Integrating Green and Sustainable Remediation Practices into an Urban Brownfield Redevelopment Project

UMass Green Remediation Conference
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Overview

- Urban Brownfield Redevelopment Project Background
- Implementation of Green and Sustainable Remediation (GSR) Practices
- GSR Benefits and Results
- Conclusions

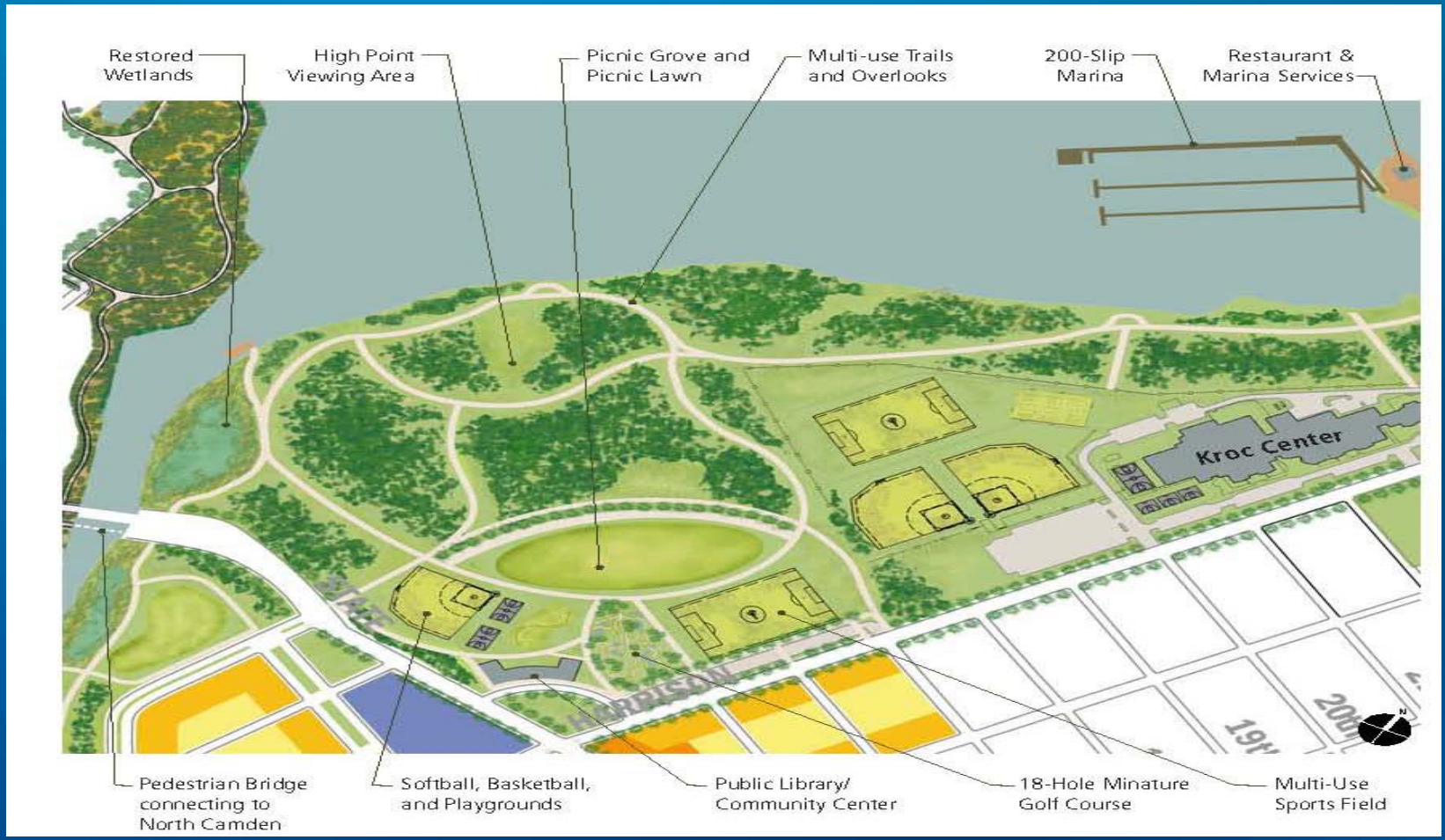
Urban Brownfield Redevelopment Project

- 85-acre municipal landfill
- 200-acre Brownfield Development Area
- Unlined landfill operated from 1952 until 1971
- Chlorinated benzenes
- Excavation performed in the “source area”; however not all source removed

Project Goals

- Characterize the onsite contamination
- Reduce overall carbon footprint
  - GSR Practices
  - IRO
  - Web-based meetings and electronic deliverables
- Strengthen community institutions and catalyze neighborhood revitalization
  - Communicate with stakeholders

