CH2M Raleigh
[illegible]

February 6, 2018

Delivered via FedEx

Ms. Bobbi Coleman
South Carolina Department of Health and Environmental Control
Assessment Section, UST Management Division
Bureau of Land and Waste Management
2600 Bull Street
Columbia, SC 29201

Subject: Free-Product Recovery Plan – Revision 4
Lewis Drive Remediation
Plantation Pipe Line Company
Belton, South Carolina
Site ID #18693, "Kinder Morgan Belton Pipeline Release"

Dear Ms. Coleman,

On behalf of Plantation Pipe Line Company (Plantation), CH2M HILL Engineers, Inc. (CH2M) has prepared this letter to modify the approach to free product recovery at the Lewis Drive Remediation site located in Belton, South Carolina. These changes were discussed with the South Carolina Department of Health and Environmental Control (SCDHEC) during a meeting in Columbia, SC on January 22, 2018. This plan supersedes the Interim Free Product Recovery Plan Revision 3, dated August 4, 2017[1]. The efficiency of product recovery by the current vacuum-enhanced method has declined significantly at the site, and we have prepared this plan to revise our approach.

As discussed at the meeting with SCDHEC, while remediation through air sparging has been highly successful, the efficiency of vacuum product recovery has declined significantly over time. The slides presented at that meeting are included as Attachment A.

Despite weekly product recovery events performed at great expense to Plantation, only 21 gallons of product have been recovered at the site per month in the last five months since September 1, 2017. This is a minute amount compared to 69,000 gallons per month that were recovered in the first two months after the release and approximately 2,700 gallons per month between February 2015 and August 2017[2].

The inefficiency of vacuum-enhanced product recovery is supported by the results of mobility testing conducted at the site in 2017[3]. During these tests, product transmissivity at the six wells tested ranged

---

[1] CH2M HILL Engineers, Inc. (CH2M). 2017. *Interim Free Product Recovery Plan – Revision 3, Plantation Pipe Line Company, Lewis Drive Remediation Site, Belton, South Carolina, Site ID #18693, "Kinder Morgan Belton Pipeline Release".* August 4.

[2] CH2M. 2018. *Lewis Drive – December 2017 Monthly Status Update, Plantation Pipe Line Company, Belton, South Carolina, Site ID #18693, "Kinder Morgan Belton Pipeline Release".* January 18.

[3] CH2M. 2017. *Light Non-Aqueous Phase Liquid Mobility Testing Technical Memorandum*, Lewis Drive Site, Belton, South Carolina. May 25.

between 0.07 and 0.54 square feet (ft^2) per day. Based on published literature, fluid recovery is considered impractical in wells with low transmissivities ranging from 0.1 to 0.8 ft^2/day[4].

Furthermore, product thickness data presented at the meeting in Columbia (Attachment A) indicate that the air sparging curtains established in the Brown's Creek Protection Zone and Cupboard Creek Protection Zone have halted migration of product toward these surface water bodies and there is no further risk posed by remaining product at the site. Indeed, air sparging has reduced product thicknesses by 95 percent in the Brown's Creek Protection Zone and by 81 percent in the Cupboard Creek Protection Zone.

The current method of enhanced vacuum product recovery also provides little resolution on the volume of product recovered by well. As a vacuum is applied to each well, product and water are emulsified and recovered together in indistinguishable quantities. Due to the large size of the recovery vessel, even after allowing product and water to settle, the volume of product recovered cannot be measured with a large degree of accuracy, and can only be obtained as aggregate over the whole site.

Therefore, as discussed with SCDHEC, Plantation is implementing the following plan to more accurately quantify the amount of product recovered by well which will allow us to focus future activities:

1. Product recovery skimmers (specifications presented in Attachment B) will be the primary method of product removal. They will be placed in monitoring wells, recovery wells, sumps, and trench risers that have 0.01 foot or greater of product present and sufficient depth below the oil/water interface to accommodate the height of the skimmer based on the manufacturer's recommendation. The skimmers will be left in place and emptied each week. To record the volume of product recovered, the skimmer canisters will be emptied into a graduated bucket or cylinder before returning them to the well. If the skimmer canisters are full, then any remaining product will be bailed out of the well, measured for volume, and recorded.
2. Petroleum-only absorbent socks will be used in wells that do not meet the minimum water column required by the manufacturer for the smallest size skimmer. The weight of each sock will be measured and recorded prior to installation. The socks will be withdrawn from each well and inspected weekly. If the sock is near or fully saturated, it will be weighed, recorded, properly disposed of, and replaced with a new sock. Otherwise, if not near or fully saturated, the sock will be returned to the well.

In accordance with previous plans, Plantation will continue to:

- Transport recovered product and water to an off-site disposal facility.
- Gauge all monitoring wells, recovery wells, recovery sumps, recovery trench risers, and piezometers monthly for depth to groundwater and free product thickness. If present, product recovery skimmers and socks will be removed from wells prior to gauging.

Based on water level gauging data from December 27, 2017, there are 22 features at the Lewis Drive site with greater than 0.01 foot of product and a 2-inch or greater diameter (Table 1 and Figure 1). Of those, four are monitoring wells, seven are recovery wells, seven are recovery sumps, and four are recovery trench risers. Table 1 presents the recommended product recovery method for each feature according to the guidelines above.

[4] Interstate Technology & Regulatory Council (ITRC). 2009. *Evaluating LNAPL Remedial Technologies for Achieving Project Goals.* LNAPL-2. Washington, D.C.: Interstate Technology & Regulatory Council, LNAPLs Team. www.itrcweb.org.

Although product is also measurable in three 1-inch piezometers (TW-28, TW-42, and TW-45), Plantation intends to abandon these features. Product recovery cannot be performed (by vacuum truck, skimmer, or standard size socks) in features with less than a 2-inch diameter. Also, capillary action makes product thickness measurements in these small-diameter piezometers inaccurate. Furthermore, there is now a network of 2-inch monitoring wells sufficient to provide enough data on groundwater elevation, product thickness, and analytical data such that the 1-inch piezometers are no longer necessary.

Plantation intends to install the skimmers and socks in the 22 features mentioned above the week of February 12, 2018. The skimmers and socks will be checked and emptied weekly for four weeks, after which the recovery volume data will be evaluated to develop a more focused plan.

If you have any further questions or concerns, please contact me at 919-760-1777 or Mr. Jerry Aycock with Plantation at 770-751-4165.

Regards,
CH2M HILL Engineers, Inc.

