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APPENDIX D

Technical Scope of Work

Operable Unit 2 – City of Pasadena/MCC Property

Remedial Investigation/Feasibility Study

US Oil Recovery Site

691849

INTRODUCTION

This appendix to the Statement of Work (SOW) provides the preliminary technical scope of work for the Remedial Investigation/Feasibility Study (RI/FS) at Operable Unit 2 (the City of Pasadena/MCC Property or the "the property") at the US Oil Recovery Superfund site (the Site). The objective of the scope of work is to evaluate the nature and extent of contamination resulting from operations at the property, to obtain information necessary to fill data gaps in the Preliminary Conceptual Site Model (PCSM) for the property, and allow the development and evaluation of remedial action alternatives in the FS. The specific activities and procedures for implementing this RI/FS will be presented in subsequent work plans described in the SOW.

As described below, this scope of work is based upon the following analyses:

(1) Development of PCSMs for the Site (human health and ecological), highlighting those potential exposure pathways and receptors for which additional data are needed to evaluate the completeness of a potential pathway and/or the significance of those pathways that are initially characterized as complete in support of the risk assessment.

(2) Design of an iterative RI site characterization program and process that provides the needed data, including identification of media to be sampled, sample locations, and associated analytical parameters.

(3) Identification of the data needed to complete the evaluation of potentially complete or potentially significant pathways in the PCSMs, and facilitate evaluation of potential remedial action alternatives in the FS.

Consistent with EPA's expectations as noted in Paragraph 2 of the SOW, an "iterative" approach to data collection will be used during the RI to maximize the overall investigative effectiveness and efficiency and to assist in decision making. Also, consistent with the SOW and the Triad Approach, a streamlined data assessment and reporting process is proposed for the RI/FS. The iterative sampling program will start with the investigation of on-site environmental media and proceed to off-site environmental media. This iterative program will use the data collected in previous phase(s) of investigation to help focus chemicals of potential concern (COPCs) and investigation areas for subsequent sampling efforts. It is believed that this approach will help minimize the likelihood of making erroneous decisions with data that are difficult to interpret, do not support the performance or acceptance criteria defined in the RI/FS Work Plan, or do not support the overall project goal of identifying potential risks associated with past Site activities.

PRELIMINARY CONCEPTUAL SITE MODELS

PCSMs are presented for human health and ecological pathways as Figures 1 and 2, respectively. PCSMs present the current understanding of the type and occurrence of potential contaminant sources and possible exposure pathways associated with the property. Consistent with EPA RI/FS Guidance (EPA, 1988), the PCSMs were developed on the basis of existing conditions (i.e., land use, historical process knowledge, hydrogeology, source areas, COPCs, and existing data). The hypotheses presented in the PCSMs will be tested iteratively, refined, and modified as necessary as data are collected during the RI. The following subsections discuss conditions at the property and available information that are important to understanding the overall PCSMs and remaining data needs.

Current Land Use

The City of Pasadena/MCC Property is located on two tracts of land at 200 North Richey Street in Pasadena, Harris County, Texas, 77506 (Figure 3). The east tract is approximately 2.92 acres in size; the west tract is approximately 1.78 acres in size. The east and west tracts are connected by a foot bridge that crosses Vince Bayou. The property is now under the custody and control of a court-appointed Receiver. The property is located in a highly industrial area. Currently the property is abandoned and enclosed within a six-foot chain link security fence with locked gates. Security cameras have been installed at the property and access is monitored by a security contractor and a site manager/inspector.

The structures and buildings on the property are associated with a former publicly-owned treatment works ("POTW") that was operated by the City of Pasadena for approximately 60 years until March 8, 2004 when the plant was closed. The structures include two clarifiers, two oxygen digesters, an oxygen activation sludge unit, an oxygen plant, a chlorination building, a gravity thickener, an aerobic digester, a belt filter press building, a pump control room, a chlorine contact tank (basin/concrete containment area), a high rate trickling filter, an oil-water separator, a primary clarifier, a final clarifier, lift stations, sand filters, and aeration basins.

The property was developed for industrial purposes in approximately 1944 and land use has remained industrial since that time. Land use in the vicinity of the property includes the following:

North: An east-west oriented pipeline right-of-way and an east-west oriented railroad line are located to the north of the property with industrial property (tank farm) and Little Vince Bayou also to the north. A Gulf Coast Waste Disposal Authority waste receiving station is located immediately north of the west tract. The US Oil Recovery Superfund Site Operable Unit 1 (USOR Property) is located to the northwest.
East: An industrial property lies directly east, with a residential area to the east and southeast.
South: Commercial and industrial properties, with a residential area to the southeast.
West: Commercial and industrial properties.

Vince Bayou flows between the two tracts, is joined by Little Vince Bayou to the east of the USOR Property (OU-1), and flows to the north and intersects with the east flowing Houston Ship Channel (HSC) approximately 0.7 miles north of the property. The closest residential land use is located approximately 0.05 miles (250 feet) southeast of the east tract. The nearest public park (Light Company Park) is located approximately 0.14 miles (750 feet) southwest of the west tract. The nearest school (Pasadena High School) is located approximately 0.4 miles southeast of the southern property boundary. The PCSMs are based on the premise that the property land use will remain commercial/industrial in the future. Documentation of future land use restrictions as an industrial/commercial property will be provided in the RI/FS Work Plan.

Topography

The elevation of the west tract ranges from approximately 15 feet above mean sea level (msl) on the southwestern portion of the tract, to approximately 8 feet msl on the northeastern portion of the tract, and slopes toward Vince Bayou. The elevation of the east tract ranges from approximately 15 feet above mean sea level (msl) on the northeastern portion of the tract, to approximately 10 feet msl on the southwestern portion of the tract, and slopes toward Vince Bayou.

Geology

Based on the Geologic Atlas of Texas – Houston Sheet (BEG, 1982), subsurface soils at the property are underlain by the Beaumont Formation, which is comprised mostly of clay, silt, and sand, and includes mainly stream channel, point-bar, natural levee, backswamp, and to a lesser extent coastal marsh and mud-flat deposits. The Beaumont Formation beneath the property is dominantly clay and mud of low permeability, high water-holding capacity, high compressibility, high to very high shrink-swell potential, poor drainage, level to depressed relief, low shear strength, and high plasticity.

Hydrogeology

The Gulf Coast Aquifer is a major aquifer underlying the Site that consists of the Evangeline, Chicot, and Jasper aquifers, which are composed of discontinuous sand, silt, clay, and gravel beds (TWDB, Report 380, July 2011). The apparent direction of groundwater flow in these units is to the southeast toward the Gulf of Mexico. In addition to the primary aquifers, groundwater often occurs in sand units in the shallow subsurface within the Beaumont Formation. These water-bearing units are not typically used for irrigation or drinking water due to relatively low yields or poor quality.

No subsurface investigations performed at the property have been identified, and therefore there is no information available on the shallow subsurface strata and hydrogeology at the property. The direction of groundwater flow at the property is not known.

Potential Source Areas and Chemicals of Potential Concern (COPCs)

The following potential source areas are present at the property:

1) Wastewater Treatment-Related Units and Vessels (sumps, wastewater process tanks, etc.)
2) Impacted Soil
3) Pipelines

Removal actions to address potential source area 1 listed above are being developed/implemented and are planned to be completed before initiation of the RI sampling program.

A preliminary list of COPCs has been developed based on historical data for hazardous substances present at the property, waste materials previously handled or currently present at the property, and analytical laboratory results of samples of discharged fluids and environmental media collected from the property and nearby off-site areas. Samples were collected by EPA and TCEQ (or their contractors) during release response actions prior to July 2010 or Site stabilization activities conducted after the Site was abandoned in July 2010. Samples were collected of liquids leaking from containment vessels, of liquids within the containment vessels, and/or impacted soil. Samples were analyzed for volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals. As summarized in the Hazard Ranking System (HRS) Documentation Record (EPA, 2011), VOCs, SVOCs, and metals were detected in the samples and are attributed to the property. A review of past industrial operations at the property supports the inclusion of VOCs, SVOCs, and metals on the initial list of COPCs for the RI. The COPC list will be refined after each iteration of the RI/FS as data are evaluated such that only those COPCs that are related to historical site operations are moved forward, as described more fully below.

It should be noted that a health consultation performed by the Agency for Toxic Substances and Disease Registry (ATSDR, 2009) concluded that exposure to metals, SVOCs, and other substances detected in soil and sediment along Vince Bayou near the City of Pasadena/MCC Property does not pose a public health hazard to recreational receptors.

Possible Exposure Pathways

The human health and ecological PCSMs for the property (Figures 1 and 2) show the range of human health and ecological exposure pathways including the primary and secondary sources, the primary and secondary release mechanisms, the exposure media (i.e., soil, groundwater, surface water, sediment, air, etc.), and potential receptors. The processes or mechanisms by which receptors may reasonably come into contact with property-related COPCs are shown from left to right on the figure. Exposure pathways are dependent on current and future land use, which is expected to remain as an industrial land use. An exposure pathway is defined by four elements (U.S. EPA, 1989):

- A source material and mechanism of constituent release to the environment;
- An environmental migration or transport media (e.g., soil) for the released constituents;
- A point of contact with the media of interest; and
- An exposure route (e.g., ingestion) at the point of contact.

An exposure pathway is considered "complete" if all four elements are present.

Potentially complete human health exposure pathways are indicated with a "C" in the potential receptors column of Figure 1. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and to evaluate the significance of the potentially complete pathway. The PCSM also identifies possibly complete pathways with a "P" in the potential receptors column of Figure 1. At this stage of the RI/FS, it is not known whether these media have been impacted by City of Pasadena/MCC Property-related activities. Information related to complete and potentially and possibly complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation of these pathways in the human health risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 1, most often because the receptor will not contact the media specified.

Potentially complete ecological exposure pathways are indicated with a "C" in the potential receptors column of Figure 2. Potentially complete pathways are assumed to be complete based on existing information. Although a pathway may be preliminarily identified as potentially complete, additional data are often needed to confirm that the pathway is complete and evaluate the significance of the potentially complete pathway. The ecological PCSM also identifies potentially complete pathways for which potential exposures will be evaluated in an iterative manner with a "P" in the potential receptors column of Figure 2. At this stage of the RI/FS, it is not known whether these media have been impacted by City of Pasadena/MCC Property-related activities. Information related to complete and potentially complete exposure pathways will be used to identify data gaps and help guide the data collection effort, ultimately ensuring that sufficient data are collected to facilitate quantitative evaluation in the ecological risk assessment. Pathways that are not viable are considered incomplete and are identified with an "I" in the potential receptors column on Figure 2, most often because the receptor will not contact the media specified.

In the first iteration of data collection, data will be collected for the on-site media (i.e, soil and groundwater) using the initial list of COPCs. The results of the evaluation of the first iteration data will then be used to develop an investigative strategy for the off-site areas (i.e., an "inside-to-outside" approach). The second iteration will involve sampling of off-site soil (and groundwater, if necessary, based on the on-site data, to evaluate the potential groundwater to surface water pathway). After evaluation of the off-site soil and possibly groundwater data, the third iteration of data collection will

include sampling of surface water and sediment in drainage paths leading to Vince Bayou, and from within Vince Bayou (and possibly Little Vince Bayou), with sample locations/collection details and analyte list developed based on data from the previous investigation iterations. Finally, based on the evaluation of all previously collected data, sampling of fish and/or shellfish in Vince Bayou (and possibly Little Vince Bayou) will be conducted during a fourth iteration, as necessary. It is envisioned that a streamlined data evaluation and reporting process will be used to move from iteration to iteration in the RI as efficiently as possible (see details in the RI/FS Data Collection Activities section below). After each data collection iteration during the RI, the PCSMs presented in Figures 1 and 2 will be updated and refined as necessary. The iterative approach to the investigation and the streamlined data evaluation and reporting process are described in greater detail in the following sections.

