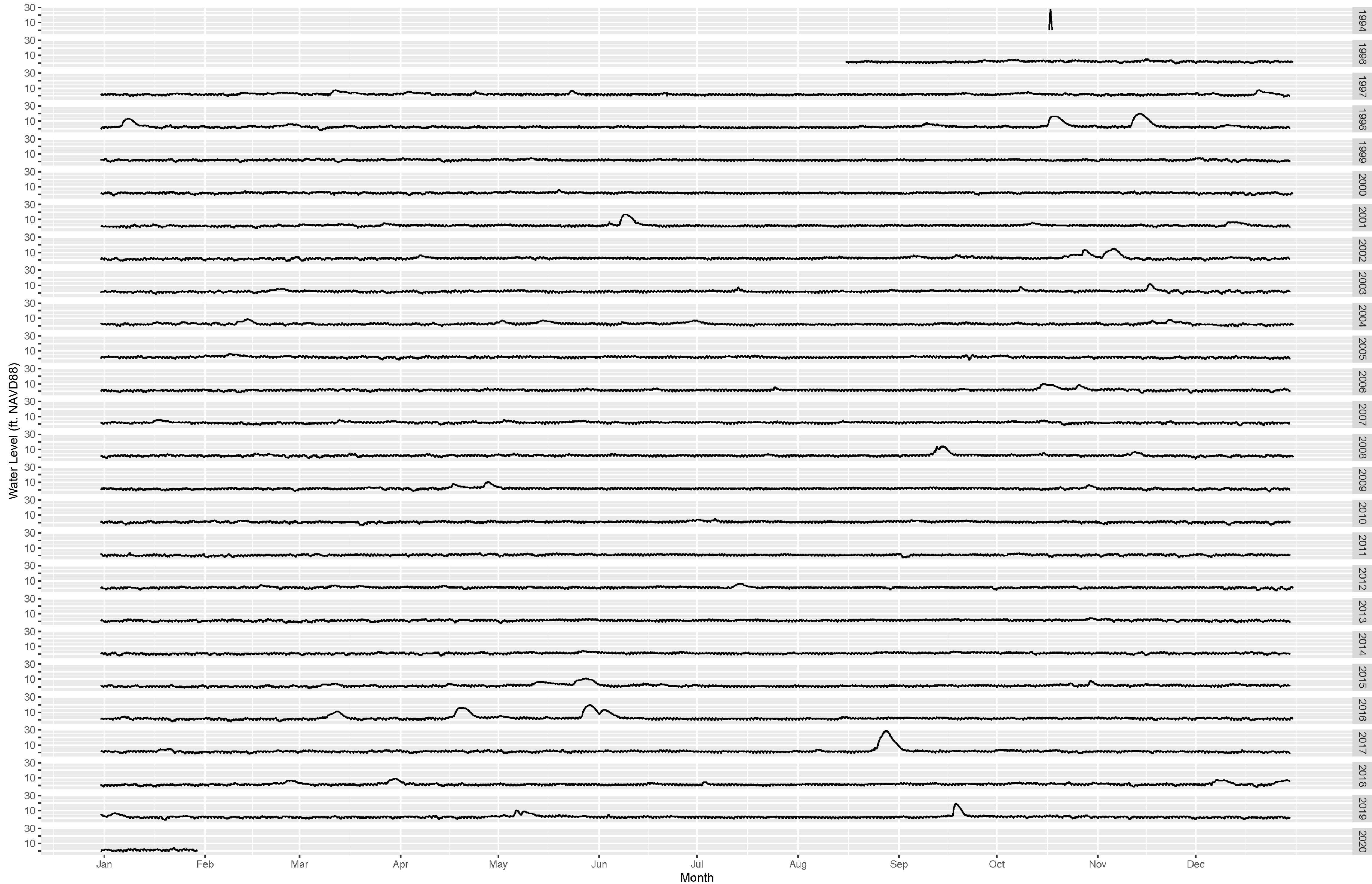
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 8, 2020

ARMORED CAP MATERIAL SAMPLE LOCATIONS

FIGURE 3-5

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR014.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

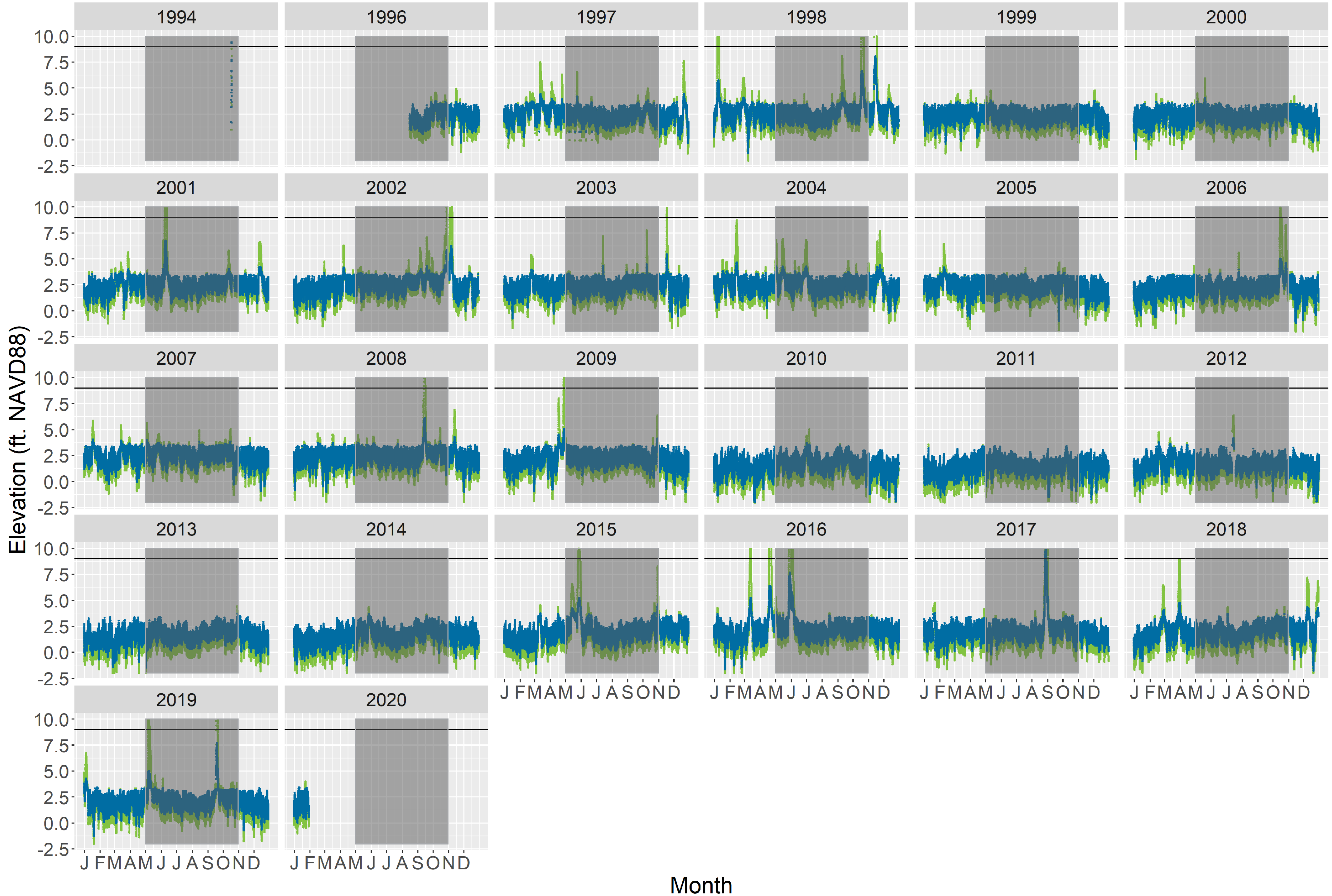
GHD

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

HISTORICAL RIVER ELEVATIONS - SHELDON GAGE

11187072
May 21, 2020

FIGURE 5-1



Legend

- Top of BMP
- Northern Impoundment Water Surface (Hindcasted)
- Sheldon Gage Water Surface (Measured)
- Non-Excavation Season (November through April)