William M. Waldron, P.E.
Program Manager

Enclosures:

Table 1 – Wells with Product Present and Recovery Method
Figure 1 – Product Thickness Map
Attachment A – Lewis Drive Remediation, SCDHEC Progress Update Presented January 22, 2018
Attachment B – Oil Skimmer Specifications

Cc (via e-mail):

Jerry Aycock, Plantation, Jerry_Aycock@kindermorgan.com
Mary Clair Lyons, Esq., Plantation, Mary_Lyons@kindermorgan.com
Richard Morton, Esq., Womble Bond Dickinson, PLLC, rmorton@wcsr.com
File

Table 1. Wells With Measurable Product Thickness
Plantation Pipe Line Company
Lewis Drive Remediation Site, Belton, South Carolina
Site ID #18693 "Kinder Morgan Belton Pipeline Release"

Well Identifier	Product Thickness (feet)	Depth to Water (feet)	Depth below oil/water interface (feet)	Well Diameter (inches)	Total Depth (feet)	Depth below oil/water interface (inches)	Recommendation
MW-08	0.01	11.61	8.19	2	19.8	98	2-inch diameter, 1-liter passive skimmer
MW-11	0.43	30.45	2.05	2	32.5	25	Oil-only absorbent sock
MW-15	0.01	14.02	7.20	2	21.22	86	2-inch diameter, 1-liter passive skimmer
MW-20	0.35	13.5	5.95	2	19.45	71	2-inch diameter, 1-liter passive skimmer
RS-01	0.42	14	9.60	4	23.6	115	4-inch diameter, 4-liter passive skimmer
RS-02	0.04	12.15	7.85	4	20	94	4-inch diameter, 4-liter passive skimmer
RS-05	0.65	13.15	12.05	4	25.2	145	4-inch diameter, 4-liter passive skimmer
RS-08	0.10	15	5.22	4	20.22	63	4-inch diameter, 4-liter passive skimmer
RS-10	0.10	10.15	9.91	4	20.06	119	4-inch diameter, 4-liter passive skimmer
RS-14	0.02	7.49	12.44	4	19.93	149	4-inch diameter, 4-liter passive skimmer
RS-17	0.01	6.39	13.52	4	19.91	162	4-inch diameter, 4-liter passive skimmer
RT-1A	0.05	14.87	6.02	4	20.89	72	4-inch diameter, 4-liter passive skimmer
RT-1B	0.05	14.82	6.28	4	21.1	75	4-inch diameter, 4-liter passive skimmer
RT-1C	0.05	15.41	5.86	4	21.27	70	4-inch diameter, 4-liter passive skimmer
RT-2K	0.01	1.25	2.89	4	4.14	35	4-inch diameter, 1-liter passive skimmer or oil-only absorbent sock
RW-02	0.59	24.1	1.62	4	25.72	19	4-inch diameter, 1-liter passive skimmer or oil-only absorbent sock
RW-03	0.05	24.25	9.14	4	33.39	110	4-inch diameter, 4-liter passive skimmer
RW-04	0.06	24.93	10.11	4	35.04	121	4-inch diameter, 4-liter passive skimmer
RW-05	1.34	34.19	4.06	4	38.25	49	4-inch diameter, 4-liter passive skimmer
RW-07	0.02	22.87	15.13	4	38	182	4-inch diameter, 4-liter passive skimmer
RW-08	0.02	17.83	15.67	4	33.5	188	4-inch diameter, 4-liter passive skimmer
RW-15	0.68	15.3	21.20	4	36.5	254	4-inch diameter, 4-liter passive skimmer
TW-28	0.60	23.7	8.14	1	31.84	98	Abandon
TW-42	0.45	26.55	0.95	1	27.5	11	Abandon
TW-45	0.11	27.76	9.10	1	36.86	109	Abandon

Note:
Only wells, sumps, and piezometers with measurable product thickness are shown.
Wells were gauged on December 27, 2017.

LEGEND

- Release Point
- Monitoring Well
- Bedrock Monitoring Well
- Seep Location
- Recovery Sump
- Piezometer ("R" indicates Replacement)
- Recovery Well (4-inch diameter)
- Vertical Bedrock Sparging Well
- Vertical Saprolite Sparging Well
- Surface Water Sampling Location
- Septic Tank
- Recovery Trench Extraction Point
- Recovery Trench
- Surface Water Flow Direction
- Horizontal Sparging Well Riser
- Horizontal Sparging Well Screen
- Pipeline
- National Hydrography Dataset Stream
- Delineated Wetland
- Beaver Dam
- Detail Area

0.43 Product thickness in feet as of 12/21/2017 and 12/27/2017

NP No product detected

NM Not measured

Base Map Sources:
*USDA, Farm Service Agency (FSA), National Agriculture Imagery Program (NAIP), Published 8/19/2015
*United States Geological Survey (USGS) National Hydrography Dataset (NHD)

N

0 175 350

Scale in Feet

Figure 1. Product Thickness Map
Lewis Drive Remediation Site
Belton, South Carolina
Site ID #18693 "Kinder Morgan Belton Pipeline Release"

ch2m

Attachment A
Lewis Drive Remediation
SCDHEC Progress Update
Presented January 22, 2018

Lewis Drive Remediation

SCDHEC Progress Update Presented January 22, 2018

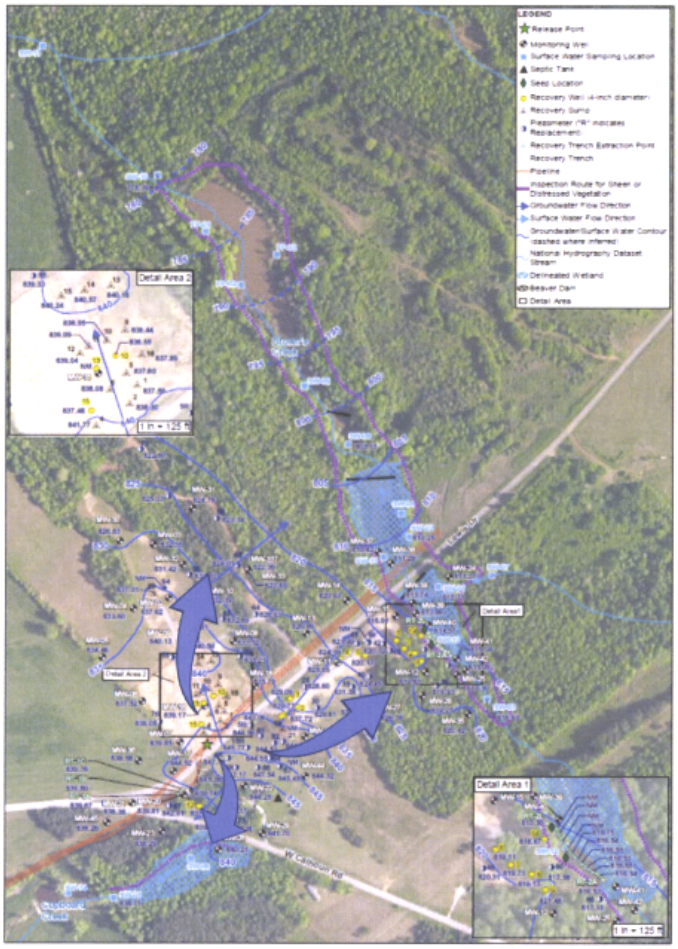
JACOBS® ch2m.

