

October 26, 2020

Ms. Karen Scott Industrial & Hazardous Waste Permits Section Texas Commission on Environmental Quality P.O. Box 13087, MC-130 Austin, Texas 78711-3087

Re: Response to TCEQ Comments/Replacement Pages Permit Renewal/Compliance Plan with Major Amendment Union Pacific Railroad Company – Houston Wood Preserving Works, Houston, Harris County, Texas Hazardous Waste Permit/Compliance Plan No.: 50343, ISWR No. 31547 Tracking No. 18836453; CN600131098/RN100674613

# Dear Ms. Scott:

Union Pacific Railroad (UPRR) submits this letter as a response to the Texas Commission on Environmental Quality (TCEQ)'s comments on the RCRA Permit Renewal/Compliance Plan with Major Amendments dated August 31, 2020 for the facility listed above (the Site) that were communicated during a conference call between the TCEQ, UPRR, and Golder Associates Inc (Golder) on October 12, 2020. Based on that conference call, TCEQ had the following comments and recommendations:

1. Update the Post Closure Care Tables VII.D and VII.E-2 in Section VII of the RCRA Permit Renewal Application to 2019 dollars.

Response: UPRR updated the estimated costs provided in Post Closure Care Tables VII.D and VII.E-2 to 2019 dollars using the U.S. Bureau of Labor Statistics Consumer Price Index (CPI) Inflation Calculator.

2. Revise Compliance Plan (CP) Attachment A figures.

Response: Based on TCEQ comments, UPRR revised the CP Attachment A figures as follows:

- Formatted the Attachment A figures to be plotted in gray-scale;
- Removed the protective concentration level exceedance (PCLE) zones from the figures;
- Reformatted Sheets 4, 5, and 6 into two figures each (i.e. a North (Sheet 4A, 5A, and 6A) and South (Sheet 4B, 5B, and 6B) section) to make the figures more legible;
- Designated MW-54B, MW-59B, and MW-60B as alternate point of exposure (APOE) wells for the B-CZ/B-TZ unit and extended the B-CZ/B-TZ Off-Site PMZ boundary to include those APOE wells;
- Added D-TZ monitoring wells to Sheet 6A and Sheet 6B; and
- Renamed Sheet 7 of 7 to Post-Response Action Care Capped Areas, NAPL Collection System, and Slurry Wall and included the NAPL Collection System in the Englewood Intermodal Yard and proposed location of the slurry wall on the figure.

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3. Adjust the location of recovery wells RW-11A and RW-14A to be in the vicinity of CPT/TarGOST locations, CPT-12-20 and CPT-15-20/CPT-16-20.

Response: UPRR adjusted the location of proposed recovery wells RW-11A and RW-14A to be in the vicinity of CPT/TarGOST locations, CPT-12-20 and CPT-15-20/CPT-16-20. Figures showing recovery wells in the CP Attachment A and Response Action Plan (RAP) were revised with the adjusted proposed locations.

4. Install additional A-TZ monitoring wells in the vicinity (within 100 feet) of CPT/TarGOST locations, CPT-56-20 and CPT-42-19.

Response: Existing A-TZ monitoring well MW-15A is within 100 feet of CPT-56-20 and therefore serves as the monitoring well in the vicinity of that location. UPRR added an additional proposed A-TZ monitoring well, PMW-102A, as a corrective action observation well (CAO), near CPT-42-19 in the Englewood Intermodal Yard. The proposed A-TZ monitoring well PMW-102A was added to the relevant figures and pages in the CP and RAP.

5. Provide analysis of CPT-03-20.

Response: The TarGOST log for CPT-03-20 with the TarGOST analysis is found in Attachment A of the Interim Non-Aqueous Phase Liquid (NAPL) and Total Petroleum Hydrocarbon (TPH)-NAPL Assessment Report which was submitted to the TCEQ on May 29, 2020. The report was included as Appendix 3D to the RAP dated August 31, 2020.

6. Revise the Financial Assurance Tables XI.E.2 and XI.E.3.

Response: UPRR revised cost estimate Tables XI.E.2 and XI.E.3 in the Compliance Plan to include the additional proposed A-TZ monitoring well (PMW-102A) as a CAO well and the reassigned B-CZ/B-TZ monitoring wells MW-54B, MW-59B, and MW-60B as APOE wells. Clarifying language was added to distinguish between site-wide background wells and background wells for RCRA-Regulated Waste Management Unit 001 (SWMU 1), and the groundwater sampling cost estimate was updated.

The above-mentioned modifications resulted in revisions to attachments, figures, and text of Sections VII and XI of Part B of the RCRA Permit Renewal. With this submittal, the following replacement pages and revised figures as Revision No. 6 are attached:

- Part B Signature Page
- Permit Section VII: Table VII.D and VII.E-2
- Permit Section XI Compliance Plan
  - o Replacement pages 7, 19, 29, and 32
  - Compliance Plan Attachment A Figures
  - Compliance Plan Table V
  - o Tables XI.E.2 and XI.E.3
- Permit Section XI Attachment D: Response Action Plan (RAP)
  - Replacement pages: Worksheet 2.1 pages 2 and 8, Worksheet 5.0 page 5, and Worksheet 6.0
  - o Attachments 2A-2a and 2A-2b

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- o Attachment 2B replacement page 1 and Figure 2B-1
- Attachments 2D-1, 2D-2, and 2D-3
- o Attachments 3A-1 and 3A-2 and Table 1 of Attachment 3A
- Attachment 5A and 5B

If you have any questions or need additional information, please feel free to call me at 414-267-4164.

Sincerely,

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Kevin Peterburs Senior Manager, Environmental Site Remediation

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TCEQ Part B Application TCEQ-00376 (Rev. 9-29-2017 M.L. Shannon)

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Task	Cost
SWMU No. 1 Task 1 – Post-Closure Care Inspections and Maintenance Task 2 – Sample Collection and Analysis Task 3 – Annual Groundwater Monitoring Report	\$11,016 \$12,401 \$5,322
subtotal	\$28,739
Contingency (10% minimum)	\$2,873.90
Total Unit Post-Closure Care Cost x 10 yrs.	\$316,129 (2019) (10 years)
SWMU No. 1 Task 4 – Well Casing Surveys (occurs every 5 years) Task 5 – Groundwater POC plugging	\$10,877 \$13,108
subtotal	\$23,985
Contingency (10% minimum)	\$2,399
Total Unit Post-Closure Care Cost (one time cost+	\$26,384 (2019) (one time cost)

# Table VII.D. - Unit Post-Closure Cost Estimate

Total Permitted Facility Post-Closure Cost (all unit costs combined)	\$342,513 (2019)
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Existing Unit Post-Closure Cost Estima	ate
Unit	Cost
SWMU No. 1	\$342,513 (2019)
Total Existing Unit Post-Closure Cost Estimate	\$342,513 (in 2019 Dollars) <sup>1</sup>

# Table VII.E.2. - Permitted Unit Post-Closure Cost Summary

Proposed Unit Post-Closure Cost Estimate			
Unit	Cost		

<sup>1</sup>As units are added or deleted from these tables through future permit amendments or modifications, the remaining itemized unit costs should be updated for inflation when re-calculating the revised total cost in current dollars.

# A. SITE SPECIFIC INFORMATION

- 1. <u>General Site Information (provide the following information):</u>
  - a. An overall plan view map of the entire facility delineating the facility's property boundary, Facility Operations Area (FOA) boundaries, as applicable, and the plume management zone (PMZ) boundaries as applicable;

# See CP Attachment A, Sheet 2 of 7 – Solid Waste Management Units (SWMUs)/Area of Concern (AOCs) Location Map

b. A 7.5 minute U.S.G.S. quadrangle topographic map showing the entire facility;

# See CP Attachment A, Sheet 1 of 7 – Facility Site Map

c. All oversized (larger than 8.5" by 11") drawings submitted in accordance with a and b, above, should be accompanied with legible photocopies of the reduced drawing on 8.5" by 11" sheet(s) of paper which shall be used as "CP Attachment A" maps in the final draft Permit/Compliance Plan. The applicant should title the map(s) accordingly as "CP Attachment A, Sheet 1 of xx – Facility Site Map"; "CP Attachment A, Sheet xx of xx, FOA Lateral Boundary Map"; "CP Attachment A, Sheet xx of xx, PMZ Boundary Location Map"; and

# The following maps are provided with this revision:

- CP Attachment A, Sheet 1 of 7 Facility Site Map
- CP Attachment A, Sheet 2 of 7 Solid Waste Management Units (SWMUs)/Area of Concern (AOCs) Location Map
- CP Attachment A, Sheet 3 of 7 Compliance Monitoring Well Network
- CP Attachment A, Sheet 4A and 4B of 7 PMZ Boundary Map, A-TZ
- CP Attachment A, Sheet 5A and 5B of 7 PMZ Boundary Map, B-CZ/B-TZ
- CP Attachment A, Sheet 6A and 6B of 7 PMZ Boundary Map C-TZ, and D-TZ Monitoring Wells
- CP Attachment A, Sheet 7 of 7 Post Response Action Care Capped Areas, NAPL Collection System, and Slurry Wall
- d. Aerial photographs through time depicting changes in the land use, if available.

# See Compliance Plan Figure XI.A.1.d (three years presented)

2. <u>Waste Management</u>

Provide a complete list and a plan view drawing(s) locating and identifying the following waste management units at the scale of 2.5 centimeters (1 inch) equal to not more than 61.0 meters (200 feet). All oversized (larger than 8.5" by 11") drawings should be accompanied with legible photocopies of the reduced drawing on 8.5" by 11" sheet(s) of paper. Please provide information for each waste management unit listed below on Table XI.A.1. – Facility History for Waste Management Units.

 All hazardous waste management units regulated under the Industrial Solid Waste and Municipal Hazardous Waste Rules (Chapter 335) required to be monitored in accordance with 30 TAC 335.164 (Detection Monitoring), 335.165 (Compliance Monitoring Program) and 335.166 (Corrective Action Program);

- a. Groundwater well recovery with surface treatment
- b. Groundwater well recovery/surface treatment/re-injection
- c. Groundwater well recovery and disposal
- d. Vapor extraction system
- e. Interceptor trench recovery and disposal
- f. Interceptor trench recovery and surface treatment
- g. In-situ treatment bioreclamation
- h. In-situ treatment chemical reaction
- i. Barrier walls/encapsulation
- j. Permeable treatment beds
- k. Other, please describe

# See CP Attachment XI.D (RAP) for the discussion and description of proposed types of corrective actions. As detailed in the RAP, the type of corrective action proposed includes:

- (i.) Barrier walls/encapsulation Slurry wall; and
- (k.) Other NAPL recovery activities.

# 2. <u>Program Description</u>

Attach a technical report providing a detailed description of a complete corrective action system including above and below ground equipment/facilities. Include discussions on the following concerns for each type of corrective action as applicable.

### See RAP (CP Attachment XI.D).

a. Recovery Wells

# See RAP (CP Attachment XI.D) and CP Attachment A Sheet 4A of 7, Sheet 4B of 7, Sheet 5A of 7, Sheet 5B of 7, Sheet 6A of 7, and Sheet 6B of 7.

