



TOPIC TALK

ACCELERATING BROWNFIELD REDEVELOPMENT:

99% CONTAMINANT REDUCTION VIA
HIGH-INTENSITY DYNAMIC IN-SITU
REMEDICATION

LOWELL KESSEL

President,
CERES Remediation Products

Accelerating Brownfield Redevelopment: 99% Contaminant Reduction via High-Intensity Dynamic In-Situ Remediation



C.E.R.E.S.
Remediation Products

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Environmental Navigation Services, Inc.

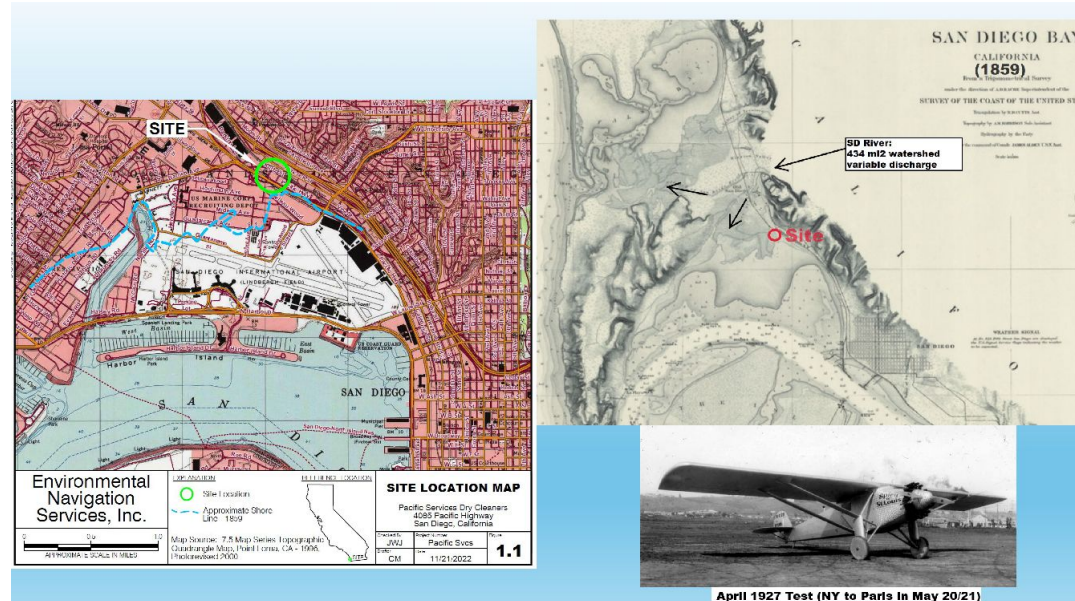
PCE DNAPL in tight, saline bay soils

Former Dry Cleaner

- 1950-2002
- 1,000s of lbs of PCE
- DNAPL

Deltaic deposits

- Silts and clays with fine sands
- Low permeability (K)
- High salinity
- High sulfate
- Shallow GW (8 ft bgs)
- Saline interface ~30 ft bgs
- Shallow impacts <40 ft bgs
- GW-Non beneficial drinking water



Open commercial center: no demolition

View from South (Pacific Hwy)



View from North (Kurtz Street)



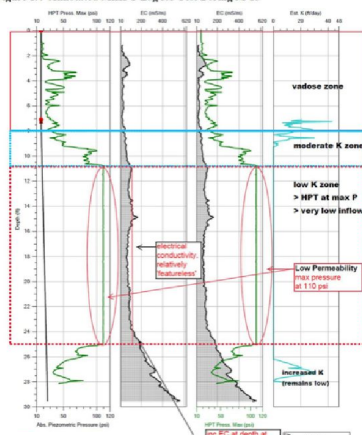
Winter flooding is common!
Twice in 2026 since injections