Agenda

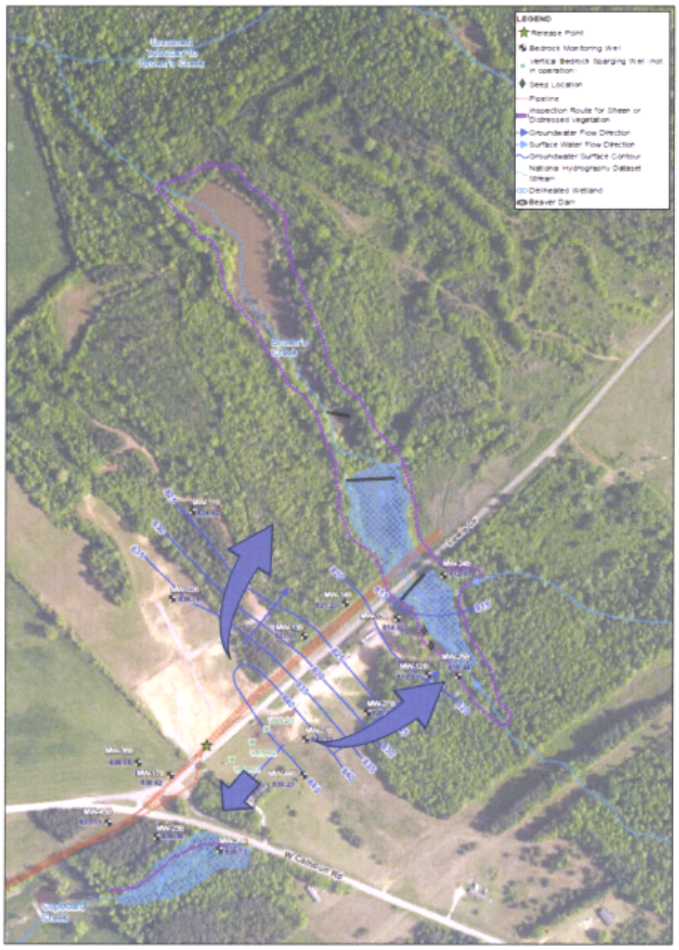
- Review remedial system effectiveness in 2017
  - Emphasis on biosparging's effectiveness in LNAPL
  - What next in 2018?
- Summary of public perception and ongoing legal activities
- Overview of recent site activities:
  - Review recent surface water detections and Environmental Standards, Inc.'s opinion
  - Review key proposed responses to SCDHEC letter dated December 14, 2017
- Discuss bedrock sparging plan feasibility and overall biosparging system expansion concepts
- Review future action items
- Any other business

Potentiometric Surface Maps

Residuum



Bedrock



Site Layout - Zones

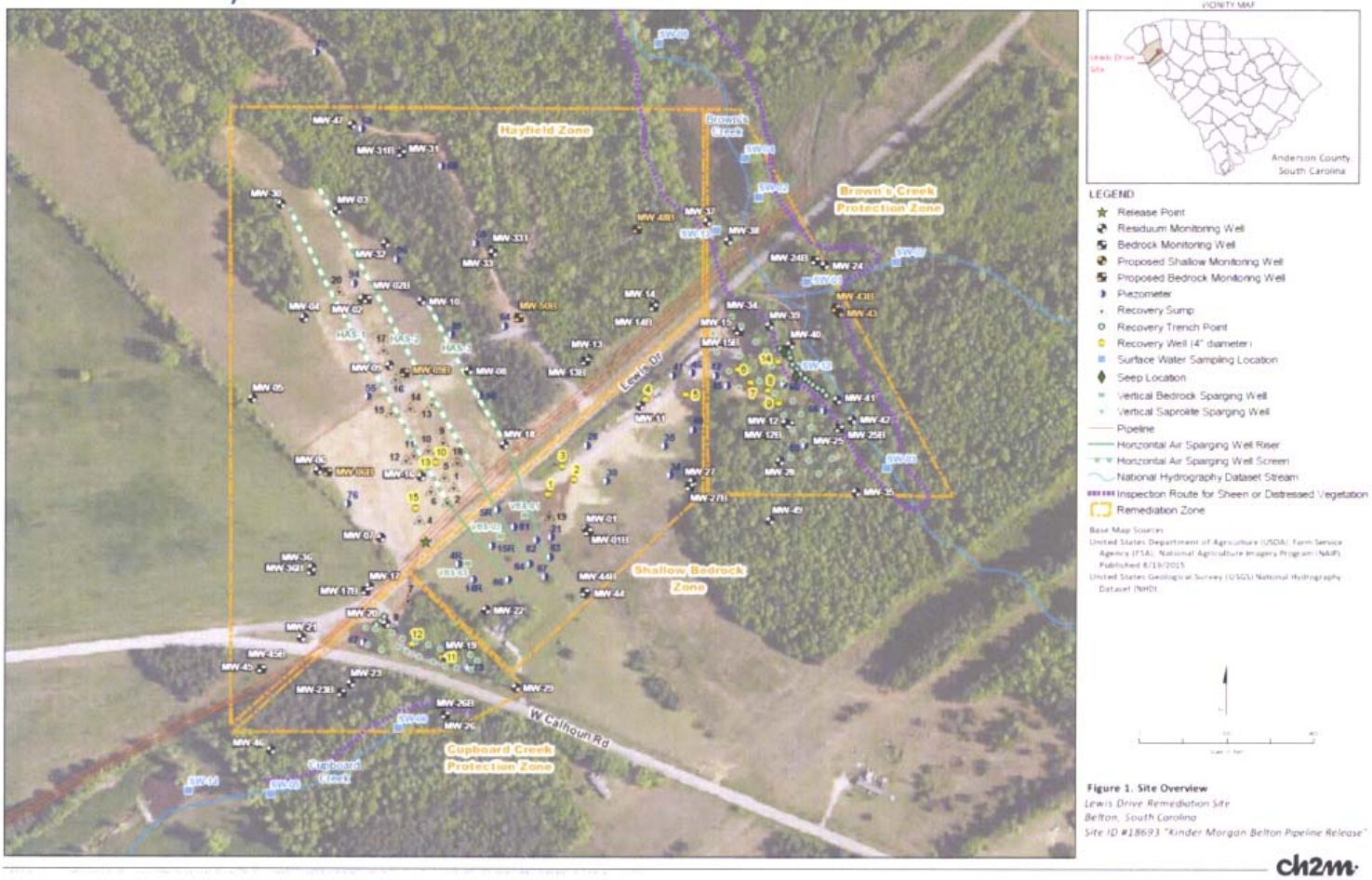


Figure 1. Site Overview
Lewis Drive Remediation Site
Belton, South Carolina
Site ID #18693 "Kinder Morgan Belton Pipeline Release"