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)"

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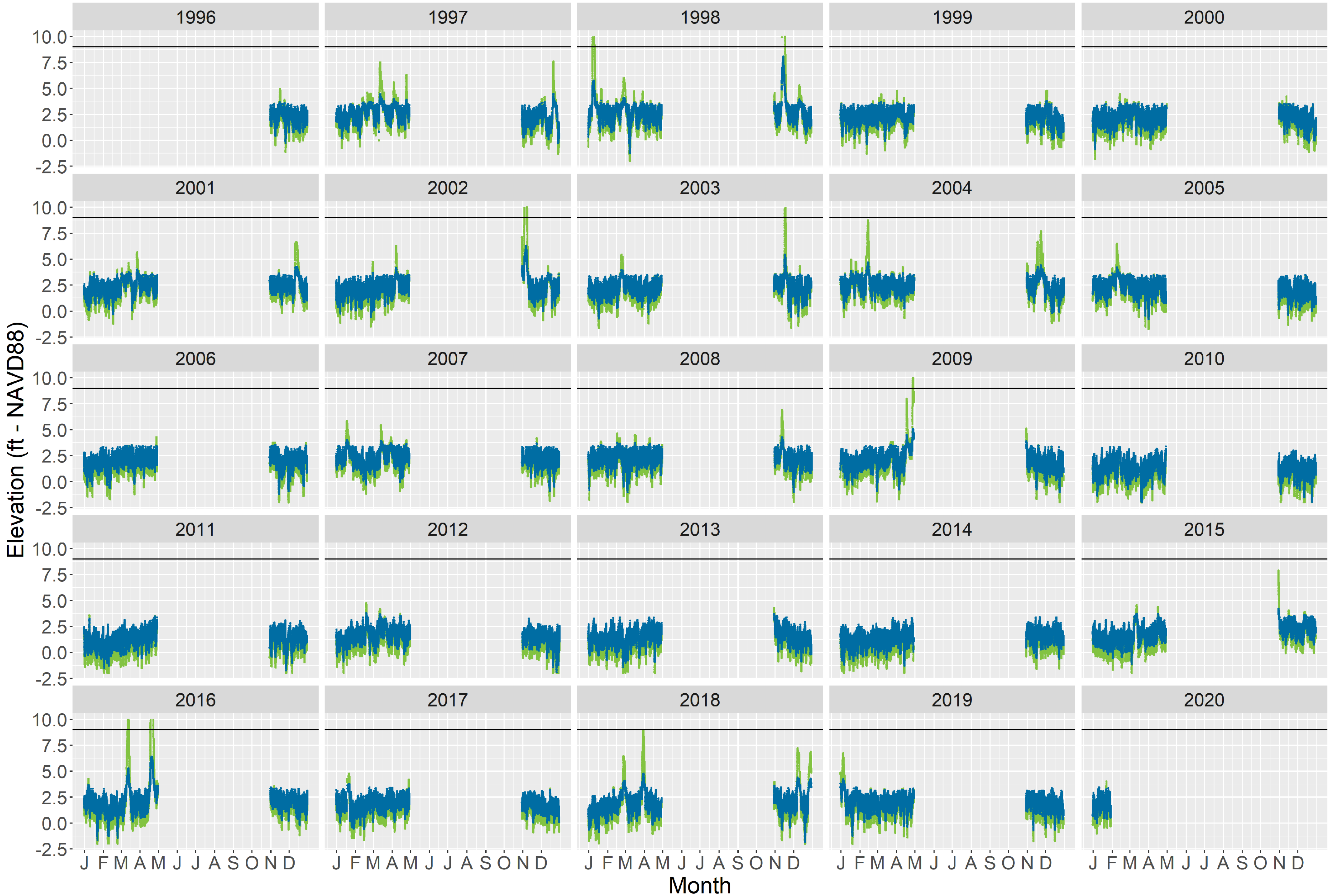
SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

11187072
May 21, 2020

HINDCASTED WATER SURFACE ELEVATIONS - YEAR ROUND

FIGURE 5-2

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR016.mxd



Legend

- Top of BMP
- 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)"

SAN JACINTO RIVER WASTE PITS SITE
HARRIS COUNTY, TEXAS
PRELIMINARY 30% REMEDIAL DESIGN - NORTHERN IMPOUNDMENT

HINDCASTED WATER SURFACE ELEVATIONS - NOVEMBER TO APRIL

11187072
May 25, 2020

FIGURE 5-3

GIS File: I:\GIS\GIS\Projects\11180000s\11187072\Layouts\REPORT_013\11187072-00(REPORT_013)GIS-BR017.mxd