- (1) Indicate on a plan view of the waste management area the anticipated location of Recovery Well(s) which would optimize the extraction of the groundwater contaminants.
- (2) Indicate on a plan view the estimated radius of influence of each Recovery Well.
- (3) Indicate the optimum pumping rate of each Recovery Well determined from the aquifer pump test.
- (4) Describe the design of the Recovery Wells and pump system including diameter, construction material, gravel packing, screen slot sizes and patterns, type of pumps and maintenance requirements.
- (5) Describe the collection and storage of the contaminated groundwater which is classified hazardous waste (on-site storage of hazardous waste shall require compliance with the applicable regulations):
  - (a) Less than 90-day tanks (see 40 CFR 262.34/40 CFR 265 Subpart J);
  - (b) Permitted Tanks (see 40 CFR 264 Subpart J);
  - (c) Less than 90-day Container Storage Area (see 40 CFR 262.34/40 CFR 265 Subpart I);
  - (d) Permitted Container Storage Area (see 40 CFR 264 Subpart I); and
  - (e) Temporary Units (see CFR 264.553).
- (6) Describe the treatment and/or final disposition of the hazardous and nonhazardous contaminated groundwater.

upgradient sample SSW1 that had a detection of bis(2-ethylhexl)phthalate (0.0092 mg/L) above the  $^{GW}GW_{ing}$  PCL of 0.006 mg/L; however, bis(2-ethylhexyl)phthalate is a common laboratory contaminant (as cited in 30 TAC§350.71(k)(2)(B)). The sanitary sewer sample analytical results suggest that there is not a significant mass loading of COCs from groundwater into the sanitary sewer.

(5) Corrective action system.

See RAP, Worksheet 2.0 (CP Attachment XI.D). UPRR will install additional recovery wells and continue DNAPL recovery activities from the wells where DNAPL has been detected and recovered (see RAP, Worksheet 3.1, Attachment 3A – Table 1 (CP Attachment XI.D) for the list of existing and proposed DNAPL recovery wells (i.e., Corrective Action System Wells)).

b. For each waste management unit/area in the proposed groundwater monitoring system, submit the locations of individual waste management unit/area monitor wells (existing or proposed) and any soil borings (plugged and unplugged) specifically drilled for assessment of contamination. These individual monitor wells shall be identified by respective well number on a plan view drawing and only the background, point of compliance, point of exposure wells and/or alternate point of exposure wells should be indicated in CP Table V – Designation of Wells by Function. The plan view map depicting the location of individual monitoring wells for corrective action monitoring should be labeled as "CP Attachment A, sheet xx of xx" in the text box. The title box should also include reference to the facility name, Permit/Compliance Plan Number, Solid Waste Registration Number, Unit Description or name with Notice of Registration (NoR) Unit No. 0000. The "CP Attachment A" map(s) and CP Table V shall also become part of the final Permit/Compliance Plan.

The following maps show the monitoring wells proposed as part of the Corrective Action Monitoring Program for the facility-wide approach using PMZs:

- CP Attachment A, Sheet 4A and 4B of 7 PMZ Boundary Map, A-TZ
- CP Attachment A, Sheet 5A and 5B of 7 PMZ Boundary Map, B-CZ/B-TZ
- CP Attachment A, Sheet 6A and 6B of 7 PMZ Boundary Map, C-TZ, and D-TZ Monitoring Wells

See Compliance Plan Table V (Designation of Wells by Function) and associated sheets.

5. Waste Management Units/Areas Addressed Under Other Corrective Action Programs -Facility Operations Area (FOA), specific to the requirements of 30 TAC 350.131 - 350.135. The Permittee should also complete Sections XI.D.4. for other units not addressed by the FOA that may require corrective action outside the FOA boundary. For other units not addressed by the FOA, either within the FOA or outside the FOA which may require compliance monitoring, the Permittee should complete Section XI.C. of this application accordingly.

# Not Applicable

- a. Provide an approved version of the FOA Qualifying Criteria Checklist and evidence that Steps 1 through 3 of the FOA pre-approval process has been approved by the Commission.
- b. Provide a discussion on exceptions to the TRRP rule requested.
- c. Provide a summary of the SWMUs/AOCs that will be addressed within the FOA boundary and a discussion of the multiple sources of COCs present and how FOA will better address these sources.
- d. Provide maps of appropriate scale depicting the following (maps may be combined where

See CP Attachment A, Sheet 1 of 7 - Facility Site Map.

(3) PMZ lateral boundaries

See the following maps for PMZ lateral boundaries proposed as part of the Corrective Action Monitoring Program for the facility-wide approach:

- CP Attachment A, Sheet 4A and 4B of 7 PMZ Boundary Map, A-TZ
- CP Attachment A, Sheet 5A and 5B of 7 PMZ Boundary Map, B-CZ/B-TZ
- CP Attachment A, Sheet 6A and 6B of 7 PMZ Boundary Map, C-TZ, and DTZ Monitoring Wells

UPRR proposes to monitor groundwater in wells within and around the Off-Site PMZ (City of Houston ROW) as part of the corrective action groundwater monitoring program. Data collected from the monitoring wells off-Site will be used to evaluate response actions to address the groundwater PCLE Zone.

(4) potential source areas

See RAP in CP Attachment XI.D, Attachment 1A (Figure 1A) and Figure XI.A.2.

(5) Potentiometric surface of all relevant transmissive units

# See RAP in CP Attachment XI.D, Appendix 3C (Interim Groundwater Monitoring Report (2019-2020)).

(6) Surrounding water wells

# See Permit Section VI. Geology Report – Figure VI.H

(7) extent of known contamination in each transmissive unit

# See RAP in CP Attachment XI.D, Appendix 3C (Interim Groundwater Monitoring Report (2019-2020))

(8) number, location and type of monitoring points in each stratigraphic unit to be monitored

# See RAP in CP Attachment XI.D, Worksheet 3.0 and Attachment 3A, Tables 1.

(9) Areas of potential ecological impact

None, no potential ecological impacts as discussed in the APAR (PBW, 2009).

(10) known occurrences of LNAPL or DNAPL in each transmissive unit

# See RAP in CP Attachment XI.D, Appendix 3 (Interim NAPL and TPH-NAPL Report and DNAPL Recovery Activities Quarterly Report $-2^{nd}$ Quarter 2020)

- d. Please provide sufficient cross-sections depicting the following (maps may be combined where appropriate);
  - (1) The vertical boundaries of the PMZ;
  - (2) The vertical extent of contamination;
  - (3) potentiometric surfaces for each transmissive unit.

# **CP Table V: Designation of Wells**

Point of Compliance Wells: (RCRA- Regulated Waste Management Unit 001 (SWMU 1) Only)

- A-TZ POC wells: MW-01A, MW-02, MW-07, MW-10A, and MW-11A;
- B-TZ POC wells: MW-10B, MW-11B, and P-10.

# Point of Exposure Wells:

# NONE

# Alternate Point of Exposure Wells (PMZ Wells) (for other SWMUs and AOCs):

1. <u>A-TZ</u>

On-Site: MW-12A, MW-13, MW-15A, MW-50A, MW-69A, MW-88A, MW-97A, MW-98A Off-Site: \*\*MW-101A, MW-32AR, MW-33A, \*\*MW-71A, \*\*MW-34A, MW-36A, MW-25A, MW-61A, MW-59A, MW-47A

2. <u>B-TZ/B-CZ</u>

On-Site (Main): MW-14, MW-15B, MW-50B, MW-80B, MW-88B, MW-98B On-Site (West): MW-22BR, MW-38B, MW-39B, MW-42B, MW-62B, P-10, P-12 Off-Site: \*\*RW-1B, MW-32B, MW-36B, MW-54B, MW-59B, MW-60B, MW-61B, MW-70B, MW-71B

3. <u>C-TZ</u>

On-Site: MW-15C, MW-47C, MW-19C, and MW-88C Off-Site: \*\*MW-32C, \*\*MW-71C, MW-34CR, MW-54C, MW-48C, MW-70C

# Background Wells (RCRA- Regulated Waste Management Unit 001 (SWMU 1)):

- 1. <u>A-TZ</u>: MW-8
- 2. <u>B-TZ:</u> P-12

### FOA Boundary of Compliance Wells Background Wells:

Exposure Pathway: (e.g. SWGW - Groundwater to surface water PCL for Brazos River or Barge Canal, etc)

### NONE

- **Note:** Wells that are not listed in this table are subject to change, upon approval by the Executive Director, without modification to the Compliance Plan.
  - \* Proposed APOE Wells for the Off-Site PMZ will be corrective action observation wells pending PMZ approval.
  - \*\* Proposed well, will be installed following approval of the Response Action Plan (see CP Attachment XI.D)

# TABLE XI.E.2. – GROUNDWATER MONITORING COST ESTIMATE

1. Annual Sampling and Analysis Cost	
A. Background Wells (SWMU 1 Wells only)	
(1) Number of wells	2
(2) Sample analysis cost per well	\$ 150.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 600.00 \$
B. Point of Compliance Wells (SWMU 1 Wells only)	
(1) Number of wells	8
(2) Sample analysis cost per well	\$ 150.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 2,400.00 \$
C. Recovery Wells	
(1) Number of wells	
(2) Sample analysis cost per well	\$/well
(3) Number of sampling events per year	/yr
(4) Sampling $cost (1 x 2 x 3)$	\$ - \$
D. Corrective Action Observation Wells	
(1) Number of wells	51
(2) Sample analysis cost per well	\$ 250.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 25,500 \$
E. Point of Exposure Wells	
(1) Number of wells	50
(2) Sample analysis cost per well	\$ 250.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 25,000 \$
F. Supplemental Wells (Site-Wide Background Wells)	
(1) Number of wells	3
(2) Sample analysis cost per well	\$ 250.00 \$/well
(3) Number of sampling events per year	2 /yr
	·
(4) Sampling cost $(1 \times 2 \times 3)$	\$ 1,500 \$

# TABLE XI.E.2. – GROUNDWATER MONITORING COST ESTIMATE

G. Field Quality Control Sampling	
(1) Number of wells	6
(2) Sample analysis cost per well	\$ 250.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 3,000.00 \$
2. Sampling Labor Cost:	
A. Hours of sampling per well	2 hrs/well
B. Number of sampling technicians per well	1
C. Charge per hour	\$ 95.00 \$/hr
D. Total number of wells to be sampled annually	Wells
E. Total number of wells sampled semi-annually	114 Wells
F. Total number of wells sampled quarterly	Wells
G. Total number of wells sampled monthly	Wells
H. Total number of wells sampled per year	total wells
$(2D) + (2E \times 2) + (2F \times 4) + (2G \times 12)$	228 sampled/y
I. Sampling Labor Cost (2A x 2B x 2C x 2H)	\$ 43,320 \$
*Annual Groundwater Monitoring Cost	<u>\$ 101,320</u>
3. Well Installation (typical cost):	
A. Monitor well installation cost per well	\$ 15,000 \$/well
B. Number of monitor wells to be installed	7 Wells
C. Cost of monitor well system (A x B)	\$ 105,000 \$
D. Recovery well installation cost per well	\$ 16,700 \$/well
E. Number of Recovery Wells to be installed	16 Wells
F. Cost of Recovery well system (D x E)	\$ 267,200 \$
*Total Well Installation Cost (3C + 3F)	\$ 372,200 <b>\$</b>
4. Administrative Cost:	
A. Annual cost for record-keeping and report preparation	<u>\$ 27,650</u> \$
*Annual Administrative Cost (4A)	<u>\$ 27,650</u> <b>\$</b>
5. Inspection and Maintenance Cost for the Monitoring Program:	
A. Operator's time (hours) on-site for inspections and maintenance per year	20 hour/yr
B. Charge or salary per hour	\$ 90.00 \$/hr
C. Annual cost of labor (5A x 4B)	\$ 1,800 \$/yr
D. Replacement of parts and equipment per year	\$ 7,700.00 \$/yr
*Annual Inspections / Maintenance Cost for the Groundwater Monitoring	¢ 0.500 ¢
Program (5C + 5D)	\$ 9,500 <b>\$</b>