SVW: 86k, Grab GW samples

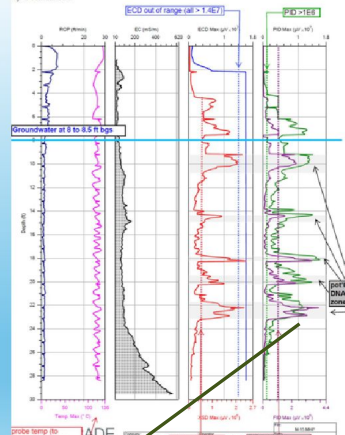
Contaminant Distribution

Target Treatment Zone
5-21 ft bgs

Figure 1.4 Annotated MHPT Log for Test Boring M-15



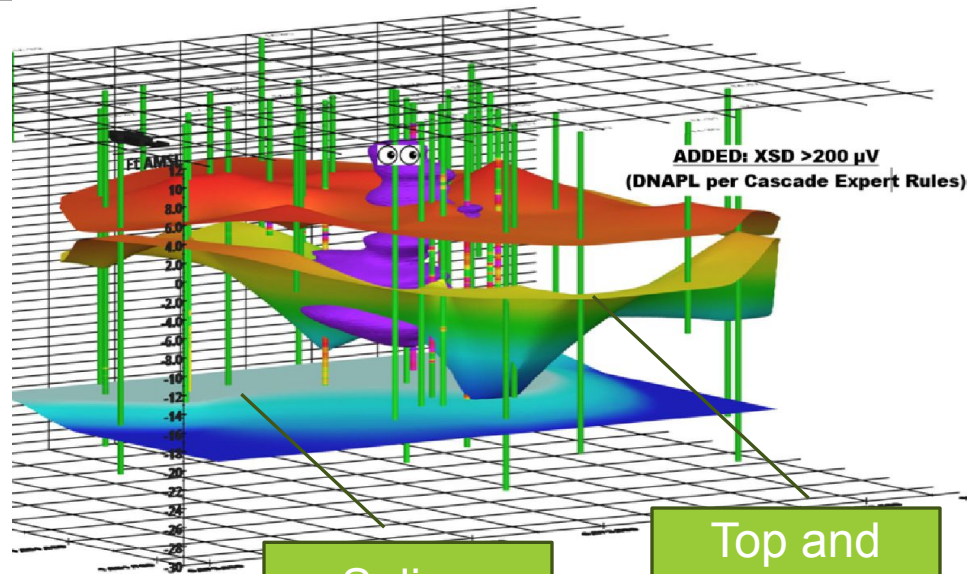
4. Continued



View from South (Pacific Hwy)



Multiple
Lenses of
DNAPL



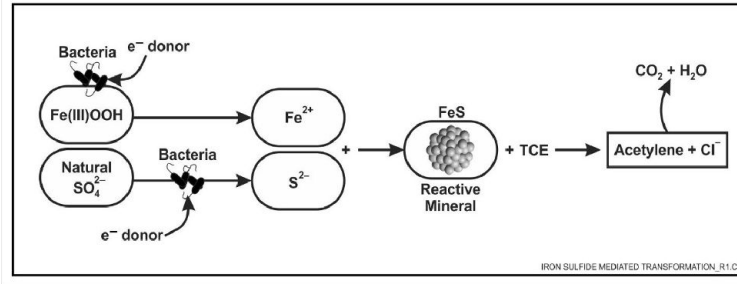
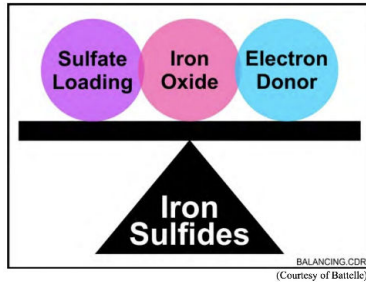
Saline
Interface

Top and
Bottom of
LOW K

Nano Scale FeS minerals degrade PCE

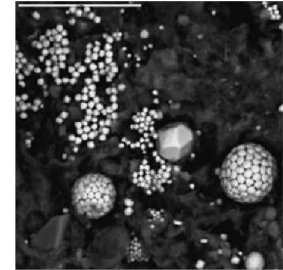
1st and Support Microbes 2nd

Reactive minerals (such as Mackawinite) will facilitate the degradation of contaminants through combined biological, mineral, and chemical pathways in the presence of Fe(III), Sulfate and carbon donor under reducing conditions.



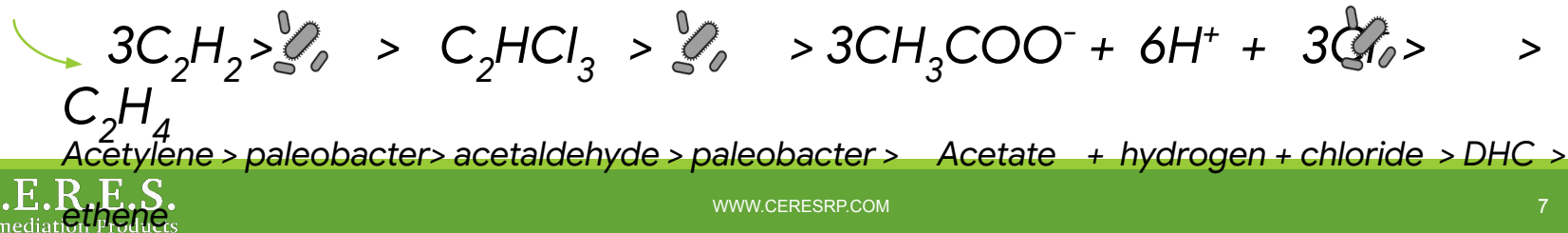
In Situ Biogeochemical Transformation Processes Schematic

Framboidal Iron Sulfide



(Courtesy of U.S. Geological Survey [USGS], 2013)