Table 2-1

First Phase Pre-Design Investigation Analytical Results - Northern Impoundment
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area: Sample Location: Sample Identification: Sample Date: Sample Type: Sample Depth: Integral Sample ID:	Units	Northern Impoundment - Waste Pits SJSB034 SL0522 11/10/2018 (6-8) ft BGS SJSB034-C4	Northern Impoundment - Waste Pits SJSB034 SL0523 11/10/2018 (8-10) ft BGS SJSB034-C5	Northern Impoundment - Waste Pits SJSB034 SL0524 11/10/2018 (10-12) ft BGS SJSB034-C6	Northern Impoundment - Waste Pits SJSB034 SL0525 11/10/2018 (12-14) ft BGS SJSB034-C7	Northern Impoundment - Waste Pits SJSB034 SL0526 11/10/2018 (14-16) ft BGS SJSB034-C8	Northern Impoundment - Waste Pits SJSB034 SL0527 11/10/2018 (16-18) ft BGS SJSB034-C9	Northern Impoundment - Waste Pits SJSB035 SL0528 11/11/2018 (0-2) ft BGS SJSB035-C1	Northern Impoundment - Waste Pits SJSB035 SL0529 11/11/2018 (2-4) ft BGS SJSB035-C2	Northern Impoundment - Waste Pits SJSB035 SL0530 11/11/2018 (4-6) ft BGS SJSB035-C3	Northern Impoundment - Waste Pits SJSB035 SL0531 11/11/2018 (6-8) ft BGS SJSB035-C4	Northern Impoundment - Waste Pits SJSB035 SL0532 11/11/2018 (8-10) ft BGS SJSB035-C5	Northern Impoundment - Waste Pits SJSB035 SL0533 11/11/2018 (10-12) ft BGS SJSB035-C6	Northern Impoundment - Waste Pits SJSB035 SL0534 11/11/2018 (12-14) ft BGS SJSB035-C7	Northern Impoundment - Waste Pits SJSB035 SL0537 11/11/2018 Duplicate (12-14) ft BGS SJSB035-C10	Northern Impoundment - Waste Pits SJSB035 SL0535 11/11/2018 (14-16) ft BGS 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB045	SJSB045	SJSB045	SJSB045	SJSB045	SJSB045	SJSB045
Sample Identification:		11187072-090719-SS-SJSB045-S- (8-10)	11187072-090719-SS-SJSB045-S- (10-12)	11187072-090719-SS-SJSB045-S- (12-14)	11187072-090719-SS-SJSB045-S- (14-16)	11187072-090719-SS-SJSB045-S- (16-18)	11187072-091119-SS-SJSB045-S (0-2)	11187072-091119-SS-DUP-2
Sample Date:	Units	9/7/2019	9/7/2019	9/7/2019	9/7/2019	9/7/2019	9/11/2019	9/11/2019
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
Sample Type:								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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB045	SJSB045	SJSB045	SJSB045	SJSB045-C1	SJSB045-C1	SJSB045-C1
Sample Identification:		11187072-091119-SS-SJSB045-S (2-4)	11187072-091119-SS-SJSB045-S (4-6)	11187072-091119-SS-DUP-3	11187072-091119-SS-SJSB045-S (6-8)	11187072-11719-KW-SJSB045-C1-S (0-2)	11187072-11719-KW-SJSB045-C1-S (2-4)	11187072-11719-KW-SJSB045-C1-S (4-6)
Sample Date:	Units	9/11/2019	9/11/2019	9/11/2019	9/11/2019	11/9/2019	11/9/2019	11/9/2019
Sample Depth:		(2-4) ft BGS	(4-6) ft BGS	(6-8) ft BGS	(6-8) 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	0.29 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047	SJSB047
Sample Identification:		11187072-100919-SS-SJSB047(8-10)	11187072-100919-SS-SJSB047(10-12)	11187072-100919-SS-SJSB047(12-14)	11187072-100919-SS-SJSB047(14-16)	11187072-100919-SS-SJSB047(16-18)	11187072-101019-SS-SJSB047(0-2)	11187072-101019-SS-SJSB047(2-4)
Sample Date:		10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/9/2019	10/10/2019	10/10/2019
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
Sample Type:								
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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB047-C1	SJSB048	SJSB048	SJSB048
Sample Identification:		11187072-101719-SS-SJSB047-C1-(10-12)	11187072-101719-SS-SJSB047-C1-(12-14)	11187072-101719-SS-SJSB047-C1-(14-16)	11187072-101719-SS-SJSB047-C1-(16-18)	11187072-090819-SS-SJSB048-S- (0-2)	11187072-090819-SS-SJSB048-S- (2-4)	11187072-090819-SS-SJSB048-S- (4-6)
Sample Date:	Units	10/17/2019	10/17/2019	10/17/2019	10/17/2019	9/8/2019	9/8/2019	9/8/2019
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
Sample Type:								
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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB048	SJSB048	SJSB048	SJSB048	SJSB048	SJSB048	SJSB048-C1
Sample Identification:		11187072-090819-SS-SJSB048-S- (6-8)	11187072-090819-SS-SJSB048-S- (8-10)	11187072-090819-SS-SJSB048-S- (10-12)	11187072-090819-SS-SJSB048-S- (12-14)	11187072-090819-SS-SJSB048-S- (14-16)	11187072-090819-SS-SJSB048-S- (16-18)	11187072-11719-KW-SJSB048-C1-S (0-2)
Sample Date:	Units	9/8/2019	9/8/2019	9/8/2019	9/8/2019	9/8/2019	9/8/2019	11/7/2019
Sample Depth:		(6-8) ft BGS	(8-10) ft BGS	(10-12) ft BGS	(12-14) ft BGS	(14-16) ft BGS	(106-18) ft BGS	(0-2) ft BGS
Sample Type:								
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.
J - Estimated concentration.
UJ - Not detected; associated reporting limit is estimated.

Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB048-C1	SJSB048-C1	SJSB048-C1	SJSB048-C1	SJSB049	SJSB049	SJSB049
Sample Identification:		11187072-11719-KW-SJSB048-C1-S (14-16)	11187072-11719-KW-SJSB048-C1-S (16-18)	1187072-120519-SS-SJSB048-C1(18-20)	1187072-120519-SS-DUP-1	11187072-091119-SS-SJSB049-S (0-2)	11187072-091119-SS-SJSB049-S (2-4)	11187072-091119-SS-SJSB049-S (4-6)
Sample Date:	Units	11/7/2019	11/7/2019	12/5/2019	12/5/2019	9/11/2019	9/11/2019	9/11/2019
Sample Depth:		(14-16) ft BGS	(16-18) ft BGS	(18-20) ft BGS	(20-22) 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	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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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 U	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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		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:	Units	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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:	Units	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051	SJSB051
Sample Identification:		11187072-091019-SS-SJSB051-S (4-6)	11187072-091019-SS-SJSB051-S (6-8)	11187072-091019-SS-SJSB051-S (8-10)	11187072-091019-SS-SJSB051-S (10-12)	11187072-091019-SS-SJSB051-S (12-14)	11187072-091019-SS-SJSB051-S (14-16)	11187072-091019-SS-DUP-1
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:		(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
Sample Type:								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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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 11187072-111019-KW-SJSB053-S(14-16) 11/10/2019 (14-16) ft BGS	SJSB053 11187072-111019-KW-SJSB053-S(16-18) 11/10/2019 (16-18) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (0-2) 11/9/2019 (0-2) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (2-4) 11/9/2019 (2-4) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (4-6) 11/9/2019 (4-6) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (6-8) 11/9/2019 (6-8) ft BGS
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
Preliminary 30% 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-C1 11187072-110919-KW-SJSB053-C1-S (8-10) 11/9/2019 (8-10) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (10-12) 11/9/2019 (10-12) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (12-14) 11/9/2019 (12-14) ft BGS	SJSB053-C1 11187072-110919-KW-SJSB053-C1-S (14-16) 11/9/2019 (14-16) ft BGS	SJSB054 11187072-101319-SS-SJSB054 (0-2) 10/13/2019 (0-2) ft BGS	SJSB054 11187072-101319-SS-SJSB054 (2-4) 10/13/2019 (2-4) ft BGS	SJSB054 11187072-101319-SS-SJSB054 (4-6) 10/13/2019 (4-6) ft BGS
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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		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:	Units	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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location:		SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055	SJSB055
Sample Identification:		11187072-091019-SS-SJSB055-S (16-18)	11187072-101419-SS-SJSB055 C1 (0-2)	11187072-101419-SS-SJSB055 C1 (2-4)	11187072-101419-SS-SJSB055 C1 (4-6)	11187072-101419-SS-SJSB055 C1 (6-8)	11187072-101419-SS-SJSB055 C1 (8-10)	11187072-101419-SS-SJSB055 C1 (10-12)
Sample Date:	Units	9/10/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019	10/14/2019
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	0.60 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
Preliminary 30% 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
Preliminary 30% 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 11187072-111119-SS-SJSB056 (8-10) 11/11/2019 (8-10) ft BGS	SJSB056 11187072-111119-SS-SJSB056 (10-12) 11/11/2019 (10-12) ft BGS	SJSB056 11187072-111119-SS-SJSB056 (12-14) 11/11/2019 (12-14) ft BGS	SJSB056 11187072-111119-SS-SJSB056 (14-16) 11/11/2019 (14-16) ft BGS	SJSB056 11187072-111119-SS-SJSB056 (16-18) 11/11/2019 (16-18) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(0-2) 12/3/2019 (0-0) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(2-4) 12/3/2019 (2-4) ft BGS
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
Preliminary 30% 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(4-6) 12/3/2019 (4-6) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(6-8) 12/3/2019 (6-8) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(8-10) 12/3/2019 (8-10) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(10-12) 12/3/2019 (10-12) ft BGS	SJSB056-C1 11187072-120319-SS-SJSB056-C1(12-14) 12/3/2019 (12-14) ft BGS	SJSB056-C1 11187072-120319-SS-DUP-1 12/3/2019 (14-16) ft BGS Duplicate	SJSB056-C1 11187072-120319-SS-SJSB056-C1(14-16) 12/3/2019 (14-16) ft BGS
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.
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Table 2-3