# TABLE XI.E.3. – FINANCIAL ASSURANCE SUMMARY

Annual Off-Site Liquid Treatment / Disposal Cost	\$ 37,400	_
Annual Inspection / Maintenance / Operation Cost For The Corrective Action Program	\$ 47.000	-
Annual Groundwater Monitoring Cost	\$ 101,320	-
Annual Administrative Cost	\$ 27,650	-
Annual Inspection And Maintenance Cost For The Groundwater Monitoring Program	\$ 9,500	-
Annual DNAPL Recovery Costs (MPE)	\$ 106,110	-
Annual Sub Total	\$ 328,980	_
Total Years Used For Calculating Financial Assurance	\$ 30	Yrs
Remediation Cost	\$ 9,869,400	
(Annual Sub Total x Total Tears Osed)		-
Physical Control - Slurry Wall Construction (HWPW		
1. Pre-Design Work	\$ 294,500	
2. Engineering Design	\$ 125,900	
3. Slurry Wall Install (Mobilization/Site Prep/Construction/QA	\$ 7,007,000	_
SLURRY WALL CONSTRUCTION TOTAL	\$ 7,427,400	
NAPL Recovery- MPE System		
1. Pre-Design Work (Pilot Test)	\$ 22,000	
2. Engineering Design	\$ 21,625	
3. MPE System Construction	\$ 220,675	_
MPE SYSTEM TOTAL	\$ 264,300	
Total Well Costs (Recovery & Monitoring)	\$ 372,200	
10% Contingency	\$ 1,756,110	-

Grand Total Cost (nearest \$1000) \$ 19,689,000



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IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODI









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SWMU 12

BASE MAP FROM ERM-SOUTHWEST, INC APAR ADDENDUM, FIG 3-1, DATED JUNE 2004.

- 1 VERTICAL DATUM BASED ON CITY OF HOUSTON VERTICAL DATUM (HVD). 2.
- DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL (JANUARY 2020).
- 3. (B) - BACKGROUND WELL.
- \* PROPOSED WELL LOCATION. 4

2020-10-19 AJD AJD/RS GOLDER REVIEWED MH TEXAS GEOSCIENCE FIRM NO. 50369 TEXAS GEOSCIENCE FIRM NO. 50509 TEXAS ENGINEERING FIRM NO. 2578 APPROVED ECM PROJECT NO. REV. CP ATTACHMENT A 19119232 0 SHEET 4B of 7



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Response Action Plan Replacement Pages



LEGEND	
	UPRR PROPERTY BOUNDARY
	PROPERTY BOUNDARY (GIMS)
<b>•</b>	A-TZ MONITORING WELL LOCATION
<b>+</b>	B-CZ/B-TZ MONITORING WELL LOCATION
<b>•</b>	C-TZ MONITORING WELL LOCATION
<b>•</b>	D-TZ MONITORING WELL LOCATION
8	CORRECTIVE ACTION SYSTEM WELL (DNAPL RECOVERY)
	GROUNDWATER PCLE ZONES (JAN-MAR 2020) (A-TZ, B-CZ/B-TZ AND C-TZ)
	GROUNDWATER PCLE ZONE - ARSENIC (JAN-MAR 2020) (A-TZ AND B-TZ)
MW-10A 🙀	RCRA UNIT NO. 1 POINT OF COMPLIANCE (POC) WELL
	PROPOSED CUMULATIVE PMZ (A-TZ, B-CZ/B-TZ, AND C-TZ)
	PROPOSED ON-SITE PMZ
	PROPOSED OFF-SITE PMZ - CITY OF HOUSTON ROW
	RAILROAD BALLAST CAP AREA
	ASPHALT CAP AREA
	SOIL CAP
$\overline{///}$	CONCRETE CAP AREA
	PROPOSED SLURRY WALL (APPROX. 75 FT BGS)
	PROPOSED SLURRY WALL (APPROX. 50 FT BGS)
•	PROPOSED A-TZ MONITORING WELL LOCATION
•	PROPOSED C-TZ MONITORING WELL LOCATION
	PROPOSED CORRECTIVE ACTION WELL LOCATION (A-TZ DNAPL RECOVERY WELL)
	PROPOSED CORRECTIVE ACTION WELL LOCATION (B-CZ/B-TZ DNAPL RECOVERY WELL)
	PROPOSED CORRECTIVE ACTION WELL LOCATION (C-TZ DNAPL RECOVERY WELL)
NOTE(S)	

- VERTICAL DATUM BASED ON CITY OF HOUSTON VERTICAL DATUM (HVD).
- 2. DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL (JANUARY 2020). 3. (B) - BACKGROUND WELL.

#### REFERENCE(S)

CLIENT

PARCEL BOUNDARIES: CITY OF HOUSTON GEOGRAPHIC INFORMATION & MANAGEMENT SYSTEMS (GIMS). AERIAL: GOOGLE EARTH, IMAGERY DATED 2/23/19.



UNION PACIFIC RAILROAD CO.

PROJECT HOUSTON WOOD PRESERVING WORKS

TITLE	
<b>RESPONSE ACTION - GROUNDWATE</b>	R



PROJECT NO. 19119232



YYYY-MM-DD		2020-10-20	
DESIGNED		AJD	
PREPARED		AJD	
REVIEWED		МН	
APPROVED		ECM	
	REV.		FIGURE
	0		2A-2a



- - UPRR PROPERTY BOUNDARY PROPERTY BOUNDARY (GIMS) • A-TZ MONITORING WELL LOCATION B-CZ/B-TZ MONITORING WELL LOCATION • • C-TZ MONITORING WELL LOCATION • D-TZ MONITORING WELL LOCATION CORRECTIVE ACTION SYSTEM WELL • (DNAPL RECOVERY) ø PLUGGED AND ABANDONED GROUNDWATER PCLE ZONES (A-TZ AND B-CZ/B-TZ) GROUNDWATER PCLE ZONE - ARSENIC (A-TZ, B-CZ/B-TZ AND C-TZ) IW-10A 🗑 RCRA UNIT NO. 1 POINT OF COMPLIANCE (POC) WELL
- PROPOSED CUMULATIVE PMZ (A-TZ, B-CZ/B-TZ, AND C-TZ) PROPOSED ON-SITE PMZ
  - PROPOSED OFF-SITE PMZ CITY OF HOUSTON ROW
- RAILROAD BALLAST CAP AREA
- ASPHALT CAP AREA
- SOIL CAP
- CONCRETE CAP AREA
  - PROPOSED SLURRY WALL (TO 75 FT BGS)
- PROPOSED SLURRY WALL (TO 50 FT BGS)

- PROPOSED A-TZ MONITORING WELL LOCATION
- PROPOSED C-TZ MONITORING WELL LOCATION
- PROPOSED CORRECTIVE ACTION WELL LOCATION (A-TZ DNAPL RECOVERY WELL)
- PROPOSED CORRECTIVE ACTION WELL LOCATION (B-CZ/B-TZ DNAPL RECOVERY WELL) PROPOSED CORRECTIVE ACTION WELL LOCATION
- (C-TZ DNAPL RECOVERY WELL)

#### NOTE(S)

- VERTICAL DATUM BASED ON CITY OF HOUSTON VERTICAL DATUM (HVD).
- 2. DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL
- (JANUARY 2020). 3. (B) - BACKGROUND WELL.

#### REFERENCE(S)

PARCEL BOUNDARIES: CITY OF HOUSTON GEOGRAPHIC INFORMATION & MANAGEMENT SYSTEMS (GIMS). AERIAL: GOOGLE EARTH, IMAGERY DATED 2/23/19.



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ERIC C. MATZNER

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TITLE **RESPONSE ACTION - GROUNDWATER** OFF-SITE



PROJECT NO

19119232

YYYY-MM-DD		2020-10-	19
DESIGNED		AJD	
PREPARED		AJD	
REVIEWED		МН	
APPROVED		ECM	
	REV.		FIGURE
	0		2A-2b

# Introduction

As detailed in RAP Worksheet 2.0, the following recovery wells are proposed to be installed:

- 1. A-TZ: RW-11A, RW-14A
- 2. B-TZ/B-CZ: RW-1B, RW-2B, RW-3B, RW-4B, RW-5B. RW-6B, RW-7B, RW-8B, RW-9B, RW-10B, RW-12B, RW-13B
- 3. C-TZ: RW-15C, RW-16C

The following monitoring wells are proposed (designated with a "P") to be installed:

- 1. A-TZ: PMW-34A, PMW-101A, PMW-71A, PMW-102A
- 2. C-TZ: PMW-32C, PMW-71C, PMW-100C

The proposed new wells are shown on Attachment 2B-1. Details of the well installation are discussed below.

### Permanent Monitoring Well and Recovery Well Installation

Soil borings for recovery wells will be advanced using hollow stem auger, mud rotary, or sonic drilling methods. Soil samples will be collected continuously from each boring and will be logged in the field for lithology and sedimentary structure. Soil headspace samples will be collected every two feet and screened in the field for total organic vapor concentrations. In addition, soil core samples will be visually inspected for contamination and non-aqueous phase liquid (NAPL) presence.

Soil borings that will be used for recovery well installation will be advanced as necessary to identify the top and base of the targeted groundwater bearing-unit (GWBU) (i.e., A-TZ, B-TZ, C-TZ). Based on the boring logs for previous monitoring wells drilled at the Site, it is anticipated that these borings will be advanced to the following maximum depths (subject to field conditions):

- A-TZ: approximately 25 feet below ground surface (bgs)
- B-TZ/B-CZ: approximately 34 feet to 44 feet bgs
- C-TZ: approximately 70 feet bgs.

Surface or isolation casing (permanent isolation casing or temporary isolation casing using sonic drilling techniques) will be installed prior to penetration of any low permeability confining unit.

Permanent monitoring wells and recovery wells will be constructed after the total depth of the borehole is reached. Monitoring wells will be constructed using 2-inch or larger diameter, flush-joint-threaded Schedule 40 PVC casing and 0.010-inch slotted PVC screen. Other well casing and screen materials (i.e., stainless steel) may be used instead of PVC depending on the potential for exposure to NAPL. Permanent recovery wells will be constructed using 4-inch or larger diameter, flush-joint-threaded Schedule 40 stainless steel casing and 0.020-inch slotted steel screen. The specific well design will be determined in the field based on the observed lithology with the goal of screening the well at the base of the targeted GWBU. It is anticipated that each monitoring well screen will be approximately 10 feet in length. For the recovery wells, each well screen will likely be approximately 10 feet in length, but varying screen intervals may be installed to best capture the NAPL zone. A 5- to 10-foot sump will be installed to allow for the accumulation of NAPL within the recovery wells and will vary based on field conditions. After the boring is completed to the total depth, the casing and screen will be lowered into the borehole through the augers or sonic isolation casing.