ch2m

Remedial System Effectiveness to Date

Hayfield Zone

Horizontal sparging wells

Quantity: 3

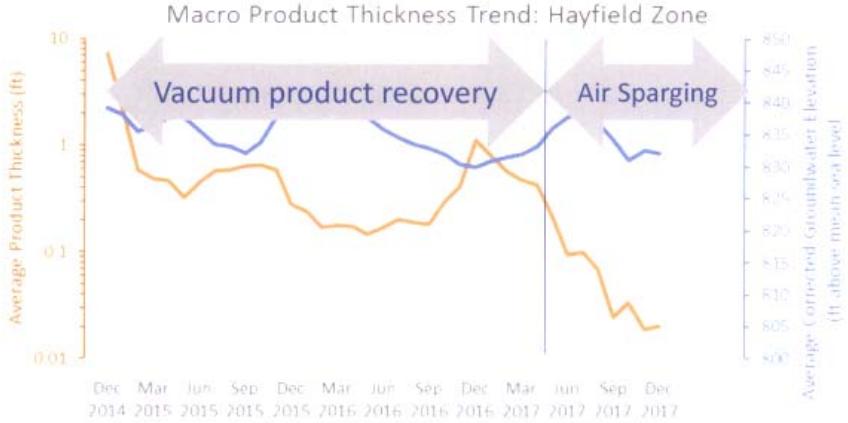
Average total length: 905 ft

Average screen length: 615 ft

Design flow rate: 0.75 scfm/ft of screen

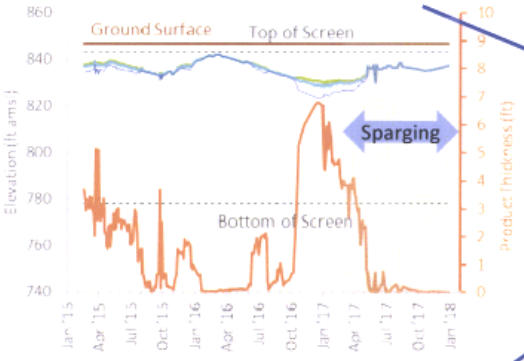
- Started sparging at 0.05 scfm/ft on May 6, 2017
- Increased 0.02 scfm/ft each week through December 2017
- Flow rate in December 2017: 0.53 scfm/ft of screen

Average reduction in product thickness: **95%**

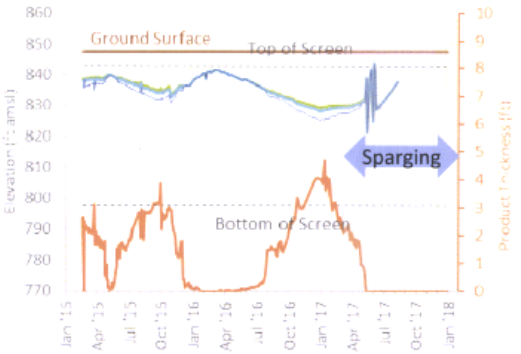


Hayfield Zone
LNAPL

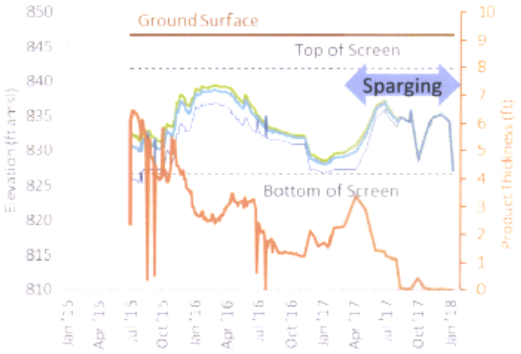
RW-10 Hydrograph



RW-13 Hydrograph

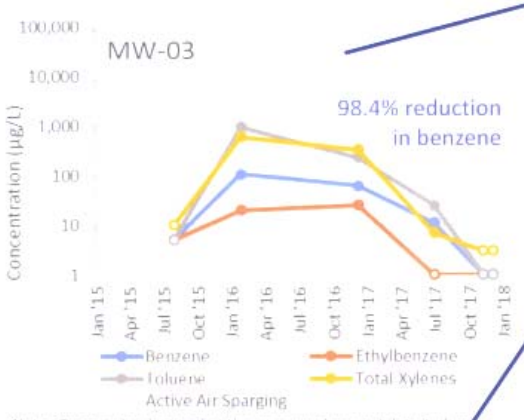


MW-18 Hydrograph

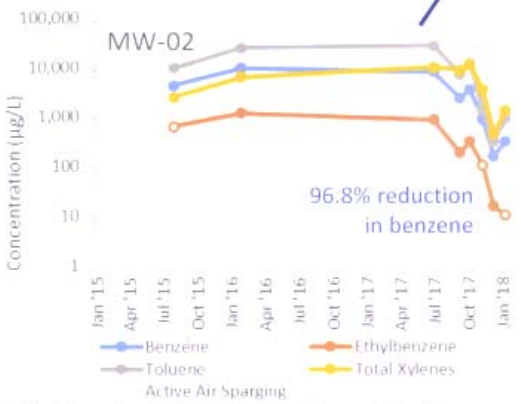


Hayfield Zone Dissolved

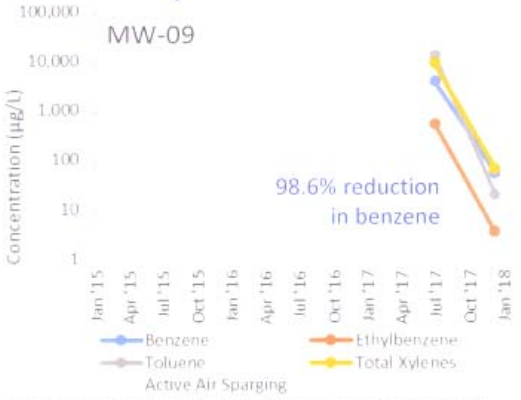
97.9% average reduction in benzene



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

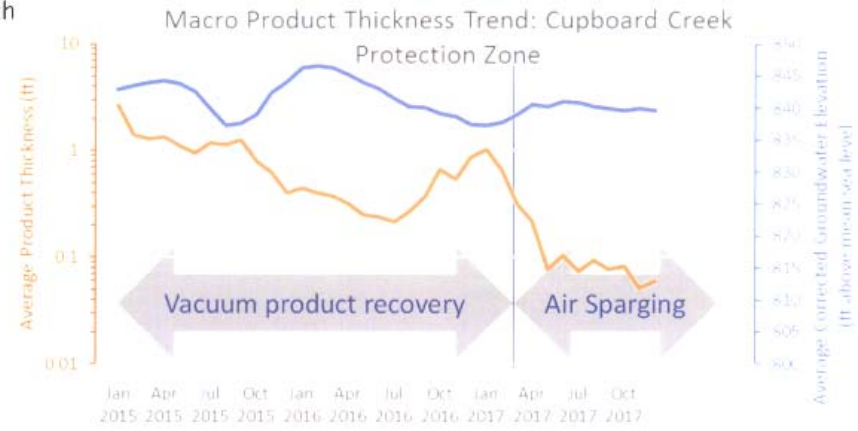
Cupboard Creek Protection Zone

Vertical sparging curtain

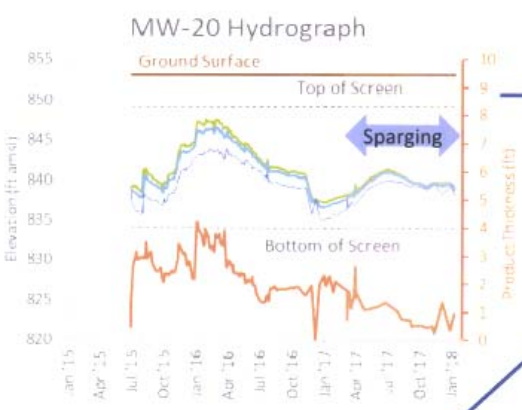
Quantity: 19
Average depth: 19 ft
Screen length: 2.5 ft
Design flow rate: 15 scfm each