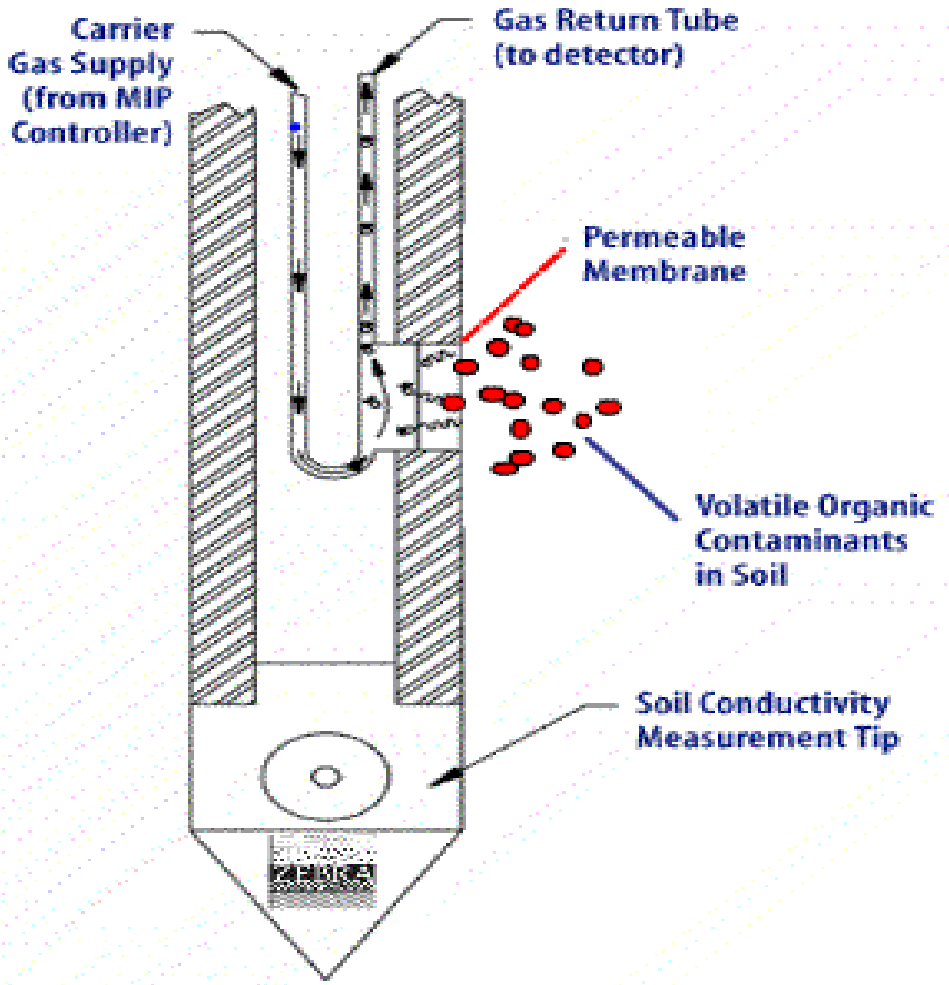
Planning/Management Phase
Waterfront Park Master Plan



Remedial Investigation Phase
Green and Sustainable Remediation Practices

- Triad Approach
- Site Conceptual Model Refinement
- Biofuels for Heavy Equipment
- Local Marina to Store Heavy Equipment

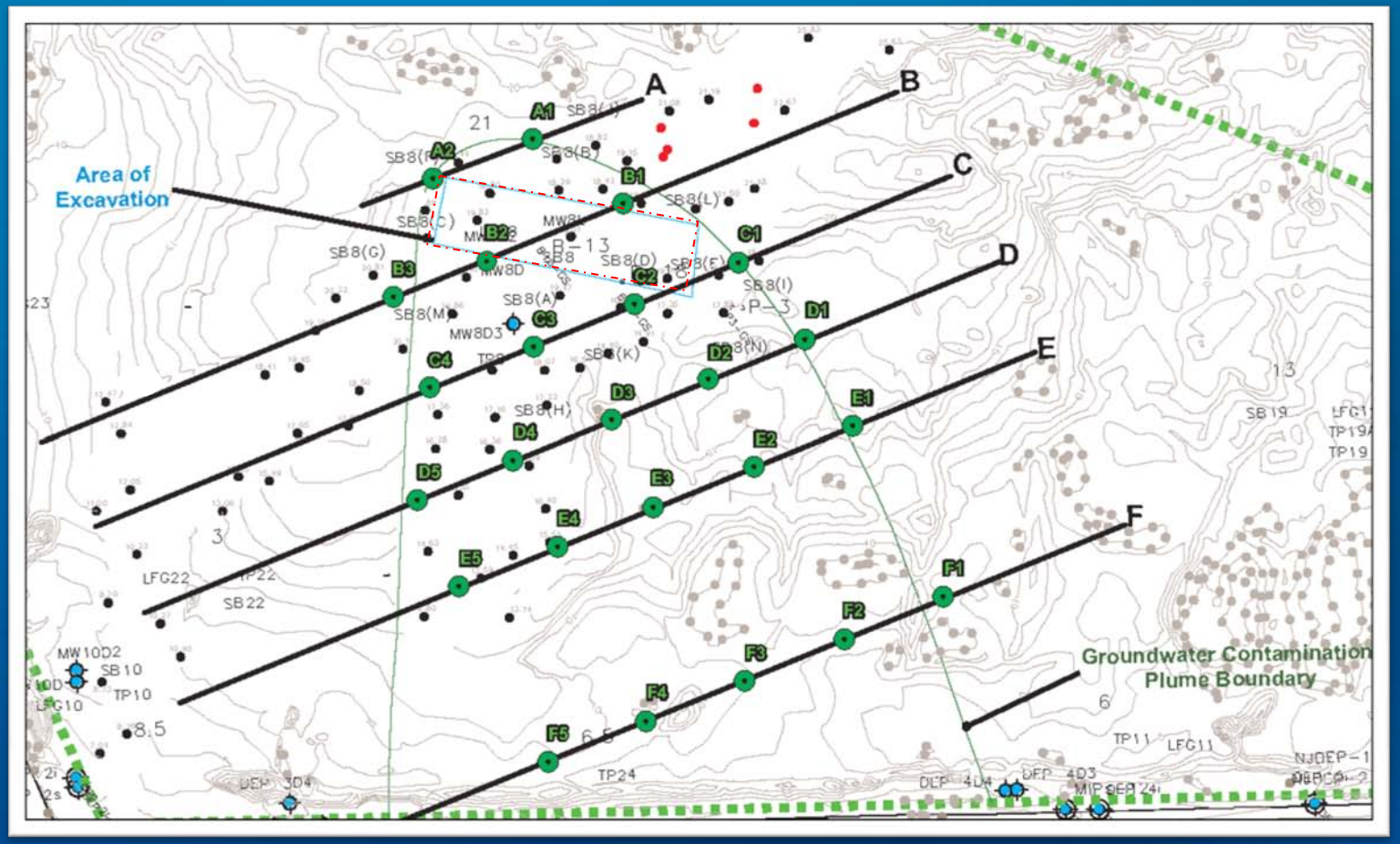
Membrane Interface Probe (MIP)
How It Works



