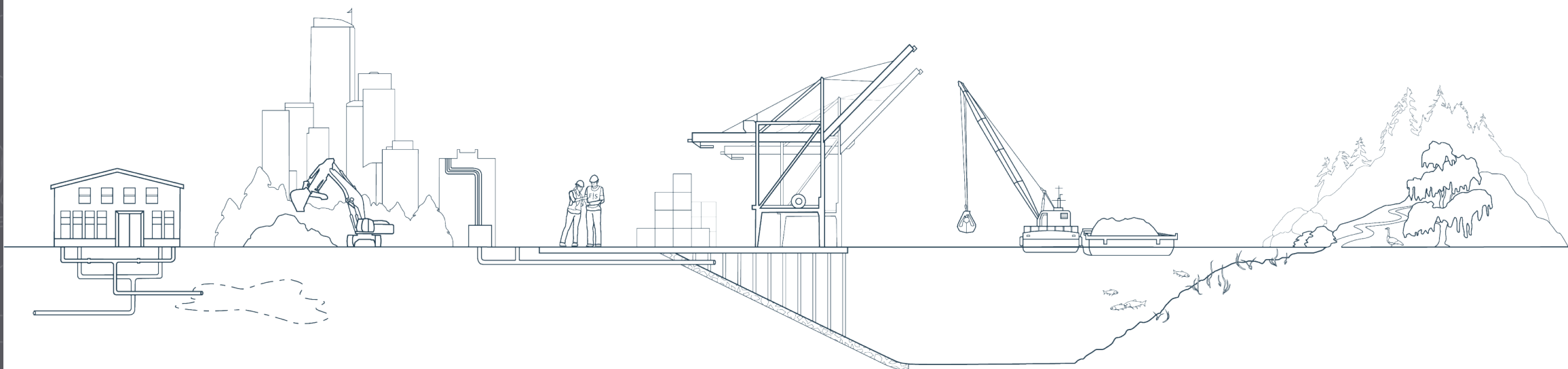


Regulatory and Design Approach for Implementation of Thermal Conductive Heating

Pasco Sanitary Landfill NPL Site

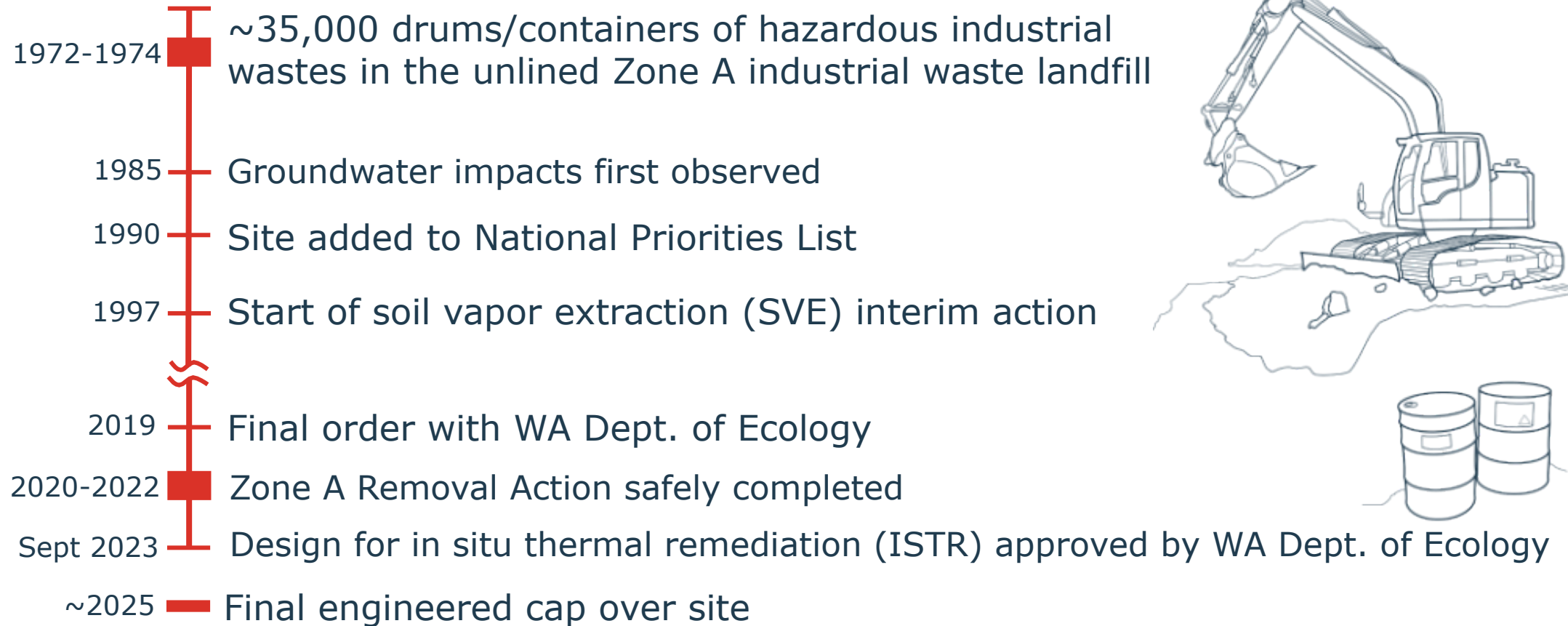
Layni Wachter, Lynn Grochala, Jessi Massingale, Floyd|Snider
Susan Avritt, TRS Group, Inc.