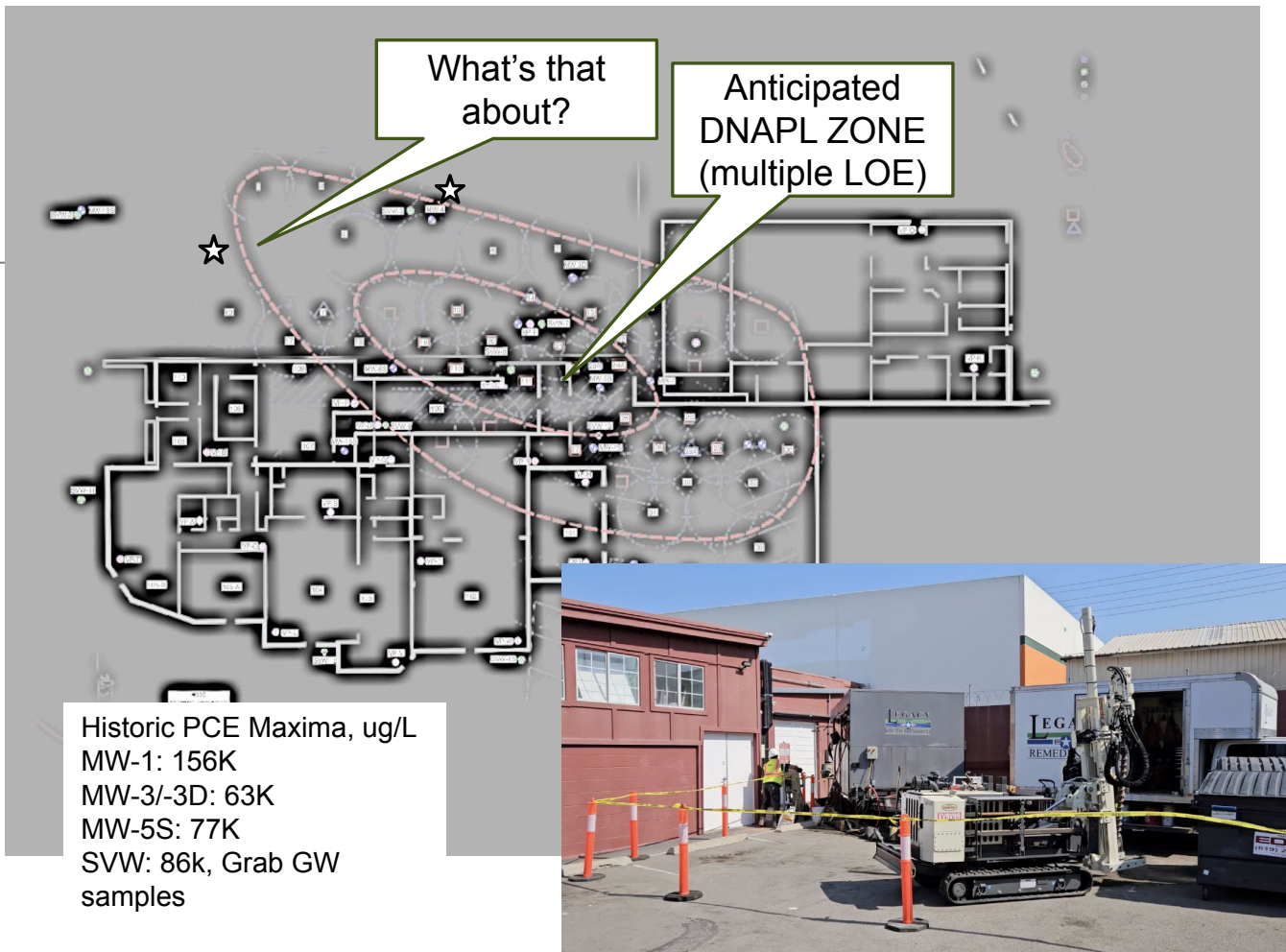
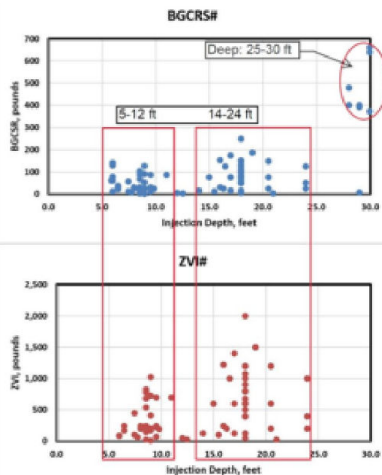
But there's more

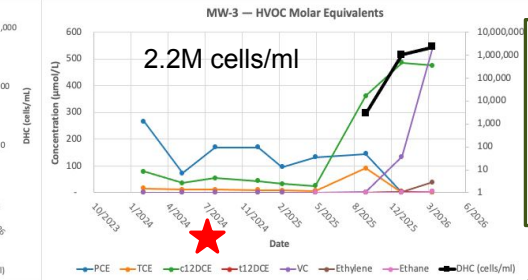
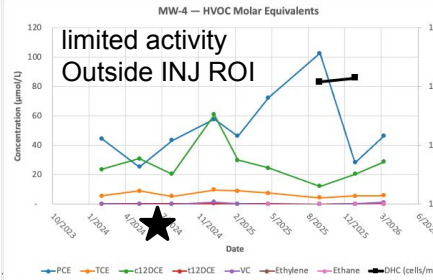
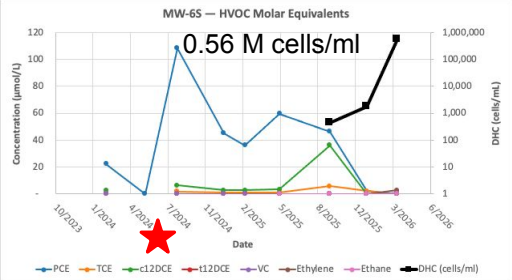