Second Phase Pre-Design Investigation Analytical Results
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Sample Location: / Sample Identification: / Sample Date: / Sample Depth: / Sample Type:	Units	SJSB058 / 11187072-101419-BN-SJSB058-S (8-10) / 10/14/2019 / (8-10) ft BGS	SJSB058 / 11187072-101419-BN-SJSB058-S (10-12) / 10/14/2019 / (10-12) ft BGS	SJSB058 / 11187072-101419-BN-SJSB058-S (12-14) / 10/14/2019 / (12-14) ft BGS	SJSB058 / 11187072-101419-BN-SJSB058-S (14-16) / 10/14/2019 / (14-16) ft BGS	SJSB058 / 11187072-101419-BN-SJSB058-S (16-18) / 10/14/2019 / (16-18) ft BGS	SJSB058 / 11187072-111219-SS-SJSB058 (18-20) / 11/12/2019 / (18-20) ft BGS	SJSB070 / 11187072-111219-SS-SJSB070 (0-2) / 11/12/2019 / (0-2) ft BGS
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
Preliminary 30% 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
Preliminary 30% 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
Preliminary 30% 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 3-1

Treatability Waste Material Characterization Results
Northern Impoundment
Preliminary 30% 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

Treatability Waste Material Characterization Results
Northern Impoundment
Preliminary 30% 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

Treatability Waste Material Characterization Results
Northern Impoundment
Preliminary 30% 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

Pilot Test Effluent Characterization Results
Northern Impoundment
Preliminary 30% 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

Pilot Test Effluent Characterization Results
Northern Impoundment
Preliminary 30% 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

Pilot Test Effluent Characterization Results
Northern Impoundment
Preliminary 30% 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

Pilot Test Effluent Characterization Results
Northern Impoundment
Preliminary 30% 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 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

Bench-Scale Contact Water Filtration Results
Northern Impoundment
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Area:	Units	Non-homogenized contact water - effluent from 100 µm filter	Non-homogenized contact water - effluent from 10 µm filter	Non-homogenized contact water - effluent from 1 µm filter	Non-homogenized contact water - effluent from 0.45 µm filter	Non-homogenized contact water - effluent from 0.1 µm filter
Sample Location:		Filter Test	Filter Test	Filter Test	Filter Test	Filter Test
Sample Identification:		11187072-Filter Test-1	11187072-Filter Test-3	11187072-Filter Test-4	11187072-Filter Test-5	11187072-Filter Test-6
Sample Date:		9/30/2019	9/30/2019	9/30/2019	9/30/2019	9/30/2019
Report Sample Delivery Group (SDG):		320-54852-1	320-54852-1	320-54852-1	320-54852-1	320-54852-1
Filter Size:		100 µm	10 µm	1 µm	0.45 µm	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

Focused Filtration Testing Results
Northern Impoundment
Preliminary 30% 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

Armored Cap Test Results
Northern Impoundment
Preliminary 30% 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	Elutriate From Armored Cap Material Berm 11187072-Berm-GW 1/29/2020 320-58170-1	Elutriate From Armored Cap Material Eastern 11187072-Eastern-GW 1/29/2020 320-58170-1	Elutriate From Armored Cap Material Western 11187072-Western-GW 1/29/2020 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

Armored Cap Test Results
Northern Impoundment
Preliminary 30% 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

Armored Cap Test Results
Northern Impoundment
Preliminary 30% 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

Applicable or Relevant and Appropriate Requirements (ARAR)
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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 developed 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 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 email (EPA, 2020), 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.*
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), unless a determination is made later in the design process to discharge to a POTW. The discharge location will be on-site, 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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Preliminary 30% Remedial Design - Northern Impoundment
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Harris County, Texas

Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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).	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. If a determination is made to discharge to a POTW, the off-site discharges to a POTW will need to comply with pretreatment effluent standards of the POTW and may require a pretreatment permit.
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 for projects that involve discharge of dredge fill or would impact waters of the U.S. or wetland. On-site activities would not require a federal permit but would require compliance with substantive state requirements. Handling of solids, sludge, or other pollutants removed in the course of treatment or control of wastewater will be disposed of in a manner such as to prevent any pollutants from entering waters of the state.
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.
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 Storm Water Pollution Prevention Plan (SWPPP) will be developed and implemented. Best management practices to control erosion will be in place before beginning, and during remediation activities. These controls may include straw bales, silt fencing and any other measures needed to minimize soil erosion.

Applicable or Relevant and Appropriate Requirements (ARAR)
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Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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 email (EPA, 2020), which states: *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.*
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. Best management practices to control erosion will be in place before beginning, and during remediation activities. These controls may include straw bales, silt fencing and any other measures needed to minimize soil erosion.
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. On-site activities would not require a federal or state permit but compliance with substantive state requirements. Handling of solids, sludge, or other pollutants removed in the course of treatment or control of wastewater will be disposed of in a manner such as to prevent any pollutants from entering waters of the state. Solid waste will be disposed off-site.

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Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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. The need for a permit will be discussed during subsequent phases of the RD with TCEQ and EPA.
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 investigation (PDI) for the remedial design (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.
Waste	Toxic Substances Control Act (TSCA)	15 USC §2601 et. seq.; 40 CFR 761.61 (c)	40 CFR 761.61 provides TSCA cleanup 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.
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.
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.

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Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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.
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.	The waste management activities for the Northern Impoundment would be required to comply with these regulations. Based on the results of the PDIs, 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.
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, it is not expected that the waste materials excavated from beneath the Northern Impoundment and transported off-site will be classified as hazardous material and these requirements will not apply to them.
Air	Clean Air Act (CAA)	42 U.S.C. §§7401 et seq.	Authorization of potential emissions of dust, VOCs, and/or HAP resulting from the excavation, solidification and stabilization of the soil in the Northern Impoundment.	Any air discharges must comply with the substantive technical requirements of the CAA. As the material handling and equipment details are determined during the design, emissions calculations will be performed to define any applicable requirements.
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. As the material handling and equipment details are determined during the design, emissions calculations will be performed to define the requirements.
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.	Section 10 of the Rivers and Harbors Act is applicable for construction of the BMP and the work will have to comply with the substantive technical requirements. Erosion/sediment control measures will be installed and maintained during remediation to minimize impacts.
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 according to the Texas Coastal Management Plan (TCMP) prepared by the General Land Office (GLO). The EPA is required to determine whether the Northern Impoundment remedial activities will be consistent with the state's CZMP.
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. Further evaluation during the RD is required to determine whether temporary alterations caused by construction of the BMP will increase the potential for flooding.