Site Location



Zone A Historical Timeline



Stacked Drums and Containers



Photo: ENTACT

Zone A Excavation

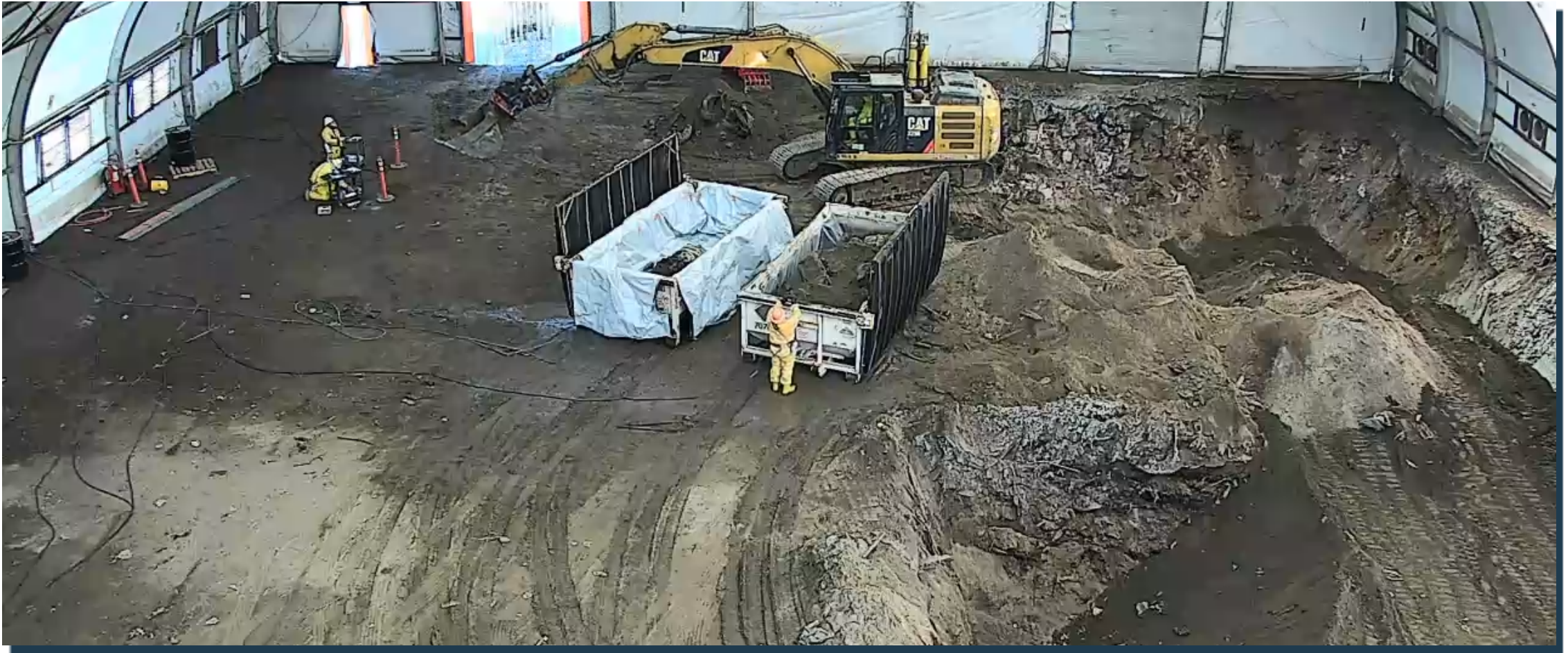
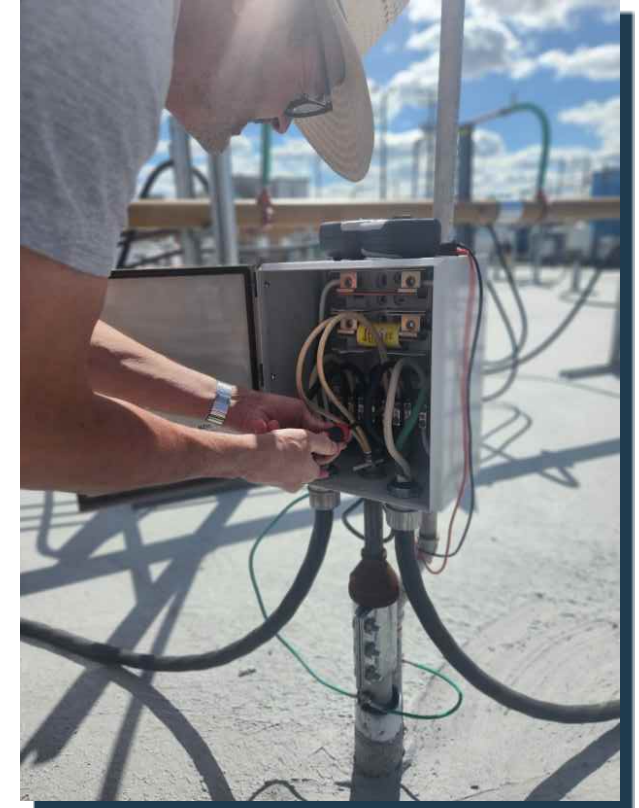