Remediation Approach

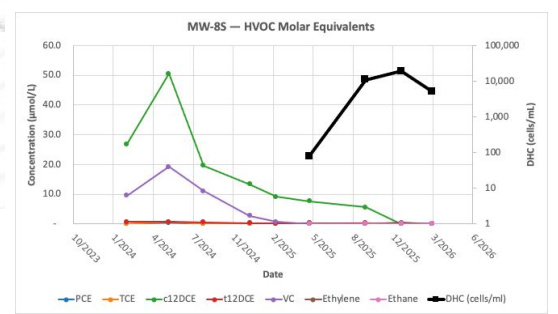
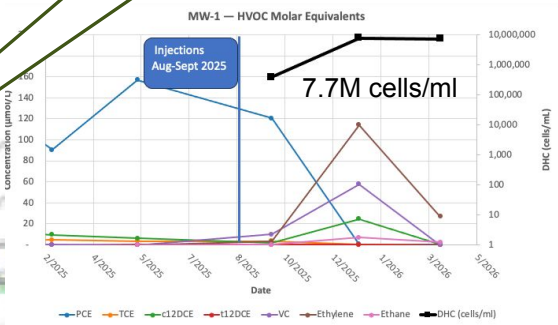
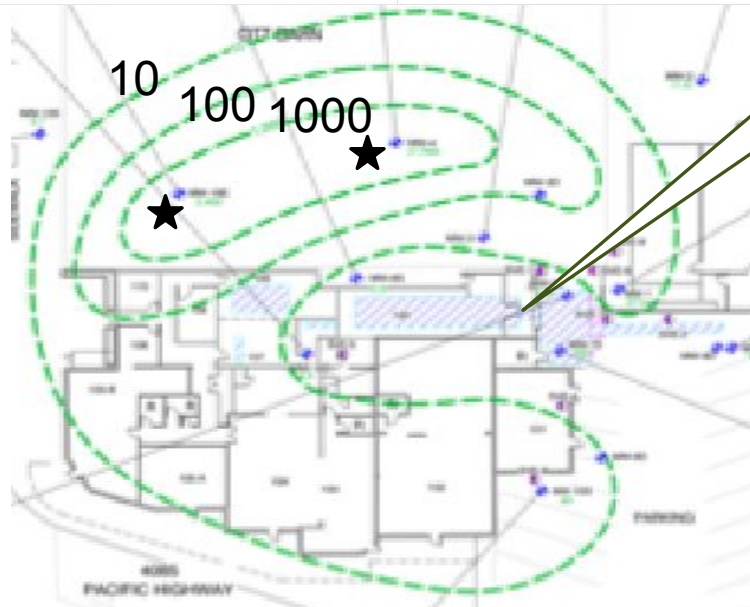
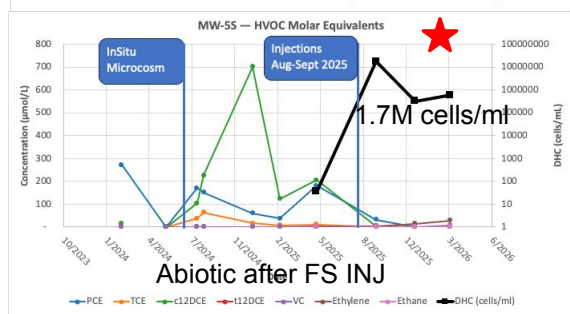
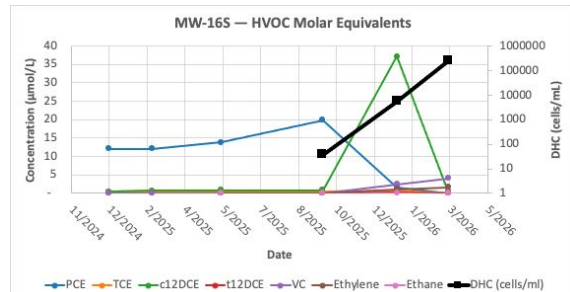
1. BGCRS only from 5 to 13ft bgs
2. ZVI + BGCRS combined below 13-21ft bgs

Totals: 47,400 pounds of ZVI mixed with ~10,300 pounds of BGCRS injected at 50 locations





Source Zone with DNAPL
Now mostly below 10ug/l



6 Month Results

Source-area PCE fell more than 99.9% by March 2026

>99.9%

MW-1 PCE

156,000 → 27 µg/L

DHC now 7.3M cells/mL

>99.9%

MW-3 PCE

63,000 → 44 µg/L

DHC now 2.2M cells/mL

>99.9%

MW-5S PCE

77,000 → 4.6 µg/L

DHC now 580K cells/mL

Downgradient, outside the injection zone: MW-4 (7,700 µg/L) and MW-19S (2,400 µg/L) show little change and no DHC. These are now the site's highest PCE levels.

Next: one trench and new injections treats the remaining “hot spots”