Applicable or Relevant and Appropriate Requirements (ARAR)
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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.	Further evaluation during the RD is required to determine whether the work on the river will cause a temporary increase in water levels associated with floods.
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 work on the Northern Impoundment is within a floodplain and further evaluation during the RD is required to determine whether project will cause adverse impacts to the floodplain during the RA and afterwards (if it is necessary to leave structures in the river). The project will be designed to minimize short or long-term adverse impacts to any wetlands areas outside of the removal activities, such as areas where roads and staging/laydown areas will be constructed.
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 activities will occur within the footprint of the Northern Impoundment, and therefore will not impact critical areas.
Dredging/Floodplain	Texas Coastal Management Plan (CMP) Consistency	31 TAC, §506.12	Specifies federal actions within the CMP boundary that may adversely affect CNRAs, specifically, selection of remedial actions.	The San Jacinto River lies within the Coastal Zone Boundary (GLO TCMP). This regulation requires that the action be evaluated for consistency with the TCMP goals and priorities.
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 would have to be coordinated with the State.
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 1/6/2017, 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% 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.

Applicable or Relevant and Appropriate Requirements (ARAR)
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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.	Based on a 2010 evaluation, as well as a desktop review of photographs and U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) species and habitat maps performed during the RI/FS, no federally listed threatened or endangered (T&E) species or their critical habitat are present on the Northern Impoundment or utilize areas in the vicinity of the Northern Impoundment.
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.
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.
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.
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.	Based on a 2010 evaluation, as well as a desktop review of photographs and USFWS and NMFS species and habitat maps performed during the RI, no state listed T&E species or their critical habitat are present on the Northern Impoundment or utilize areas in the vicinity of the Northern Impoundment.
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 Remedial Investigation/Feasibility Study (RI/FS) cultural resources assessment, “no NRHP-eligible properties are documented in the area of concern. Because of the extensive disturbance to the Site and minimal ground disturbance that will likely occur for the project, it is not likely that NRHP eligible historic properties will be affected by RI/FS or eventual Site remediation activities” (Anchor, QEA, 2009). This requirement is therefore not applicable.
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.	Assessment of historical resources during the RI/FS produced no known eligible properties and determined that disturbance of any archaeological or historic resources is unlikely within the Northern Impoundment. This requirement is therefore not expected to be applicable.

Applicable or Relevant and Appropriate Requirements (ARAR)
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Media/Topic	Status, Regulations, Standards, or Requirements	Citations or References	Description	Comment
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 requirement is therefore not expected to be applicable.
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.
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. An offense under this section is a Class C misdemeanor. Most activities are likely to not exceed the 85 decibel level beyond the immediate work area. With the exception of pile driving, 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. Noise impacts from pile driving will need to be assessed as the design is developed.

Table 5-1

Water Treatment Basis of Sizing - Approach A
Northern Impoundment
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Equipment/Process Description	Sizing/Selection Criteria Assumptions	Preliminary Design Value	Notes
Remediation Cell Dewatering Pump	To be determined.	Accommodate Flows up to 600 GPM	Trash pump.
Contact water holding tank	To be determined.	To be determined.	This holding space (type to be determined) will accommodate contact water/return stream equalization.
Treatment Feed Pump	300 GPM base treatment flow	Up to 500 GPM to accommodate return streams	Pump will operate on VFD to adjust treatment rate, as required.
Rapid Mix Tank	Approximate retention time: 30 seconds	400 gallon capacity	Tank will include baffles to prevent vortexing. Tank will be mixed by top entry mixer with paddle-type blades to prevent shearing solids.
Flocculation Tank	Nominal retention time: 20 minutes	15,500 gallon capacity	Tank will include baffles to prevent vortexing. Tank will be mixed by top entry mixer(s) with paddle-type blades to prevent shearing solids. Mixer shall be variable speed.
Inclined Plate Clarifier	Hydraulic Loading rate: 0.25 GPM/ft^2	200 ft^2 of inclined plate separation area	Clarifier shall include integral sludge hopper to allow for chemical sludge withdrawal.
Filter Feed Tank	Nominal retention time of 20 minutes	6,000 gallon capacity	Tank will include baffles to prevent vortexing. Tank will be mixed by top entry mixer(s) with paddle-type blades to prevent shearing solids.
Filter Feed Pump	300 GPM base treatment flow	Up to 400 GPM	Pump will be positive displacement type and will operate on VFD
Multimedia Filters	5-15 GPM/ft^2 Hydraulic Loading	20- 60 ft^2 of active media filter area	Minimum two vessels configured in parallel; sand/anthracite media. The units shall be feed forward automatic backwashing filters.
Nominal Rated Filters	Nominally Rated Filters @ 10 micron	Nominally rated 10 micron bag filters	Bag Filters configured in multiple bag pressure vessels.
Nominal Rated Filters	Nominally Rated Filters @ 1 micron	Nominally rated 1 micron bag filters	Bag Filters configured in multiple bag pressure vessels.
Absolute Rated Filters	Absolute rated @ 1 micron	Absolute rated 1 micron cartridge filters	Cartridge Filters configured in multiple cartridge pressure vessels.
Granular Activated Carbon	10 minute Empty Bed Contact Time (min) per stage 5 GPM/ft^2 Hydraulic Loading	400 ft^3 Bed Volume; 60 ft^2 of active bed area	GAC vessels will be configured in a lead-lag configuration providing a total contact time up to 20 minutes (total).
Treated Effluent Holding Tank	Sufficient volume for non-potable service water (10,000 US gallon minimum).	18,500 gallon holding tank	-
Treated Effluent Discharge Pumps	300 GPM base treatment flow	Up to 500 GPM to accommodate process fluctuations	Pump will operate on VFD to adjust discharge rate as required.
Gravity Sludge Thickener	16 lbs/ft^2 day solids Loading	900 ft^2 of thickener surface area	Thickener shall allow for decanting operation and removal of thickened sludge in a cone bottom tank.
Thickener Decant Return Pump	85% volume (liquid) removal in thickener	Up to 150 GPM Flow	Pump will operate on VFD to adjust decant return flow.
Thickened Sludge Wasting Pump	Assume 15% volume as Thickened sludge in Thickener	Up to 50 GPM	Thickened sludge pump will be positive displacement type; Pump will operate on VFD to adjust decant return flow.
Thickened Sludge Holding Tank	Sludge generated during 100-yr storm event	1000 gallons (minimum)	-
Coagulant Feed Pumps	Flow paced at dosage of 50 ppm coagulant solution	Up to 2 GPH	Variable speed chemical metering pumps.
Organosulfide Feed Pumps	Flow paced at dose of 50 ppm organosulfide solution	Up to 2 GPH	Variable speed chemical metering pumps.
Acid/Caustic Feed Pumps	Flow paced based on measured pH of contact water	Up to 2 GPH	Variable speed chemical metering pumps
Polymer Feed Pumps	Flow paced at dose of 500 ppm (neat polymer)	Up to 15 GPH (dilute polymer solution)	Variable speed chemical metering pumps; polymer activation/aging equipment will be provided as needed.