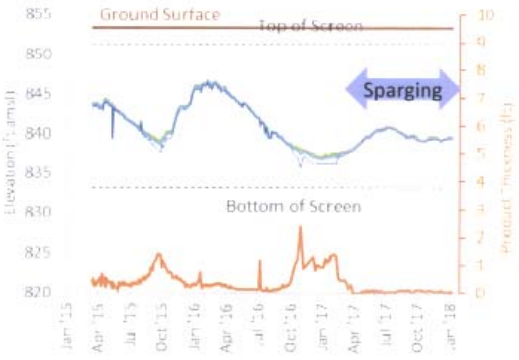
- Started air sparging at 1 scfm on March 6, 2017
- Increased 1 scfm/week in March to 4 scfm
- Maintained 4 scfm through June
- Increased to 6 scfm July to October
- Increased 1 scfm/week in November to 10 scfm
- Flow rate in December 2017: 10 scfm each

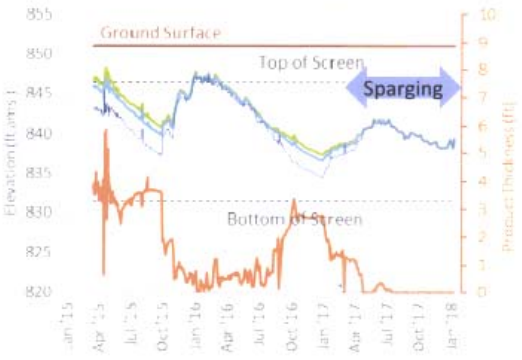
Average reduction in product thickness: **81%**



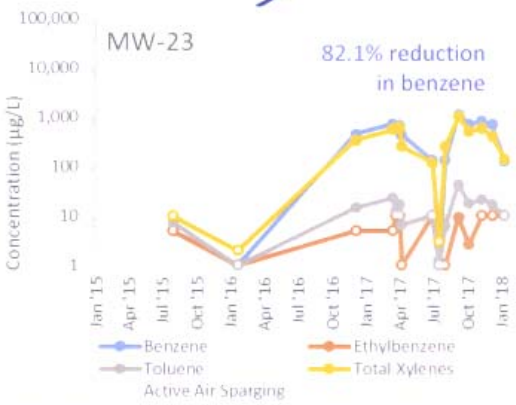
Cupboard Creek Protection Zone
LNAPL



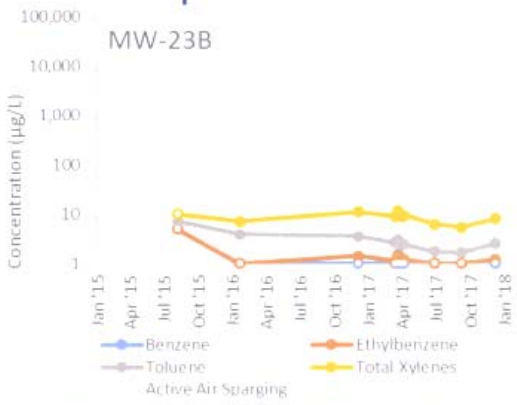




Cupboard Creek Protection Zone Dissolved



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

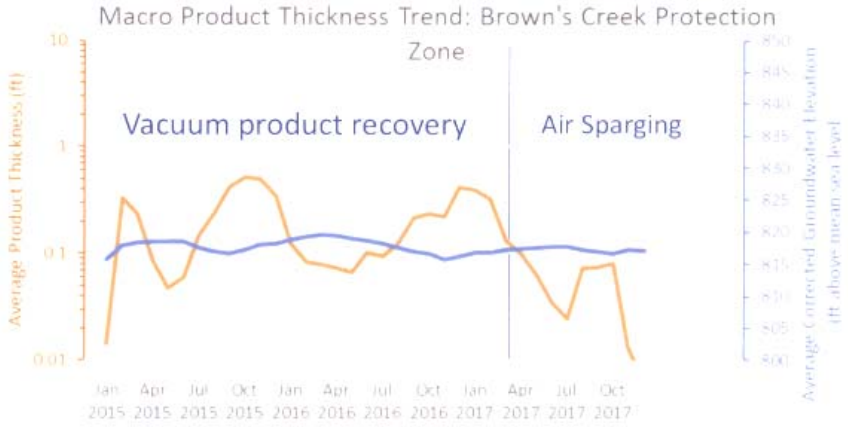
Brown's Creek Protection Zone

Vertical sparging curtain

Quantity: 27
Average depth: 44 ft
Screen length: 30 in
Design flow rate: 15 scfm each

- Started air sparging at 1 scfm on March 6, 2017
- Increased 1 scfm/week in March to 4 scfm
- Maintained 4 scfm through June
- Increased to 6 scfm July to October
- Increased 1 scfm/week in November to 10 scfm
- Flow rate in December 2017: 10 scfm each

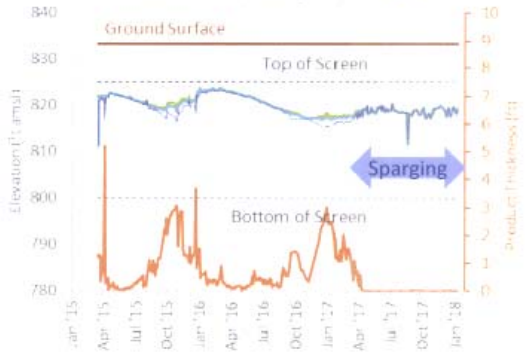
Average reduction in product thickness: **95%**



