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Site Characterisation for Chlorinated Solvents





A Challenging Contaminant...Why?

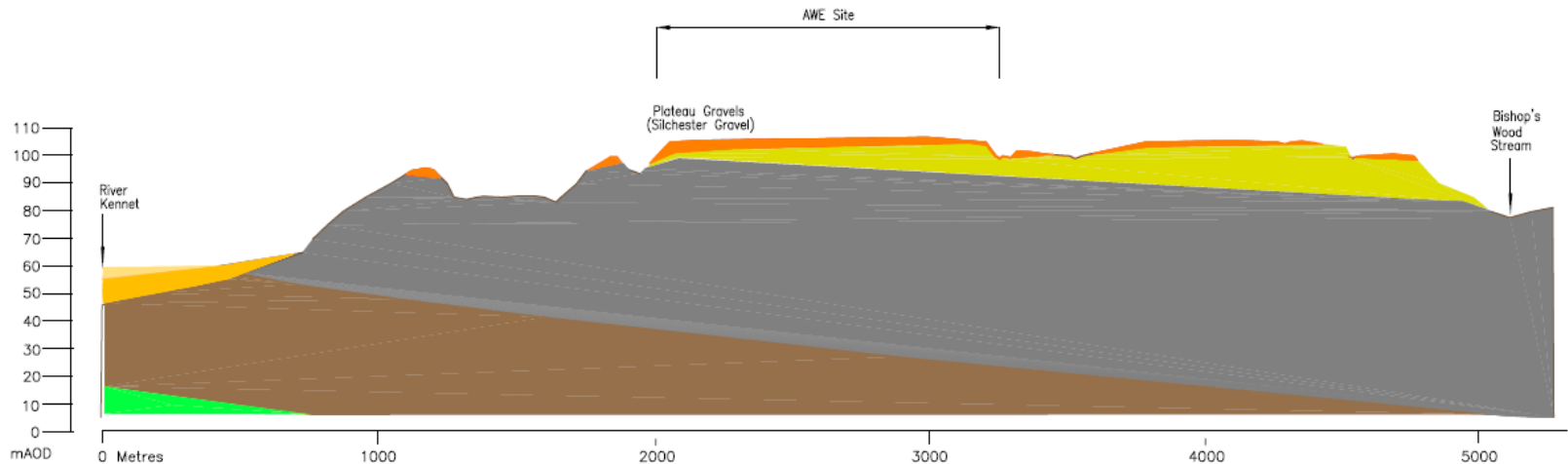
- Two large industrial sites: 285 and 89 hectares
- Manufacturing, processing, research and scientific activities
- 1950's to 1970's emphasis on research and production
 - Extensive history of chlorinated solvent use – since WW2
 - Little concern for environmental fate or impact of chlorinated solvents





A Challenging Contaminant...Why?

- Chemical sampling of surface water outfalls in 1996
- Chlorinated solvents identified in 4 catchments;
 - TCE, TCA, mix of PCE, TCE, CT, TCM and BTEX
- Carbon filtration units installed at three outfalls, another outfall closed and hydraulic cut off wall – groundwater pump and treat
- 1999 to 2010 extensive site wide investigation and characterisation
 - Three further chlorinated solvent “issues” – and other “detects”





Three Principal Projects



- Solvent Disposal 'Evaporation' Pit
- Climatic Control Facility
- WW2 Petrol Store & 1980's MT



Site Investigation

- Given that data is at the centre of everything we do and understand, then the importance of data collection is paramount;
- We must never underestimate the importance that touching, feeling and seeing the site environment, soil and groundwater can give;
- Our experience at AWE and elsewhere indicates that direct visual identification of chlorinated solvents is unlikely and so we have to rely on multiple techniques to help us build our Lines of Evidence.
- We will briefly cover the following areas:
 - Field Monitoring and analysis;
 - Membrane Interface Probe (MIP); and
 - Groundwater Monitoring.