Notes:
The 30% process flow diagram (drawing P-01) and piping and instrumentation diagrams (drawings P-02 and P-03) illustrate the major water treatment system equipment and components.
GPM - Gallons per minute
VFD - Variable frequency drive
ft^2 - Square feet
ft^3 - Cubic feet
ppm - Parts per million
GPH - Gallons per hour

Table 5-2

Water Treatment Basis of Sizing - Approach B
Northern Impoundment
Preliminary 30% Remedial Design - Northern Impoundment
San Jacinto River Waste Pits Site
Harris County, Texas

Equipment/Process Description	Sizing/Selection Criteria Assumptions	Preliminary Design Value	Notes
Remediation Cell Dewatering Pump	Estimated volume of impacted water in each cell and time required to dewater cell	Accommodate Flows up to 2000 GPM	Trash pump
Mixed Holding Tanks	To be determined	To be determined	-
Treatment Feed Pump	2000 GPM base treatment flow	Two treatment trains will operate in parallel which the maximum flow for each train would be 1000 GPM	Pump will operate on VFD to adjust treatment rate as required. The minimum operation rate will be at 250 gpm for each treatment train
Mixing box	To provide enough retention time after chemical injection for floc formation (pH adjustment)	Type of mixing to be determined	The mixing box shall provide enough agitation for chemical mixing and floc formation and prevent breakdown of formed flocs
Dewatering boxes	To be determined by contractor	To provide dewatering rate of up to 2000 GPM	Multiple dewatering boxes will operate in parallel. Geotubes shall include multiple injection line for evenly distributing solids into geotubes
Filter Feed Pump	2000 GPM base treatment flow	1000 GPM for each treatment train	Pump will be positive displacement type and will operate on VFD
Multimedia Filters	5-15 GPM/ft^2 Hydraulic Loading	150-400 ft^2 of active media filter area (75-200 ft^2 in each treatment train)	Minimum two vessels configured in parallel; sand/anthracite media. The units shall be feed forward automatic backwashing filters
Dirty backwash holding tank	Based on backwash flux and backwash duration as recommended by water treatment contractor	18,500 gallon holding tank	-
Dirty backwash recirculation pump	To be determined by contractor	Will be determined (based on the number of media filters and its dimensions)	This pump shall have enough discharge head to be able to inject the dirty backwash water from the holding tank into the upfront of treatment train
Nominal Rated Filters	Nominally Rated Filters @ 10 micron	Nominally rated 10 micron bag filters	Bag Filters configured in multiple bag pressure vessels
Nominal Rated Filters	Nominally Rated Filters @ 1 micron	Nominally rated 1 micron bag filters	Bag Filters configured in multiple bag pressure vessels
Absolute Rated Filters	Absolute rated @ 1 micron	Absolute rated 1 micron cartridge filters	Cartridge Filters configured in multiple cartridge pressure vessels
Granular Activated Carbon	10 minute Empty Bed Contact Time (min) per stage 5 GPM/ft^2 Hydraulic Loading	20,000 ft^3 Bed Volume (10,000 ft^3 for each train); 400 ft^2 of active bed area (200 ft^2 in each train)	GAC vessels will be configured in a lead-lag configuration providing a total contact time up to 20 minutes (total)
Treated Effluent Holding Tank	Sufficient volume for non-potable service water (10,000 US gallon minimum).	18,500 gallon holding tank	This tank should be equipped with level sensors to control water level and keep enough water as needed for line flushing, chemical preparation, etc.
Treated Effluent Discharge Pumps	2000 GPM base treatment flow	1000 GPM for each treatment train	Pump will operate on VFD to adjust discharge rate, as required
Coagulant Feed Pumps	Flow paced at dosage of 50 ppm coagulant solution	Up to 6 GPH	Variable speed chemical metering pumps
Organosulfide Feed Pumps	Flow paced at dose of 50 ppm organosulfide solution	Up to 6 GPH	Variable speed chemical metering pumps
Acid/Caustic Feed Pumps	Flow paced based on measured pH of contact water	Up to 6 GPH	Variable speed chemical metering pumps
Polymer Feed Pumps	Flow paced at dose of 500 ppm (neat polymer)	Up to 60 GPH (dilute polymer solution)	Variable speed chemical metering pumps

Notes:
The 30% process flow diagram (drawing P-05) and piping and instrumentation diagrams (drawings P-06 and P-07) illustrate the major water treatment system equipment and components.
GPM - Gallons per minute
VFD - Variable frequency drive
ft^2 - Square feet
ft^3 - Cubic feet
ppm - Parts per million
GPH - Gallons per hour

Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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
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
Lead-210	pCi/g	--	0.713 +/-0.0564	--	--	--	0.694 +/-0.0588
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
Preliminary 30% 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 (15-17.5 CM) 12/7/2019 (15-17.5) cm	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
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	0.1845 U+/-0.09896	0.1497 U+/-0.08256	0.1376 U+/-0.08681	0.1214 U+/-0.07948	0.09617 U+/-0.07003
Lead-210	pCi/g	0.5 +/-0.0513	0.635 +/-0.0545	0.682 +/-0.0577	0.513 +/-0.059	0.538 +/-0.0583
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
Preliminary 30% 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 (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	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
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	0.09826 U+/-0.06292	0.1139 U+/-0.07255	0.1443 U+/-0.07964	0.1333 U+/-0.08375	0.1145 U+/-0.07314
Lead-210	pCi/g	0.599 +/-0.0532	0.465 +/-0.0503	0.456 +/-0.0478	0.399 U+/-0.0504	0.657 +/-0.0547
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
Preliminary 30% 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(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	--	--	--	--	0.114 U+/-0.06986	0.08665 U+/-0.05227
Lead-210	pCi/g	--	--	--	--	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
Preliminary 30% 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
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
Lead-210	pCi/g	0.28 +/-0.0495	0.226 +/-0.0474	0.245 +/-0.0566	0.342 +/-0.0461	0.326 +/-0.0472
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
Preliminary 30% 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 (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	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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	10 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	980
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	2.2 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	41
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.35 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	4.1 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.56 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.2 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.79 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.096 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	2.7 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.6 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.40 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.37 J
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	4.9 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	34
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	8.4
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	5.0 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	160 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	8.8 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	53 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	19 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	12 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	82 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	20 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	15.5
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	15.5
Radiochemistry						
Cesium-137	pCi/g	0.0845 U+/-0.0547	0.06443 U+/-0.03829	0.03835 U+/-0.02381	0.09548 U+/-0.05456	--
Lead-210	pCi/g	0.331 +/-0.0483	0.38 +/-0.0497	0.266 +/-0.0437	0.487 +/-0.0502	--
General Chemistry						
Percent solids	%	--	--	--	--	62.3