MIP DETECTORS	
Screening Tool	**Contaminants**
PID	BTEX
FID	Methane, Butane
ECD	Chlorinated Substances

Remedial Investigation Phase
Systematic Planning - Transects

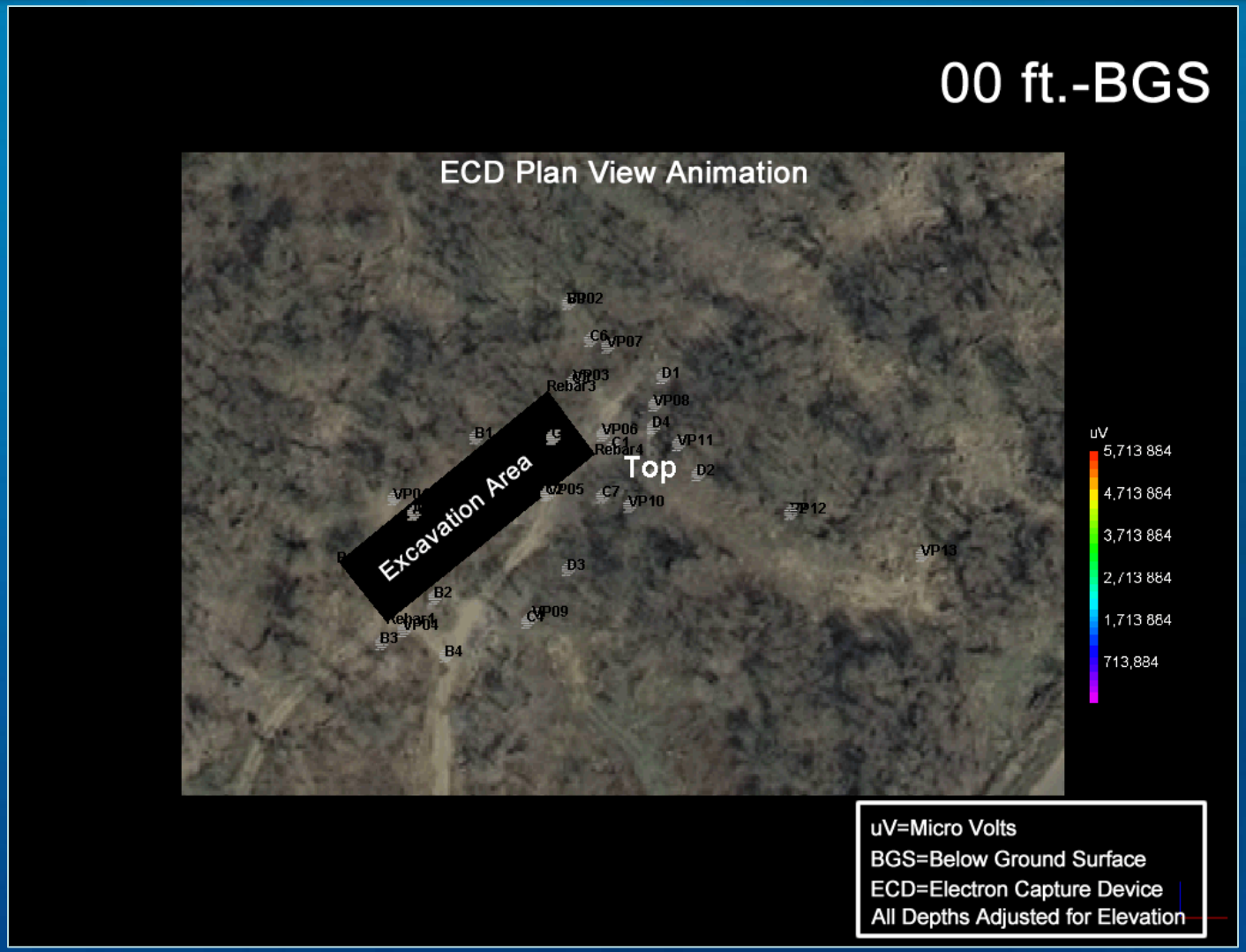
Systematic Planning



Remedial Investigation Phase
ECD Plan View Animation

Real-time Measurement

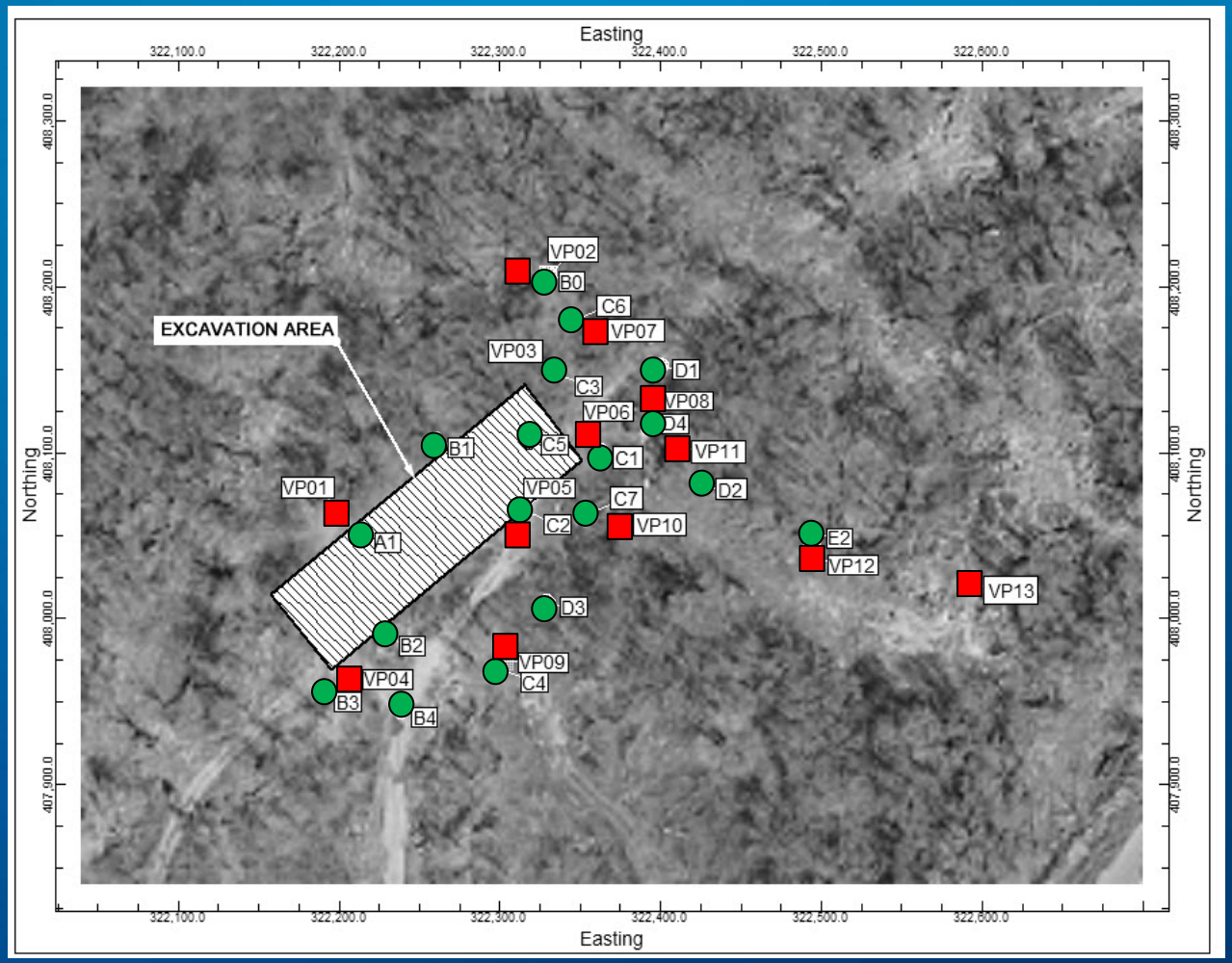
CDM



Remedial Investigation Phase Sampling Locations

Dynamic Work Strategies

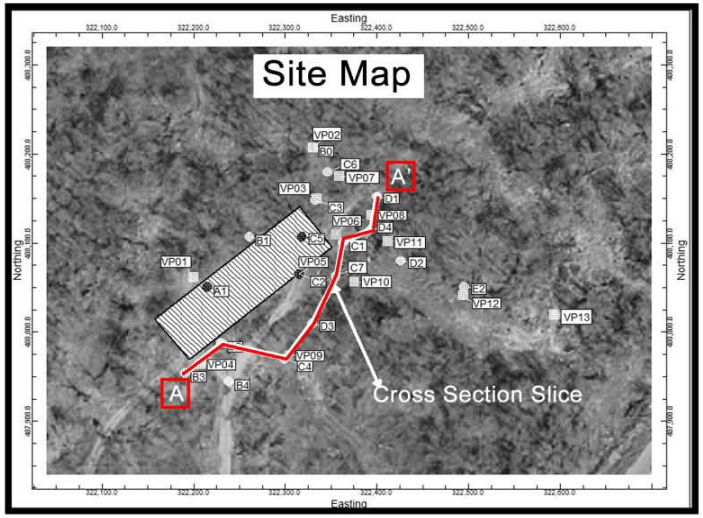
CDM

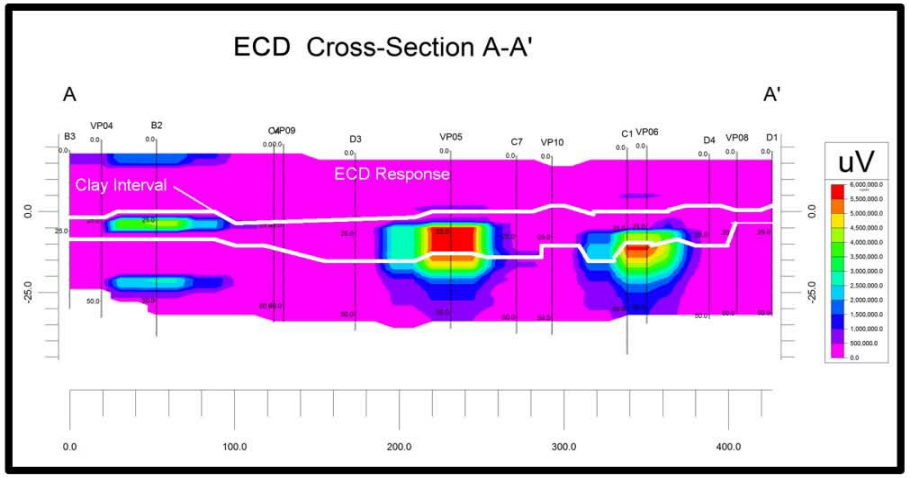