DATA NEEDS

Based on an evaluation of the exposure pathways identified in Figures 1 and 2, and an analysis of the information needed to assess the completeness of these pathways, the data needs listed in Table 1 were developed for the City of Pasadena/MCC Property. Table 1 illustrates the data needs development process by: (1) noting the PCSM exposure medium for exposure pathways that were not judged to be incomplete; (2) identifying the specific data needed to determine whether that pathway is potentially complete; (3) listing the existing data that were reviewed as part of RI/FS scoping; and (4) describing the RI activities, approaches, and data collection methods to be performed to fill the identified data need.

A list of general data needs is also included in Table 1, and includes supplemental information needed for the RI such as land use, quality of habitat, climate, subsurface migration pathways, etc.

FS data needs are not included in Table 1 at this time. As FS data needs are identified as the iterative RI/FS process proceeds, appropriate programs to fill these needs will be developed. The development and evaluation of remedial alternatives will be performed as specified in the RI/FS guidance. First, the risk assessment findings will be used to develop remedial action objectives. General response actions will be developed to address these objectives, and then technology/alternatives associated with those response actions will be screened. If at any time during this process a data need related to the FS is identified, a program to collect that data will be developed and implemented.

EXISTING DATA EVALUATION

As noted above, existing data were reviewed and used during development of the PCSMs and the data needs summary (Table 1).

Existing soil and groundwater data from the City of Pasadena/MCC Property were compiled into the tables listed below and attached to this Scope of Work. The soil data tables also contain any data from off-site areas that were investigated as a result of past releases from the property. Surface water and sediment data collected for EPA in 2011 (Weston Solutions, Inc., 2011) from Vince Bayou and Little Vince Bayou were also compiled because these data have been used by EPA to rank the Site using the HRS. All of the existing data are used for scoping purposes only and are not intended for use in risk assessment calculations or as the sole basis for evaluation of potential remedial alternatives in the FS. Sampling locations for the existing data shown in the tables are shown on Figures 4 and 5.

It should be noted that there are very limited historic data for soil at the City of Pasadena/MCC Property, and there are no historic groundwater data. The soil sample data are limited to four samples collected by EPA in 2009 and two samples collected by EPA in 2011 (including a background sample collected at a park approximately 0.5 miles north of the property). Surface water and sediment data were collected by

EPA in 2011 in Vince Bayou and Little Vince Bayou adjacent to the Operable Unit 1 and Operable Unit 2 properties and these data are included in the summary tables.

The following data summary tables were compiled for Operable Unit 2:

Table 2 - Metals Concentrations in Soil Samples
Table 3 – Semi-Volatile Organic Compound and TPH Concentrations in Soil Samples
Table 4 – Metals Concentrations in Surface Water Samples – 2011 Data
Table 5 – Metals Concentrations in Sediment – 2011 Data
Table 6 – Volatile and Semi-Volatile Organic Compound Concentrations in Sediment – 2011 Data

DATA QUALITY OBJECTIVES

Data quality objectives (DQOs) (Table 7) are developed as part of the systematic planning process to define the type and quality of the data sufficient to characterize the City of Pasadena/MCC Property, conduct human health and ecological risk assessments, and perform the evaluation of remedial alternatives. The DQOs, therefore, support the rationale for the property investigation strategy and approach detailed in the following section. The data quality details of the DQO process will also be documented in the Quality Assurance Project Plan (QAPP) that will be developed with the RI/FS Work Plan.

The DQOs have been developed in general accordance with the "Guidance on Systematic Planning Using the Data Quality Objectives Process, EPA QA/G-4" (EPA, 2006). When data are collected during the RI/FS, the EPA-recommended systematic planning tool is the DQO process. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. The seven steps of the DQO process described by EPA are:

1. State the problem.
2. Identify the goal of the study.
3. Identify information inputs.
4. Define the boundaries of the study.
5. Develop the analytic approach.
6. Specify performance or acceptance criteria.
7. Develop the plan for obtaining data.

Steps 1 through 4 of the process are included in Table 7. Steps 5 through 7 will be developed in the RI/FS Work Plan and QAPP. Some of the more important issues related to the DQOs are described in the following paragraphs.

Step 1: State the Problem

Historical City of Pasadena/MCC Property information suggests that contaminants have migrated off-site during unauthorized releases, spills and overland runoff following storm events. Contamination may also exist in on-site soil in areas of former operations. Previous sampling efforts, historical aerial photographs, relevant property information and reports have been thoroughly reviewed to better understand where contamination may be on-site, what COPCs are potentially present, and what fate and transport of these COPCs may have occurred.

Because of the gradual topographic slope at the property, if COPCs were transported from the property, they would most likely migrate from the property to the southwest from the east tract and to the northeast from the west tract, deposit onto the surface soils in these areas and either remain in those soils or be

transported further down-slope. Vince Bayou surface water and sediment would be the potential endpoint of transport and migration of City of Pasadena/MCC property-related COPCs. Due to the highly industrialized nature of the surrounding area and the numerous possible point and non-point sources of contaminants in Vince Bayou unrelated to the property, it is difficult to identify City of Pasadena/MCC property-related COPCs without a thorough and complete understanding of on-site source characteristics and the transport/migration pathways off-site.

Develop the CSM for the Area of Investigation

The PCSMs introduced above (Figures 1 and 2) convey what is known about the sources, releases, release mechanisms, contaminant fate and transport, exposure pathways, potential receptors and risks. The PCSMs were developed based on the review of relevant property information and with input from the PRP Group and EPA. Data collected during the RI/FS will be used to verify and revise the models as necessary. These DQOs were developed using the PCSMs.

Establish the Planning Team

The planning team is composed of project management and technical staff from EPA, TCEQ, the PRP Group, and PBW. The Project Team and organization will be described in the RI/FS Work Plan. The project management section of the RI/FS Work Plan will describe the decision-level authority and communication. Project management team members have been designated as members of the project decision-making team and as technical expertise support. Lines of communication are established between field staff, project management, the PRP Group, EPA, and other agency stakeholders to convey data from the field to decision makers and to convey decisions back to the field staff.

Identify Available Resources, Constraints and Deadlines

During the systematic planning, several critical field activities were identified. The outcome of these critical field activities may impact the scope and extent of other City of Pasadena/MCC Property investigation tasks. The critical field activities are the on-site surface and subsurface soil sampling, on-site sediment and surface water sampling, installation of monitoring wells on-site, and groundwater sampling from these monitoring wells. Based on the data obtained from the initial field work, additional field activities will be undertaken in subsequent iterations. These subsequent iterations are anticipated to include the installation of additional monitoring wells on-site or off-site, groundwater sampling of these monitoring wells, off-site surface and/or subsurface soil sampling, and collection of background soil samples. Data obtained from these additional on-site and/or off-site sampling efforts will be used to focus subsequent off-site sediment and surface water (near the property and background), and potential fish and/or biota sampling investigation iterations.

Other practical constraints such as access and physical location that will affect characterization activities will need to be addressed. The presence of pipelines, utility easements, and other site features will be evaluated and sampling locations may change from the locations identified in this Scope of Work if necessary. The overall deliverable for the investigative activities at the City of Pasadena/MCC Property will be the RI/FS Report. However, several data assessment meetings (working meetings) will be held with EPA and TCEQ to review the RI data as it is collected and develop work plan refinements as needed.

The available resources include the project management, technical staff, and drilling, and environmental laboratory contractors. Scheduling constraints of these personnel are not anticipated at this time. City of Pasadena property characterization will be conducted in accordance with the Scope of Work provided herein and described in greater detail in the RI/FS Work Plan.

Step 2. Identify the Goal of the Study

The over-arching goals for the project are to characterize the nature and extent of contamination associated with past property-related activities, estimate potential human health and ecological risks from property-related COPCs, and design an effective remedial action plan for property-related impacts.

The review of historical data for the City of Pasadena/MCC property was used in conjunction with the PCSMs to develop the data needs table shown in Table 1. This table was used to tie the potentially complete exposure pathways to the media of concern so that relevant data could be collected to support the goals of the study. As noted previously, the overall sampling strategy for the project is an "inside-out" approach and, as such, off-site samples will be collected in an iterative fashion once the on-site data have been analyzed and evaluated.

At this point in the DQO process, the principal study questions, actions, and decision statements are developed in a detailed manner for each media to be investigated. The result of these and subsequent steps of the DQO development process are presented in Table 7.

RI/FS DATA COLLECTION ACTIVITIES

The PCSMs, the conceptual descriptions of RI/FS activities in Table 1, and the DQOs were used to develop the initial RI/FS data collection activities and sample locations described below. Historical information (e.g., maps, aerial photographs, reports, and other documentation) regarding potential source areas, and to a lesser degree the limited existing data, were used to guide the placement of initial investigation locations. The number of samples and sample locations ultimately needed to satisfy overall RI/FS objectives will be determined by the property conditions and the data obtained during the iterative phases of the RI/FS. However, consistent with the overarching objective of this scope of work, sample numbers/locations are proposed herein for the initial investigation phase (i.e., on-site soil and groundwater sampling) to fill the identified data needs.

As noted previously, and as illustrated by the PCSMs, data needs summary table (Table 1), and DQOs, investigation activities will initially focus on on-site environmental media (i.e., Iteration 1 – on-site soil and on-site groundwater). Consistent with an "inside-out" investigative approach, off-site media will be sampled iteratively after review of data collected from the on-site media, as described in more detail below.

An iterative approach is proposed as the logical and effective and time-efficient manner for which the RI should be performed. This is due to the nature of the City of Pasadena/MCC Property where the source areas are located topographically higher than some of the potential receptors and potential impacts are primarily related to the movement of COPCs from the property to the receptors via surface drainage. Furthermore, receptors in Vince Bayou also are potentially impacted from the other documented industrial activities within the Vince Bayou watershed. In this regard, the determination of the impacts from the property, versus those from other sources of contaminants to Vince Bayou, must be carefully executed through the iterative progression of investigation activities beginning on the property and working towards Vince Bayou. This method will allow for the allocation of the relative contributions of COPCs to Vince Bayou among the multiple potential sources.

The iterative data collection program is described more fully below:

ITERATION	DESCRIPTION
1	On-site media (soil and groundwater) will be sampled and analyzed for the initial list of COPCs (metals, VOCs, and SVOCs) per the RI/FS Work Plan Sampling and Analysis Plan (SAP) and QAPP. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan. The screening criteria will be confirmed with EPA prior to performing the activity, but will likely be a combination of EPA Soil Screening Levels and TCEQ Texas Risk Reduction Program Protective Concentration Levels (PCLs). Data assessment tools (summary tables, maps, GIS data visualization, etc.) will be used for the comparison to screening criteria. A working "data assessment" meeting will be held with the EPA and agency stakeholders where the data comparisons are reviewed and decisions are made regarding: 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; 2) locations of off-site soil samples for the second iteration of the RI/FS; locations for groundwater samples for the second iteration of the RI/FS, if necessary; and 3) sample intervals, etc. Data from a detailed topographic survey (to be conducted), the location of historical spills/releases, and other pertinent information will also be used to guide the selection of off-site soil and/or groundwater sample locations. A Workplan Refinement Notice (WRN) with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
2	Off-site soil and/or groundwater will be sampled and analyzed for the COPCs that were carried forward from the first iteration of sampling. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan. A working "data assessment" meeting will be held with the EPA and agency stakeholders where the data comparisons are reviewed and decisions are made regarding 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; 2) locations for off-site surface water and sediment samples from Vince Bayou (and Little Vince Bayou, if needed) for the third iteration of the RI/FS; and 3) sample intervals, etc. Data from a detailed topographic survey (to be conducted), the location of historical spills/releases, hydrodynamic information for Vince Bayou and other pertinent information will also be used to guide the selection of off-site surface water and sediment sample locations. A WRN with the agreed-upon recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
3	Off-site surface water and sediment will be sampled and analyzed for the COPCs that were carried forward from the second iteration of sampling. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan or subsequently. A working "data assessment" meeting will be held with the EPA and agency stakeholders where the data comparisons are reviewed and decisions are made regarding 1) COPCs that will be carried forward and COPCs that can be eliminated from subsequent iterations of the RI/FS; 2) methods and locations for collection of fish and shellfish samples (if necessary) from Vince Bayou (and Little Vince Bayou, if needed) for the fourth iteration of the RI/FS; 3) other sampling and analytical considerations, etc. A WRN with the agreed-upon

	recommendations for the next iteration of sampling will be prepared for EPA approval. Upon receiving EPA approval, the specific activities proposed in the WRN will be initiated.
4	Prior to sampling fish and shellfish, sediment and surface water will be evaluated to determine what COPCs should be included in the fish/shellfish sampling program per recommendations and procedures identified in the TCEQ (2002) guidance that is largely based on EPA procedures for evaluating potential impacts from the fish ingestion pathway when establishing surface water quality standards. Fish and shellfish will be sampled and analyzed for the COPCs that were carried forward from the third iteration of sampling. After data validation, the sample concentrations will be compared to the screening criteria for that medium to be developed in the RI/FS Work Plan or subsequently. A working "data assessment" meeting will be held with the EPA and agency stakeholders where the data comparisons are reviewed and decisions are made regarding the need for subsequent sampling for any media.