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
Preliminary 30% 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(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	5.5 U	1.6 U	120	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	810	700	2300	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.1 U	0.42 U	11	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	34	30	90	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 U	0.082 U	1.5 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.66 J	0.084 U	2.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.48 J	0.40 J	0.95 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.095 U	0.081 U	1.5 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.87 J	0.56 J	2.7 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.14 U	0.11 U	0.21 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.3 J	2.2 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.32 J	0.091 U	1.1 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.32 J	0.20 J	0.62 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.10 U	0.090 U	0.34 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.26 J	0.083 U	0.89 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	12	0.92 J	24	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	3.8	0.20 J	8.5	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	2.8 J	0.98 J	27 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	130 J	110 J	270 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	2.3 J	0.52 J	24 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	53 J	32 J	61 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	2.1 J	0.78 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	11 J	6.1 J	9.3 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	28 J	2.8 J	58 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	17 J	4.9 J	15 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.42	1.32	14.8	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.45	1.35	14.8	--	--
Radiochemistry						
Cesium-137	pCi/g	--	--	--	0.1187 U+/-0.07539	0.09875 U+/-0.06434
Lead-210	pCi/g	--	--	--	0.516 +/-0.0512	0.278 +/-0.0511
General Chemistry						
Percent solids	%	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
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J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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 (22.5-25 CM) 12/6/2019 (22.5-25) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (30-32.5 CM) 12/6/2019 (30-32.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (37.5-40 CM) 12/6/2019 (37.5-40) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (45-47.5 CM) 12/6/2019 (45-47.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (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	0.07308 U+/-0.04441	0.06646 U+/-0.043	0.08151 U+/-0.04759	0.0821 U+/-0.05179	0.094 U+/-0.05404
Lead-210	pCi/g	0.302 +/-0.0498	0.447 +/-0.0471	0.261 +/-0.0447	0.452 +/-0.0469	0.286 +/-0.0498
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
Preliminary 30% 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 (60-62.5 CM) 12/6/2019 (60-62.5) cm	Sand Separation Area SJSSA03 11187072-120619-SS-SJSSA03 (70-72.5 CM) 12/6/2019 (70-72.5) cm	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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	12 U
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	720
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	1.7 U
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	31
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.32 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	1.2 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.63 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.41 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.88 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.61 J
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	2.4 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	1.1 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.40 U
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.16 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.77 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	43
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	11
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	4.9 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	130 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	4.1 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	41 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	2.7 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	8.9 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	72 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	21 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	16.7
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	16.9
Radiochemistry						
Cesium-137	pCi/g	0.06385 U+/-0.0392	0.05209 U+/-0.0324	0.06432 U+/-0.04086	0.1421 U+/-0.08159	--
Lead-210	pCi/g	0.0695 U+/-0.0435	0.402 +/-0.0489	0.476 +/-0.055	1.11 +/-0.0613	--
General Chemistry						
Percent solids	%	--	--	--	--	41.6

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
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Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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(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	35 U	9.2 U	190	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2100	750	4700	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	4.2 J	1.0 U	20	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	57	31	180	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.56 U	0.36 U	2.2 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.8 J	0.78 J	5.6 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	0.63 J	1.9 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.2 J	0.33 J	2.6 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.5 J	0.99 J	4.4 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.31 U	0.16 U	0.39 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	2.3 J	2.5 J	5.7 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.6 J	0.70 J	3.9 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.71 U	0.40 U	0.88 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.31 U	0.16 U	0.92 J	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.0 J	0.60 J	2.1 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	50	29	110	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	13	7.7	31	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	12 J	2.5 J	65 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	220 J	120 J	610 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	6.4 J	1.1 J	29 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	40 J	39 J	96 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	5.4 J	2.1 J	16 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	5.3 J	7.7 J	13 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	89 J	52 J	180 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	19 J	16 J	39 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	20.4	11.9	49.2	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	20.8	12.1	49.3	--	--
Radiochemistry						
Cesium-137	pCi/g	--	--	--	0.0665 U+/-0.03796	0.04764 U+/-0.02799
Lead-210	pCi/g	--	--	--	1 +/-0.0639	0.93 +/-0.0592
General Chemistry						
Percent solids	%	50.8	46.1	42.6	--	--

Notes:
pg/g - picogram per gram
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Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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
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
Lead-210	pCi/g	0.889 +/-0.0681	1.05 +/-0.0586	0.638 +/-0.0505	0.607 +/-0.0531	0.832 +/-0.0595
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
Preliminary 30% 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 (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	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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	10 J	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	550	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	1.5 J	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	18	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.27 J	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	2.1 J	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.37 J	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.49 J	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.56 U	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.10 U	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	1.4 J	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	1.8 J	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.18 U	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.11 U	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	1.0 J	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	78	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	18	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	3.7 J	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	70 J	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	3.5 J	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	20 J	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	4.5 J	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	3.3 J	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	130 J	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	22 J	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	27.0	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	27.1	--
Radiochemistry						
Cesium-137	pCi/g	0.1293 U+/-0.07496	0.1496 U+/-0.08865	0.1537 U+/-0.08935	--	0.1064 U+/-0.06604
Lead-210	pCi/g	0.881 +/-0.0591	0.84 +/-0.052	0.749 +/-0.055	--	0.212 +/-0.052
General Chemistry						
Percent solids	%	--	--	--	64.1	--

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
Preliminary 30% 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 (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	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (15-17.5 CM) 12/8/2019 (15-17.5) cm
Dioxins/Furans							
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	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	190	140	380	160	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	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	8.0	7.2	15	6.6 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.23 J	0.39 J	0.066 U	0.071 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.26 J	0.21 J	0.28 J	0.13 U	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.36 J	0.31 J	0.45 J	0.29 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.090 U	0.12 U	0.12 U	0.14 U	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.29 U	0.41 U	0.38 U	0.31 U	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.31 J	0.20 J	0.17 J	0.18 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.71 J	0.76 J	1.1 J	0.54 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.33 J	0.24 J	0.38 J	0.27 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.13 U	0.16 U	0.20 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.071 U	0.094 U	0.088 U	0.11 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.094 U	0.10 U	0.086 U	0.13 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	6.0	2.9 J	9.9 J	4.5	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	1.5	0.76 J	2.7	1.3 J	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	1.4 J	1.9 J	1.8 J	1.0 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	29 J	25 J	65 J	24 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	0.57 J	0.41 J	0.45 J	0.18 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	11 J	12 J	28 J	10 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.33 J	0.24 J	0.85 J	0.27 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	2.4 J	3.3 J	7.6 J	3.0 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	9.1 J	4.1 J	16 J	6.4 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.0 J	4.1 J	14 J	4.5 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	2.42	1.33	4.17	1.98	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	2.53	1.44	4.30	2.13	--	--
Radiochemistry							
Cesium-137	pCi/g	--	--	--	--	0.1099 U+/-0.06103	0.1084 U+/-0.06582
Lead-210	pCi/g	--	--	--	--	0.259 +/-0.0486	0.35 +/-0.0423
General Chemistry							
Percent solids	%	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
Preliminary 30% 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 (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
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	0.07979 U+/-0.04556	0.09782 U+/-0.05617	0.07139 U+/-0.05011	0.06645 U+/-0.04037	0.09536 U+/-0.05946
Lead-210	pCi/g	0.119 +/-0.0422	0.181 +/-0.079	0.073 +/-0.0455	0.0704 U+/-0.0418	0.317 +/-0.0542
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
Preliminary 30% 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 (60-62.5 CM) 12/8/2019 (60-62.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-DUP1 12/8/2019 (60-62.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (70-72.5 CM) 12/8/2019 (70-72.5) cm	Sand Separation Area SJSSA05 11187072-120819-BN-SJSSA05 (80-82.5 CM) 12/8/2019 (80-82.5) cm	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (0-2.5 CM) 12/6/2019 (0-2.5) 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	0.08828 U+/-0.04935	0.1223 U+/-0.06922	0.1146 U+/-0.06916	0.06587 U+/-0.04211	0.06482 U+/-0.03688
Lead-210	pCi/g	0.352 +/-0.0526	0.333 +/-0.0544	0.442 +/-0.0572	0.365 +/-0.0568	0.221 +/-0.057
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
Preliminary 30% 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(0-1) 12/6/2019 (0-1) ft BGS	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(1-2) 12/6/2019 (1-2) ft BGS	Sand Separation Area SJSSA06 11187072-120619-SS-DUP1 12/6/2019 (1-2) ft BGS	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(2-4) 12/6/2019 (2-4) ft BGS	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06(4-6) 12/6/2019 (4-6) ft BGS	Sand Separation Area SJSSA06 11187072-120619-SS-SJSSA06 (7.5-10 CM) 12/6/2019 (7.5-10) cm
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	--	--	--	--	--	0.05367 U+/-0.03063
Lead-210	pCi/g	--	--	--	--	--	0.161 +/-0.0493
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
Preliminary 30% 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 (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
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	0.03911 U+/-0.02794	0.06255 U+/-0.03486	0.1076 U+/-0.06432	0.0544 U+/-0.0336	0.07865 U+/-0.04602
Lead-210	pCi/g	0.0939 +/-0.0491	0.215 +/-0.0476	0.113 +/-0.0522	0.0852 +/-0.0513	0.166 +/-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
Preliminary 30% 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 (52.5-55 CM) 12/6/2019 (52.5-55) cm	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
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	0.0497 U+/-0.03368	0.03504 U+/-0.02395	0.05251 U+/-0.03429	0.04477 U+/-0.02713	0.112 U+/-0.06301
Lead-210	pCi/g	0.0697 U+/-0.0434	0.113 +/-0.0485	0.188 +/-0.054	0.0941 +/-0.0531	0.905 +/-0.062
General Chemistry						
Percent solids	%	--	--	--	--	--