Once the casing and screen are in place, the remaining well materials (filter sand, bentonite pellets, and cement/bentonite grout) will be added to the hole as the augers/sonic casings are slowly removed. Depths to the top of the annular materials will be measured with a weighted, calibrated tape and recorded on the Well Completion Log. A bentonite seal layer will be installed on top of the filter sand and will be a minimum of 2 feet in thickness. The remainder of the borehole annulus will be filled with a



LEGEND

- - UPRR PROPERTY BOUNDARY
  - PROPERTY BOUNDARY (GIMS)
  - A-TZ MONITORING WELL LOCATION
  - B-CZ/B-TZ MONITORING WELL LOCATION
  - C-TZ MONITORING WELL LOCATION
  - D-TZ MONITORING WELL LOCATION
  - CORRECTIVE ACTION SYSTEM WELL .
  - (DNAPL RECOVERY) ∯ PLUGGED AND ABANDONED

- PROPOSED CUMULATIVE PMZ (A-TZ, B-CZ/B-TZ, AND C-TZ)
- PROPOSED ON-SITE PMZ
  - PROPOSED OFF-SITE PMZ CITY OF HOUSTON ROW
- RAILROAD BALLAST CAP AREA
  - ASPHALT CAP AREA
- SOIL CAP
- CONCRETE CAP AREA

- PROPOSED A-TZ MONITORING WELL LOCATION
- PROPOSED C-TZ MONITORING WELL LOCATION
- PROPOSED CORRECTIVE ACTION WELL LOCATION (A-TZ DNAPL RECOVERY WELL)
- PROPOSED CORRECTIVE ACTION WELL LOCATION (B-CZ/B-TZ DNAPL RECOVERY WELL)
- PROPOSED CORRECTIVE ACTION WELL LOCATION (C-TZ DNAPL RECOVERY WELL)

#### NOTE(S)

- VERTICAL DATUM BASED ON CITY OF HOUSTON VERTICAL DATUM (HVD).
- DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL (JANUARY 2020). 2.
- 3. (B) BACKGROUND WELL.

#### REFERENCE(S)

PARCEL BOUNDARIES: CITY OF HOUSTON GEOGRAPHIC INFORMATION & MANAGEMENT SYSTEMS (GIMS). AERIAL: GOOGLE EARTH, IMAGERY DATED 2/23/19.

PMZ MW-99C		<b>H</b>	
MW-54B MW-54C		MW-66D	
A			
7C		And And And	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
MW-61B			
	0	150 300 FEET	

### UNION PACIFIC RAILROAD CO.

PROJECT HOUSTON WOOD PRESERVING WORKS

#### TITLE PROPOSED MONITORING AND RECOVERY WELL LOCATION MAP

CONSULTANT



PROJECT NO

19119232

YYYY-MM-DD		2020-10-1	19
DESIGNED		AJD	
PREPARED		AJD	
REVIEWED		МН	
APPROVED		ECM	
	REV.		FIGURE
	0		2B-1

Plume Management Zone	RAP Worksheet 2.1 Page 2 of 17			
Associated Information: Attachments 2D, 2E	ID No.: 31547	Report Date: October 26, 2020 – Rev 6		

restrictive covenants/deed notices (City of Houston ROW) prohibiting the use of groundwater within the PMZs; and 2) performance of on-going groundwater monitoring. The proposed deed recordation and restrictive covenants that have been signed by the landowners will be filed in the Harris County deed records once executed by the TCEQ (Appendix 5).

The proposed PMZs were established using the January-March 2020 groundwater data (Appendix 2) collected from the Site. An evaluation of the January-March 2020 groundwater data, including groundwater PCLE zones and preliminary trend analysis of COC concentrations, was provided to the TCEQ in the Interim Groundwater Monitoring Report (2019-2020) dated April 30, 2020 and is also included in Appendix 3. A more extensive statistical evaluation and revised trend test results are included in Appendix 7.

In the 4<sup>th</sup> TNOD (Specific comment T35(4), T42(4), T43(3), T44(4), T45(4), and T48(3)), TCEQ requested that UPRR defer proposed MNA as a remedy component and designating new attenuation monitoring point (AMP) wells and attenuation action levels (AALs) until the plume completely reaches steady-state conditions and readily recoverable DNAPL removal is completed. Following the response actions proposed in this RAP, AMP wells and AALs will be established. To meet the NAPL Trigger response endpoints, Corrective Action System (CAS) wells will be established for the A-TZ. Based on that, the following wells have been designated APOE, Corrective Action Observation (CAO), or CAS wells:

# On-site PMZ:

- APOE wells: MW-12A, MW-13, MW-15A, MW-50A, MW-69A, MW-88A, MW-97A, and MW-98A.
- Corrective Action Observation (CAO) wells: MW-17, MW-18A, MW-20A, MW-49A, MW-77A, MW-79A, proposed well MW-102A
- CAS Wells (DNAPL recovery): MW-57A, MW-58A, and MW-78A
- Background well: MW-51A.

# Off-site COH ROW PMZ:

- Off-Site APOE wells: MW-25A, MW-32AR, MW-33A, proposed well MW-34A, MW-36A, MW-47A, MW-59A, MW-61A, proposed well MW-71A, proposed well MW-101A.
- Off-site CAO wells: MW-26A, MW-28A, MW-35A, MW-44A, MW-68A, MW-84A, MW-91A, MW-94A, and MW-95A.
- Off-Site CAS Wells: Two proposed recovery wells along northern perimeter, RW-11A and RW-14A.
- Background well: MW-27A.

In accordance with §350.33(f)(4)(A), the ATZ on-site and off-site COH ROW PMZs for the A-TZ Unit will be actively monitored (semi-annually).

Is the alternate POE	E propo	sed to be	e beyond the current limits of th	he PCLE zone? X Yes I	No
If yes, how far?	Appro	ximately	500 feet (Off-Site COH ROW	(§350.37(I) or (m) as applicable)	
	PMZ)				
Is it to be off-site?	X	Yes	No		
On an off-site prop	erty that	at curren	tly does not contain a residentia	ial-based groundwater PCLE zone?	
Yes X N	lo				

If yes and this is a Class 2 groundwater, provide the basis for concluding that this groundwater does not have a reasonably anticipated future beneficial use (§350.37(I)(3)).



LEGEND	
	UPRR PROPERTY BOUNDARY
	ROAD, PARLING LOT, SIDEWALK
XX	FENCE
—× ×	RAILROAD
<b>•</b>	A-TZ MONITORING WELL LOCATION
MW-15A	ALTERNATE POINT OF EXPOSURE (APOE)
8	A-TZ CORRECTIVE ACTION SYSTEM WELLS (CAS) (DNAPL RECOVERY)
	PCLE ZONE
	ARSENIC PCLE ZONE
	INFERRED GROUNDWATER FLOW DIRECTION
	PROPOSED A-TZ PMZ BOUNDARY
	PROPOSED A-TZ OFF-SITE PMZ BOUNDARY
	CUMULATIVE PROPOSED ON-SITE PMZ
	RAILROAD BALLAST CAP AREA
	ASPHALT CAP AREA
	SOIL CAP
////	CONCRETE CAP AREA
	PROPOSED OFF-SITE PMZ - CITY OF HOUSTON ROW
	PROPOSED SLURRY WALL (TO 75 FT BGS)
	PROPOSED SLURRY WALL (TO 50 FT BGS)
•	PROPOSED A-TZ APOE MONITORING WELL LOCATION
	PROPOSED CORRECTIVE ACTION WELL LOCATION (A-TZ DNAPL RECOVERY WELL)

#### NOTE(S)

- 1. DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL (JANUARY 2020).
- 2. PCLE ZONE ESTABLISHED BASED ON JANUARY 2020 DATA. 3. \* PROPOSED A-TZ CORRECTIVE ACTION OBSERVATION WELL.

REFERENCE(S) BASE MAP FROM ERM-SOUTHWEST, INC APAR ADDENDUM, FIG 3-1. DATED JUNE 2004.



CLIENT UNION PACIFIC RAILROAD CO.

PROJECT HOUSTON WOOD PRESERVING WORKS

TITLE

# PMZ BOUNDARY MAP - A-TZ



Plume Management Zone	<b>RAP Workshee</b>	t 2.1 Page 8 of 17
Associated Information: Attachments 2D, 2E	ID No.: 31547	Report Date: October 26, 2020 – Rev 6

groundwater PCLE Zone extends beyond the northern side of the proposed off-site COH ROW PMZ boundary by approximately 650 feet (Attachment 2D-2). The arsenic groundwater PCLE Zone will continue to be evaluated, as detailed in the response letter dated August 4, 2020.

For the B-CZ/B-TZ On-Site PMZ (West), the creosote-related groundwater PCLE Zone is within the UPRR property boundary. The arsenic PCLE Zone on the west side extends to the southwest and beyond the proposed PMZ boundary off-site to the west (Attachment 2D-2).

The proposed on-Site and off-Site COH ROW PMZs for the B-CZ/B-TZ PCLE zones consists of two components: 1) filing of institutional controls including deed recordation (UPRR-Owned properties) and restrictive covenants/deed notices (City of Houston ROW) prohibiting the use of groundwater within the PMZs; and 2) performance of on-going groundwater monitoring. The proposed deed recordation and restrictive covenants that have been signed by the landowners will be filed in the Harris County deed records once executed by the TCEQ (Appendix 5).

The proposed PMZs were established using the January-March 2020 groundwater data (Appendix 2) collected from the Site. An evaluation of the January-March 2020 groundwater data, including groundwater PCLE zones and preliminary trend analysis of COC concentrations, was provided to the TCEQ in the Interim Groundwater Monitoring Report (2019-2020) dated April 30, 2020 and is also included in Appendix 3. A more extensive statistical evaluation and revised trend test results are included in Appendix 7.

In the 4<sup>th</sup> TNOD (Specific comment T35(4), T42(4), T43(3), T44(4), T45(4), and T48(3)), TCEQ requested that UPRR defer proposed MNA and designating new attenuation monitoring point (AMP) wells and attenuation action levels (AALs) until the plume completely reaches steady-state conditions and readily recoverable DNAPL removal is completed. Following the response actions proposed in this RAP, AMP wells and AALs will be established. To meet the NAPL Trigger response endpoints, CAS wells will be established for the B-CZ/B-TZ. Based on the PMZ and NAPL response requirements, the following wells have been designated APOE, CAO, or CAS wells:

# On-site PMZ (Main and West):

- APOE wells (Main): MW-14, MW-15B, MW-50B, MW-80B, MW-88B, MW-98B.
- APOE wells (West): MW-22BR, MW-38B, MW-39B, MW-42B, MW-62B, P-10, P-12
- CAO wells (Main): MW-57B, MW-72B, MW-74B, MW-76B, MW-81B.
- CAO wells (West): MW-40B, TW-41B, P-11
- CAS wells (Main): DNAPL recovery MW-49B, MW-75B
- CAS wells (West): DNAPL recovery MW-12B, MW-41B

# Off-site COH ROW PMZ:

- Off-Site APOE wells: New recovery well RW-1B, MW-32B, MW-36B, MW-54B, MW-59B, MW-60B, MW-61B, MW-70B, MW-71B.
- Off-site CAO wells (outside of the off-site COH ROW PMZ): MW-33BR, MW-35B, MW-63B, MW-67B, MW-82B, MW-83B, MW-84B, MW-89B, MW-90B, MW-92B, MW-93B, MW-96B.
- Off-Site CAS Wells: MW-32B, MW-68B, and MW-70B and proposed recovery wells (within and outside of the proposed PMZ) RW-2B, RW-3B, RW-4B, RW-5B, RW-6B, RW-7B, RW-8B, RW-9B, RW-10B, RW-12B, and RW-13B.

In accordance with §350.33(f)(4)(A), the B-CZ/B-TZ on-site and off-site COH ROW PMZs for the B-CZ/B-TZ Unit will be actively monitored (semi-annually).