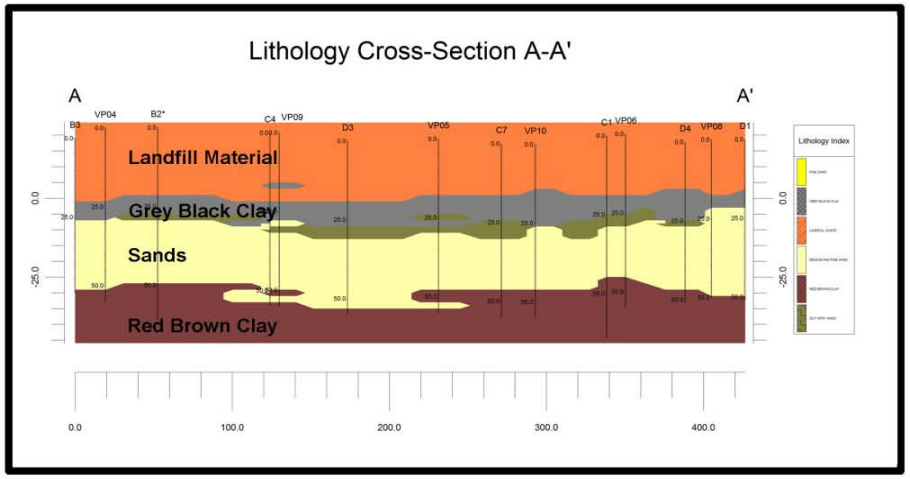
- MIP
- Sampling

Remedial Investigation Phase
Cross-Sections & Refining CSM

Electron Capture Detector
and
Lithology (EC)
Cross Sections

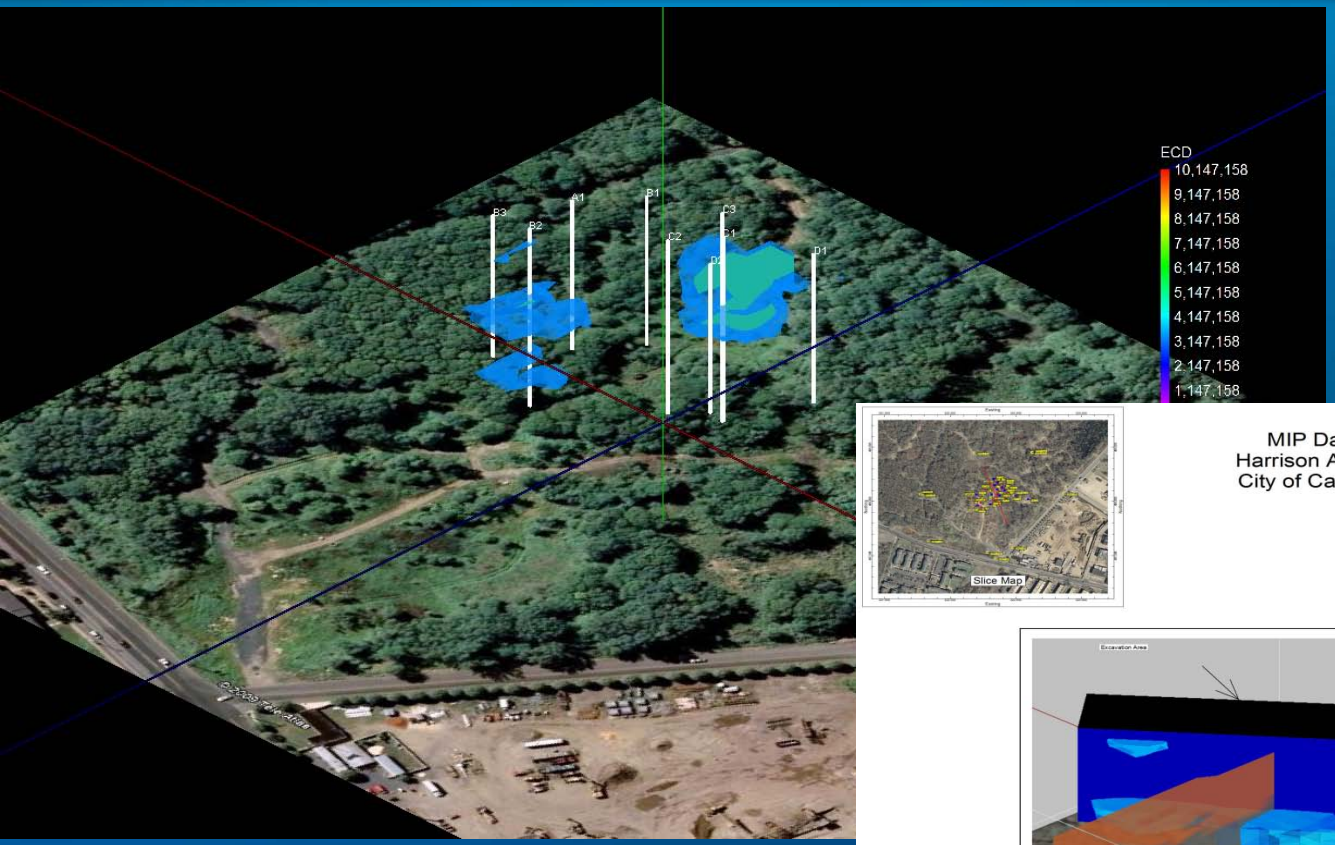






Note: EC – electronic conductivity
ECD – electron capture detector

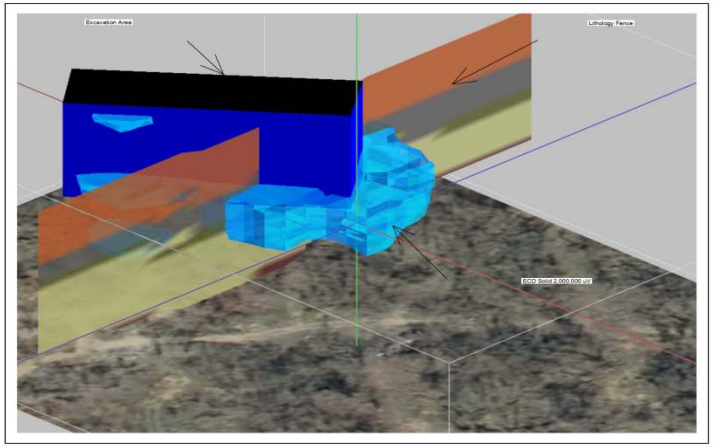
Remedial Investigation Phase
3-D Data Visualizations



CDM
MIP Data Vizualization
Harrison Avenue Landfill Site
City of Camden, New Jersey

LEGEND

TVOC = Total Volatile Organic Carbons