Brown's Creek Protection Zone LNAPL

RW-07 Hydrograph

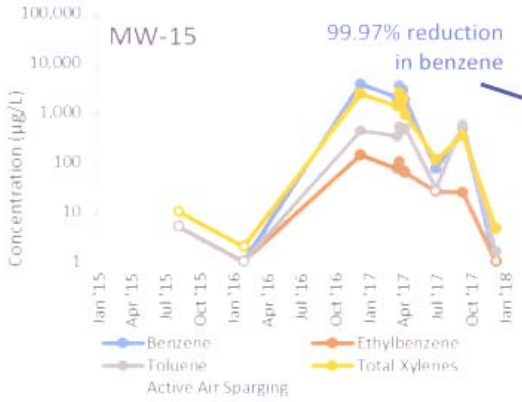
RW-08 Hydrograph



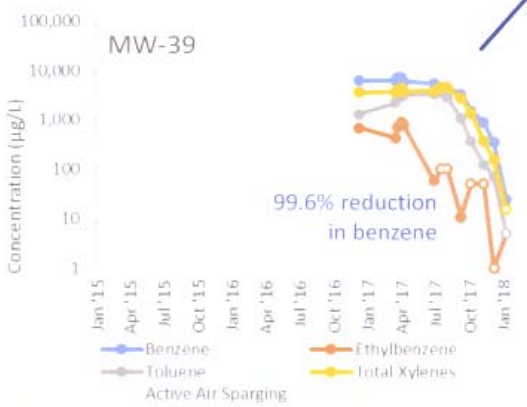
RW-09 Hydrograph

Brown's Creek Protection Zone Dissolved

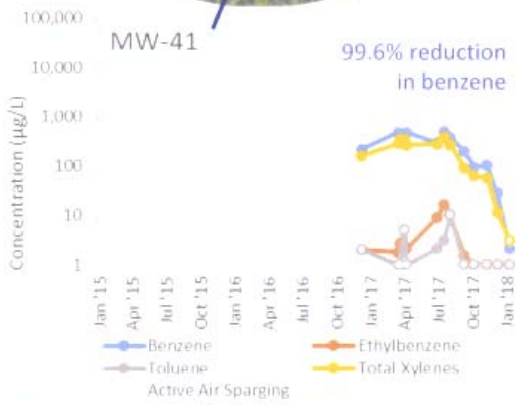
99.7% average reduction in benzene



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

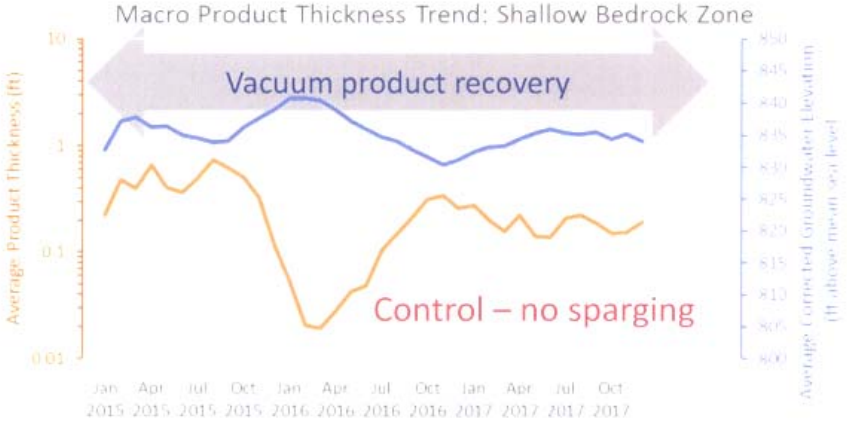


Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

Shallow Bedrock Zone

Control: Weekly vacuum recovery; no sparging

Average reduction in product thickness: **-22%**



Surface Water Aerators

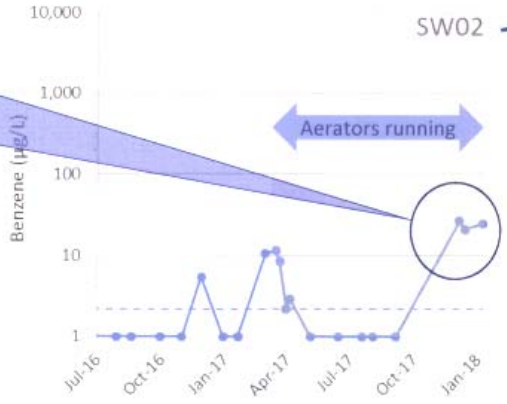
Quantity: 2

Design flow rate: 15 scfm each

- Started bubbling at 1 scfm each on March 6, 2017
- Increased 1 scfm/week to 6 scfm each in April
- Reduced to 4 scfm June to October
- Starting October, increased 1 scfm/week
- Flow rate in December 2017: 10 scfm each
- Increasing to 15 scfm each in January 2018

Surface Water Impacts

Environmental Standards, Inc.'s opinion is this is unrelated to Plantation release

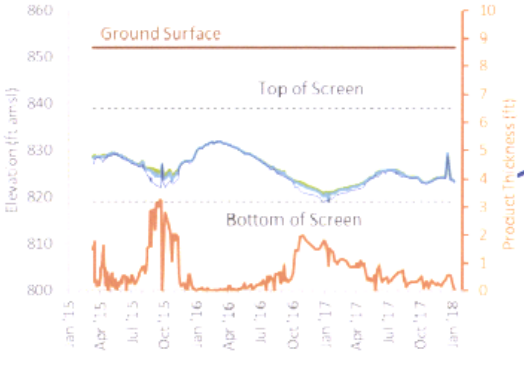


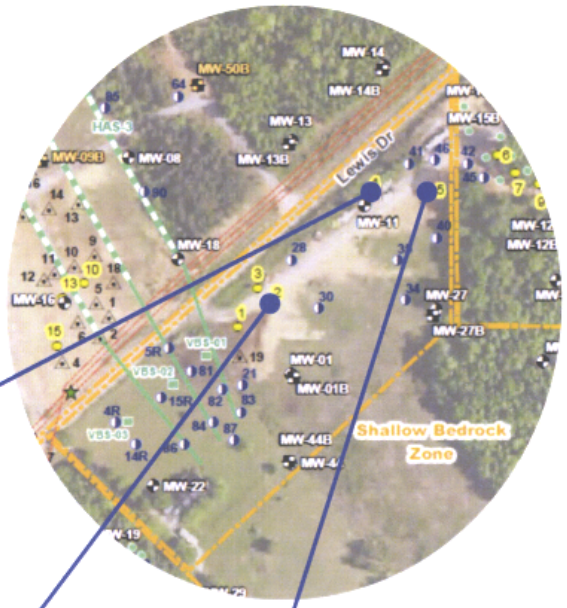
What Next?

Challenge:
Shallow Bedrock Zone LNAPL

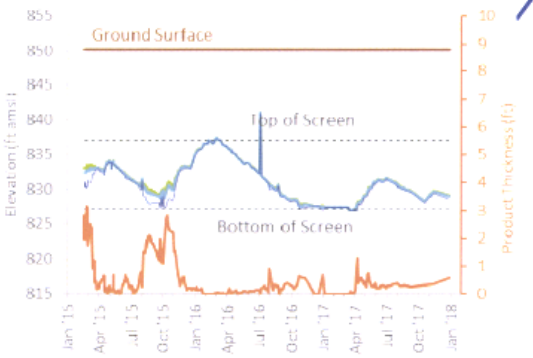
- 25 wells still with LNAPL in Dec 2017
- Only 6 wells with >0.5 ft LNAPL
- Outside sparging influence
- Perform focused product recovery
  - Socks
  - Vac truck
  - AFVR?