Is the alternate POE proposed to be beyond the current limits of the PCLE zone? X Yes No If yes, how far? Approximately 300 feet (east perimeter of the (§350.37(I) or (m) as applicable) Off-Site COH ROW PMZ)



	LEGEND	
		UPRR PROPERTY BOUNDARY
		ROAD, PARKING LOT, SIDEWALK
	<u> </u>	FENCE
		RAILROAD
	<b>•</b>	B-TZ MONITORING WELL LOCATION
Г	MW-15B	ALTERNATE POINT OF EXPOSURE (APOE)
	8	B UNIT CORRECTIVE ACTION SYSTEM WELLS (CAS) (DNAPL RECOVERY)
	B-CZ (CLASS 3 GW) B-TZ (CLASS 2 GW	B-TZ/B-CZ BOUNDARY
Ę.		PCLE ZONE
AL L		ARSENIC PCLE ZONE
		INFERRED GROUNDWATER FLOW DIRECTION
		PROPOSED B-TZ/B-CZ PMZ BOUNDARY
		PROPOSED B-TZ/B-CZ OFF-SITE PMZ BOUNDARY
		CUMULATIVE PROPOSED ON-SITE PMZ
		RAILROAD BALLAST CAP AREA
_		ASPHALT CAP AREA
-	$\langle / / \rangle$	SOIL CAP
		CONCRETE CAP AREA
		PROPOSED OFF-SITE PMZ - CITY OF HOUSTON ROW
		PROPOSED SLURRY WALL (TO 75 FT BGS)
		PROPOSED SLURRY WALL (TO 50 FT BGS)
		PROPOSED CORRECTIVE ACTION WELL LOCATION (B-CZ/B-TZ DNAPL RECOVERY WELL)

#### NOTE(S)

- 1. DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL
- (JANUARY 2020).
- 2. PCLE ZONE ESTABLISHED BASED ON JANUARY 2020 DATA.

REFERENCE(S) BASE MAP FROM ERM-SOUTHWEST, INC APAR ADDENDUM, FIG 3-1. DATED JUNE 2004.



CLIENT UNION PACIFIC RAILROAD CO.

PROJECT HOUSTON WOOD PRESERVING WORKS

TITLE

# PMZ BOUNDARY MAP - B-CZ/B-TZ





	UPRR PROPERTY BOUNDARY
	ROAD, PARKING LOT, SIDEWALK
<u> </u>	FENCE
	RAILROAD
•	C-TZ MONITORING WELL LOCATION
MW-15C	ALTERNATE POINT OF EXPOSURE (APOE)
	C-TZ CORRECTIVE ACTION SYSTEM WELLS (CAS) (DNAPL RECOVERY)
	PCLE ZONE
	ARSENIC PCLE ZONE
	INFERRED GROUNDWATER FLOW DIRECTION
	PROPOSED C-TZ PMZ BOUNDARY
	PROPOSED C-TZ OFF-SITE PMZ BOUNDARY
	CUMULATIVE PROPOSED ON-SITE PMZ
	RAILROAD BALLAST CAP AREA
	ASPHALT CAP AREA
$\langle / / \rangle$	SOIL CAP
$\Box$	CONCRETE CAP AREA
	PROPOSED OFF-SITE PMZ - CITY OF HOUSTON ROW
	PROPOSED SLURRY WALL (TO 75 FT BGS)
	PROPOSED SLURRY WALL (TO 50 FT BGS)
•	PROPOSED C-TZ MONITORING WELL LOCATION
•	PROPOSED CORRECTIVE ACTION WELL LOCATION (C-TZ DNAPL RECOVERY WELL)
NOTE(S) 1. DNAPL = DENS (JANUARY 202 2. PCL E ZONE E	SE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL 10). STABLISHED BASED ON JANUARY 2020 DATA.

CLIENT UNION PACIFIC RAILROAD CO.

PROJECT HOUSTON WOOD PRESERVING WORKS

TITLE PMZ BOUNDARY MAP - C-TZ



IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM.

### ATTACHMENT 3A - TABLE 1

### PROPOSED PLUME MANAGMENT ZONE (PMZ) MONITORING WELL NETWORK UPRR HOUSTON WOOD PRESERVING WORKS, HOUSTON, TEXAS

WELL NO.	On-Site or Off- Site	WELL DESIGNATION	DATE INSTALLED	NORTHING	EASTING	TOP OF CASING ELEVATION (FT HVD)	TOTAL DEPTH (FT BGS)	Top Screen Interval (FT BGS)	Bottom Screen Interval (FT BGS)	Zone
A-TZ MONITOR	RING WELLS			•		•				
MW-12A	On-Site	APOE	2/27/1997	728,333	3,166,004	49.96	30.00	17.5	27.5	A-TZ
MW-13	On-Site	APOE	2/25/1997	728,777	3,165,977	50.65	25.00	9	22.5	A-TZ
MW-15A	On-Site	APOE	2/25/1997	728,755	3,166,931	50.41	30.00	12	26.1	A-1Z
MW-50A	On-Site	APOE	3/1/2007	727,501	3,167,958	46.96	25.00	15	25	A-1Z
MW-69A	On-Site	APOE	2/22/2020	728,130	3,100,234	45.71	24.00	0.0	10.0	A-1Z
MW-97A	On-Site		2/22/2020	727 373	3 166 767	47.87	24.00	10.5	20 5	Δ-ΤΖ
MW-98A	On-Site		2/10/2020	727,370	3 167 312	48.35	21.00	10.5	20.5	A-12 A-T7
MW-51A	On-Site	Background	2/28/2007	726,925	3,166,885	47.80	25.00	15	25	A-TZ
MW-17	On-Site	CAO	3/25/1997	728,787	3,167,447	50.92	35.00	18	32.5	A-TZ
MW-18A	On-Site	CAO	2/26/1997	728,839	3,168,227	51.57	35.00	18	32.5	A-TZ
MW-20A	On-Site	CAO	9/28/1998	728,600	3,167,091	50.43	30.00	15	25	A-TZ
MW-49A	On-Site	CAO	2/28/2007	728,345	3,168,191	46.18	30.00	20	30	A-TZ
MW-77A	On-Site	CAO	5/7/2014	727,672	3,166,981	49.05	25.00	13	23	A-TZ
MW-79A	On-Site	CAO	5/7/2014	728,237	3,167,666	48.95	30.00	17	27	A-TZ
PMW-102A	On-Site	CAO	Proposed							
MW-57A	On-Site	CAS	1/22/2009	728,859	3,167,973	50.89*	27.00	12	27	A-TZ
MW-58A	On-Site	CAS	1/23/2009	728,875	3,168,176	47.76	29.00	14	29	A-TZ
MW-78A	On-Site	CAS	5/6/2014	727,953	3,167,512	48.68	30.00	15	25	A-IZ
IVIVV-25A	Off-Site	APOE	3/7/2000	729,089	3,168,524	44.65	29.00	18.5	28.5	A-1Z
IVIVV-32AR	Off Site	APOE	12/15/2011	728,925	3,167,400	44.74	22.00	10	20	A-1Z
IVIVV-33A	OII-SILE	APUE	12/30/2003	720,440	3,107,000	44.25	25.00	13	23	A-1Z
NIVV-36A	Off Site	APUE	2/22/2007	729,148	3,108,167	44.53	28.00	18	28	A-1Z
MM/-50A	Off-Site		3/17/2020	728 155	3 169 259	40.00 // 10	20.00	10	<u>∠0</u> 21	A-1Z
MW-614	Off-Site		1/26/2009	728,100	3 168 630	44.10 AA 67	21.00	12	∠ I 22	Δ_T7
PMW-34A	Off_Site		Proposed	120,000	3,100,030	-14.07	22.00	14	22	Δ_T7
PMW-71A	Off-Site	APOE	Proposed							A-TZ
PMW-101A	Off-Site	APOE	Proposed							A-TZ
MW-27A	Off-Site	Background	3/26/2001	730.002	3,169,610	44.90	30.00	17	27	A-TZ
MW-26A	Off-Site	CAO	3/7/2000	729,159	3,167,519	44.62	26.00	14.5	24.5	A-TZ
MW-28A	Off-Site	CAO	3/26/2001	729,462	3,167,926	43.86	28.00	16	26	A-TZ
MW-35A	Off-Site	CAO	2/21/2007	728,985	3,167,045	44.75	28.00	13	28	A-TZ
MW-38A	Off-Site	CAO	2/21/2007	728,402	3,165,934	46.39	22.00	12	22	A-TZ
MW-44A	Off-Site	CAO	2/22/2007	729,021	3,168,349	45.11	28.00	18	28	A-TZ
MW-68A	Off-Site	CAO	5/21/2019	729,160	3,167,324	43.24	23.40	13	23	A-TZ
MW-84A	Off-Site	CAO	2/19/2020	729,510	3,167,399	44.67	24.00	13.5	23.5	A-TZ
MW-91A	Off-Site	CAO	2/19/2020	729,702	3,167,937	44.02	25.00	14.5	24.5	A-TZ
MW-94A	Off-Site	CAO	2/18/2020	729,052	3,166,533	45.21	22.00	11.5	21.5	A-TZ
MW-95A	Off-Site	CAO	2/19/2020	728,564	3,165,893	46.19	21.00	15	25	A-TZ
RW-11A	Off-Site	CAS	Proposed							A-TZ
RW-14A	Off-Site	CAS	Proposed							A-TZ
B-CZ/B-TZ MO	NITORING WELL	S	T	r	1	r	<b>-</b>		-	
MW-14	On-Site (Main)	APOE	2/27/1997	728,718	3,166,550	50.66	45.00	28	42.5	B-TZ
MW-15B	On-Site (Main)	APOE	12/19/2011	728,761	3,166,960	47.05	40.00	28	38	B-TZ
MW-50B	On-Site (Main)	APOE	2/7/2020	727,585	3,167,950	47.55	40.00	34.5	39.5	B-IZ
MW-80B	On-Site (Main)	APOE	5/8/2014	727,907	3,168,201	47.11	35.00	29	34	B-IZ
NIV OOD	On-Site (Main)	APOE	2/19/2020	728,245	3,100,778	31.57	24.00	30	40	B-IZ
MW 57P	On-Site (Main)	APOE	2/11/2020	720,057	3,107,300	40.39	40.50	33	40	
MW-72B	On-Site (Main)	CAO	12/21/2011	728,007	3 167 702	47.93	40.00	32	37	B-TZ
MW-74B	On-Site (Main)	CAO	12/20/2011	728,373	3 167 718	40.09	40.00	26.5	36.5	B-TZ
MW-76B	On-Site (Main)	CAO	2/12/2020	727 463	3 166 640	47.00	40.00	31	36	B-TZ B-TZ
MW-81B	On-Site (Main)	CAO	5/11/2014	727.292	3,167.926	46.77	40.00	29	34	B-TZ
MW-49B	On-Site (Main)	CAS	1/24/2009	728.375	3,168,184	46.43	35.00	30	35	B-CZ
MW-75B	On-Site (Main)	CAS	12/20/2011	728,066	3,168,022	47.18	40.00	32.2	37.2	B-TZ
MW-22BR	On-Site (West)	APOE	1/24/2018	727,904	3,165,660	45.71	39.00	27.6	37.6	B-TZ
MW-38B	On-Site (West)	APOE	12/31/2003	728,319	3,165,945	45.51	37.00	25.5	35.5	B-TZ
MW-39B	On-Site (West)	APOE	12/16/2003	728,424	3,166,019	49.58	40.00	29.5	39.5	B-TZ
MW-42B	On-Site (West)	APOE	8/24/2006	728,257	3,166,324	50.52	42.00	30	40	B-TZ
MW-62B	On-Site (West)	APOE	1/21/2009	728,190	3,165,880	48.16	35.00	25	35	B-TZ
P-10	On-Site (West)	APOE	3/26/1991	727,786	3,165,866	47.71	50.00	36.2	38.2	B-TZ
P-12	On-Site (West)	APOE	3/27/1991	727,912	3,166,127	48.76	50.00	36.3	38.3	B-TZ
MW-40B	On-Site (West)	CAO	12/15/2004	728,341	3,166,122	49.59	40.00	29.5	39.5	B-TZ
P-11	On-Site (West)	CAO	3/25/1991	728,049	3,166,025	48.98	50.00	36.2	38.2	B-TZ
1W-41B	On-Site (West)	CAO	1/22/2009	728,222	3,166,002	49.67	40.00	30	40	B-TZ
MW-12B	On-Site (West)	CAS	2/27/1997	728,328	3,166,004	50.02	45.00	32.5	42.5	B-TZ
MVV-41B	Un-Site (West)	CAS	1/7/2003	/28,176	3,166,003	49.37	40.00	29.5	39.5	B-IZ
IVIVV-36B	Off Cite	APOE	6/24/2010	729,161	3,168,172	44.07	43.00	38	43	B-CZ
IVIVV-54B	Off Cite	APOE	2/22/2020	729,308	3,168,727	45.25	40.00	34.5	39.5	B-CZ
MW/-60B			0/20/2010	720 012	3 169 904	44.30	33.00	20	33	B-CZ
MW/-61P	Off-Site		2/23/2020	120,012	3 169 620	47.04	40.00	30	40	B-02
MW-01D	Off-Site		12/12/2020	728.056	3 167 051	40.09	40.00	20	37	B-02
MW/_32R	Off-Site		12/13/2011	720,900	3 167 400	40.00	40.00	32 26	36	B-12 B-T7
MW_70R	Off_Site		12/13/2011	728.0//	3 167 671	44.73	40.00	20	30	B-12 B-07
RW-1B	Off-Site	APOF/CAS	Proposed	120,344	0,107,071	70.02	+0.00	20		0-02
MW-33BR	Off-Site	CAO	12/19/2011	729.142	3,167,662	44.86	40.00	28	38	B-C7
MW-35B	Off-Site	CAO	2/26/2007	728,988	3,167,045	44.83	42.00	32	42	B-CZ