MIP = Membrane Interface Probe
ECD = Electron Capture Detector
PID = Photo Ionization Dectector
ECD/PID Units = Micro Volts (UV)
TVOC Units = mg/kg
Cond Units = Millisiemens/Meter
Distance units = Feet (ft)
Depth Units = Feet (ft)



Created for CDM by ZEBRA Environmental -- subsurface soil, groundwater and data collection since 1992.

Remedial Investigation Phase
Renewable Fuel

- **5-percent biodiesel fuel used to operate all heavy equipment** (MIP, Geoprobe® track unit, and support vehicle)
- **Bio-hydraulic fluids** (non-hazardous, high-performance) replaced all petroleum-based hydraulic fluids

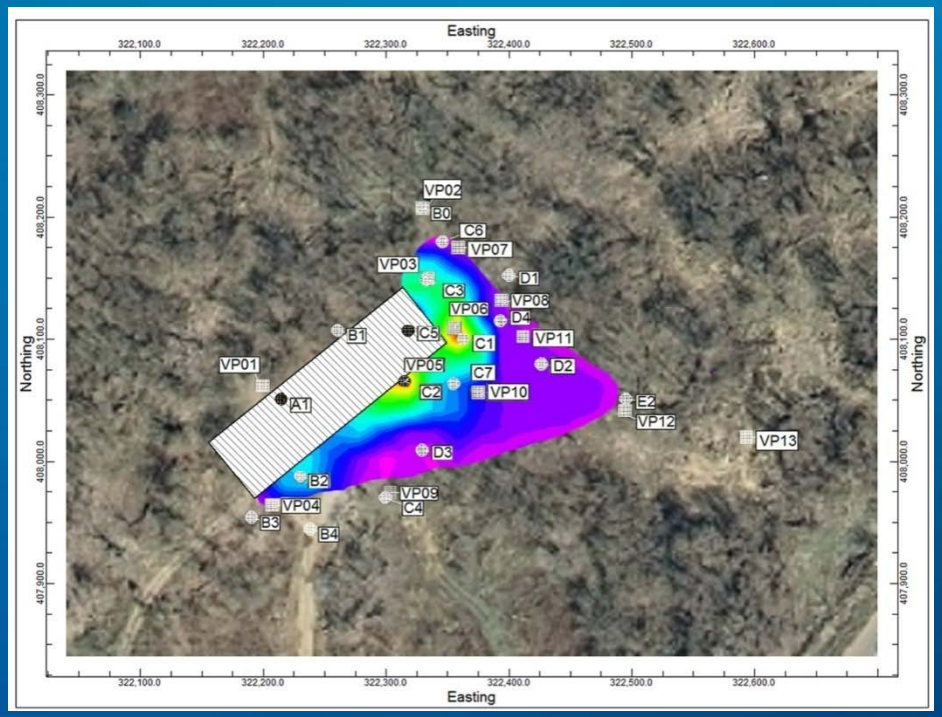
Remedial Investigation Phase
Benefits of Implementing GSRs

TRIAD Approach - Biofuels	Traditional Sampling Program (non-TRIAD)
■ 405 hours of operation	■ 668 hours of operation
■ 26 tons CO_2e	■ 45 tons CO_2e
■ 1.2 tons biogenic CO_2	
■ 2,675 gallons of 5% biodiesel-blend used	■ 4,400 gallons of diesel used
■ Bio-hydraulic fluids (non-hazardous, high-performance)	■ Petroleum-based hydraulic fluids