RW-04 Hydrograph

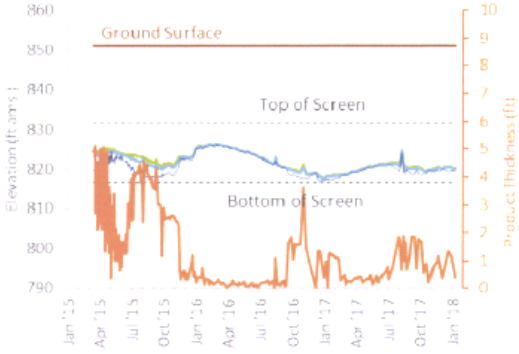




RW-02 Hydrograph

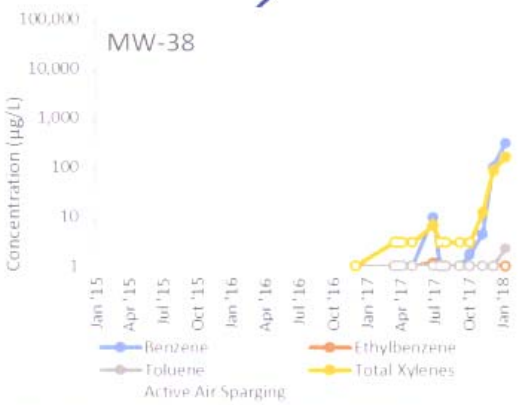


RW-05 Hydrograph

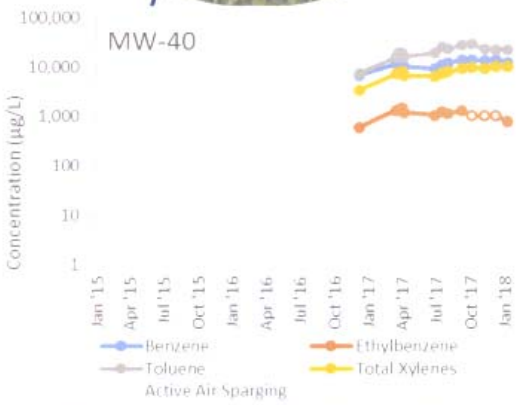


Challenge:
Brown's Creek Protection Zone

- Optimize flow and pulsing sequencing
- Increase flows in vicinity of MW-40 from 10 scfm to design flow of 15 scfm; adjust pulsing or consider continuous
- Install two wells upgradient of MW-38 to evaluate source of impacts in MW-38



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

Discussion of Recent Key Site Activities

- Impacts to Chandler well
  - unrelated to release per Environmental Standards, Inc.
- Recent surface water detections
  - unrelated to release per Environmental Standards, Inc.
- Key proposed responses to SC DHEC letter dated December 14, 2017

Potential Bedrock Sparging Pilot Test and Potential Sparging System Expansion

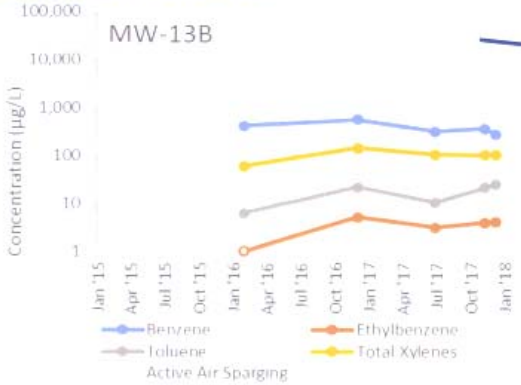
Highlight Key Decisions and Action Items

Questions?
Other Business?

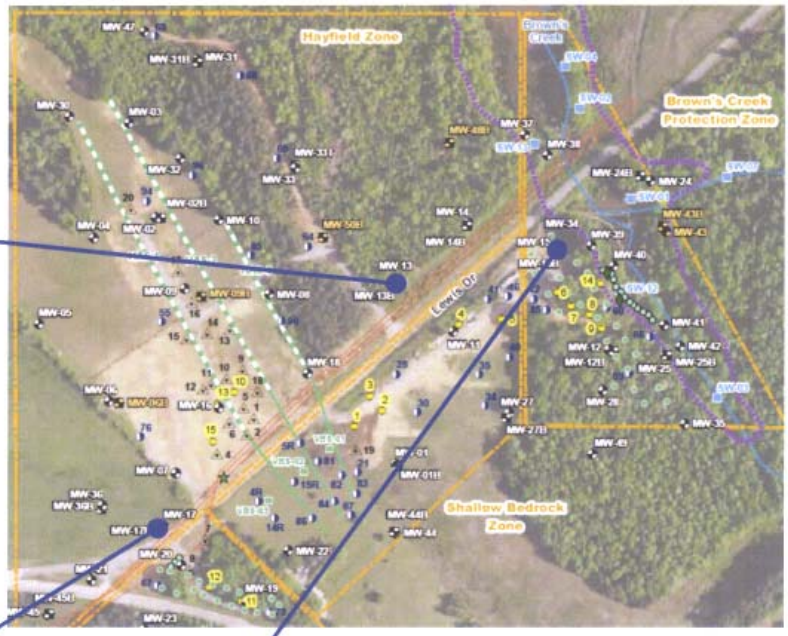
JACOBS ch2m

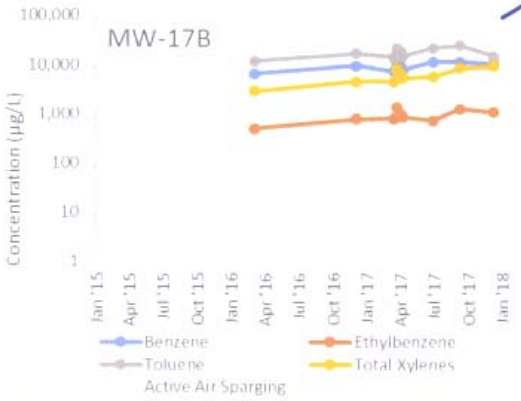
Status of Public Perception and Ongoing Legal Activities?

Challenge: Increasing Bedrock Wells

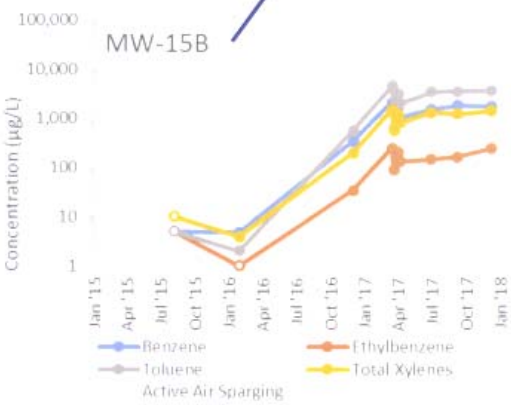


Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.





Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.



Note: Open circles denote that the compound was not detected; non-detects are plotted at the reporting limit.