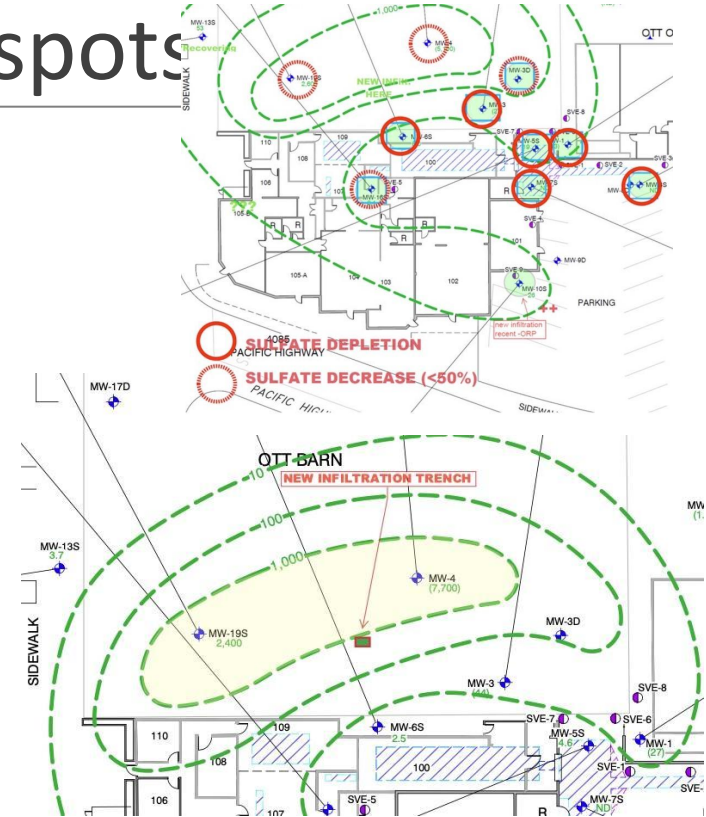
Target: PCE at MW-4 and MW-19S, 60 ft apart; only 32% and 23% degraded

Waiting for reagent to drift there would take years; the SCAP grant is time-limited

Trench inside the active trolley garage: 3 × 6 × 7 ft, traffic-rated vault, built at midday

Gravity-feed 10 fill volumes (320 ft³) of BGCRS at 25 g/L; track
ORP at both wells

Workplan sent to RWQCB-SD June 30, 2026; work starts on approval



Source: ENSI, Revised IRM Workplan Addendum to RWQCB-SD, June 30, 2026.

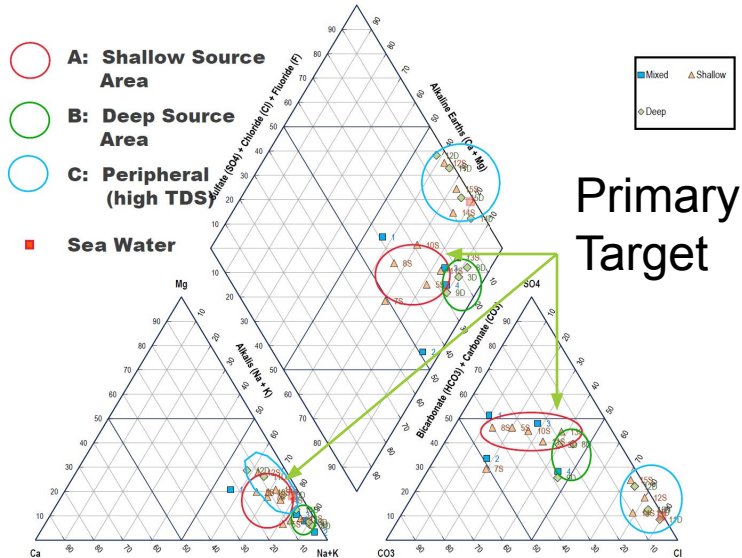
Thank you & Acknowledgements

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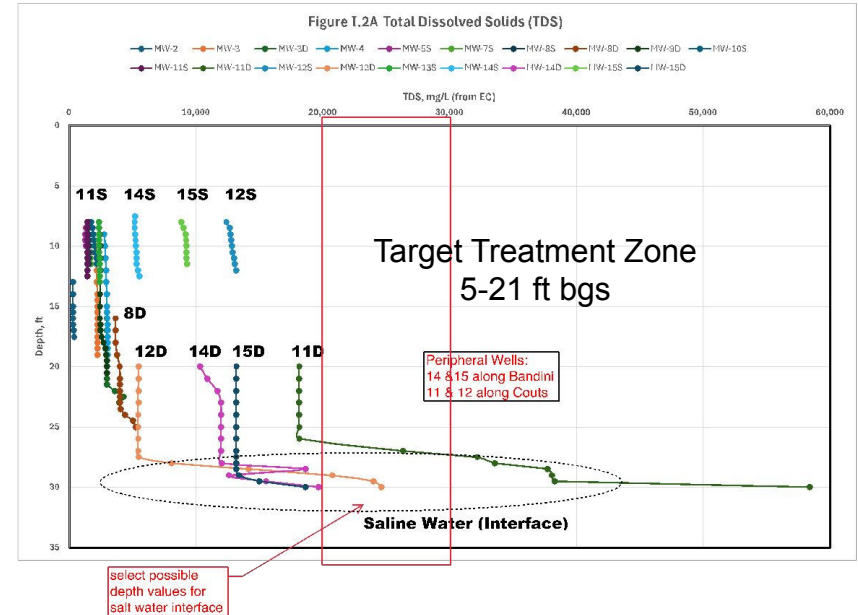
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Appendix