Given that the number of samples, the locations of the samples, and analytes to be measured in the samples for the off-site media cannot be determined until after the on-site media data are evaluated, locations for off-site sampling activities that are described in the following sections and presented on the attached maps are subject to change. Detailed descriptions of the RI data collection activities will initially be provided in the RI/FS Work Plan, the Field Sampling Plan (FSP) and the QAPP as specified in the SOW. These plans will include descriptions of data collection activities for all iterations of the RI/FS. In other words, even though a particular media will not be sampled in the first iteration of the RI/FS (e.g., off-site sediment), the proposed methods for collection of those particular media samples will be included in the RI/FS Work Plan. The specific locations, analytes, and other specific information required for data collection in iterations two through four will be provided in the WRNs.

General Investigation Activities

As shown in the General Data Needs section of Table 1, general investigation activities will be conducted and are related to the 1) potential presence of threatened and endangered species in the vicinity of the property; 2) subsurface utilities present at the property and off-site areas; 3) erosion potential of soils; 4) climate; 5) zoning and land use; 6) location of the flood plain; 7) historic property ownership activities, deed records, restrictive covenants, or deed notices; and 8) presence of ecological habitat. In addition, a water well records search will be conducted to identify registered water wells located within ½-mile of the property. A walking survey of immediately adjacent properties will also be conducted to identify the potential presence of un-registered water wells.

Analytical Methods and Analytes

Based on the COPCs described above, samples for the first iteration of data collection (on-site soil and on-site groundwater) will be analyzed using the methods listed in the following table:

COPC	ANALYTICAL METHOD	ANALYTES
VOCs	USEPA Method 8260B	Target Compound List (TCL)
SVOCs	USEPA Method 8270C	TCL
Metals	USEPA Methods 6010B/7471A	Toxic Analyte List (TAL)[1]

[1] Aluminum, antimony, arsenic, barium, beryllium, cadmium, calcium, chromium, cobalt, copper, iron, lead, magnesium, manganese, mercury, nickel, potassium, selenium, silver, sodium, thallium, vanadium, and zinc.

The COPCs for off-site media will be developed based on the results from the previous iterations of the investigation. Sample collection techniques, analytical method details, and other analyses that will be conducted on selected samples (e.g., total organic carbon, total dissolved solids, bulk density, grain size, etc.) will be described in detail in the FSP and QAPP to be submitted with the RI/FS Work Plan.

On-Site Soil Investigation

The on-site soil investigation will be performed as described in the following paragraphs:

Topographic Survey

Given the number of documented historic spills/releases and the general topographic slope away from the property to the adjacent off-site areas and surface water bodies, a detailed understanding of the potential drainage pathways at the property is critical. A topographic survey of the property with a contour interval of 0.5 feet will be performed to achieve this objective. The topographic survey will be used to evaluate the on-site data and to determine the appropriate locations for subsequent off-site samples. It is anticipated that this activity would be completed prior to the initial RI/FS data collection activities.

Soil Borings

Proposed soil boring locations are shown on Figure 6. The locations of soil borings are based on review of historic documents, historic aerial photographs, and reconnaissance observations from the City of Pasadena/MCC Property. More specifically, the locations coincide with one or more of the following:

1) Locations of wastewater treatment-related units and vessels (e.g., tanks, thickener, filter, basins, headworks, filter press, lift stations, digesters, etc.);
2) Locations of documented releases from wastewater treatment-related units and vessels (e.g., the August 20, 2009 release from the trickling filter on the west tract, see EPA, 2011); and
3) Areas that appear to receive drainage from the City of Pasadena Property source areas.

Figure 6 also includes preliminary locations for off-site soil samples that are anticipated to be sampled during the second iteration of data collection. These locations are shown for information purposes only and the locations are subject to change based on the results of the topographic survey, the data from the on-site soil sampling, or other information obtained prior to the off-site soil investigation (Iteration 2).

All soil borings will be advanced to the top of the uppermost water-bearing unit (anticipated to be approximately 10-15 feet below ground surface) for characterization of surface and subsurface soil and the collection of soil samples. Discrete soil samples will be collected for laboratory analysis of the initial list of COPCs (VOCs, SVOCs, metals). Samples will be collected from the following intervals:

- Surface (0.0-0.5 ft. bgs);
- Shallow (0.5-5.0 ft. bgs) - actual sample interval will be selected from the 0.5-5.0 bgs interval based upon field conditions including visual evidence of contamination, organic vapor meter (OVM) measurements, etc. or from 4.0-5.0 bgs if no evidence of contamination is observed.
- Subsurface (greater than 5.0 ft. bgs) – actual sample interval will be selected from the greater than 5.0 ft depth interval based upon field conditions including visual evidence of contamination, organic vapor meter measurements, etc. or from the one-foot interval above the saturated zone if no evidence of contamination is observed.

The specific sample intervals will depend on the location and purpose of the particular sample. At locations based on the presence of a current or historic source area or evidence of industrial activity

(shown in red on Figure 6), samples will be collected from all three sample intervals listed above. At sample locations along drainage pathways (shown in blue on Figure 6), samples will be collected from the upper two intervals (surface soil, shallow soil).

Selected representative soil samples will be analyzed for potential fate and transport parameters (total organic carbon, bulk density, etc.). A detailed description of the program for soil sample analysis will be presented in the RI/FS Work Plan, the FSP, and the QAPP.

Given the characteristics of the property (i.e., unconsolidated sediments, shallow depth to groundwater, etc.), it is anticipated that soil sampling will be conducted using direct-push technology (DPT) (i.e., geoprobe).

The soil boring and monitoring well investigation program will be conducted prior to the investigations of the other on-site media. Data and observations from the soil sampling program may be used to revise the subsequent media investigations described in the following section. For example, if field observations during soil sampling activities indicate the presence of non-aqueous phase liquids (NAPL), the locations and/or quantity of monitoring wells and/or the methods for well construction may be altered. Additional discussion of this issue and detailed procedures for the on-site sampling program will be presented in the RI/FS Work Plan, the FSP, and the QAPP.

On-Site Groundwater Investigation

As shown on Table 1, the on-site groundwater investigation will be performed as described in the following paragraphs.

High-Resolution Site Characterization

Concepts of the Groundwater High-Resolution Site Characterization approach (EPA, 2003) will be incorporated into the on-site groundwater investigation, as appropriate based on conditions. Initially, a series of vertical subsurface profiles using cone penetrometer testing (CPT) and/or the rapid optical screening tool (ROST) will be conducted perpendicular to the likely direction of groundwater flow (presumed to be to the northeast toward Vince Bayou on the west tract, southwest for the east tract) (Figure 6). These profiles will allow for the collection of a large amount of subsurface data in a short period of time. The CPT/ROST locations will be advanced to the base of the uppermost water bearing unit beneath the property. Although no information has been made available on the subsurface stratigraphy, it is likely that the uppermost groundwater bearing unit is no deeper than 30 feet below ground surface. The maximum depth of the CPT/ROST investigations will be 50 feet. At most of the transect locations, only the CPT tool will be advanced to provide stratigraphic information (i.e., soil type – sand, silt, or clay). At locations in the central part of the property, the CPT and ROST tool will be advanced. The ROST tool provides information on soil type and the potential presence of NAPL in soils. If evidence of significant contamination is observed at any location (e.g., the presence of NAPL), advancement of the CPT/ROST tool will be halted. If evidence of significant contamination is not observed, the CPT/ROST boring will continue until the base of the uppermost groundwater bearing unit.

The CPT borings will be ground-truthed using DPT soil borings. After review of the CPT data, DPT borings will be conducted at a subset of the CPT boring locations. For the DPT borings, soil will be collected for visual inspection for the entire length of the boring. Furthermore, the CPT borings will be completed prior to the on-site soil investigation described above. Information from the CPT borings may be used to revise the locations, sampling intervals, etc. for the on-site soil borings.

Additional HRSC techniques will be evaluated as the investigation proceeds. For instance, the collection of depth-discrete groundwater samples using multi-level sampling tools may be proposed if distinct multiple groundwater bearing units are observed, or if the groundwater-bearing units are of significant thickness.

Information from the HRSC techniques, in conjunction with information from the monitoring wells (stratigraphy, water levels, etc.) will allow for assessment of the potential hydrogeologic connection between property groundwater and Vince Bayou.

Detailed procedures for the groundwater HRSC program will be provided in the RI/FS Work Plan, FSP, and QAPP.

Monitoring Well Installation and Groundwater Sampling

The on-site soil sampling and groundwater HRSC programs will be used to determine the locations for permanent groundwater monitoring wells to be installed in the uppermost groundwater bearing unit at the property (Figure 6). If possible, soil borings will be converted to permanent monitoring wells at the locations where soil boring and monitoring well locations are located near each other.

After development, samples will be collected from the monitoring wells and analyzed for the initial list of COPCs. Samples from selected monitoring wells will be analyzed for general or natural attenuation parameters such as cations/anions, total dissolved solids (TDS), etc.. Groundwater field parameters (temperature, specific conductance, pH, dissolved oxygen (DO), oxidation-reduction potential (ORP), etc.) will be measured during sample collection at all monitoring wells. Samples will be collected for total and dissolved concentrations of selected metals.

Groundwater sampling events will be conducted to assess seasonal variability (e.g., sample quarterly for a year, evaluate results, then determine appropriate monitoring program frequency).

All wells will be surveyed by a professional land surveyor to determine spatial (X-Y) coordinates and the elevation above mean sea level of the top of the monitoring well casing.

At a minimum, a water-level measurement will be recorded from each well prior to it being sampled. Separate water-level measurement events not associated with groundwater sampling may also be conducted. If NAPL is encountered, an in-well NAPL thickness measurement will be performed.

The results of the on-site groundwater investigation will be used to 1) determine the need for the investigation of deeper groundwater at the Site; and 2) guide off-site groundwater investigation activities. If necessary, these investigations will be conducted during the off-site soil investigation (i.e., the second iteration of investigation).

Detailed procedures for groundwater monitoring well installation and sampling will be provided in the RI/FS Work Plan, FSP, and QAPP.

Hydraulic Testing

Hydraulic testing (slug testing) will be conducted in selected wells to estimate the hydraulic conductivity of the groundwater bearing unit(s). These data will be used to establish groundwater classification (in conjunction with TDS concentrations), estimate groundwater flow velocities, etc. Detailed procedures for hydraulic testing will be provided in the RI/FS Work Plan, FSP, and QAPP.

Off-Site Soil Investigation

Based on the results of the on-site soil investigation and the detailed topographic survey, a program for sampling off-site soils will be developed in a WRN. Samples will be collected from areas where COPCs from City of Pasadena/MCC Property sources areas may have migrated via surface water drainage. Samples will also be collected from areas where known releases occurred and/or where industrial activities have occurred based on historical aerial photograph or document review. Preliminary locations are shown on Figure 6 and are subject to revision based on the data and information collected during the previous iterations of the investigation. Samples will be analyzed for the COPCs that were retained after evaluation of the on-site soil sampling data (or for COPCs related to the documented release areas that will be sampled). Discrete sample intervals also will be specified in the WRN based on the data from the previous on-site soil sampling.

During this program, an evaluation of property characteristics (e.g., presence and quality of vegetative cover, soil type, etc.) will be performed to qualitatively evaluate the potential for erosion of soils.