Notes:
pg/g - picogram per gram
pCi/g - picocuries per gram
DUP - indicates the result from a duplicate sample
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Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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(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	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
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	--	--	--	--	0.05777 U+/-0.03325	0.1033 U+/-0.0658
Lead-210	pCi/g	--	--	--	--	0.853 +/-0.0707	0.912 +/-0.0704
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
- U - Not detected at the associated reporting limit.
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Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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 (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	0.0679 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	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.
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Northern Impoundment
Preliminary 30% 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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	--	20
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	--	930
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	3.1 J
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	28
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	0.53 U
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.84 J
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.31 J
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.37 J
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	0.57 J
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.16 U
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	1.3 J
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.49 J
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	0.20 J
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	0.12 U
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	0.29 J
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	11
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	4.1
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	--	7.1 J
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	--	89 J
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	--	4.4 J
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	--	18 J
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	--	3.6 J
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	--	2.4 J
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	--	26 J
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	--	6.4 J
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	--	6.44
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	--	6.45
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

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
Preliminary 30% 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(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	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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	53	93	8.6 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	2600	3600	830	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	6.6 J	13	2.3 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	73	110	35	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	1.0 U	2.2 J	0.41 U	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	2.5 J	10	4.0 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.98 J	1.4 J	0.35 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	1.1 J	3.2 J	0.99 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	1.7 J	2.6 J	0.90 J	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.16 U	0.34 J	0.21 U	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	3.0 J	4.8 J	2.3 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	1.2 J	6.9 J	2.7 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.49 J	1.5 J	0.52 J	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.25 J	0.59 J	0.16 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.86 J	5.2 J	2.6 J	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	32	260	120	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	10	75	35	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	16 J	29 J	4.6 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	240 J	370 J	130 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	12 J	29 J	6.5 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	50 J	80 J	40 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	7.3 J	27 J	8.7 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	6.4 J	11 J	8.2 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	68 J	540 J	260 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	17 J	92 J	47 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	16.5	109	49.9	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	16.5	109	49.9	--	--
Radiochemistry						
Cesium-137	pCi/g	--	--	--	0.0429 U+/-0.02742	0.06693 U+/-0.04252
Lead-210	pCi/g	--	--	--	0.0758 U+/-0.045	0.0683 U+/-0.0422
General Chemistry						
Percent solids	%	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
Preliminary 30% 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 (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	0.09049 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	0.083 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
Preliminary 30% 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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	--	--	--	4.4 U	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	--	--	--	300	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.83 J	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	7.4	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	0.087 U	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.33 J	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.087 U	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.073 U	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.31 U	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.13 J	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	0.34 J	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.35 J	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.070 U	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.092 U	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	13	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	--	--	--	2.3 J	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	--	--	--	27 J	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	--	--	--	0.83 J	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	--	--	--	3.3 J	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	--	--	--	0.76 J	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	--	--	--	0.14 U	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	--	--	--	19 J	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	--	--	--	3.0 J	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	--	--	--	4.56	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	--	--	--	4.67	--
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	--

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.
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-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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 (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	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
Dioxins/Furans						
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	pg/g	3.6 U	4.1 U	7.3 U	--	--
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	pg/g	180	180	130	--	--
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	pg/g	1.2 J	1.1 J	1.1 J	--	--
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	6.2 J	6.1 J	5.5 J	--	--
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	pg/g	0.35 J	0.56 J	0.32 J	--	--
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.78 J	3.3 J	0.64 J	--	--
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.096 U	0.24 J	0.27 J	--	--
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.32 J	0.82 J	0.28 J	--	--
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.50 U	0.21 U	0.19 U	--	--
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	pg/g	0.28 J	0.46 J	0.23 J	--	--
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	0.58 J	0.44 J	0.36 J	--	--
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.64 J	1.2 J	0.40 J	--	--
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.12 U	--	--
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	pg/g	0.073 U	0.10 U	0.094 U	--	--
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	pg/g	0.079 U	0.61 J	0.092 U	--	--
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	pg/g	20	44	14	--	--
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.4	9.7	3.0	--	--
Total heptachlorodibenzofuran (HpCDF)	pg/g	4.0 J	2.5 J	3.0 J	--	--
Total heptachlorodibenzo-p-dioxin (HpCDD)	pg/g	18 J	22 J	16 J	--	--
Total hexachlorodibenzofuran (HxCDF)	pg/g	3.3 J	4.6 J	1.2 J	--	--
Total hexachlorodibenzo-p-dioxin (HxCDD)	pg/g	4.3 J	5.0 J	3.3 J	--	--
Total pentachlorodibenzofuran (PeCDF)	pg/g	0.74 J	2.7 J	0.40 J	--	--
Total pentachlorodibenzo-p-dioxin (PeCDD)	pg/g	0.15 U	0.18 U	0.14 J	--	--
Total tetrachlorodibenzofuran (TCDF)	pg/g	29 J	68 J	20 J	--	--
Total tetrachlorodibenzo-p-dioxin (TCDD)	pg/g	4.4 J	11 J	3.3 J	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0)	pg/g	6.75	15.0	4.70	--	--
Total WHO Dioxin TEQ(Human/Mammal)(ND=0.5)	pg/g	6.87	15.1	4.79	--	--
Radiochemistry						
Cesium-137	pCi/g	--	--	--	0.09609 U+/-0.05366	0.08249 U+/-0.05073
Lead-210	pCi/g	--	--	--	0.0718 U+/-0.0451	0.0967 +/-0.0467
General Chemistry						
Percent solids	%	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
U - Not detected at the associated reporting limit.
J - Estimated concentration.
-- - Not analyzed

Table 6-1

Sand Separation Area Analytical Results
Northern Impoundment
Preliminary 30% 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 (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	0.1153 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	0.0732 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
Preliminary 30% 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

Appendices

Appendix A
Pre-Design Investigation Supporting Documents

Appendix B
Northern Impoundment
Geotechnical Engineering Report

Appendix C
Treatability Study Supporting Documents

Appendix D
Northern Impoundment
Preliminary Vibration Analysis

Appendix E
Design Drawing Package

Appendix F
Northern Impoundment BMP Wall-Type Analysis

Appendix G
Supporting Deliverables

Appendix H
Sand Separation Area Supporting Documents

about GHD

GHD is one of the world's leading professional services companies operating in the global markets of water, energy and resources, environment, property and buildings, and transportation. We provide engineering, environmental, and construction services to private and public sector clients.

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