Geochemistry

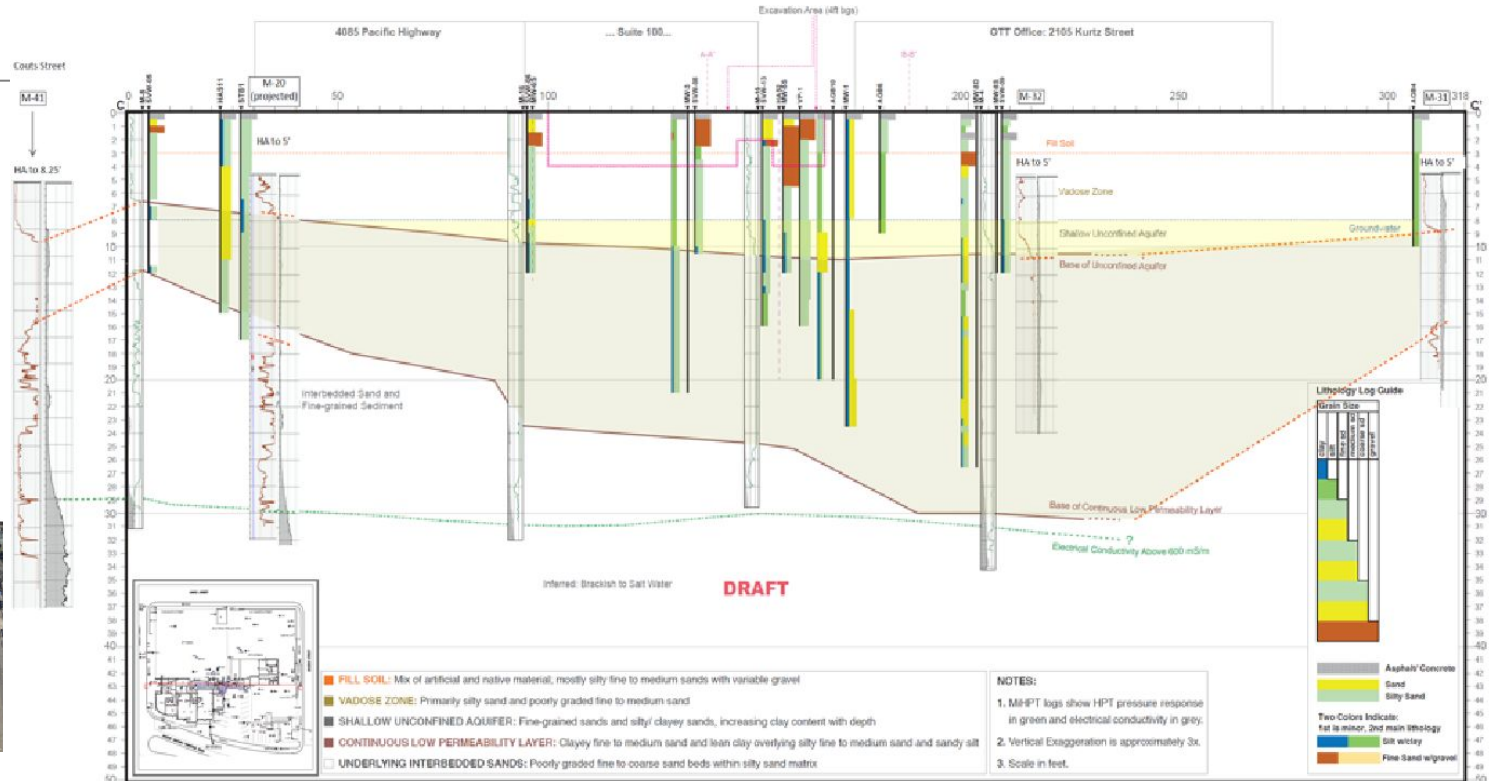


Note: ISM testing recently conducted at 5S and 7S



Three-layer, low-K site model

Three layer system
 1. thin unconfined
 2. low K dense
 clayey sand
 3. interbedded sand
 and f.g sediments