Off-Site Groundwater Investigation

As mentioned above, off-site groundwater investigation activities and the investigation of deeper groundwater units (if necessary based on the results from the uppermost groundwater bearing unit) will be conducted concurrent with the off-site soil investigation. The locations and depths of the wells, and the COPCs to be evaluated will be developed in a WRN.

Off-Site Surface Water and Sediment Investigation

A program for the evaluation of COPCs from City of Pasadena/MCC Property-related activities in Vince Bayou (and possibly Little Vince Bayou) surface water and sediment will be developed in a WRN. As shown on Table 1, information on the watershed flow paths, surface water/sediment hydrodynamics, and other potential sources of COPCs to Vince Bayou will be reviewed during the development of this program. Surface water and sediment samples in Vince Bayou will be collected, as required, for analysis of COPCs retained from earlier iterations of the RI/FS.

Fish/Shellfish Investigation

Sampling of fish, shellfish or other biota in Vince Bayou (and Little Vince Bayou) may be conducted if the results of previous RI/FS data collection iterations show that City of Pasadena/MCC Property-related COPCs are present in surface water and/or sediment at concentrations above screening levels or if bio-accumulative COPCs are present above applicable thresholds. A WRN will be developed that describes the appropriate species for sampling, the methods for sampling, the COPCs to be analyzed, etc.

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TABLES

TABLE 1
DATA NEEDS SUMMARY
USOR SUPERFUND SITE – CITY OF PASADENA/MCC PROPERTY - OPERABLE UNIT 2
DRAFT

PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
On-Site Groundwater (proceeding to off-site groundwater if necessary)	1) Site-specific hydrogeology (hydraulic gradient, hydraulic conductivity, hydrostratigraphy, lithology, etc.). 2) Nature and extent of COPC concentrations. 3) General groundwater chemistry at site (salinity, cations/anions, groundwater classification, etc.). 4) Uses of groundwater at and in the vicinity of OU-2. 5) Discharge of groundwater to surface water. 6) Potential for groundwater to contribute to vapor intrusion and ambient air. 7) Potential presence of other groundwater plumes in the area.	1) Existing site hydrogeology data. 2) Area water well survey and use survey. 3) Historic site groundwater concentration data. 4) Surrounding property groundwater quality data.	1) Evaluate site hydrogeology. 2) Evaluate concentrations of COPCs in uppermost groundwater-bearing unit. 3) Perform more detailed water well and water use survey of site area. 4) Perform a water well records search within ½-mile of OU-2. Confirm that nearby properties are provided potable water from the local municipality. 5) Perform subsurface utility survey to identify obstructions for drilling program and preferential pathways for migration of COPCs. 6) Identify ongoing and/or historic spills/releases that have or have the potential to impact groundwater. 7) Evaluate potential for discharge of	1) Perform initial high-resolution site characterization (HRSC) using a combination of assessment methods (e.g., cone penetrometer testing, depth-discrete groundwater sampling of the uppermost groundwater unit, and traditional soil borings). 2) Install permanent groundwater monitoring wells at pre-selected locations based on results of review of initial site characterization results. Based on the results, refine the OU-2 COPC list. 3) Measure general groundwater parameters (temperature, specific conductance, pH, dissolved oxygen (DO). oxidation-reduction potential (ORP), TDS, etc.). 4) Collect groundwater samples to characterize on-site groundwater and evaluate potential impacts from source areas. Assess the potential for off-site migration and vertical migration on-site, if needed. 5) Conduct groundwater sampling events to assess seasonal variability e.g., quarterly for a year, evaluate, then determine appropriate monitoring program). 6) Perform hydraulic testing (slug testing) in selected wells. This data will be used with TDS data to establish groundwater classification. 7) Evaluate total versus dissolved concentrations of metals in groundwater samples. 8) Perform a water well records search to identify registered water wells located within ½-mile of the site. In addition, perform a walking survey of immediately adjacent properties to identify the potential presence of un-registered water wells. 9) Assess the hydrogeologic connection and the potential for discharge of groundwater to Vince Bayou through the evaluation of water levels and the

TABLE 1
DATA NEEDS SUMMARY
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PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
			groundwater to surface water. 8) Evaluate groundwater data to assess possibility of vapor intrusion (model).	development of hydrogeologic cross-sections.
On-Site Soil	1) Nature and extent of COPC concentrations in on-site soil. 2) Potential source areas (e.g., sumps, wastewater process tanks, impacted soils, pipelines, etc.). 3) Surface water drainage patterns. 4) General soil characteristics to evaluate impact on COPC mobilization and sequestration in soil.	1) Concentrations of COPCs in soil collected during various investigations at OU-2, and correlation of existing on-site soil data with potential sources (including historical sources).	1) Evaluate lateral and vertical extent of COPCs in samples of site surface soil (0 to 0.5 ft bgs), shallow soils (0.5 to 5 ft bgs) and subsurface soil (greater than 5 ft bgs). 2) Collect general soil chemistry data (pH, TOC, grain size, etc.). 3) Evaluate topography and preferential surface water drainage pathways. 4) Identify ongoing and/or historic spills releases that have or have the potential to impact on-site soil.	1) Perform detailed topographic survey of site and adjacent and contiguous off-site areas (to Vince Bayou). 2) Advance soil borings to top of uppermost water-bearing unit to characterize surface and subsurface soil. 3) Collect discrete soil samples for laboratory analysis of COPCs. 4) Analyze selected representative samples for potential fate and transport parameters (total organic carbon, bulk density, etc.). 5) Evaluate site characteristics (e.g., presence and quality of vegetative cover, soil type, etc.) to qualitatively evaluate potential for erosion of site soils (see Off-Site Surface Soil section below). 6) Refine COPC list based on existing and newly-acquired data set.

TABLE 1
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PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Site Surface Soil [2]	1) Surface water drainage patterns. 2) Based on surface water drainage patterns and on-site soil concentrations, areas for off-site soil sampling; step-out sampling only as warranted. 3) Nature and extent of COPC concentrations in off-site surface soil, as needed. 4) General soil characteristics to evaluate impact on COPC mobilization and sequestration in soil.	1) Surface water drainage patterns from site to off-site areas. 2) Concentrations of COPCs in on-site and off-site soil collected during various investigations at the site.	1) Identify ongoing and/or historic spills/releases that have the potential to impact off-site surface soil. 2) Evaluate lateral and vertical extent of COPCs in off-site surface soil samples.	1) Perform detailed topographic survey of site and off-site areas. 2) Evaluate site characteristics (e.g., presence and quality of vegetative cover, soil type, etc.) to qualitatively evaluate potential for erosion of site soils. 3) Pending evaluation of results from site soil samples and determination of pathway completeness, collect discrete soil samples along drainage pathways for laboratory analysis of COPC concentrations.
On-Site Air	1) COPC concentrations in on-site air (derived from COPCs concentrations in on-site soil).	1) Concentrations of COPCs in on-site soil collected during various investigations at the Site. 2) Review of existing ambient air monitoring data for site area, if available.	1) Use on-site soil COPC concentration data to estimate and/or model potential emissions of volatile organic compounds and fugitive dust in on-site air.	1) Evaluate site characteristics (e.g., presence and quality of vegetative cover, soil type, etc.). 2) Evaluate local meteorological data. 3) Estimate and/or model potential COPC concentrations in on-site air using on-site soil and groundwater COPC concentrations data and qualitative data described above.

TABLE 1
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		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Site Air	1) COPC concentrations in off-site air (derived from COPCs concentrations in off-site soil)	1) Concentrations of COPCs in off-site soil collected during various investigations at the Site. 2) Review of existing ambient air monitoring data for site area, if available.	1) Use off-site soil COPC concentration data to estimate and/or model potential emissions of volatile organic compounds and fugitive dust in off-site air.	1) Evaluate off-site characteristics (e.g., presence and quality of vegetative cover, soil type, etc.). 2) Evaluate local meteorological data. 3) Estimate and/or model potential COPC concentrations in off-site air using off-site soil COPC concentrations data and qualitative data described above.

TABLE 1
DATA NEEDS SUMMARY
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PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Site Surface Water [2]	1) Presence of surface water and associated uses. 2) Watershed sub-basin. 3) Commercial, industrial, and municipal activities located up-stream of OU-2 along Vince Bayou and Little Vince Bayou, including the identification of permitted outfalls. 4) Documented "spills/ releases" within the watershed sub-basin that had and/or continue to have the potential to impact surface water at OU-2. 5) Surface water flow characteristics. 6) Background concentrations of COPCs in Vince Bayou surface water. 7) Concentrations of COPCs in surface water samples attributable to OU-2 sources.	1) Site source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from site to soil and surface water. 3) Surface water drainage patterns from site to off-site areas, extending to Vince Bayou and Little Vince Bayou. 4) Nature and extent of COPCs in on-site and off-site soil. 5) COPC concentration data from samples of surface water. 6) Surface water advisories and associated data.	1) Delineate the boundary and drainage within the watershed sub-basin. 2) Identify potential land use practices that might have impacted surface water adjacent to site. 3) Identify on-going and/or historic spills/releases that have or have the potential to impact surface water. 4) Collect data to characterize surface water flow regime (e.g., flow velocity, groundwater to surface water interactions, etc.). 5) Evaluate the surface water quality and the potential presence of COPCs in surface water.	1) Obtain information from the USGS and other local sources to define the extent and flow paths within the watershed sub-basin. 2) Perform an area reconnaissance to identify properties located within the watershed sub-basin that have the potential to impact the surface water system. After facility identification, obtain regulatory information from public sources to confirm facility operations. 3) Perform a regulatory database search to identify spills and/or releases that have occurred within the watershed that reached or had the potential to reach Vince Bayou or Little Vince Bayou. 4) Obtain publically available information on the physical flow properties of Vince Bayou and Little Vince Bayou (e.g., under normal and storm events). 5) Collect surface water samples in Vince Bayou for analysis of water quality parameters and COPCs. As part of this assessment, address total versus dissolved COPC concentrations, designed to address ecological benchmark criteria. 6) Evaluate Vince Bayou surface water sample COPC data relative to background COPC data for surface water samples collected in Little Vince Bayou as well as upstream in Vince Bayou.

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		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Off-Site Sediment [2]	1) Sediment and surface water hydrodynamics in Vince and Little Vince Bayou. 2) Background concentrations of COPCs in Vince Bayou sediment. 3) Concentrations of COPCs in sediment samples attributable to site sources.	1) Site source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from site. 3) Surface water drainage patterns from site extending to Vince Bayou and Little Vince Bayou. 4) Nature and extent of COPCs in on-site and off-site soil. 5) COPC concentration data from historic sediment samples.	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact off-site sediment. 2) Collect data necessary to characterize sediment regime (sediment thickness, depositional patterns, TOC, grain size, etc.). 3) If necessary based on iterative approach to site characterization, collect samples of sediment for analysis of site COPCs.	1) Refine site COPC list by evaluating source area, soil and groundwater sample data. 2) Collect sediment samples in Vince Bayou for analysis of site COPCs, if warranted. 3) Evaluate potential for site to contribute COPCs to sediment in Vince Bayou above background levels collected in Little Vince Bayou and upstream in Vince Bayou. 4) Evaluate general chemistry of sediment (pH, TOC, grain size, organic carbon, etc.) in all samples.

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		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
Fish/Shellfish [2]	1) Identify fish/shellfish species present and affinity for site. 2) Concentrations of COPCs in fish/shellfish tissue attributable to site sources. 3) Assess the potential for fish/shellfish consumption in the area.	1) Site source data (concentrations of COPCs, source type, etc.). 2) Historical information on releases from site. 3) Surface runoff patterns from site to off-site areas, including surface water. 4) Nature and extent of COPCs in on-site and off-site soil. 5) COPC concentration data from samples of surface water, sediment and fish/shellfish. 6) Fish/shellfish advisories and associated data. 7) Other data from trustees.	1) Identify ongoing and/or historic spills/releases that have or have the potential to impact fish/shellfish. 2) Collect data necessary to characterize aquatic conditions relative to fish in Vince Bayou (e.g., fish/shellfish species present, site fidelity, prey items, etc.). 3) If necessary based on iterative approach to site characterization, collect fish/shellfish samples for analysis of site COPCs.	1) Refine site COPC list by evaluating source area, soil and groundwater sample data. 2) Identify fish/shellfish species present and affinity for site. 3) Collect fish/shellfish samples in Vince Bayou for analysis of site COPCs, if warranted. 4) Evaluate potential for site to contribute COPCs to fish/shellfish tissue in Vince Bayou above background concentrations measured in fish from Little Vince Bayou and upstream in Vince Bayou.