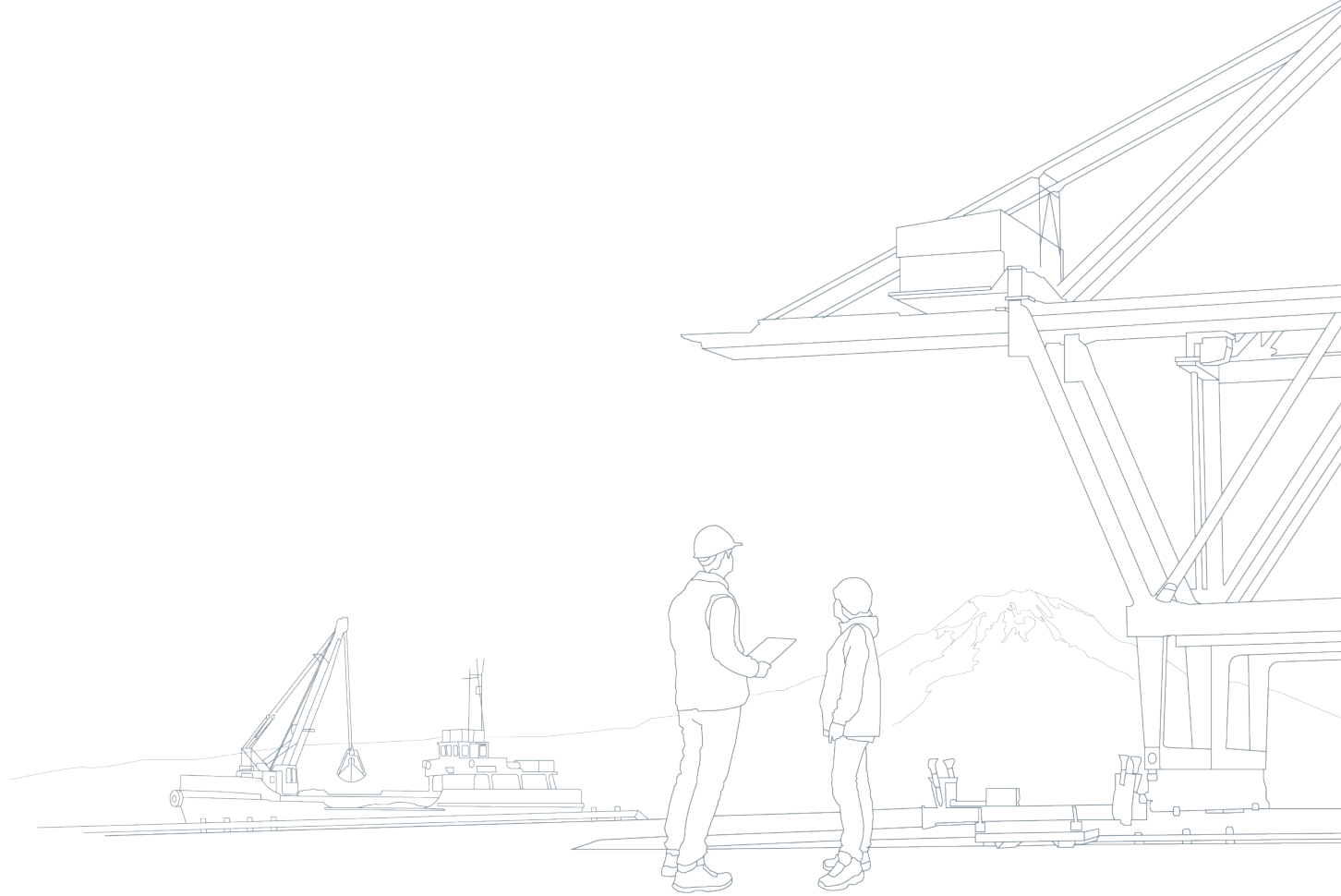
Photo: ENTACT

In Situ Thermal Remediation (ISTR)

- Thermal conduction heating (TCH) is selected technology
- TRS is thermal vendor and system designer
- Approximately 27,000 cubic yards of soil with heterogenous patterns of contaminants:
 - Chlorinated volatile organic compounds (CVOCs)
 - Total petroleum hydrocarbons (TPH)
 - Other organic and nonorganic analytes
- ISTR operation currently ongoing at Zone A
 - First phase of treatment expected to be complete by September 2024
 - Final completion in 2025