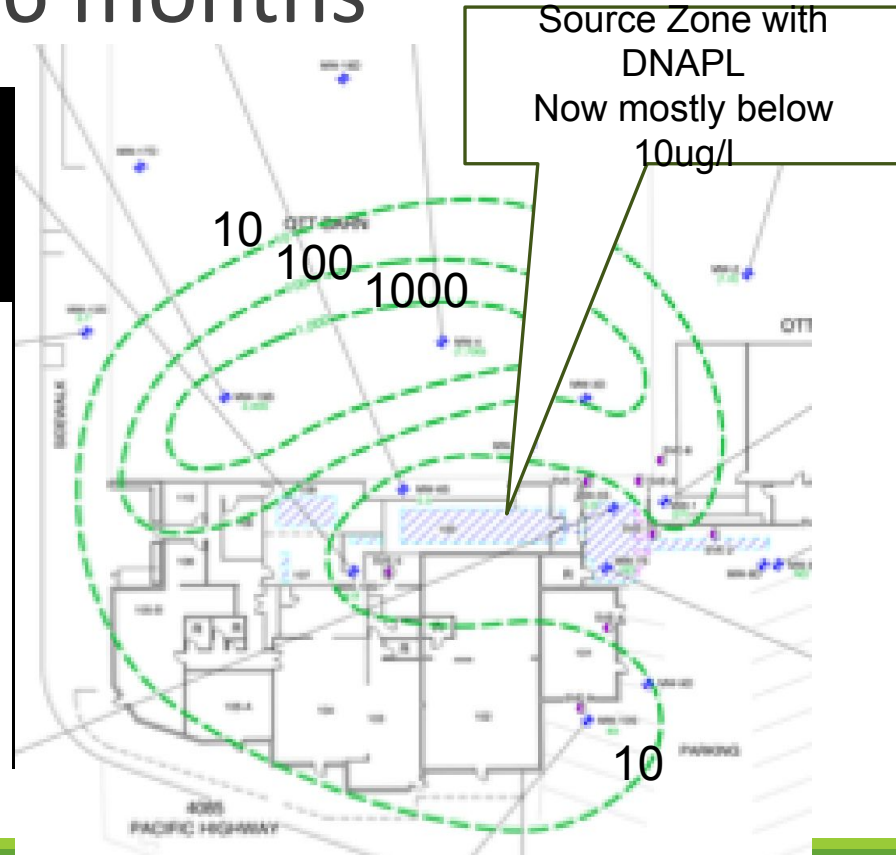


99% VOC reduction in 6 months

Source Area	Sample	PCE RESULTS, ug/L					n-fold change		DHC MICROBIAL, cells/ml			
		Q3 PCE	Q4 25 (Dec/Jan)	Q1 26 (March)	decrease				Q3 25	Q4 25 (Dec/Jan)	Q1 26 (March)	n-fold change
X	MW-1	20000	100	27	99.9%	741			380,000	7,700,000	7,300,000	19
	MW-2	2.4	2	1	58.3%	2			ND<4.2	520	52	
X	MW-3	24000	200	44	99.8%	545			2,800	1,000,000	2,200,000	786
X	MW-3D	14000	530	610	95.6%	23			13	800,000	700,000	53,846
	MW-4	17000	4700	7700	54.7%	2			120	140	ND<6.3	
X	MW-SS	5200	31	4.6	99.9%	1130		(DHC INU)	17,100,000	320,000	580,000	

Key Take Aways

- DHC are not capable of surviving at this site with high sulfate and high salinity
- BGCRS can utilize those conditions to optimize abiotic and biotic reduction as evidenced by rapid DHC proliferation and rapid TVOC reduction
- BGCRS flooding in vadose zone is tremendously effective at VI risk reduction coincident with source and plume reduction



Review of performance Abiotic and Biotic Reduction

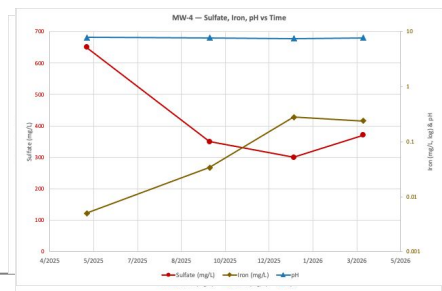
Group 0 -- MW-1 (high ZVI and FeS): Only well with primarily solid-phase micro ZVI and found in well annulus.

Group A -- MW-5S, MW-7S (Microcosm wells): Direct SDC-9 injection and high-concentration BGCRS. Fe²⁺ peaks 150-370 mg/L drove vigorous FeS formation. March 2026 DHC rebounds (580K, 530K cells/mL) confirm in situ culture establishment.

Group B -- MW-3, MW-3D (delayed infiltration, biotic dominant): BGCRS reached shallow zone via Suite 100 trench from December 2025 (~3 months delay). Low Fe²⁺ 1.7-3.7 mg/L; biotic-dominant processing. Sulfide may be problematic.

Group C -- MW-16S (Infiltration only): No bioaugmentation. BGCRS transported by subsurface flow. Moderate Fe²⁺ peaks (16-32 mg/L). Limited VC accumulation.

Group D -- MW-4, MW-10S, MW-17D (limited ROI- no delivery): No amendment reached these wells. Aerobic. Detached plume at MW-4/MW-19S (PCE 7,700/2,400 ug/L) requires separate treatment via new BGCRS and or ZVI.



% Reduction Σ Parents	Monitoring Well
99.9%	★
29.8%	★
38.6%	★
52.7%	
99.4%	★
99.2%	
99.4%	★
99.9%	
93.0%	
88.9%	
4.8%	
92.4%	
91.0%	
72.5%	

Growing list of customers



C.E.R.E.S. Product Selection Support and Performance Testing Services

Technical Support (free)

Site Evaluations for remediation feasibility assessment

Data gap evaluations and guidance on design parameters

Preliminary estimates of product demand

Remediation design approach guidance

Bench scale study guidance on reagent dosage and preparation

Product Samples

Bench Scale Treat-ability Study Services

Batch or Column studies

Heavy metals stabilization and sequestration dosage studies

Zero Valent Iron (ZVI) site specific kinetic rates studies

Bioremediation and bioaugmentation performance studies

Ex-situ and In-situ applications for soil and groundwater remediation

Feasibility assessment support



Bioremediation -Customized Solutions



Chlorinated

Bioremediation (Chlorinated Solvents, Petroleum & select Metals) - Soluble, colloidal, or granular options available

- **Emulsified Vegetable Oil (EVO)**- Effective for chlorinated solvents, nitrate and some metals reduction. Including rapid release donors and particle size of <1 micron.
- **Microcrystalline cellulose**- >97% pure slow release carbon substrate and 5-44 micron scale particle size.
- **Lactates (Ethyl or Sodium), Lactose, Glycerol, Ferrous gluconate, acetates, and other fast donors.**
- **SDC 9**- Dehalococcoides Bacteria for chlorinated solvents.

Petroleum

- **Petroleum Treatment Solution (PTS)**- *Customized* biostimulant electron acceptors for hydrocarbon reducing bacteria.
- **PTS Advanced – LNAPL *customized*** biodegradable surfactant and very effective biostimulant.
- **Petroleum Bacteria (PTBac)**- Bacteria consortium specifically designed long chain petroleum hydrocarbons reducing bacteria.