TABLE 1
DATA NEEDS SUMMARY
USOR SUPERFUND SITE – CITY OF PASADENA/MCC PROPERTY - OPERABLE UNIT 2
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PRELIMINARY CONCEPTUAL SITE MODEL POTENTIAL EXPOSURE MEDIUM[1]	ITERATIVE DATA NEED	APPROACH TO FILL DATA NEED		
		EXISTING DATA REVIEWED	REMEDIAL INVESTIGATION ACTIVITY	REMEDIAL INVESTIGATION APPROACH AND DATA COLLECTION METHODS
General Data Needs	1) Collect qualitative data needed to support risk assessments such as the presence of T&E species, land use in the vicinity, receptor survey and use restrictions at OU-2. 2) Identify potential preferential subsurface migration pathways. 3) Identify vegetative cover. 4) Identify climate patterns. 5) Identify land use within the watershed sub-basin. 6) Assess the potential for flooding. 7) Identify historic site ownership and use. 8) Assess the presence and quality of ecological habitat. 9) Identify any restrictive covenants on-Site			1) Contact TPWD to determine potential presence of T&E species in the vicinity. 2) Contact the City of Pasadena Engineering Department to obtain a map of all subsurface utilities in the vicinity of OU-2. In addition, contact the pipeline companies that operate subsurface pipelines in on-site and adjacent properties. 3) Assess the erosion potential of soils, which could create off-site impacts, extending to Vince Bayou. 4) Understand precipitation, prevailing wind direction, and assess how these parameters could impact mobilization of COPCs. 5) Obtain a current aerial photograph and access information from the City of Pasadena to obtain site zoning information to define land use. 6) Obtain floodplain maps from FEMA to delineate the 100-year floodplain. 7) Establish historic site ownership and use through obtaining a chain-of-title and historic documents, extending back to a date, prior to site development. 8) Perform a reconnaissance and use public data to identify ecological habitats. 9) Evaluate property record to identify any restrictive covenants on-Site.

See table notes on following page.

TABLE 1
DATA NEEDS SUMMARY
USOR SUPERFUND SITE – CITY OF PASADENA/MCC PROPERTY - OPERABLE UNIT 2
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Notes:
1) Refer to Exposure Medium column on Figure 1 for human health receptors and on Figure 2 for ecological receptors.
2) Sampling of these media to be performed in conjunction with appropriate background sampling, if necessary.
3) Color coding per Figures 1 and 2, as follows:

Green – Primary media to be sampled during initial stage of RI/FS.
Blue – Second iteration media to be sampled based on primary media sample data.
Pink – Third iteration media to be sampled based on primary media and second iteration media sample data.
Orange – Fourth iteration media to be sampled based on primary media and second and third iteration media sample data.
Yellow – For human health risk assessment, exposure medium concentration will be estimated using primary media sample concentrations.

Table 2 - USOR Operable Unit 2
Metals Concentrations in Soil Samples

Location	Sample ID	Sample Date	Aluminum (mg/kg)	Antimony (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Lead (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
March 2011 EPA START-3 Sampling Event (HRS, p. 14, Reference 44)																			
SS-06	SS-06-03-51	03/01/11	10500	<1.2J	2.2J	142	<0.6J	<0.6J	11.4J	4.3J	10.8J	31J	184J	0.59	8.7J	<3	1.4	17.8J	88.4J
SS-07	SS-07-03-51	03/01/11	17700	<1.2J	2.8J	268	<1.2J	1J	19.3J	6.2J	27.2J	29.9J	272J	0.66	14.9J	<6.1	5.1	22J	145J
EPA 2009 Sampling related to May 2009 Release (Preliminary Assessment Reference 11)																			
Background [1]	Background[1]	2009	---	---	4.1	150	---	0.48	13	---	---	63	---	0.093	---	0.3J	0.14J	---	---
East Side of Bayou	East Side of Bayou	2009	---	---	3.2	130	---	0.57	11	---	---	38	---	0.13	---	0.71J	2.40	---	---
West Side of Bayou	West Side of Bayou	2009	---	---	4.2	200	---	0.80	16	---	---	47	---	0.36	---	0.57J	3.80	---	---
Near Roll Off Box	Near Roll Off Box	2009	---	---	4.6	220	---	0.87	18	---	---	47	---	0.31	---	0.76J	3.80	---	---

Notes:
1. Background sample was collected at Memorial Park approximately 0.5 miles north of the property.
2. --- = No value available for that compound for that sample.
3. < = not detected above reporting limit
4. J = estimated concentration.
5. Not all qualifier flags from original data are included in this table.
6. Only metals detected in at least one soil sample are included in this table.

Table 3 - USOR Operable Unit 2
Semi-Volatile Organic Compound and TPH
Concentrations in Soil Samples

Location	Sample ID	Sample Date	Anthracene (mg/kg)	Bis(2-ethylhexyl) phthalate (mg/kg)	Butyl benzyl pthalate (mg/kg)	Benzo (a) anthracene (mg/kg)	Benzo (a) pyrene (mg/kg)	Benzo (b) fluoranthene (mg/kg)	Benzo (g,h,i) perylene (mg/kg)	Benzo (k) fluoranthene (mg/kg)	Chrysene (mg/kg)	Dibenz(a,h) anthracene (mg/kg)	Fluoranthene (mg/kg)	Indeno (1,2,3-cd) pyrene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	TPH C6-C35 (mg/kg)
EPA 2009 Sampling related to May 2009 Release (Preliminary Assessment Reference 11)																	
Background [1]	Background[1]	2009	0.21	<0.14	<0.11	1.80	1.30	1.90	0.43	1.40	1.70	0.21	3.30	0.54	1.10	2.5	<57
East Side of Bayou	East Side of Bayou	2009	<0.25	0.68	0.38J	0.67	1.00	1.40	0.31J	0.97	0.95	<0.51	1.40	0.56J	0.36	1.2	82
West Side of Bayou	West Side of Bayou	2009	<0.23	0.68	0.15J	0.32	0.60	0.66J	0.31J	0.28J	0.60	0.29J	0.57	0.43J	0.30	0.76	450
Near Roll Off Box	Near Roll Off Box	2009	<0.25	0.51J	<0.5	0.28	0.49	0.66J	<0.5	0.23J	0.51	<0.5	0.28J	0.29J	<0.25	0.61	1400

Notes:
1. Background sample was collected at Memorial Park approximately 0.5 miles north of the property.
2. --- = No value available for that compound for that sample.
3. < = not detected above reporting limit
4. J = estimated concentration.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one soil sample are included in this table.

Table 4 - USOR Operable Unit 2
Metals Concentrations in Surface Water Samples
2011 Data

Location	Sample ID	Date Sampled	Aluminum (mg/L)	Antimony (mg/L)	Arsenic (mg/L)	Barium (mg/L)	Beryllium (mg/L)	Cadmium (mg/L)	Chromium (mg/L)	Cobalt (mg/L)	Copper (mg/L)	Iron (mg/L)	Lead (mg/L)	Magnesium (mg/L)	Manganese (mg/L)	Mercury (mg/L)	Nickel (mg/L)	Potassium (mg/L)	Selenium (mg/L)	Silver (mg/L)	Vanadium (mg/L)	Zinc (mg/L)
March 2011 EPA START-3 Sampling Event (HRS, p. 14, Reference 44)																						
PPE-01	PPE-01-00-11-20110303	3-Mar-11	0.426 J	<0.002	0.0158 J	0.0704	<0.001	<0.001	0.004 J	<0.001	0.002 J	0.211	0.0018 J	229	0.0336	<0.0002	0.0045	82.3	<0.005	<0.001	0.0009 J	0.0172 J
PPE-02	PPE-02-00-11-20110303	3-Mar-11	0.284 J	<0.002	0.0191 J	0.0655 J	<0.001	<0.001	0.0033 J	<0.001	0.0024 J	<0.2	<0.002	280	0.0338	<0.0002	0.0036 J	97	<0.005	<0.001	<0.005	0.0128 J
PPE-03	PPE-03-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0192 J	0.0789	<0.001	<0.001	0.004 J	<0.001	<0.002	0.202	<0.001	260 J	0.0429	<0.0002	0.0042	90.4 J	<0.005	<0.001	<0.005	0.0131 J
PPE-04	PPE-04-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0188 J	0.0917	<0.001	<0.001	0.0039 J	<0.001	<0.002	0.0977 J	<0.001	285	0.0453	<0.0002	0.0042	95 J	0.0054J	<0.001	0.0012 J	0.0098 J
PPE-05	PPE-05-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0192 J	0.0688	<0.001	<0.001	0.0032 J	<0.001	<0.002	0.141 J	<0.001	258 J	0.0469	<0.0002	0.0039	89 J	0.0105J	<0.001	<0.0024	0.0142 J
PPE-06	PPE-06-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0191 J	0.0695	<0.001	<0.001	<0.002	<0.001	<0.002	0.171 J	<0.001	232	0.0465	<0.0002	0.0041	81	0.0087J	<0.001	0.0015 J	0.0149 J
SED-01	BG-01-00-11-20110303	3-Mar-11	0.069 J	<0.004	0.021 J	0.0582 J	<0.002	<0.001	<0.004	<0.002	<0.004	<0.4	<0.002	240	0.0352	<0.0002	<0.002	85.5	<0.01	<0.001	<0.01	0.0201 J
SED-02	BG-02-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0149 J	0.0728	<0.001	<0.001	<0.002	<0.001	<0.002	0.16 J	0.0016 J	264	0.0426	<0.0002	0.0039	89.8	<0.005	0.0017 J	0.0027 J	0.0141 J
SW-01	SW-01-00-11-20110302	2-Mar-11	<0.02	<0.002	0.02 J	0.0768	<0.001	<0.001	0.0043 J	<0.001	<0.002	0.16 J	<0.001	256	0.0381	<0.0002	0.0041	88.9	<0.005	<0.001	0.002 J	0.0139 J
SW-02	SW-02-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0189 J	0.0738	<0.001	<0.001	0.0042 J	<0.001	<0.002	0.121 J	0.001	267	0.0372	<0.0002	0.0042	92.6	<0.005	<0.001	0.00016 J	0.0125 J
SW-03	SW-03-00-11-20110303	3-Mar-11	1.42	<0.002	0.0169 J	0.083	<0.001	<0.001	0.006 J	0.0018J	0.0058 J	1.24	0.016	245	0.0786	<0.0002	0.0055	86.5	<0.005	<0.001	0.0038 J	0.0347 J
SW-04	SW-04-00-11-20110303	3-Mar-11	0.466	<0.002	0.0148 J	0.0687	<0.001	<0.001	0.0041 J	<0.001	0.002 J	0.247	0.0025	230	0.0344	<0.0002	0.0041	82.5	<0.005	<0.001	0.00021 J	0.0152 J
SW-05	SW-05-00-11-20110303	3-Mar-11	0.118 J	<0.002	0.018 J	0.0612 J	<0.001	<0.001	0.0029 J	<0.001	0.0035 J	<0.2	<0.002	232	0.0314	<0.0002	0.0038 J	82.3	<0.005	<0.001	<0.005	0.015 J
SW-06	SW-06-00-11-20110302	2-Mar-11	0.277	<0.002	0.0143 J	0.0486	<0.001	<0.001	0.0033 J	<0.001	0.0012 J	0.0686 J	<0.001	121	0.0235	<0.0002	0.0035	50.6	<0.005	<0.001	<0.005	0.0185 J
SW-07	SW-07-00-11-20110303	3-Mar-11	0.306	<0.002	0.0132 J	0.0518	<0.001	<0.001	<0.002	<0.001	0.0014 J	0.0986 J	0.001	139	0.0247	<0.0002	0.0038	55.8	<0.005	<0.001	0.00042 J	0.0188 J
SW-08	SW-08-00-11-20110303	3-Mar-11	0.152 J	<0.002	0.0159 J	0.0533 J	<0.001	<0.001	0.0028 J	<0.001	0.0016 J	<0.2	<0.002	169	0.0261	<0.0002	0.0032 J	75.1	<0.005	<0.001	<0.005	0.0131 J
SW-09	SW-09-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0189 J	0.092	<0.001	<0.001	0.0037 J	<0.001	<0.002	0.0942 J	<0.001	288 J	0.0445	<0.0002	0.0042	94.7 J	0.0057J	<0.001	0.00065 J	0.0091 J
SW-10	SW-10-00-11-20110302	2-Mar-11	<0.02	<0.002	0.0185 J	0.0617	<0.001	<0.001	0.0032 J	<0.001	<0.002	0.0932 J	<0.001	229 J	0.0334	<0.0002	0.0037	80.8 J	0.0064J	<0.001	0.0016 J	0.0147 J
SW-11	SW-11-00-11-20110301	1-Mar-11	<0.02	<0.002	0.0168 J	0.0662	<0.001	<0.001	<0.002	<0.001	<0.002	0.101 J	<0.001	217	0.0427	<0.0002	0.0039	78.3	0.0067	<0.001	0.0021 J	0.014 J

Notes:
1. All surface water samples from Vince Bayou are included on this table, regardless of their location relative to Operable Unit 1 or Operable Unit 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < = not detected above reporting limit.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one sample are included in this table.