Approach



ISTR Design Steps

- Post-Excavation Characterization
 - Soil analytical testing
 - Soil moisture and porosity
 - Bench-scale treatment test
- Development of Remediation Levels (RELs) and ISTR design
 - Soil characterization results + bench scale testing
 - Technical feasibility
 - Final engineered cap



Photos: Floyd|Snider

Development of RELs

Based on:

- Greater than 10% samples exceeding screening levels
- Evaluation of groundwater data
- Grouping analytes

CVOCs

- Trichloroethene
- Tetrachloroethene
- Vinyl chloride

BTEX

- Benzene
- Ethylbenzene
- Toluene
- Xylene

SVOCs

- Naphthalene
- 1-methylnaphthalene
- 2-methylnaphthalene

TPH

- Gasoline-Range
- Diesel-Range

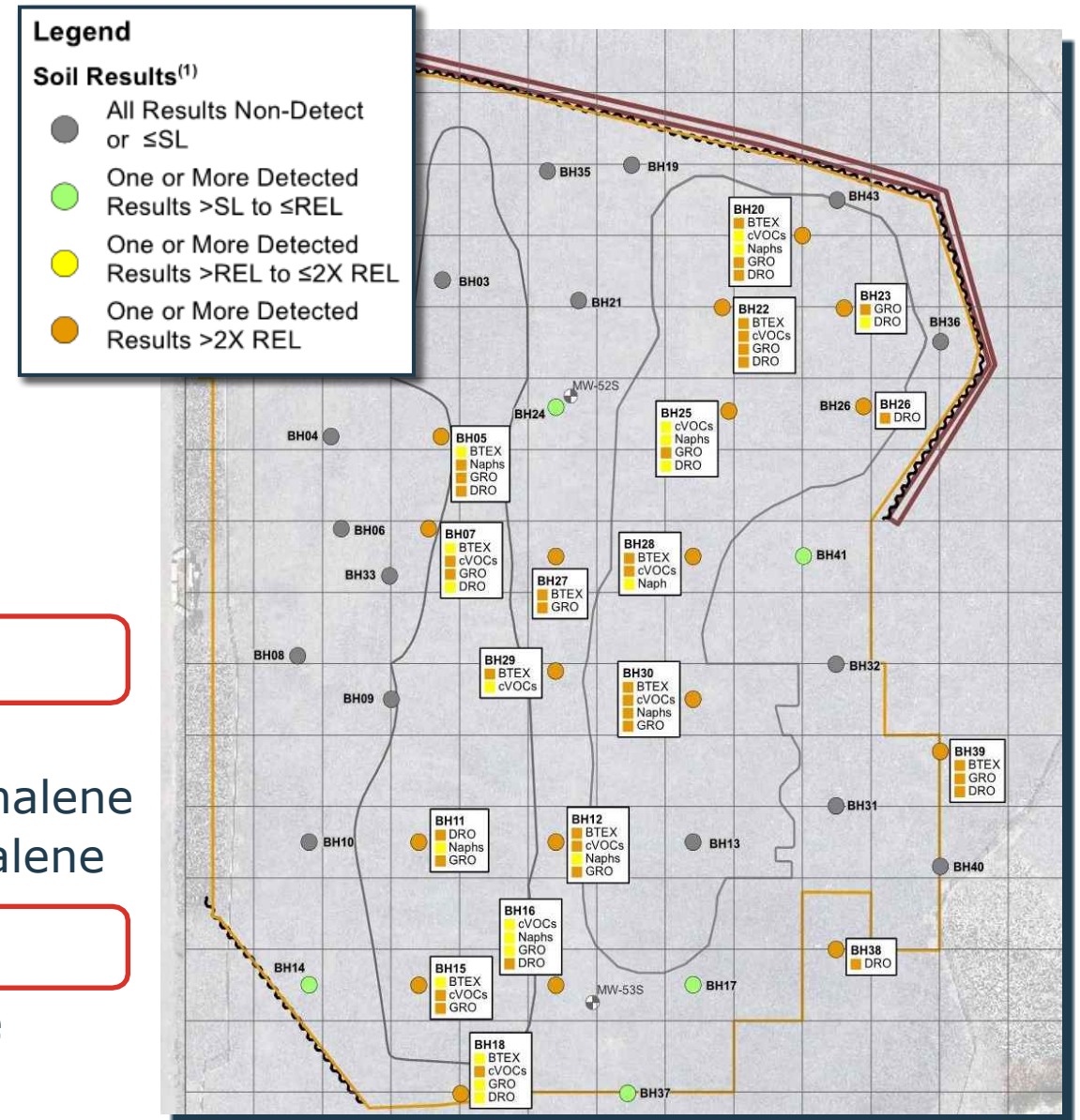


Figure 5.6 from Zone A Post-Excavation Engineering Design Report

Soil Profile Of Pasco Landfill

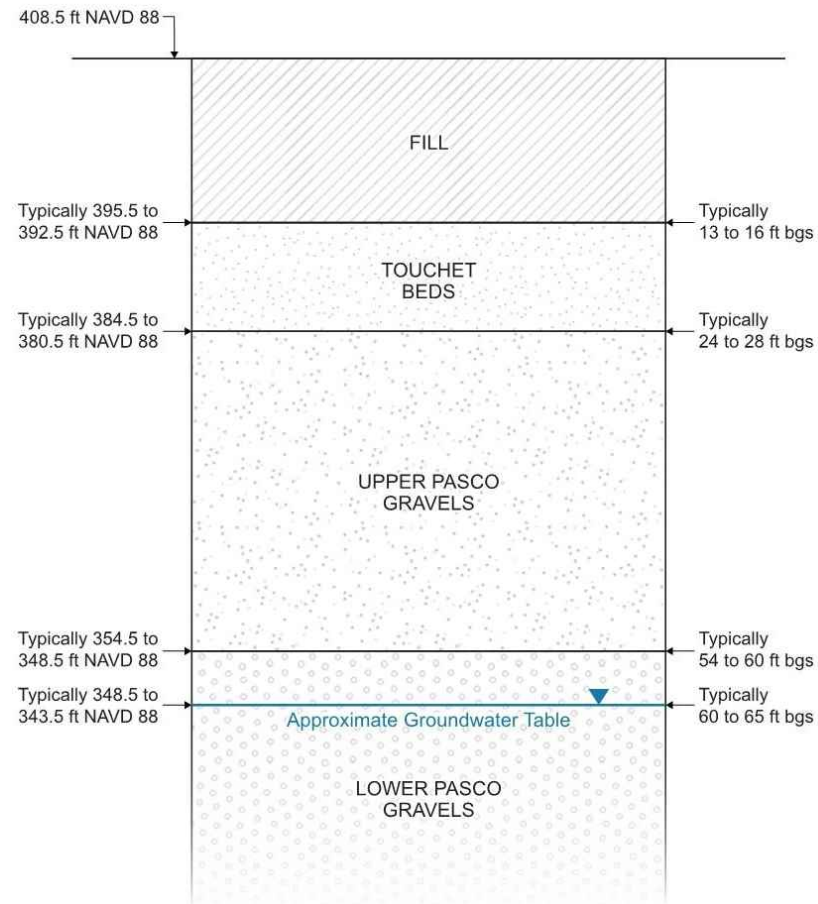


Photo: Floyd|Snider