Emissions nearly cut in half by use of TRIAD/Biofuels

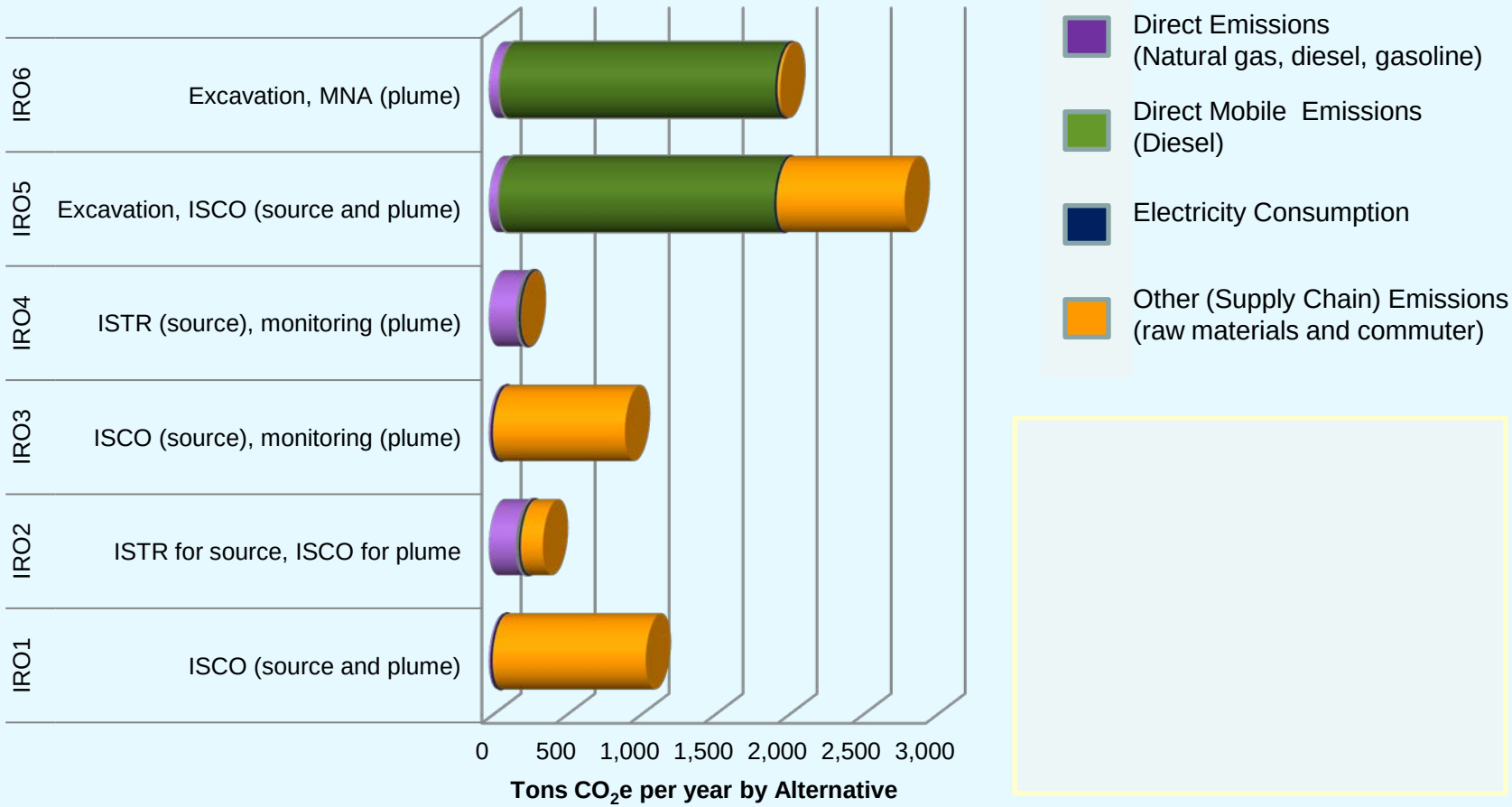
Feasibility Study Phase
Interim Response Options (IROs) Evaluated