Table 5 - USOR Operable Unit 2
Metals Concentrations in Sediment Samples
2011 Data

Location	Sample ID	Sample Date	Aluminum (mg/kg)	Arsenic (mg/kg)	Barium (mg/kg)	Beryllium (mg/kg)	Cadmium (mg/kg)	Calcium (mg/kg)	Chromium (mg/kg)	Cobalt (mg/kg)	Copper (mg/kg)	Iron (mg/kg)	Lead (mg/kg)	Magnesium (mg/kg)	Manganese (mg/kg)	Mercury (mg/kg)	Nickel (mg/kg)	Potassium (mg/kg)	Selenium (mg/kg)	Silver (mg/kg)	Sodium (mg/kg)	Vanadium (mg/kg)	Zinc (mg/kg)
March 2011 EPA START-3 Sampling Event (HRS, p.14, Reference 44)																							
PPE-01	PPE-01-03-51	3/3/2011	9620	10.3J	103	0.67U	0.67U	20000	20.4J	4J	13.6J	11300J	76.3	3080	164J	0.35	7.2J	1530	3.4 UJ	1	1870	17.1J	71J
PPE-02	PPE-02-03-51	3/3/2011	12800	4.7J	115	0.79U	0.79U	8820	24.9J	5.6J	22.7J	13200J	120	3930	155J	0.32	13J	2040	7.9 UJ	2.3	2180	18.5J	118J
PPE-03	PPE-03-03-51	3/2/2011	8550	2.2J	78.6	0.85UJ	1.1J	17200	14.4J	3.4J	15.5J	10000	57.3J	3140	74.3J	0.11J	7.3J	1620	---	1.1	2490J	13.7J	112J
PPE-04	PPE-04-03-51	3/2/2011	7480	2J	85.2	0.72UJ	0.72UJ	18000	14J	4.6J	13.9J	9740	32J	2790	94.1J	0.064J	7.8J	1420	---	0.72U	2070J	16J	76.3J
PPE-05	PPE-05-03-51	3/2/2011	13300	2.4J	96.4	0.95UJ	0.95UJ	28900	17.2J	4.8J	18.7J	13600	41.2J	4390	123J	0.13J	10.3J	2430	---	0.95U	3080J	18.7J	116J
PPE-06	PPE-06-03-51	3/2/2011	10500	2.6J	102	0.88UJ	0.88UJ	32700	16.4J	4.5J	17.7J	12000	34.8J	3830	118J	0.051J	8.6J	1920	---	0.88U	2080J	17.7J	101J
SED-01	BG-01-03-51	3/3/2011	16900	2.3J	196	0.81J	0.65U	133000	12.4J	4.3J	5.9J	15200J	10.3	6330	148J	0.0083J	9.5J	2970	3.3 UJ	0.65U	1440	20.1J	16.9J
SED-02	BG-02-03-51	3/2/2011	10100	2.3J	81	0.7UJ	0.7UJ	25200	16.2J	4.3J	16.7J	12600	50.5J	3630	158J	0.076J	7.8J	1880	---	0.7U	2120J	16.1J	74J
SW-01	SED-01-03-51	3/2/2011	9760	13.1J	117	0.82UJ	0.82UJ	34100	18.9J	5.7J	15.7J	13700	106J	3420	215J	0.15J	8.9J	1710	---	0.82U	2600J	20J	103J
SW-02	SED-02-03-51	3/2/2011	18900	11.8J	150	0.93J	0.68UJ	29200	13.1J	4.9J	5.2J	16400	15.6J	4140	113J	0.92	7.6J	2230	---	0.68U	2020J	21.2J	16.6J
SW-03	SED-03-03-51	3/2/2011	14400	5.9J	114	0.87U	0.87U	18200	19.9J	4.7J	21.7J	14000J	64.4	4550	91.8J	0.32	10.8J	2360	4.4 UJ	1.7	2460	19.9J	118J
SW-04	SED-04-03-51	3/3/2011	6310	19.3J	109	0.67U	0.67U	9000	15.8J	3.4J	10.4J	6030J	57.5	1770	83.8J	1.8	6.5J	997	3.4 UJ	0.7	982	17.4J	30.6J
SW-05	SED-05-03-51	3/3/2011	8000	1.3J	62	0.74U	0.74U	6880	11.4J	2J	9.7J	8650J	38.4	2280	71J	0.13J	5.5J	1260	3.7 UJ	0.74U	1790	9.8J	65.9J
SW-06	SED-06-03-51	3/3/2011	7700	4J	86.7	0.6U	0.6U	137000	15.9J	3.8J	12.2J	11600J	57.1	4620	305J	0.075J	9J	1080	6 UJ	0.6U	1470	13.9J	132J
SW-07	SED-07-03-51	3/3/2011	10800	2.4J	89	0.69U	0.69U	16000	17J	5J	11.8J	12800J	55	4070	203J	0.14	9.4J	1760	3.5 UJ	0.92	1270	17.7J	87.4J
SW-08	SED-08-03-51	3/3/2011	17100	2.9J	291	1.1J	0.9	8890	40.6J	5.8J	45.3J	16200J	196	5640	116J	0.81	17J	2630	8.2 UJ	7.9	2220	23.9J	160J
SW-09	SED-09-03-51	3/2/2011	12800	2.2J	110	0.74J	0.69UJ	19900	21.1J	4.4J	14.8J	14600	122J	4330	106J	0.33	10.1J	2190	---	1.8	2220J	18.8J	114J
SW-10	SED-10-03-51	3/2/2011	15400	5.9J	178	3.4UJ	0.68UJ	3740	19.6J	26.7J	9.5J	17400	30.1J	2450	1030J	0.013J	14.1J	1740	---	0.68U	1770J	48.7J	13.5J
SW-11, PPE-06A	SED-11-03-51	3/2/2011	2630	2.3J	41.7	0.64UJ	0.64UJ	137000	23.4J	1.6J	8.1J	5640	9.8J	9770	310J	0.027J	4.5J	639U	---	0.64U	1160J	15J	40.1J

Notes:
1. All sediment samples from Vince Bayou are included on this table, regardless of their location relative to Operable Unit 1 or Operable Unit 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < or U = not detected above reporting limit.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one sample are included in this table.

Table 6 - USOR Operable Unit 2
Volatile and Semi-Volatile Organic Compound Concentrations in Sediment Samples

Location	Sample ID	Sample Date	Anthracene (mg/kg)	Benzo (a) anthracene (mg/kg)	Benzo (a) pyrene (mg/kg)	Benzo (b) fluoranthene (mg/kg)	Benzo (g,h,i) perylene (mg/kg)	Benzo (k) fluoranthene (mg/kg)	Bis (2-ethylhexyl) phthalate (mg/kg)	Carbon disulfide (mg/kg)	Chlorobenzene (mg/kg)	Chrysene (mg/kg)	Dibenz (a,h) anthracene (mg/kg)	Di-n-octyl phthalate (mg/kg)	Fluoranthene (mg/kg)	Fluorene (mg/kg)	Indeno (1,2,3-cd) pyrene (mg/kg)	Methyl acetate (mg/kg)	2-Methylnaphthalene (mg/kg)	Naphthalene (mg/kg)	Phenanthrene (mg/kg)	Pyrene (mg/kg)	Toluene (mg/kg)	Xylenes (mg/kg)
EPA Emergency Response 2011																								
PPE-01	PPE-01-03-51	3/3/2011	<0.289	<0.723	<0.723	<0.723	<0.723	<0.723	<0.723	<0.0982	<0.0982	<0.723	<0.723	<0.723	<0.289	<0.289	<0.723	<0.245	<0.289	<0.289	<0.289	<0.289	<0.0982	<0.196
PPE-02	PPE-02-03-51	3/3/2011	<0.294	0.778	1.26	1.56	1.45J	1.01	<0.735	<0.0999	<0.0999	1.17	<0.735	<0.735	1.58	<0.294	1.1	<0.25	<0.294	<0.294	0.428	1.54	<0.0999	<0.2
PPE-03	PPE-03-03-51	3/2/2011	<0.309	0.934	1.24	1.49	0.892	0.982	7.45	0.146B	<0.1	1.27	<0.772	<0.772	2.28	<0.309	<0.772	<0.25	<0.309	<0.309	0.318	2.43	<0.1	<0.2
PPE-04	PPE-04-03-51	3/2/2011	<0.289	0.873	1.4	1.81	0.805	1.13	1.21	<0.0991	<0.0991	1.54	<0.721	<0.721	2.02	<0.289	0.794	<0.248	<0.289	<0.289	0.56	2.22	<0.0991	<0.198
PPE-05	PPE-05-03-51	3/2/2011	<0.406	1.4	2.16	2.55	1.79	1.65	1.88	<0.0992	<0.0992	2.43	<1.01	<1.01	3.15	<0.406	1.59	<0.248	0.544	0.416	1.25	3.71	<0.0992	<0.198
PPE-06	PPE-06-03-51	3/2/2011	<0.332	1.29	2.01	2.41	1.57	1.62	1.95	<0.0999	<0.0999	2.25	<0.831	<0.831	2.81	<0.332	1.42	<0.25	<0.332	<0.332	0.834	3.37	<0.0999	<0.2
SED-01	BG-01-03-51	3/3/2011	<0.252	<0.629	<0.629	<0.629	<0.629	<0.629	<0.629	<0.099	<0.099	<0.629	<0.629	<0.629	<0.252	<0.252	<0.629	<0.248	<0.252	<0.252	<0.252	<0.252	<0.099	<0.198
SED-02	BG-02-03-51	3/2/2011	<0.278	1.16	1.74	1.9	1.37	1.39	<0.694	<0.0998	<0.0998	1.75	<0.694	<0.694	2.53	<0.278	1.16	<0.249	<0.278	<0.278	0.75	2.74	<0.0998	<0.2
SW-01	SED-01-03-51	3/2/2011	<0.278	2.05	2.82	3.04	2.27	1.99	0.904B	<0.0836	<0.0836	3.02	<0.695	<0.695	4.72	<0.278	2.08	0.485	<0.278	<0.278	1.79	4.73	<0.0836	<0.167
SW-02	SED-02-03-51	3/2/2011	<0.267	<0.668	<0.668	<0.668	<0.668	<0.668	<0.668	<0.0998	<0.0998	<0.668	<0.668	<0.668	0.491	<0.267	<0.668	<0.25	<0.267	<0.267	<0.267	0.513	<0.0998	<0.2
SW-03	SED-03-03-51	3/2/2011	<0.279	1.2	1.69	1.94	1.36J	1.62	<0.699	<0.1	<0.1	1.65	<0.699	<0.699	2.67	<0.279	1.27	<0.25	<0.279	<0.279	0.741	2.19	<0.1	0.2
SW-04	SED-04-03-51	3/3/2011	<0.268	<0.669	<0.669	<0.669	<0.669	<0.669	<0.669	<0.0999	<0.0999	<0.669	<0.669	<0.669	<0.268	<0.268	<0.669	<0.25	<0.268	<0.268	<0.268	<0.268	<0.0999	<0.2
SW-05	SED-05-03-51	3/3/2011	<0.263	1.62	2.5	2.93	2.1J	1.86	<0.657	<0.0999	<0.0999	2.22	0.725	<0.657	3.08	<0.263	1.95	<0.25	<0.263	<0.263	0.711	3.2	<0.0999	<0.2
SW-06	SED-06-03-51	3/3/2011	<0.241	<0.603	1	1.06	0.824J	0.701	<0.603	<0.1	<0.1	0.737	<0.603	<0.603	0.887	<0.241	0.656	<0.25	<0.241	<0.241	0.363	0.968	<0.1	<0.2
SW-07	SED-07-03-51	3/3/2011	<0.27	0.889	1.5	1.87	1.63J	1.33	<0.675	<0.0998	<0.0998	1.44	<0.675	<0.675	2.01	<0.27	1.41	<0.25	<0.27	<0.27	0.579	2.19	<0.0998	<0.2
SW-08	SED-08-03-51	3/3/2011	<0.303	<0.757	0.998	1.21	0.92	<0.757	<0.757	<0.1	<0.1	0.872	<0.757	<0.757	1.07	<0.303	0.774	<0.25	<0.303	<0.303	<0.303	1.14	<0.1	<0.2
SW-09	SED-09-03-51	3/2/2011	<0.279	0.82	1.28	1.29	1.19	1.09	<0.698	<0.0999	<0.0999	1.22	<0.698	<0.698	1.63	<0.279	1.09	<0.25	<0.279	<0.279	0.424	1.53	<0.0999	<0.2
SW-10	SED-10-03-51	3/2/2011	<0.252	<0.63	<0.63	<0.63	<0.63	<0.63	<0.63	<0.0997	<0.0997	<0.63	<0.63	<0.63	<0.252	<0.252	<0.63	<0.249	<0.252	<0.252	<0.252	<0.252	<0.0997	<0.199
SW-11, PPE-06A	SED-11-03-51	3/2/2011	<0.22	<0.55	<0.55	<0.55	<0.55	<0.55	0.563B	<0.0998	<0.0998	<0.55	<0.55	<0.55	<0.22	<0.22	<0.55	<0.25	<0.22	<0.22	<0.22	<0.22	<0.0998	<0.2