Figure 4.2 from Zone A Post-Excavation Engineering Design Report

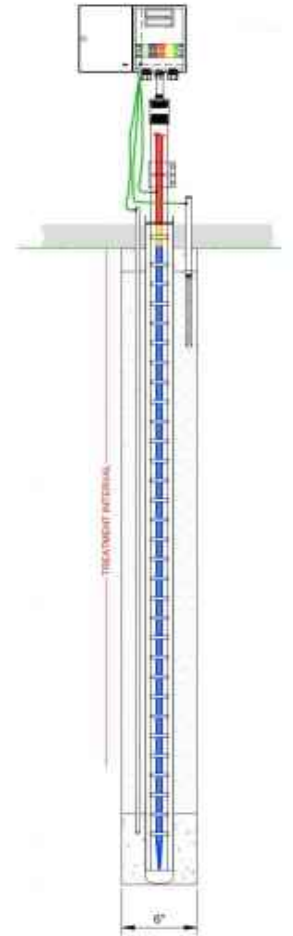
Contact Boundary Between Lithologies (dashed where inferred)

ND	All VOCs Non-Detect		Horizontal Vapor Extraction Screen
+	<1 mg/kg		
	1 mg/kg to <10 mg/kg	Boring	Water Table
	10 mg/kg to <100 mg/kg		Removed Vapor Extraction Well
	100 mg/kg to <1,000 mg/kg		
	≥1,000 mg/kg		



ISTR Design

- TRS confirmed selection of TCH technology
 - Dry soil conditions = Less energy required for desiccation
- Target temperature of 105°C to 120°C based on bench scale test
 - Reaching desiccation removed 93% to 97% of primary analyte organic mass during bench test
- Continue to use regenerative thermal oxidizer (RTO) on site
 - Existing air discharge permit for the RTO modified and reissued
- Thermal treatment area divided into two phases
 - Work within limits of existing RTO permit
 - Sustainably reuse heater and vapor recovery components