#### ATTACHMENT 3A - TABLE 1

#### PROPOSED PLUME MANAGMENT ZONE (PMZ) MONITORING WELL NETWORK UPRR HOUSTON WOOD PRESERVING WORKS, HOUSTON, TEXAS

WELLNO	On-Site or Off-	WELL	DATE	NORTHING	EASTING	TOP OF CASING		Top Screen	Bottom Screen	Zono
WELL NO.	Site	DESIGNATION	INSTALLED	NORTHING	LASTING	ELEVATION (FT HVD)	(FT BGS)	(FT BGS)	Interval (FT BGS)	Zone
MW-63B	Off-Site	CAO	1/28/2009	729,361	3,167,652	44.48	36.00	31	36	B-CZ
MW-67B	Off-Site	CAO	6/26/2010	729,782	3,167,588	43.93	40.00	35	40	B-CZ
MW-82B	Off-Site	CAO	1/22/2018	729,102	3,166,703	44.64	38.00	29.6	34.6	B-TZ
MW-83B	Off-Site	CAO	1/30/2018	729,389	3,167,015	45.33	37.00	29.6	34.6	B-TZ
MW-84B	Off-Site	CAO	1/23/2018	729,503	3,167,399	44.50	43.00	34.6	39.6	B-TZ
MW-89B	Off-Site	CAO	7/12/2018	729,869	3,167,249	44.57	40.40	30	40	B-TZ
MW-90B	Off-Site	CAO	7/13/2018	729,616	3,167,173	44.39	35.40	30	35	B-TZ
MW-92B	Off-Site	CAO	2/20/2020	729,583	3,166,814	44.91	35.50	30	35	B-TZ
MW-93B	Off-Site	CAO	2/26/2020	729,451	3,166,744	45.05	35.50	30	35	B-TZ
MW-96B	Off-Site	CAO	2/24/2020	727,929	3,165,446	47.02	22.00	27	37	B-TZ
MW-68B	Off-Site	CAS	12/15/2011	729,162	3,167,328	44.93	40.00	28	38	B-TZ
RW-2B	Off-Site	CAS	Proposed							
RW-3B	Off-Site	CAS	Proposed							
RW-4B	Off-Site	CAS	Proposed							
RW-5B	Off-Site	CAS	Proposed							
RW-6B	Off-Site	CAS	Proposed							
RW-7B	Off-Site	CAS	Proposed							
RW-8B	Off-Site	CAS	Proposed							
RW-9B	Off-Site	CAS	Proposed							
RW-10B	Off-Site	CAS	Proposed							
RW-12B	Off-Site	CAS	Proposed							
RW-13B	Off-Site	CAS	Proposed							
C-TZ MONITOR			•							-
MW-15C	On-Site	APOE	4/25/1997	728,761	3,166,947	50.01	75	64	73.5	C-TZ
MW-19C	On-Site	APOE	10/15/1998	728,620	3,167,727	53.05	73	63	73	C-TZ
MW-47C	On-Site	APOE	3/16/2007	728,725	3,168,535	45.52	71	61	71	C-TZ
MW-88C	On-Site	APOE	1/21/2018	728,195	3,166,845	51.17	75	64.6	74.6	C-TZ
MW-12C	On-Site	CAO	4/21/1997	728,345	3,166,005	50.14	75.3	69	73.5	C-TZ
MW-17C	On-Site	CAO	12/10/2003	728,779	3,167,446	50.17	70	59.5	69.5	C-TZ
MW-18C	On-Site	CAO	4/25/1997	728,849	3,168,219	51.47	80.2	62	76.5	C-IZ
MW-76C	On-Site	CAO	5/7/2014	727,485	3,166,628	47.84	70	60	70	C-12
MW-85C	On-Site	CAO	1/20/2018	727,661	3,166,988	49.10	75	59.9	69.9	C-1Z
MW-86C	On-Site	CAU	1/18/2018	727,083	3,166,438	46.61	70	59.6	69.6	C-1Z
MW-23C	On-Site	CAS	10/14/1998	728,759	3,167,722	54.16^	72.5	62.5	72.5	C-1Z
MW-34CR	Off-Site	APOE	5/9/2014	728,982	3,168,227	46.47	70	60	70	C-1Z
MW-48C	Off-Site	APOE	2/2/2004	728,417	3,168,241	44.68	72	60	70	C-1Z
NIV-54C	Off-Site	APOE	8/15/2006	729,218	3,108,700	44.99	72	60	70	0.12
NIW-70C	OII-Site		2/21/2020	728,954	3,107,074	45.07	70	56	68	C-12
PIVIW-32C	Off Site	APOE	Proposed							
FIVINU-710	Off-Site	Background	4/16/2001	730.000	3 160 610	45.04	73 5	60.5	70.5	C_T7
MW 25C	Off Site		2/7/2000	720,009	2 169 519	40.04	74	50	69	C TZ
NIW-25C	Off Site		5/1/2000	729,009	3,100,310	44.49	74	50	70	C-1Z
MW-00C	Off Site	CAO	1/21/2010	729,104	2 167 044	44.00	70	57.6	67.6	C-12
MW-07C	Off-Site	CAO	2/23/2020	729,200	3,107,944	44.20	70	59.5	69.5	C-TZ
MW-44C		040	1/16/2004	729,000	3 168 3/0	45.33	70	57.5	67.5	C-TZ
MW-44C	Off-Site	CAS	1/20/2004	729,021	3 168 512	43.13	70	58	68	C-TZ
MW-46C	Off-Site	CAS	1/9/2004	729 121	3 168 576	44.94	72	60	70	C-TZ
RW-15C		CAS	Proposed	120,121	0,100,070	77.04	12	00	10	0-12
RW-16C	Off-Site	CAS	Proposed							
		UNU	Toposeu							
	Off Site	040	6/22/2010	720 462	2 169 190	11 22	110	100	110	D T7
	Off Site	CAU	0/23/2010	729,102	3,100,100	44.33	110	100	110	
NIN 65D	Off Site	CAU	1/27/2009	720,114	3,100,300	44.22	110	108	110	
	Off Site	CAU	1/17/2009	729,512	3,108,331	44.55	110	100	102	
IVIVV-66D	UII-Site	CAU	1/20/2009	/29,13/	3,169,381	46.51	103	93	103	D-IZ

Notes:

APOE - Alternate Point of Exposure Wells CAO - Corrective Action Observation Well CAS - Corrective Action System Well (NAPL Recovery Well, CAS only wells not sampled)

BGS=Below Ground Surface HVD = Elevations relative to Houston Vertical Datum, Houston Monument System Northing/Easting = Coordinates based on NAD 1927 Texas State Plane, South Central Zone, US Survey Feet \* Wells were resurveyed after casings were modified from above ground to flush grade during soil cap construction (2016).



LEGEND	UPRR PROPERTY BOUND		
	UPRR PROPERTY BOUND		
		AK Y	
	PROPERTY BOUNDARY (G	IMS)	
◆	A-TZ MONITORING WELL L	OCATION	
<b>+</b>	B-CZ/B-TZ MONITORING W	ELL LOCATION	
<b>\$</b>	C-TZ MONITORING WELL L	OCATION	
<b>•</b>	D-TZ MONITORING WELL L	OCATION	
		TEM WELL (CAS)	
WW-10A 🏟	RCRA UNIT NO. 1 POINT O	F COMPLIANCE (POC)	WELL
MW-15A	ALTERNATE POINT OF EXI	POSURE (APOE)	
•	PROPOSED CUMULATIVE	PM7 (A-T7 B-C7/B-T7	AND C-TZ)
	PROPOSED ON-SITE PMZ	- me (***2, 8 62/8 *2,	<u>, , , , , , , , , , , , , , , , , , , </u>
	PROPOSED OFF-SITE PMZ	- CITY OF HOUSTON	NOW
	]		
	RAILROAD BALLAST CAP A	AREA	
	ASPHALT CAP AREA		
	SOIL CAP		
•	PROPOSED A-TZ APOE MC	DNITORING WELL LOC	ATION
•	PROPOSED C-TZ APOE MO		ATION
	PROPOSED CORRECTIVE (A-TZ DNAPL RECOVERY V	ACTION WELL LOCATI VELL)	ON
	PROPOSED CORRECTIVE (B-CZ/B-TZ DNAPL RECOV	ACTION WELL LOCATI ERY WELL)	ON
	PROPOSED CORRECTIVE	ACTION WELL LOCATI	ON
1. VERTICAL DA	TUM BASED ON CITY OF HO	OUSTON VERTICAL DA	TUM (HVD).
2. DNAPL = DEN (JANUARY 20)	20).	LIQUIDS DETECTED IN	MONITORING WELL
<ol> <li>(B) - BACKGR</li> <li>* - PROPOSEI</li> </ol>	OUND WELL.	N OBSERVATION WELL	
REFERENCE(S) PARCEL BOUNDAR	IES: CITY OF HOUSTON GE		ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS).	RIES: CITY OF HOUSTON GE		ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE F	RIES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2	23/19.	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE B	RIES: CITY OF HOUSTON GE	23/19.	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE F	RIES: CITY OF HOUSTON GE	23/19.	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE F	RIES: CITY OF HOUSTON GE	23/19.	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E	RIES: CITY OF HOUSTON GE	200 400	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE F	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 0 0 1'' = 400'	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 0 1" = 400'	23/19.	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE I CLIENT UNION PACIF	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 0 1" = 400' FIC RAILROAD CO.	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE F	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 0 1" = 400' FIC RAILROAD CO.	200 400	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E CLIENT UNION PACIE	RIES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 0 1" = 400' FIC RAILROAD CO.	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE I CLIENT UNION PACIF	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 1" = 400" FIC RAILROAD CO.	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E CLIENT UNION PACIF PROJECT HOUSTON W	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO.	200 400 FEET GWORKS	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E CLIENT UNION PACIF PROJECT HOUSTON W	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO.	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE I CLIENT UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO. 'OOD PRESERVINC	200 400 23/19. FEET G WORKS RING NETWOR	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE E UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN	0 EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO. VOOD PRESERVINC	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE I CLIENT UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN CONSULTANT	0 EARTH, IMAGERY DATED 2/2 1" = 400" FIC RAILROAD CO. VOOD PRESERVING	200 400 FEET	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE I CLIENT UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN CONSULTANT	RES: CITY OF HOUSTON GE EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO. OOD PRESERVING	200 400 23/19. FEET S WORKS RING NETWOR YYYY-MM-DD DESIGNED DEFINICE	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE H UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN CONSULTANT	0 EARTH, IMAGERY DATED 2/2 1" = 400' FIC RAILROAD CO. OOD PRESERVING	200 400 FEET  WORKS  RING NETWOR  YYYY-MM-DD  DESIGNED  PREPARED  REVIEWED	ION & MANAGEMENT
REFERENCE(S) PARCEL BOUNDAR SYSTEMS (GIMS). AERIAL: GOOGLE H CLIENT UNION PACIF PROJECT HOUSTON W TITLE PMZ GROUN CONSULTANT	COD PRESERVINC  COD PRESERVI	200 400 FEET COURT AND	ION & MANAGEMENT