Chemical Oxidation - Customized Solutions

Chemical Oxidation (Organics and Heavy Metals)

-Soluble, colloidal, or granular options available

- Persulfate
- Peroxides/percarbonates
- Permanganate

***Can be combined with MTS, ZVI, and other technologies for mixed contaminants of concern.**

Chemical Reduction - Customized Solutions



Chemical Reduction and Sequestration (Organics and Heavy Metals)

-Soluble, colloidal, or granular options available

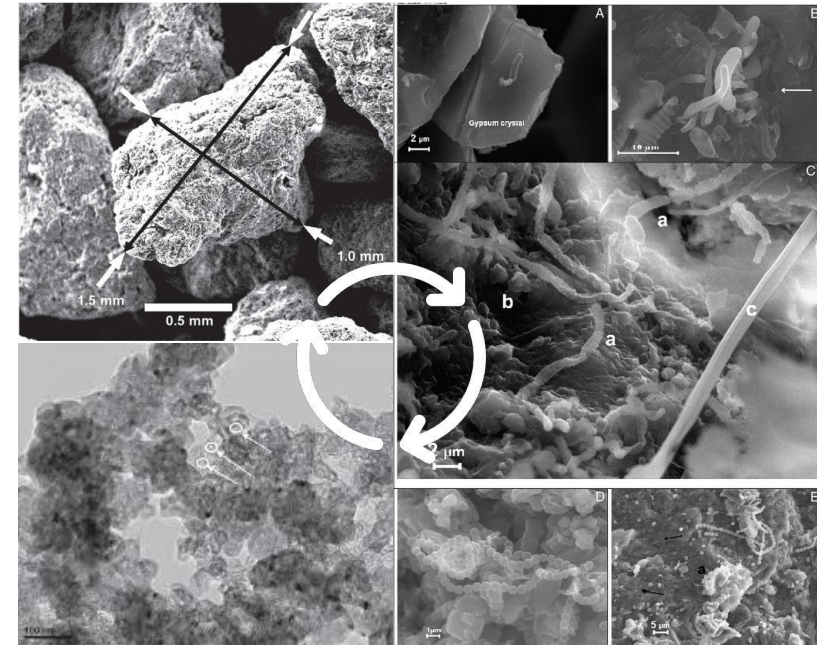
- **Zero Valent Iron (ZVI)** –Abiotic reduction of chlorinated compounds and Biogeochemical. From 1 micron to mm size available.
- **BioGeoChemical Reduction (BGCR)**- *Site Specific Formulation of* pure fast and slow , ZVI, ferrous gluconate, acetate, sulfate, iron, buffer, oxygen scavenger, nutrients and Vitamin B₁₂.
- **Options**
 - 100% soluble / nano scale
 - Microscale to granular 5-150 micron

Activated Carbon Sequestration -Customized Solutions



-Soluble, colloidal, or granular options available

- **Colloidal Activated Carbon** – 2 micron at 25-30% wt
- **iPAC- injectable Powder Activated Carbon** – avg: 10-15 micron, high adsorption carbon for in-situ remediation applications.
 - Often used for bioremediation applications!
- **P-Sorb** for PFAS sequestration,
 - InSitu Injection/Trench
 - ExSitu Treatment Systems

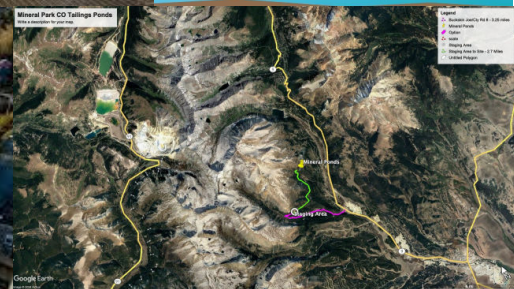
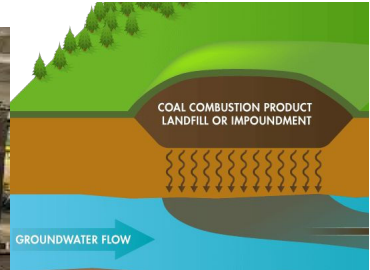


Heavy Metals

- Customized Solutions

Chemical Reduction and Sequestration (Heavy Metals and Organics)

- **Metals Treatment Solution (MTS®)**- *Site Specific Designed* chemistry to reduce or sequester heavy metals (As, CrVI, Pb, Mo, Ba, Bo, Co, Cd, Ag, Zn, Hg, Ni, Cu, Li, + others).
 - Apatite/Phosphate
 - Ion-exchange/Zeolite
 - Iron sulfide - Mackinawite
 - Iron
 - Magnesium
 - Oxides/hydroxides
 - Silicates
 - Sulfates/sulfides
 - Carbon
 - Engineered biochar
 - Proprietary reagents and activators





CALIFORNIA LAND RECYCLING CONFERENCE

Imagine | Innovate | Implement
September 29 – October 1, 2026 | Foster City

THANK YOU!

**IMAGINE, INNOVATE, IMPLEMENT
THE FUTURE OF LAND RECYCLING**



We appreciate your feedback, follow this QR code
to submit an evaluation form on Whova.

Join the conversation, use **#CALRC2026** to share
your photos, insights and highlights!



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