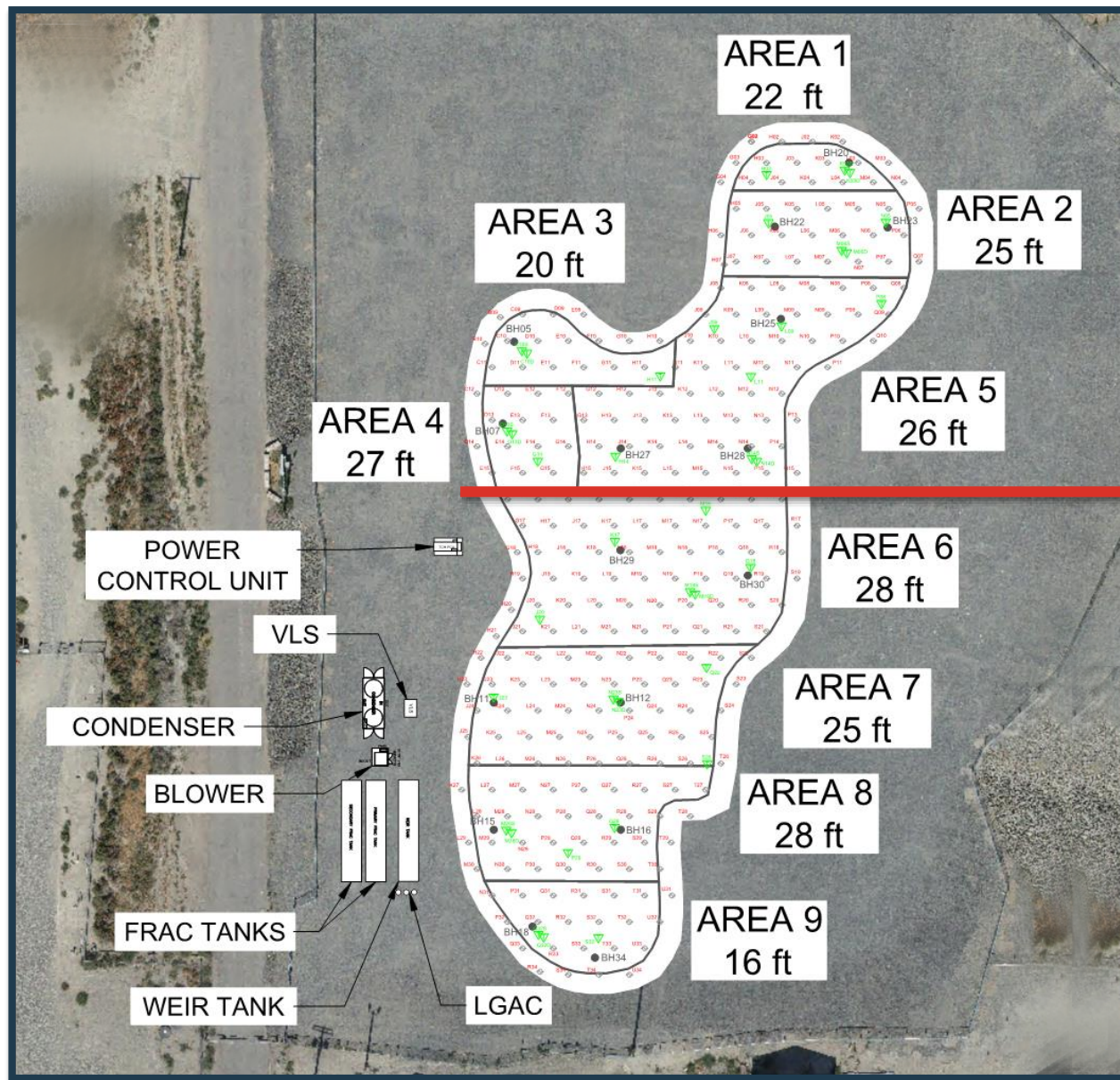


Figure by TRS from Engineering Design Report Appendix E

~Nov 2024 to
~April 2025

Phase 2

Phase 1

April 2024 to
~Sept 2024

ISTR Layout

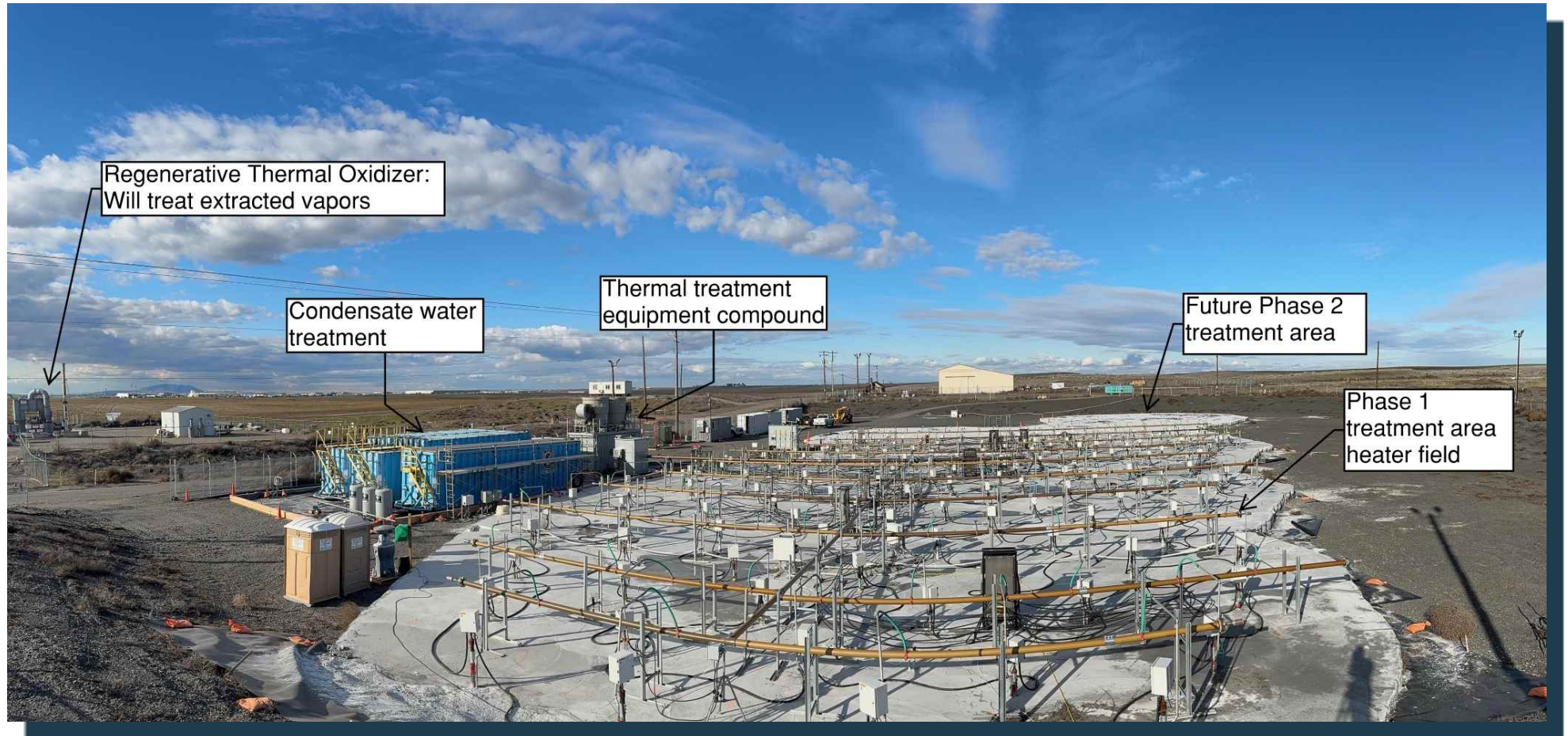


Photo: TRS

ISTR Layout

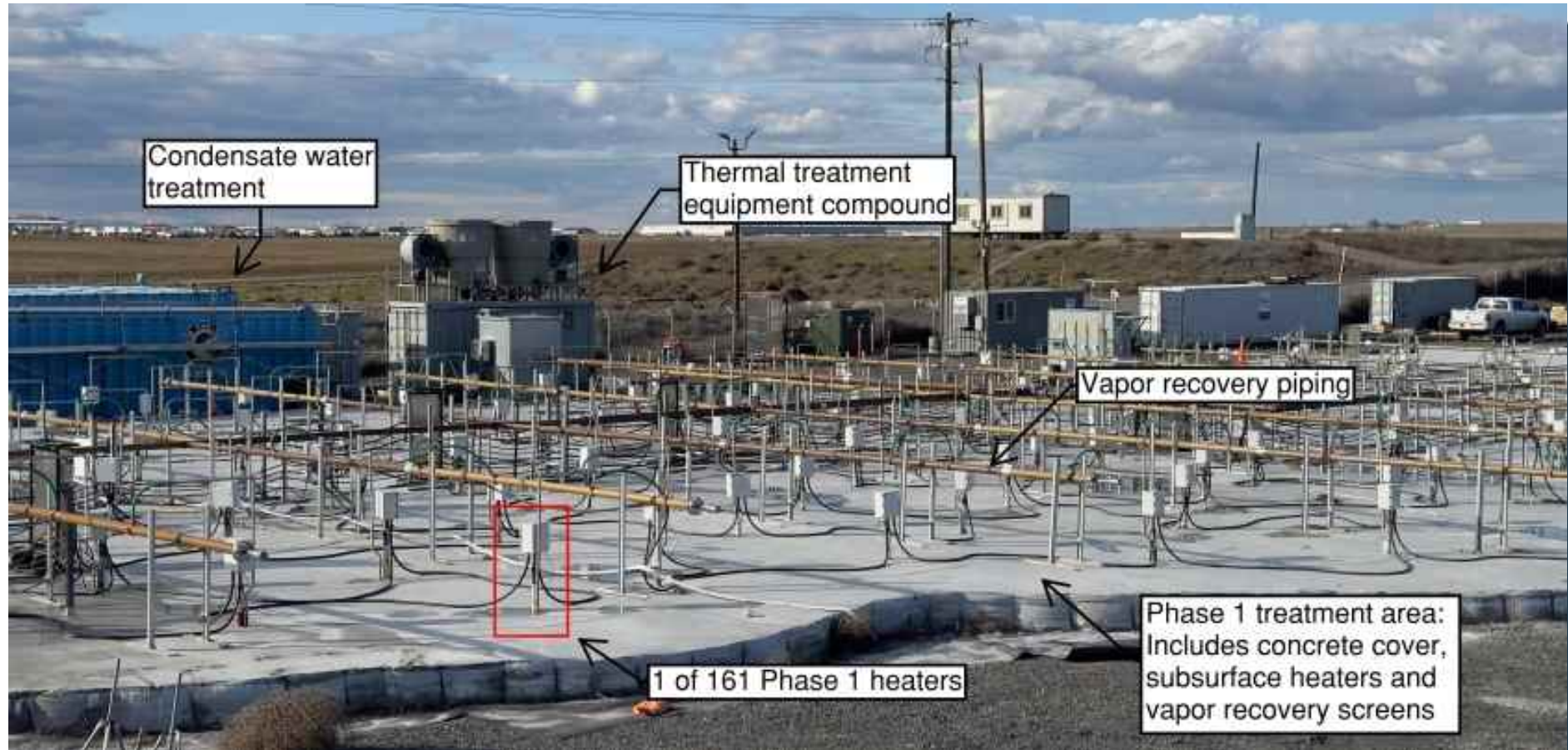


Photo: TRS

ISTR Performance Evaluation

- Performance samples collected as system operation data indicate treatment is complete
- Collaboration with WA Dept of Ecology and TRS to develop evaluation matrix
- Evaluating Performance Samples
 - Phased approach
 - Multiple lines of evidence
 - Statistical evaluation
 - Coordination with WA Dept of Ecology