ASPHALT CAP AREA

CONCRETE CAP AREA

SOIL CAP

PROPOSED CORRECTIVE ACTION WELL LOCATION (C-TZ DNAPL RECOVERY WELL)

#### NOTE(S)

- DNAPL = DOLINING ASED ON CITY OF HOUSTON VERTICAL DATUM (HVD). DNAPL = DENSE NON-AQUEOUS PHASE LIQUIDS DETECTED IN MONITORING WELL (JANUARY 2020). 2.
- 3. (B) BACKGROUND WELL.

#### REFERENCE(S)

PARCEL BOUNDARIES: CITY OF HOUSTON GEOGRAPHIC INFORMATION & MANAGEMENT SYSTEMS (GIMS). AERIAL: GOOGLE EARTH, IMAGERY DATED 2/23/19.

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MW-15A 🕥

C-TZ MONITORING WELL LOCATION

D-TZ MONITORING WELL LOCATION

(DNAPL RECOVERY)

CORRECTIVE ACTION SYSTEM WELL (CAS)

ALTERNATE POINT OF EXPOSURE (APOE)



#### CLIENT UNION PACIFIC RAILROAD CO.

# PROJECT

HOUSTON WOOD PRESERVING WORKS

#### TITLE PMZ GROUNDWATER MONITORING NETWORK - OFF-SITE AREA

CONSULTANT		YYYY-MM-DD		2020-10	-23
		DESIGNED		AJD	
	COLDED	PREPARED		AJD	
TEXAS G	TEXAS GEOSCIENCE FIRM NO. 50369	REVIEWED		ΜН	
	TEXAS ENGINEERING FIRM NO. 2578	APPROVED		ECM	
PROJECT NO.			REV.		ATTACHMENT
19119232			0		3A-2

Post-Response Action Care	RAP Worksh	eet 5.0 Page 5 of 5
Associated Information: Attachments 5A-5C	ID No.: 31547	Report date: October 26, 2020

# **Cost Estimate**

Complete this portion of the form only if a physical control is proposed (installed hydraulic control system, slurry wall, cap, etc.). Provide in Attachment 5B a detailed cost estimate for a third party to operate and maintain the physical control during the PRAC period, based on current dollar amount.

Specify the physical control to which this information applies

HWPW Vegetated Clay Cap, Asphalt Roadway, City of Houston ROW Sidewalk, Englewood Intermodal Yard Concrete Pavement, and Railroad Ballast (shown on Attachment 5A), Groundwater Monitoring and MPE NAPL Recovery

Complete this worksheet for each physical control that will be used as part of the response action.

What is the total estimated annual cost of O&M for the PRAC period? \$328,980

What is the total estimated cost for a third party to perform PRAC activities? \$9,869,400 (30-yr)

Identify the type of financial assurance mechanism to be used, and the contact person managing fiduciary responsibility, if known.

UPRR will submit an appropriate financial assurance mechanism to TCEQ within 90 days of the Revised RAP approval.

Does the person meet the criteria and definition of a small business? (see \$350.33(n)) Yes X No If yes and the person desires to pursue the reduced amount of financial assurance, provide a legally binding affidavit as Attachment 5C. Include in the affidavit the information requested in 30 TAC \$350.33(l), (m), and (n). An example affidavit is attached in the instructions.



	UPRR PROPERTY BOUND	ARY	
	PROPERTY BOUNDARY (C	GIMS)	
<del>••</del>	A-TZ MONITORING WELL	OCATION	
• • • • • • • • • • • • • • • • • • •	B-CZ/B-TZ MONITORING W	ELL LOCATION	
<b>_</b>	C-TZ MONITORING WELL	OCATION	
Ă		OCATION	
<b>T</b>	CORRECTIVE ACTION SYS	STEM WELL (CAS)	
	(DNAPL RECOVERY)	x- /	
MW-10A 🙀	RCRA UNIT NO. 1 POINT C	F COMPLIANCE (POC	) WELL
IW-15A) 🕥	ALTERNATE POINT OF EX	POSURE (APOE)	
₩-18A <del>Φ</del>	CORRECTIVE ACTION OB	SERVATION WELLS (C	CAO)
	GROUNDWATER PCLE ZO	NES	
	GROUNDWATER PCLE ZO	-) NE - ARSENIC	
	PROPOSED SLURRY WAL	L (TO 75 FT BGS)	
	PROPOSED SLURRY WAL	L (TO 50 FT BGS)	
		PMZ (A-T7 B-C7/B-T7	AND C-TZ)
	PROPOSED ON-SITE PMZ	<u>י אוב (ה-12, ש-12/0-12</u>	., AND 0-12)
	PROPOSED OFF-SITE PM2	Z - CITY OF HOUSTON	ROW
	RAILROAD BALLAST CAP	AREA	
	ASPHALT CAP AREA		
	SOIL CAP		
	PROPOSED C-TZ APOE M	ONITORING WELL LO	CATION
	PROPOSED CORRECTIVE	ACTION WELL LOCAT	ΓΙΟΝ
_	PROPOSED CORRECTIVE	ACTION WELL LOCAT	ΓΙΟΝ
	(B-CZ/B-TZ DNAPL RECOV	ERY WELL)	
	PROPOSED CORRECTIVE	ACTION WELL LOCAT	FION
		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	
NOTE(S)			
<ol> <li>VERTICAL DA</li> <li>DNAPL = DEN</li> </ol>	ISE NON-AQUEOUS PHASE	LIQUIDS DETECTED I	N MONITORING WELL
(JANUARY 20	20).		
3. (B) - BACKGR	OUND WELL.		
4 PROPOSEI	D A-12 CORRECTIVE ACTIO	IN OBSERVATION WE	LL.
REFERENCE(S)			
PARCEL BOUNDAF	RIES: CITY OF HOUSTON GE	OGRAPHIC INFORMA	TION & MANAGEMENT
SYSTEMS (GIMS).			
AERIAL: GOOGLE I	EARTH, IMAGERY DATED 2/	23/19.	
	0	200 400	
		200 400	
	1'' = 400'	FEET	
CLIENT			
UNION PACI	FIC RAILROAD CO.		
PROJECT			
HOUSTON W	OOD PRESERVIN	G WORKS	
TITLE			
POST-RESP	UNSE ACTION CAP		IG MAP
CONSULTANT		YYYY-MM-DD	2020-10-20
<b>~</b>		DESIGNED	AJD
· 🔼 🤈		PREPARED	AJD
· 🕎 💆		REVIEWED	МН
TE	EXAS ENGINEERING FIRM NO. 50369	APPROVED	ECM
			/ ATTAOU
UDO IFOT NO		REY	v. ATTACHI
PROJECT NO. 19119232		0	

# **ATTACHMENT 5B**

# **TABLE 1 - POST-RESPONSE ACTION CARE COST ESTIMATE** HWPW - DNAPL RECOVERY AND CAP INSPECTIONS

1.	Pun	nping Capacity Per Year:		
	A.	Daily average system pumping rate		gal/day
	B.	Annual groundwater volume recovered(est. purge water plus recovered creosote	 4000	aal/yr
	DNA	APL)	 4000	gal/yi
2.	Off-	Site Liquid Treatment / Disposal Cost:		
	A.	Volume of treated contaminated water to be disposed of off-site yearly	 4000	gal/yr
	В.	Transportation of liquid waste disposed of off-site yearly		
		(1) Transportation cost per gallon		\$/gal
		(2) Gallons of contaminated water shipped per year		gal/yr
		(3) Annual cost of transportation (1 x 2)	\$ 3,400.00	\$/yr
	C.	On-site yearly storage cost prior to off-site disposal		\$/yr
	D.	Off-site yearly treatment cost of liquid waste		
		(1) Treatment charge per gallon		\$/gal
		(2) Total volume to be treated per year		gal/yr
		(3) Annual treatment cost (1 x 2)		\$/yr
	E.	Off-site disposal cost of liquid waste per year		
		(1) Disposal charge per gallon	\$ 10.00	\$/gal
		(2) Total volume to be disposed per year	 3400	gal/yr
		(3) Annual disposal cost (1 x 2)	\$ 34,000	\$/yr
*An	nual	Off-Site Liquid Treatment / Disposal Cost (2B3 + 2C + 2D3 + 2E3)	\$ 37,400	\$

#### 3. On-site Waste Water Treatment System Cost and On-site Treatment / Disposal Cost:

Submit a cost estimate for a treatment system specifically designed and used exclusively for the groundwater corrective action program and operational after some start up maintenance. Estimates to clean out the system should also be included in the following cost.

A.	Initial capital expenditure for treatment system including start up maintenance	\$
*On-Site	Waste Water Treatment System Capital Cost (3A)	\$ - \$
В.	Gallons of contaminated water to be treated on-site per year	gal/yr
C.	Cost of on-site treatment per gallon	 \$/gal
D.	Cost of sludge, or solids disposal per year	 \$/yr
E.	Cost per year of maintenance on treatment system and recovery system, along with any additional equipment and repairs needed for the systems	\$/yr
F.	Cost of on-site disposal per year	 \$/yr
*Annua	l On-Site Treatment / Disposal Cost [(3B x 3C) + 3D + 3E + 3F]	\$ - \$

#### Inspections, Maintenance and Operation Cost for the Corrective Action Program: (Soil 4. Cap, Asphalt Roadway, Concrete Sidewalk, Concrete Cap, and Railroad Ballast Inspections)

А.	Operator's time on-site for inspections and maintenance per year		40 hou	ur/yr
В.	Charge of salary per hour	\$	100.00 \$/h	ır
C.	Annual cost of labor (4A x 4B)	\$	4,000 \$/y	r
D.	Replacement of parts and equipment per year (includes mowing and repairs)	\$	43,000 \$/y	r
E.	Electricity cost per year		\$/y	r
*Annual	Inspections / Maintenance / Operation Cost for the	\$	47.000 \$	
Correct	ive Action Program (4C + 4D + 4E)	ۍ 	47,000 \$	

\*

1.