Attachment B
Oil Skimmer Specifications

Go To Geotech

Oil Skimmers

geotech

Geotech PRC Passive Skimmer

The Geotech PRC (Product Recovery Canister) is a passive skimmer with a floating intake that separates and recovers light hydrocarbons from groundwater. The Geotech PRC collects floating product down to a sheen then is emptied through a discharge valve at the bottom of the canister after being raised to the surface.

FEATURES

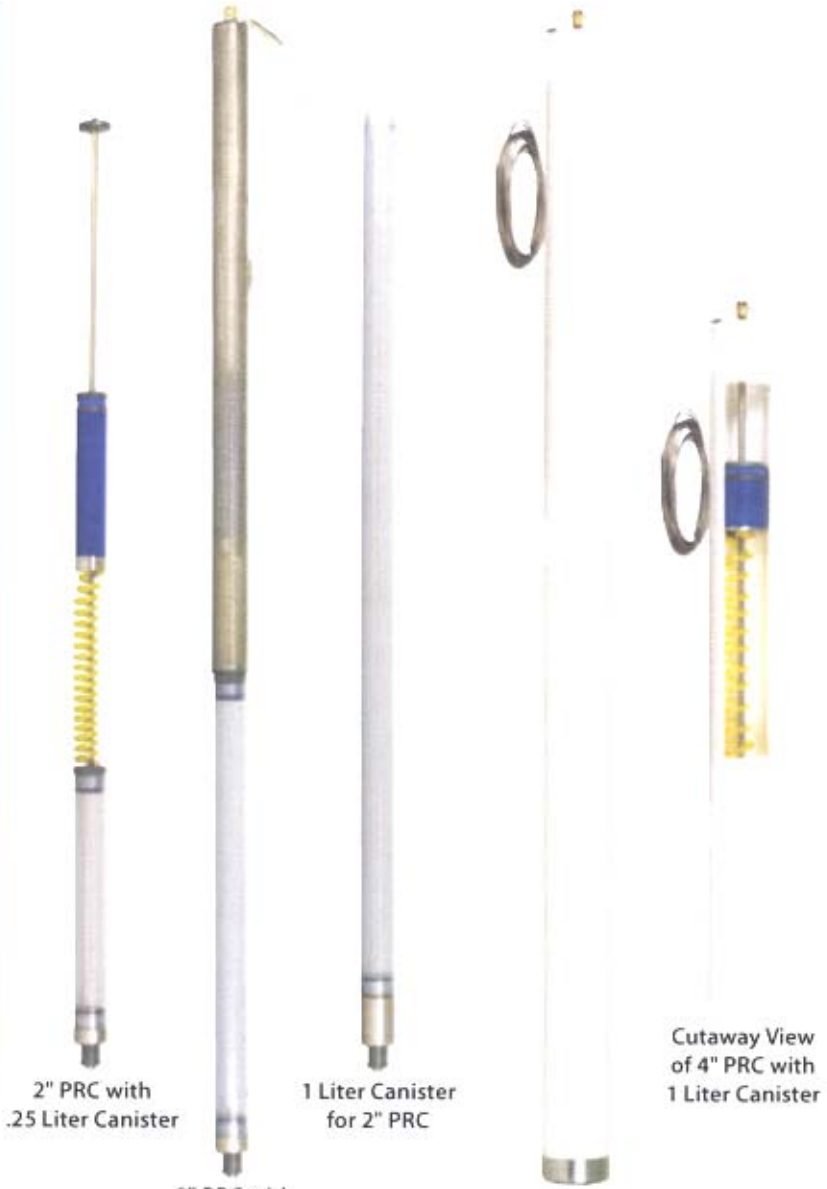
- Oleophilic/Hydrophobic filter buoy recovers product without taking in water
- Quick fill time – about 15 minutes with ample product
- Protected easy release drain valve
- Able to convert to active recovery systems

2" PRC

- 12" (30.5 cm) effective buoy travel
- 3 recovery capacities: .25, .5 and 1 liter
- Transparent recovery canister
- 2" (5 cm) or larger monitoring well applications
- Optional protective screen

4" PRC

- 16" (40.6 cm) effective buoy travel
- 3 recovery capacities: 1, 3 and 4 liter
- 4" (10 cm) or larger monitoring well applications
- Buoy protected in 0.020 (.5mm) slot PVC screen



2" PRC with .25 Liter Canister

2" PRC with .5 Liter Canister and Screen

1 Liter Canister for 2" PRC

4" PRC with 4 Liter Canister

Cutaway View of 4" PRC with 1 Liter Canister

CALL GEOTECH TODAY (800) 833-7958

Geotech Environmental Equipment, Inc.
2650 East 40th Avenue • Denver, Colorado 80205
(303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242
email: sales@geotechenv.com website: www.geotechenv.com

Oil Skimmers

Geotech PRC Passive Skimmer

4" PRC SPECIFICATIONS

	1 Liter	3 Liter	4 Liter
Dimensions:	37.0" L x 3.5" OD (94cm x 9cm)	53.0" L x 3.5" OD (135cm x 9cm)	60.0" L x 3.5" OD (152cm x 9cm)
Empty Weight:	8 lbs. (3.7kg)	15 lbs. (6.8kg)	16 lbs. (8.2kg)
Full Weight:	9.5 lbs. (4.3kg)	19 lbs. (8.6kg)	25.5 lbs. (11.6kg)
Capacity:	.26 gal.	.8 gal.	1.06 gal.
Min. Water Required:	18.5" (47cm)	35.0" (89cm)	43.0" (109cm)
Materials (All):	Stainless steel, brass, and engineered plastics		

2" PRC SPECIFICATIONS

	.25 Liter	.5 Liter	1 Liter
Dimensions:	49.0" L x 1.75" OD (149cm x 4.4cm)	59.5" L x 1.75" OD (151cm x 4.4cm)	82.5" L x 1.75" OD (210cm x 4.4cm)
Empty Weight: With Screen:	3.1 lbs. (1.4kg) 4.5 lbs. (2.0kg)	3.5 lbs. (1.6kg) 4.9 lbs. (2.2kg)	5.2 lbs. (2.4kg) 6.6 lbs. (3.0kg)
Full Weight: With Screen:	3.5 lbs. (1.6kg) 4.9 lbs. (2.2kg)	4.3 lbs. (2.0kg) 5.7 lbs. (2.6kg)	6.7 lbs. (3.0kg) 8.1 lbs. (3.7kg)
Capacity:	.07 gal.	0.13 gal.	0.26 gal.
Min. Water Required:	29.0" (74cm)	39.5" (100cm)	62.0" (157cm)
Materials (All):	Stainless steel, brass, and engineered plastics		

CALL GEOTECH TODAY (800) 833-7958

Geotech Environmental Equipment, Inc.
2650 East 40th Avenue • Denver, Colorado 80205
(303) 320-4764 • **(800) 833-7958** • FAX (303) 322-7242
email: sales@geotechenv.com website: www.geotechenv.com