- Final confirmation dataset will achieve the RELs based on 95% upper confidence level of the mean

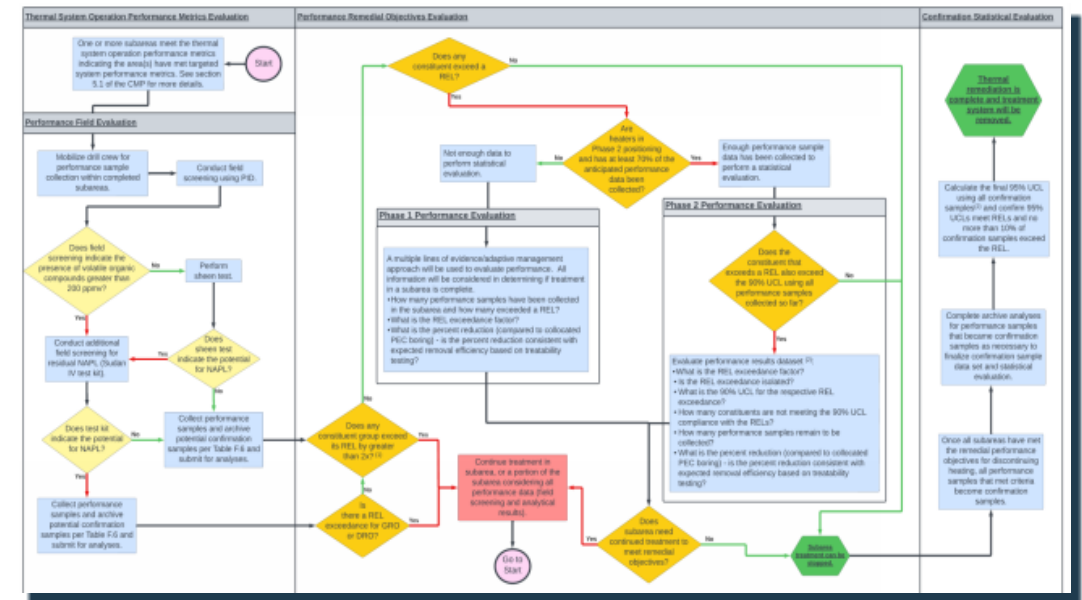


Figure F.5 from Zone A Post-Excavation Engineering Design Report

Lessons Learned



Agency Coordination

- Early and ongoing coordination with WA State Ecology
 - Multiple design work sessions with agency were crucial
- Developed customized approach to RELs within Washington's cleanup regulatory framework
- Supported project efficiency and compliance with the agency cleanup action plan scope
- Agreed upon removal action approaches for waste management and condensate treatment and reuse carried forward to ISTR



Consultant Coordination

- Range of expertise brought by TRS, Floyd|Snider, PLP group members, and third-party thermal expert reviewer
 - Assessment of thermal design at multiple stages
- Engaged TRS early during drum removal
 - Worked with PBS to incorporate existing vapor recovery lines and RTO
 - Facilitated coordination with Franklin County PUD
- Leveraged drum removal contractor on site to facilitate early ISTR planning



Photo: TRS

Thank you!

We look forward to completing operations in 2025 and assessing the effectiveness of ISTR.

Keep an eye out for a future presentation from our team to report back and share our project conclusions!