Notes:
1. All sediment samples from Vince Bayou are included on this table, regardless of their location relative to Operable Unit 1 or Operable Unit 2.
2. Samples SED-01 and SED-02 were collected at background locations
3. J = estimated concentration.
4. < or U = not detected above reporting limit.
5. Not all qualifier flags from original data are included in this table.
6. Only compounds detected in at least one sample are included in this table.

TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

DQO STEP:	**Preliminary Conceptual Site Model Exposure Media**
1. State the Problem	*Historical information suggests that contamination exists in on-site soil in areas of former operations, and that contaminants may have migrated off-site during unauthorized releases, spills and overland runoff following storm events.*
2. Identify the Goal of the Study	*Conduct a site investigation and assess the potential risks posed by releases of chemicals associated with the property, assess potential human health and ecological risks associated with past site activities, and develop remedial alternatives to address any unacceptable risks.*
ON-SITE GROUNDWATER	
2a. Identify the Principal Study Questions	1. Do COPCs in groundwater exceed applicable state and federal groundwater quality standards or site-specific risk-based criteria established for human receptors? 2. Do non-aqueous phase liquids (NAPLs) or the potential for NAPL based on COPC concentrations exist in on-site groundwater?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the property i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	• Evaluate site hydrogeology. • Evaluate concentrations of COPCs in uppermost groundwater-bearing unit. • Perform water well and water use survey of site area. • Perform a water well records search within ½-mile of OU-2. Confirm that nearby properties are provided potable water from the local municipality. • Perform subsurface utility survey to identify obstructions for drilling program and preferential pathways for migration of COPCs. • Identify ongoing and/or historic spills/releases that have or have the potential to impact groundwater. • Evaluate potential for discharge of groundwater to surface water. • Evaluate groundwater data to assess possibility of vapor intrusion (model).

TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

DQO STEP:	Preliminary Conceptual Site Model Exposure Media
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are the groundwater contained within the property and any down-gradient groundwater that may have been impacted by on-site groundwater. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for groundwater is the entire upper-most groundwater bearing unit when evaluating the potential for vapor intrusion, or point of exposure wells if impacted groundwater discharges to surface water, or lower groundwater units if shown to be impacted.
ON-SITE SOIL	
2a. Identify the Principal Study Questions	1. Do COPCs in on-site soil pose an unacceptable risk to human health or ecological receptors? 2. Do COPCs in on-site subsurface soil pose an unacceptable risk to human health receptors? 3. What are the general soil characteristics to evaluate impact or COPC mobilization or sequestration in soil? 4. What is surface runoff drainage patterns at the site?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the property i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	• Evaluate lateral and vertical extent of COPCs in samples of site surface soil (0 to 0.5 ft bgs), shallow soils (0.5 to 5 ft bgs) and subsurface soil (greater than 5 ft bgs). • Collect general soil chemistry data (pH, TOC, grain size, etc.). • Evaluate topography and preferential surface water drainage pathways. • Identify ongoing and/or historic spills releases that have or have the potential to impact on-site soil.
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are the soil contained within the property and any topographically lower areas that may have been impacted by surface runoff or direct releases. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for soil is 0 to 0.5 feet below ground surface (bgs), 0.5 to 5 ft. bgs, and 5 ft. bgs to the top of the saturated zone.

TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

ON-SITE AND OFF-SITE AIR	
2a. Identify the Principal Study Questions	1. Do COPCs in on-site and off-site soil or groundwater pose an unacceptable risk to human health via inhalation? 2. How do site characteristics such as the presence and quality of vegetative cover, soil type and local meteorological data effect on- and off-site air concentrations (outdoor ambient air as well as indoor air)?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the property i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	1. Use on-site soil and groundwater COPC concentration data and site-specific information to estimate or model potential emissions of volatile organic compounds and fugitive dust in on-site and off-site air.
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are affected area of soil and groundwater. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for this pathway will be surface soil for fugitive dust generation, subsurface for VOC emissions and impacted subsurface soil and groundwater for indoor VOC intrusion.

TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

OFF-SITE SURFACE SOIL	
2a. Identify the Principal Study Questions	1. Do COPCs in off-site soil pose an unacceptable risk to human health or ecological receptors? 2. Do COPCs in on-site and off-site soil or groundwater pose an unacceptable risk to human health via inhalation? 3. What are the general soil characteristics to evaluate impact or COPC mobilization or sequestration in soil? 4. What are surface runoff drainage patterns in the off-site area?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the property i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	1. Evaluate lateral and vertical extent of COPCs in samples of site surface soil (0 to 0.5 ft bgs), shallow soils (0.5 to 5 ft bgs) and subsurface soil (greater than 5 ft bgs), depending on the nature of the soil area being investigated.. 2. Collect general soil chemistry data (pH, TOC, grain size, etc.). 3. Evaluate topography and preferential surface water drainage pathways. 4. Identify ongoing and/or historic spills releases that have or have the potential to impact off-site soil.
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are the off-site soil outside of the property extending to Vince Bayou. • The PCSMs show the receptors of potential concern for this pathway. The sampling unit for soil is 0 to 0.5 feet below ground surface (bgs), 0.5 to 5 ft. bgs, and 5 ft. bgs to the top of the saturated zone, depending on the nature of the soil area being investigated.
OFF-SITE SURFACE WATER	
2a. Identify the Principal Study Questions	1. Do COPCs in off-site surface water in Vince Bayou pose an unacceptable risk to human health or ecological receptors? 2. Do COPCs in off-site surface water in background areas pose an unacceptable risk to human health or ecological receptors? 3. What is the general chemistry of off-site surface water (near the site and in background areas)? 4. What is the watershed sub-basin and what are the associated uses of the off-site surface water? 5. What is the nature of the habitat in areas where off-site surface water is present? 6. What are the surface water flow characteristics in Vince Bayou?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the Site i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*

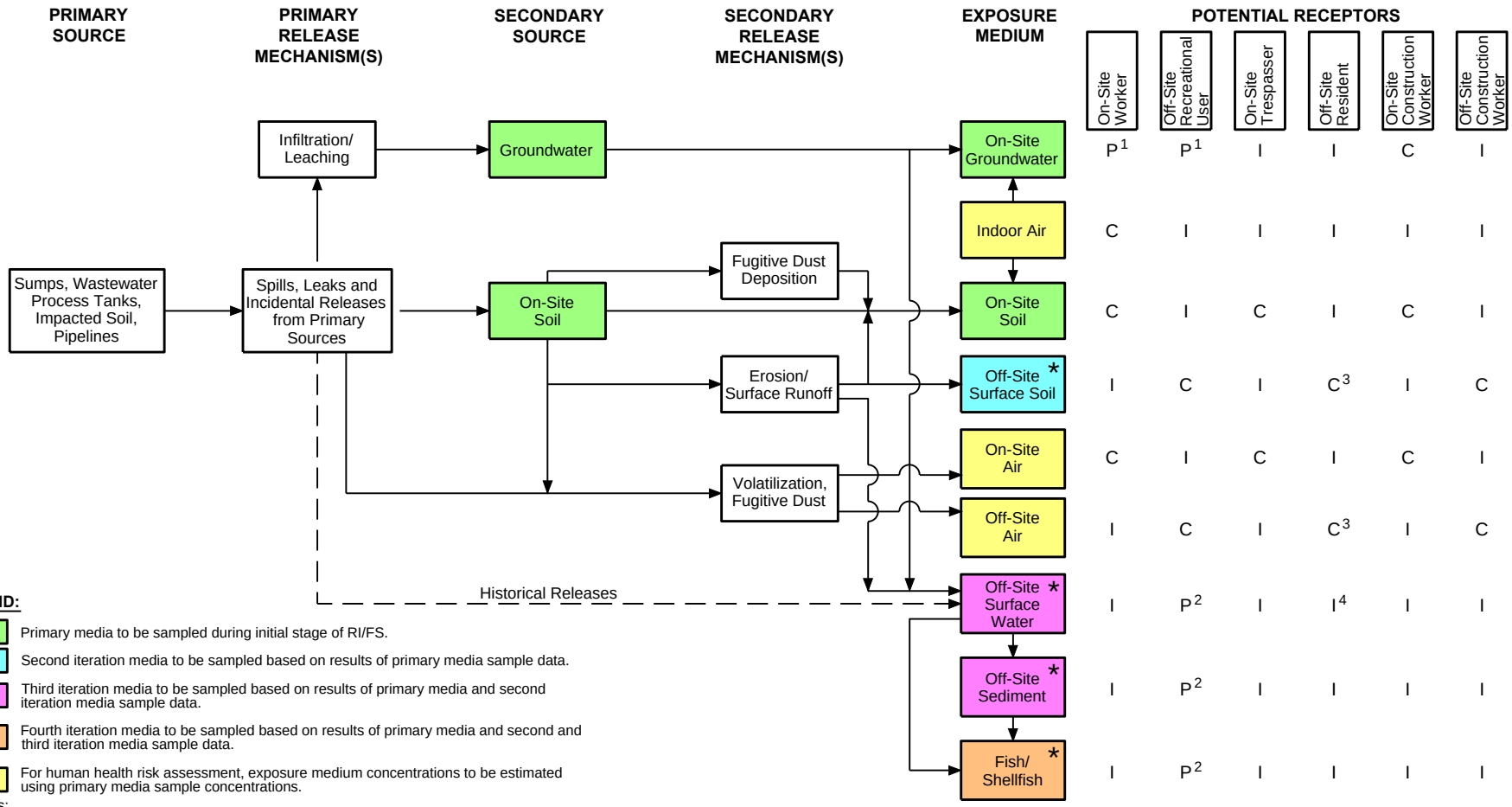
TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

3. Identify Information Inputs	1. Delineate the boundary and drainage within the watershed sub-basin. 2. Identify potential land use practices that might have impacted surface water adjacent to site. 3. Identify on-going and/or historic spills/releases that have or have the potential to impact surface water. 4. Collect data to characterize surface water flow regime (e.g., flow velocity, groundwater to surface water interactions, etc.). 5. Evaluate the surface water quality and the potential presence of COPCs in surface water.
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are the surface water in Vince Bayou near the property. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for surface water is a depth approximately halfway between the surface and the bottom of the water body in Vince Bayou and background areas.
OFF-SITE SEDIMENT	
2a. Identify the Principal Study Questions	1. Do COPCs in off-site sediment pose an unacceptable risk to human health or ecological receptors? 2. Do COPCs in off-site sediment in background areas pose an unacceptable risk to human health or ecological receptors? 3. What is the nature of habitat in areas where sediment is present? 4. What is the general chemistry and physical characteristics of off-site sediment (near the property and in background areas)?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the Site i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	1. Identify ongoing and/or historic spills/releases that have or have the potential to impact off-site sediment in Vince Bayou or Little Vince Bayou. 2. Collect sediment samples from Vince Bayou and background areas upstream in Vince Bayou and Little Vince Bayou.
4. Identify the Boundaries of the Study	• The spatial boundaries of the project are the sediments in Vince Bayou near the property. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for these sediments is the biologically active zone in Vince Bayou and background sediment.