# ATTACHMENT 5B

# TABLE 1 - POST-RESPONSE ACTION CARE COST ESTIMATEGROUNDWATER MONITORING COST ESTIMATE

Annual	Sampling and Analysis Cost		
A.	Background Wells (SWMU 1 Wells only)		
	(1) Number of wells	 2	
	(2) Sample analysis cost per well	\$ 150.00 \$	S/well
	(3) Number of sampling events per year	2 /	yr
	(4) Sampling $cost (1 x 2 x 3)$	\$ 600.00 \$	5
В.	Point of Compliance Wells (SWMU 1 Wells only)		
	(1) Number of wells	 8	
	(2) Sample analysis cost per well	\$ 150.00 \$	S/well
	(3) Number of sampling events per year	 2 /	yr
	(4) Sampling $cost (1 x 2 x 3)$	\$ 2,400.00 \$	5
C.	Recovery Wells		
	(1) Number of wells	 	
	(2) Sample analysis cost per well	 \$	S/well
	(3) Number of sampling events per year	/	yr
	(4) Sampling $cost (1 x 2 x 3)$	\$ - \$	5
D.	Corrective Action Observation Wells		
	(1) Number of wells	 51	
	(2) Sample analysis cost per well	\$ 250.00 \$	S/well
	(3) Number of sampling events per year	2 /	yr
	(4) Sampling $\cot(1 \ge 2 \le 3)$	\$ 25,500 \$	5
E.	Point of Exposure Wells		
	(1) Number of wells	 50	
	(2) Sample analysis cost per well	\$ 250.00 \$	S/well
	(3) Number of sampling events per year	 2 /	yr
	(4) Sampling $\cot(1 \ge 2 \le 3)$	\$ 25,000 \$	5
F.	Supplemental Wells (Site-wide background wells)		
	(1) Number of wells	 3	
	(2) Sample analysis cost per well	\$ 250.00 \$	S/well
	(3) Number of sampling events per year	2 /	yr
	(4) Sampling cost (1 x 2 x 3)	\$ 1,500 \$	5

# ATTACHMENT 5B

# TABLE 1 - POST-RESPONSE ACTION CARE COST ESTIMATEGROUNDWATER MONITORING COST ESTIMATE

G. Field Quality Control Sampling	
(1) Number of wells	6
(2) Sample analysis cost per well	\$ 250.00 \$/well
(3) Number of sampling events per year	2 /yr
(4) Sampling $cost (1 x 2 x 3)$	\$ 3,000.00 \$
2. Sampling Labor Cost:	
A. Hours of sampling per well	2 hrs/well
B. Number of sampling technicians per well	1
C. Charge per hour	\$ 95.00 \$/hr
D. Total number of wells to be sampled annually	Wells
E. Total number of wells sampled semi-annually	114 Wells
F. Total number of wells sampled quarterly	Wells
G. Total number of wells sampled monthly	Wells
H. Total number of wells sampled per year	total wells
$(2D) + (2E \times 2) + (2F \times 4) + (2G \times 12)$	228 sampled/y
I. Sampling Labor Cost (2A x 2B x 2C x 2H)	\$ 43,320 \$
*Annual Groundwater Monitoring Cost	\$ 101,320 <b>\$</b>
3. Well Installation (typical cost):	
A. Monitor well installation cost per well	\$ 15,000 \$/well
B. Number of monitor wells to be installed	6 Wells
C. Cost of monitor well system (A x B)	\$ 90,000 \$
D. Recovery well installation cost per well	\$ 16,700 \$/well
E. Number of Recovery Wells to be installed	18 Wells
F. Cost of Recovery well system (D x E)	\$ 300,600 \$
*Total Well Installation Cost (3C + 3F)	<u>\$ 390,600</u> <b>\$</b>
4. Administrative Cost:	
A. Annual cost for record-keeping and report preparation	\$ 27,650 \$
*Annual Administrative Cost (4A)	<u>\$ 27,650</u> <b>\$</b>
5. Inspection and Maintenance Cost for the Monitoring Program:	
A. Operator's time (hours) on-site for inspections and maintenance per year	20 hour/yr
B. Charge or salary per hour	\$ 90.00 \$/hr
C. Annual cost of labor (5A x 4B)	\$ 1,800 \$/yr
D. Replacement of parts and equipment per year	\$ 7,700.00 \$/yr
*Annual Inspections / Maintenance Cost for the Groundwater Monitoring	\$ 0.500 <b>\$</b>
Program $(5C + 5D)$	\$ 9,500 <b>\$</b>

# ATTACHMENT 5B TABLE 1 - POST-RESPONSE ACTION CARE COST ESTIMATE

Annual Off-Site Liquid Treatment / Disposal Cost	\$ 37,400	
Annual On-Site Treatment / Disposal Cost		
Annual Inspection / Maintenance / Operation Cost For The Corrective Action Program	\$ 47,000	
Annual Groundwater Monitoring Cost	\$ 101,320	
Annual Administrative Cost	\$ 27,650	
Annual Inspection And Maintenance Cost For The Groundwater Monitoring Program	\$ 9,500	
Annual DNAPL Recovery Costs (MPE)	\$ 106,110	
Annual Sub Total	\$ 328,980	
Total Years Used For Calculating PRAC	\$ 30	Yrs
PRAC Costs (Annual Sub Total x Total Years Used)	\$ 9,869,400	

Grand Total Cost (nearest \$1000)

\$ 9,869,400

Implementation Schedule	RAP Worksheet 6.0 Page 1 of		
	ID No.: SWR ID 31547	Report Date: October 26, 2020 – Rev 6	

Document the proposed schedule for implementing the response action. Include all major response action activities through the life of the project, including all removal, decontamination, and control actions, component installations, O&M, monitoring, and post-response action care activities.

Implementation of Response Action	Start	Finish	Duration
(specify component or action)			
Filing of deed recordation for UPRR-owned properties requiring commercial/industrial land use and prohibiting groundwater use. Deed recordation will also restrict excavation activities over capped areas	Upon Revised RAP approval	Within 120 days from RAP approval	120 days
Filing of restrictive covenants prohibiting groundwater use for off-site PMZ. Filing of deed recordation for City of Houston ROW for prohibiting groundwater use and restriction of excavation where concrete sidewalk will be installed.	Upon Revised RAP approval	Within 120 days from RAP approval	120 days
Plugging of monitoring wells within the capped area, installation of additional monitoring wells at the POEs	Completed	Completed	Completed
Excavation of Surface Soil PCLE Zone, relocation under the AOC Policy, and construction of the soil cap, asphalt roadway, and concrete sidewalk	Completed	Completed	Completed
Installation of the NAPL Collection System in the Englewood I Yard (Interim Corrective Action)	Completed	Completed	Completed
NAPL Collection System in the Englewood IM Yard (Interim Corrective Action) Weekly Inspections	Ongoing	Uncertain – to be evaluated annually	Uncertain – to be evaluated annually
Quarterly cap inspections (soil cap, asphalt roadway, Englewo IM Yard concrete cap, and concrete sidewalk)	Ongoing	30 years	30 yr O&M
Semi-annual groundwater monitoring (submitted to TCEQ under the Post-Response Action Care Reports (PRACR)/Ann Groundwater Monitoring Report)	Ongoing	Submitted by March 31 of the following year	30 yr O&M – sample freq. and wells to be evaluated annually
DNAPL Recovery Activities (pneumatic pumps and MPE Events) (with annual evaluation of effectiveness), quarterly status reports to be submitted to the TCEQ.	Ongoing/ Start MPE Events within 60 days of Mobile MPE Pilot Study completion	Uncertain – to be evaluated annually	Uncertain – to be evaluated annually
Physical Barrier (Cap/Sidewalk/Pavement/Ballast) Inspection and Maintenance	Ongoing	30 years	30 yr O&M
Slurry Wall Construction and Installation	Within 120 days of completing slurry wall design	Within 390 days of completing slurry wall design	270 days
Mobile MPE Well Install and Implementation (MPE Events monthly for the first 12 months, then quarterly for the next three years, evaluate frequency an annual basis and continuation of response action)	Within 90 days of completing the Mobile MPE Pilot Study	Uncertain – to be evaluated annually	Uncertain – to be evaluated annually

Implementation Schedule	<b>RAP Worksheet</b>	6.0 Page 2 of 3
	ID No.: SWR ID 31547	Report Date: October 26, 2020 – Rev 6

Annual Groundwater Corrective Action Monitoring Report, documenting all remediation and post-response action activities at the Site including the PRACR	See the following Submittal table	See the following Submittal table	See the following Submittal table
Pre-Design Assessments/Schedule			
Slurry Wall Pre-Design Assessment	Within 60 days of RAP Approval	Within 150 days of RAP Approval	90 Days
Slurry Wall Design/ Bid Support	Upon completion pre-design assessment	Within 180 days of completing pre-design assessment	180 Days
Mobile MPE Pilot Study: Installation of recovery wells	Within 60 days of RAP Approval	Within 120 days of RAP Approval	60 Days
Englewood IM Yard Test Pit Evaluation Report	Within 60 days of RAP Approval	Within 120 days of RAP Approval	60 Days

List the proposed schedule for report submittals. Add additional lines if more reports than listed will be needed to complete the response action.

Reports	Submittal date		
Response Action Effectiveness Report (RAER)			
RAER submittal number 1	March 31, 2024 (submitted within the		
	PRACR)		
RAER submittal number 2	March 31, 2027 (submitted within the		
	PRACR)		
RAER submittal number 3	March 31, 2030 (submitted within the		
Subsequent BAEB submittals	PRACK)		
Subsequent RAER Submitted Second (BACR) (Following installation of the slurry	Within 90 days completing the slurry		
	wall construction		
Post-Response Action Care Report (PRACR) (to be submitted with the Annual G	roundwater Monitoring Report as an		
attachment:			
PRACR submittal number 1	March 31, 2021		
PRACR submittal number 2	March 31, 2022		
PRACR submittal number 3	March 31, 2023		
PRACR submittal number 4	March 31, 2024		
PRACR submittal number 5	March 31, 2025		
PRACR submittal number 6	March 31, 2026		
PRACR submittal number 7	March 31, 2027		
PRACR submittal number 8	March 31, 2028		
PRACR submittal number 9	March 31, 2029		
PRACR submittal number 10	March 31, 2030		
PRACR submittal number 11	March 31, 2031		
PRACR submittal number 12	March 31, 2032		
PRACR submittal number 13	March 31, 2033		
PRACR submittal number 14	March 31, 2034		
PRACR submittal number 15	March 31, 2035		
PRACR submittal number 16	March 31, 2036		
PRACR submittal number 17	March 31, 2037		

Implementation Schedule	RAP Worksheet 6.0 Page 3 of 3	
	ID No.: SWR ID 31547	Report Date: October 26, 2020 – Rev 6

PRACR submittal number 18	March 31, 2038
PRACR submittal number 19	March 31, 2039
PRACR submittal number 20	March 31, 2040
PRACR submittal number 21	March 31, 2041
PRACR submittal number 22	March 31, 2042
PRACR submittal number 23	March 31, 2043
PRACR submittal number 24	March 31, 2044
PRACR submittal number 25	March 31, 2045
PRACR submittal number 26	March 31, 2046
PRACR submittal number 27	March 31, 2047
PRACR submittal number 28	March 31, 2048
PRACR submittal number 29	March 31, 2049
PRACR submittal number 30	March 31, 2050

\*This schedule assumes RAP approval by December 31, 2020 and PMZ implementation (i.e., filing of required restrictive covenants) by March 31, 2021.