Extent of Clay Contamination

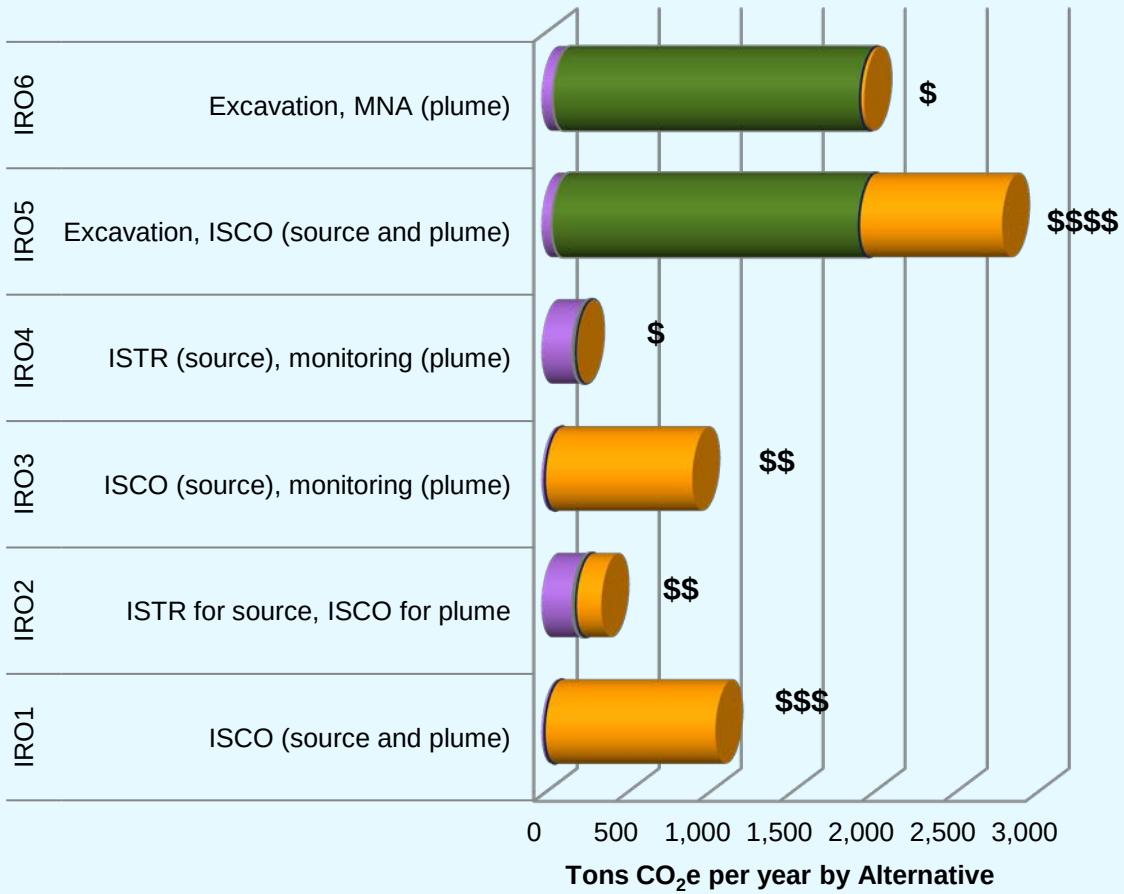


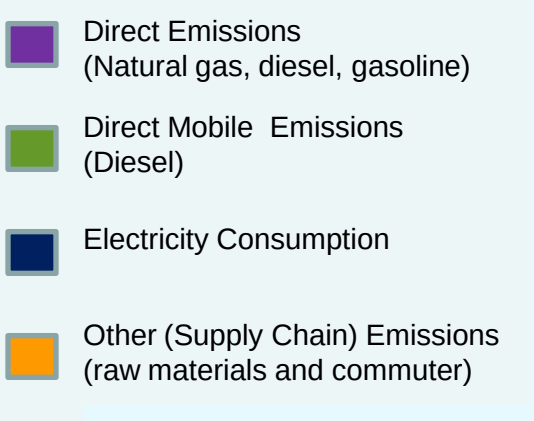
- IRO1 – ISCO (source & plume)
- IRO2 – ISTR (source)/ISCO (plume)
- IRO3 – ISCO (source)/ Monitoring (plume)
- IRO4 – ISTR (source)/Monitoring (plume)
- IRO5 – Excavation (source)/ISCO (plume)
- IRO6 - Excavation (source)/ Monitoring (plume)

Feasibility Study Phase
IRO Comparison: GHG Emissions



Feasibility Study Phase
IRO Comparison: GHG Emissions vs Cost





How does this compare to IROs cost estimates?

Results and Conclusions

- Working with stakeholders on selecting GSR Practices, and implement GSR practices
  - 45% reduction in CO_2e
  - 50% reduction in analytical costs and schedule
  - 40% reduction in field effort
  - Reduced generation of IDW
  - Calculated CO_2e emissions for IRO
- The most Sustainable IRO alternative is not always the most expensive

THANK YOU!

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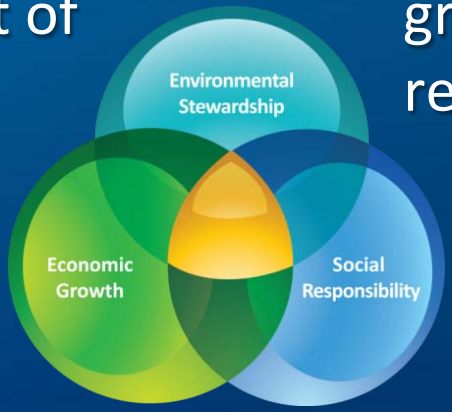
What is Green and Sustainable Remediation?

- **Green Remediation:** The practice of considering all environmental effects of remedy implementation and incorporating options to maximize net environmental benefit of cleanup actions (EPA 2008)

- **Sustainable Remediation:** A remedial approach that incorporates certain practices to simultaneously achieve excellence in environmental stewardship, economic growth, and social responsibility



Feasibility Study Phase

CO_2e Annual Emissions for IROs

	IRO1	IRO2	IRO3	IRO4	IRO5	IRO6	
	ISCO (source and plume)	ISTR (source), ISCO (plume)	ISCO (source), monitoring (plume)	ISTR (source), monitoring (plume)	Excavation (source) , ISCO (plume)	Excavation (source), MNA (plume)	
Onsite Operations							
Natural Gas Combustion	0	415,698	0	415,698	0	0	lbs CO_2e/year
Diesel Combustion	0	0	0	0	99,656	109,147	lbs CO_2e/year
Gasoline Combustion	40,120	0	44,840	0	40,120	44,840	lbs CO_2e/year
Raw Materials:							
50% Hydrogen Peroxide	1,828,570	290,853	1,537,717	0	1,828,570	0	lbs CO_2e/year
Persulfate	111,490	0	124,606	0	0	0	lbs CO_2e/year
Steel	0	2,818	0	2,818	0	0	lbs CO_2e/year
Electricity Usage	0	4,497	0	4,497	0	0	lbs CO_2e/year
Mobile Emissions							
Gasoline Combustion: Commutes	165,354	30,922	147,949	13,517	43,514	26,109	lbs CO_2e/year
Diesel Combustion: Commutes	190,478	20,050	170,428	0	50,126	30,075	lbs CO_2e/year
Diesel Combustion: Excavation	0	0	0	0	4,128,847	4,128,847	lbs CO_2e/year
Diesel Combustion: Drilling	0	39,607	0	39,607	0	0	lbs CO_2e/year
Duration:	532	420	476	420	140	84	days
Scope 1: Direct Onsite Emissions	18.2	188.6	20.3	188.6	63.4	69.8	Metric Tons CO_2e/year
Scope 1: Direct Mobile Source Emissions	0.0	18.0	0.0	18.0	1,872.8	1,872.8	Metric Tons CO_2e/year
Scope 2: Electricity Consumption	0.0	2.0	0.0	2.0	0.0	0.0	Metric Tons CO_2e/year
Scope 3: Other (Supply Chain) Emissions	1,041.4	156.3	898.4	7.4	871.9	25.5	Metric Tons CO_2e/year