TABLE 7 – DATA QUALITY OBJECTIVES FOR OU2
DRAFT

FISH AND SHELLFISH	
2a. Identify the Principal Study Questions	1. Do COPCs in Vince Bayou and Little Vince Bayou fish tissue pose an unacceptable risk to human health or ecological receptors?
2b. Define Alternative Actions	*The alternative actions that could result from the resolution of the principal study questions are to recommend that portions of the site i) require no further evaluation or selection of a remedy; or ii) warrant additional assessment or selection of a remedy.*
3. Identify Information Inputs	• Collect samples from finfish species (legal size limit) commonly caught in the area and consumed; and samples from shellfish caught in the vicinity of the site. • Measure City of Pasadena/MCC-property-related COPCs in fish tissue samples collected (COPCs, excluding essential nutrients, detected above sample quantitation limits (SQLs) and background in the sediment samples will determine the list of COPCs to be analyzed in fish tissue samples). • Validate the analytical data. • If warranted, analyze background fish tissue samples for selected COPCs reported in fish tissue samples. • QA/QC samples: Collect 1 field duplicate and 1 MS/MSD sample per species for COI analyses. • Analytical method detection limit targets will be identified following sediment sampling.
4. Define Boundaries of the Study	• The boundaries are the approximate property boundaries as extended to the adjacent Vince Bayou. Background samples will be collected from a designated area upstream of this area as well as in Little Vince Bayou. • No vertical boundaries – fish may be sampled from any depth. • The PCSMs show the receptors of potential concern for this pathway. • The sampling unit for fish and shellfish are individual fillet samples although composite shellfish samples may be necessary to provide adequate sample volume.

FIGURES



LEGEND:

- Primary media to be sampled during initial stage of RI/FS.
- Second iteration media to be sampled based on results of primary media sample data.
- Third iteration media to be sampled based on results of primary media and second iteration media sample data.
- Fourth iteration media to be sampled based on results of primary media and second and third iteration media sample data.
- For human health risk assessment, exposure medium concentrations to be estimated using primary media sample concentrations.

Notes:

C Pathway is potentially complete.

P Pathway is possibly complete.

I Pathway is incomplete.

1 It is unlikely that shallow groundwater in this area is useable given the salinity. However, Site data will be collected to characterize the salinity of all relevant groundwater bearing units. A survey of the on- and off-site area for the presence of water wells will also be performed as part of the groundwater investigation. Potential impacts will be investigated to ensure that these pathways are incomplete for off-site groundwater and/or deeper groundwater units, if appropriate.

2 Potential exposures and associated chemicals of concern for these receptors will be evaluated through an iterative process in consideration of primary source data and data for transport media collected during the RI/FS.

3 Potential impacts from soil VOC and particulate dust emissions potentially impacting nearby residents will be evaluated based on the primary media data to evaluate the completeness of migration pathways to off-site air, fruit trees, above-ground and below-ground produce, and domestic livestock.

4 Surface water is not a potable or agricultural resource due to high natural salinity and bacterial levels in the area.

* Sampling of these media to be performed in conjunction with appropriate background sampling, if necessary.

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FOR DISCUSSION PURPOSES ONLY

US OIL RECOVERY SITE

PASADENA, TEXAS

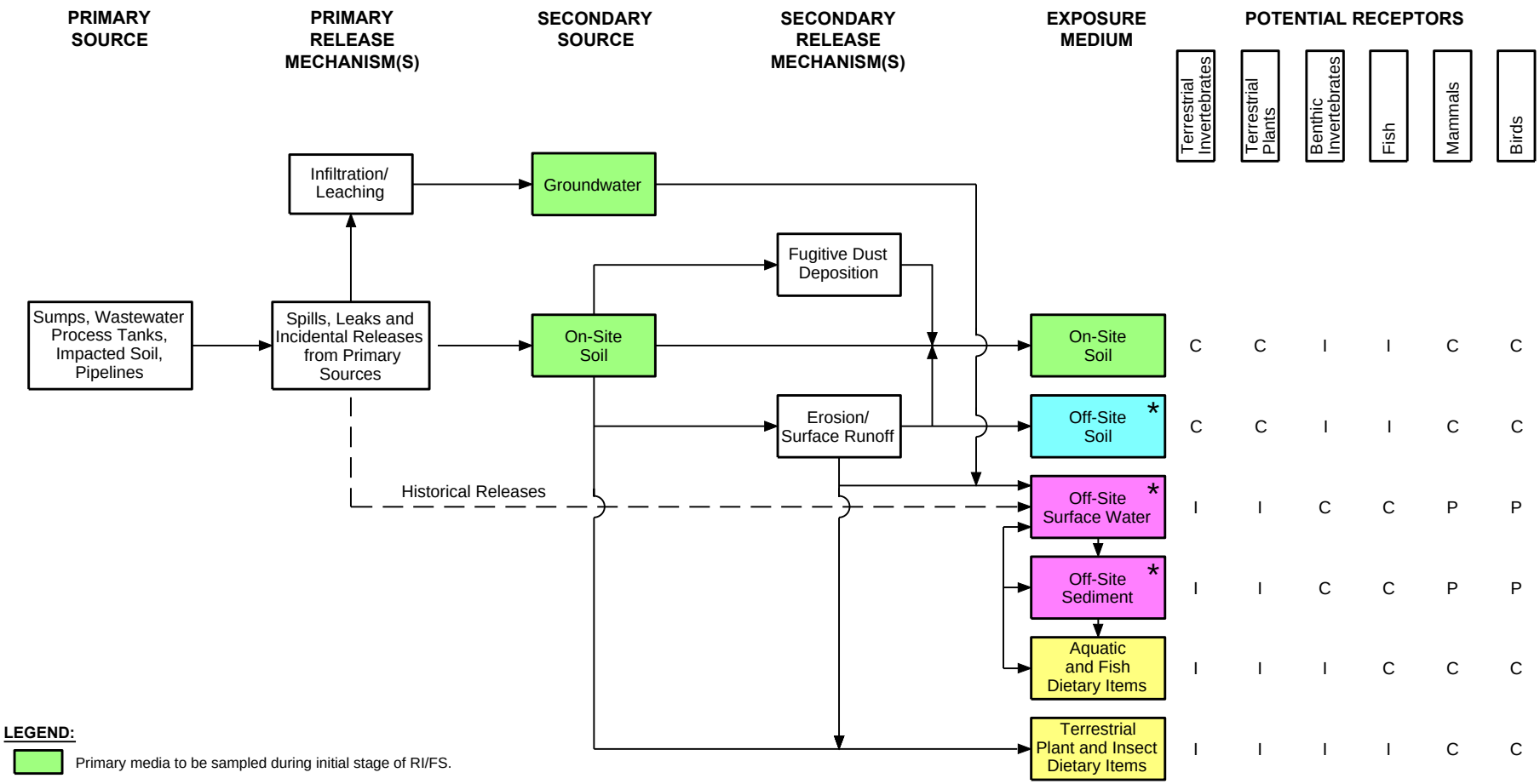
Figure 1

PRELIMINARY HUMAN HEALTH CONCEPTUAL SITE MODEL CITY OF PASADENA/MCC PROPERTY

PROJECT: 1863	BY: ZGK	REVISIONS
DATE: JUNE, 2013	CHECKED: KHT	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS



LEGEND:

- Primary media to be sampled during initial stage of RI/FS.
- Second iteration media to be sampled based on results of primary media sample data.
- Third iteration media to be sampled based on results of primary media and second iteration media sample data.
- For screening level ecological risk assessment, exposure medium concentrations to be estimated using primary media sample concentrations.

Notes:

C Pathway is potentially complete.

I Pathway is incomplete.

P Potential exposures for COPCs will be evaluated in an iterative manner based on sample results from primary media.

* Sampling of these media to be performed in conjunction with appropriate background sampling, if necessary.

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FOR DISCUSSION PURPOSES ONLY

US OIL RECOVERY SITE

PASADENA, TEXAS

Figure 2

PRELIMINARY ECOLOGICAL CONCEPTUAL SITE MODEL CITY OF PASADENA/MCC PROPERTY

PROJECT: 1863	BY: ZGK	REVISIONS
DATE: JUNE, 2013	CHECKED: KHT	

PASTOR, BEHLING & WHEELER, LLC

CONSULTING ENGINEERS AND SCIENTISTS

EXPLANATION

Approx. Property Boundary

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N

Approx. Scale in Feet

0 40 80

Source:
Houston-Galveston Area Council, April 2012 Image, 2012 Aerial Imagery Data is the sole property of Houston-Galveston Area Council, which reserves all rights thereto. Use or reproduction of this data is strictly prohibited absent written consent from the Houston-Galveston Area Council.

US OIL RECOVERY
PASADENA, TEXAS

Figure 3

OPERABLE UNIT 2
SITE LAYOUT

PROJECT: 1863	BY: AJD	REVISIONS
DATE: JUNE, 2013	CHECKED: MKW	

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EXPLANATION

- Approx. Property Boundary
- Approx. Surface Water and/or Sediment Sample Location
- Approx. Background Surface Water and Sediment Sample Location
- Approx. Soil Sample Location

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N

Approx. Scale in Feet

0 40 80

Source:
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US OIL RECOVERY
PASADENA, TEXAS

Figure 4

OPERABLE UNIT 2
HISTORICAL DATA SAMPLE LOCATION MAP

PROJECT: 1863	BY: AJD	REVISIONS
DATE: JUNE, 2013	CHECKED: MKW	

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EXPLANATION

- Approx. Property Boundary
- Approx. Surface Water and/or Sediment Sample Location (EPA, 2011)
- Approx. Background Surface Water and Sediment Sample Location

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N

Approx. Scale in Feet

0 125 250

Source:
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US OIL RECOVERY
PASADENA, TEXAS

Figure 5

HISTORICAL SURFACE WATER AND SEDIMENT SAMPLING LOCATIONS

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DATE: JUNE, 2013	CHECKED: MKW	

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EXPLANATION

- Approx. Property Boundary
- Proposed Soil Boring Location (Source Areas/Industrial Activities)
- Proposed Soil Boring Location (Drainage Areas)
- Proposed Monitoring Well Location
- Proposed CPT Transect Location
- Proposed CPT Location
- Proposed CPT/ROST Location

Note:
All locations are approximate and subject to change.

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FOR REVIEW ONLY

N

Approx. Scale in Feet
0 40 80

Source:
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US OIL RECOVERY
PASADENA, TEXAS

Figure 6
OPERABLE UNIT 2
PROPOSED SAMPLING LOCATIONS
RI/FS ITERATION 1

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DATE: JUNE, 2013	CHECKED: MKW	

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