Field Monitoring

- Soil descriptions (olfactory/visual);
- Take advantage of contaminant characteristics;
- Enhance our own senses;
- Analysis of soils





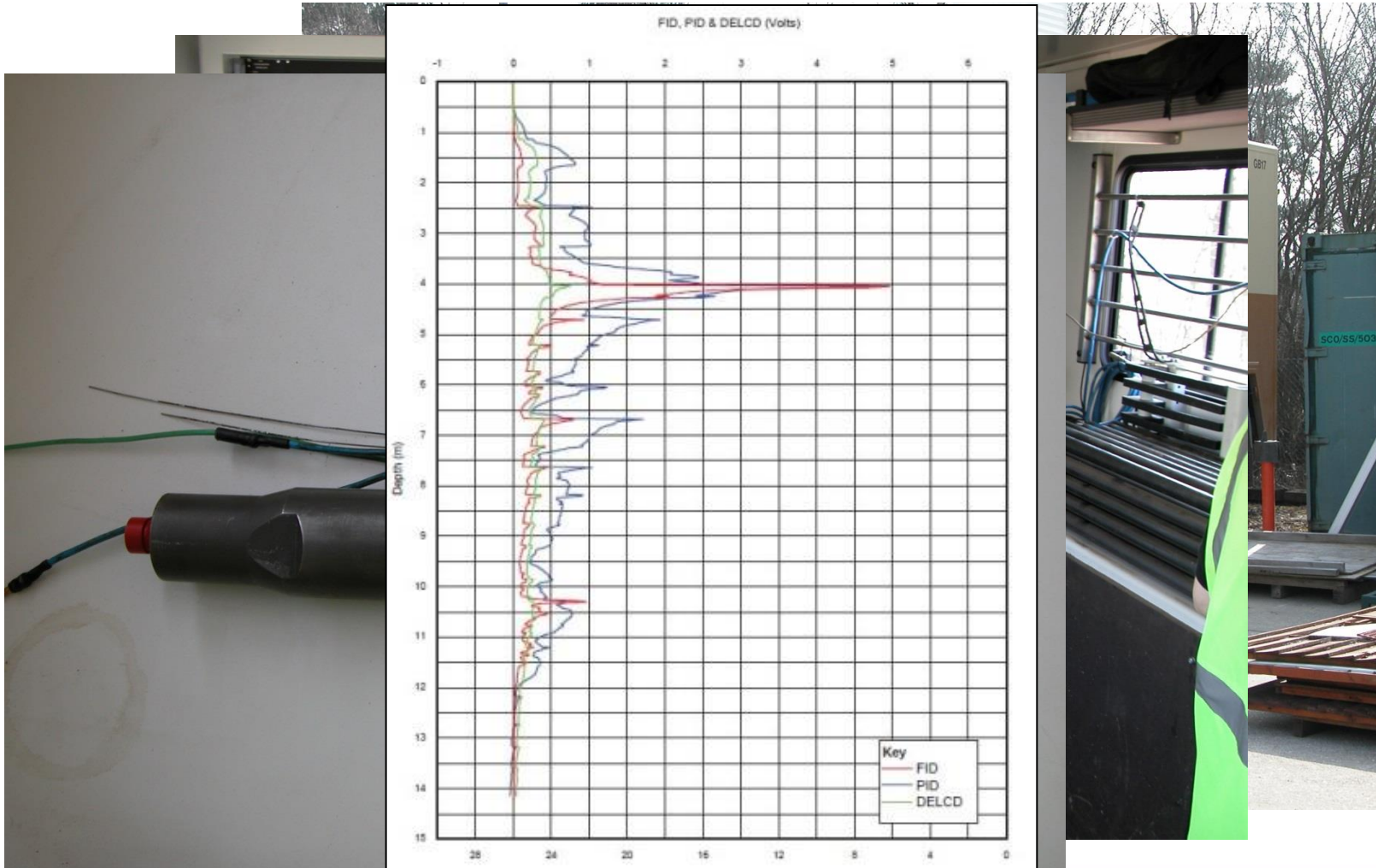
Site Investigation - MIP

- Membrane Interface Probe (MIP) has been a key part of characterisation for both Source and Plume at AWE;
- What is MIP?
- Why has MIP been so valuable?

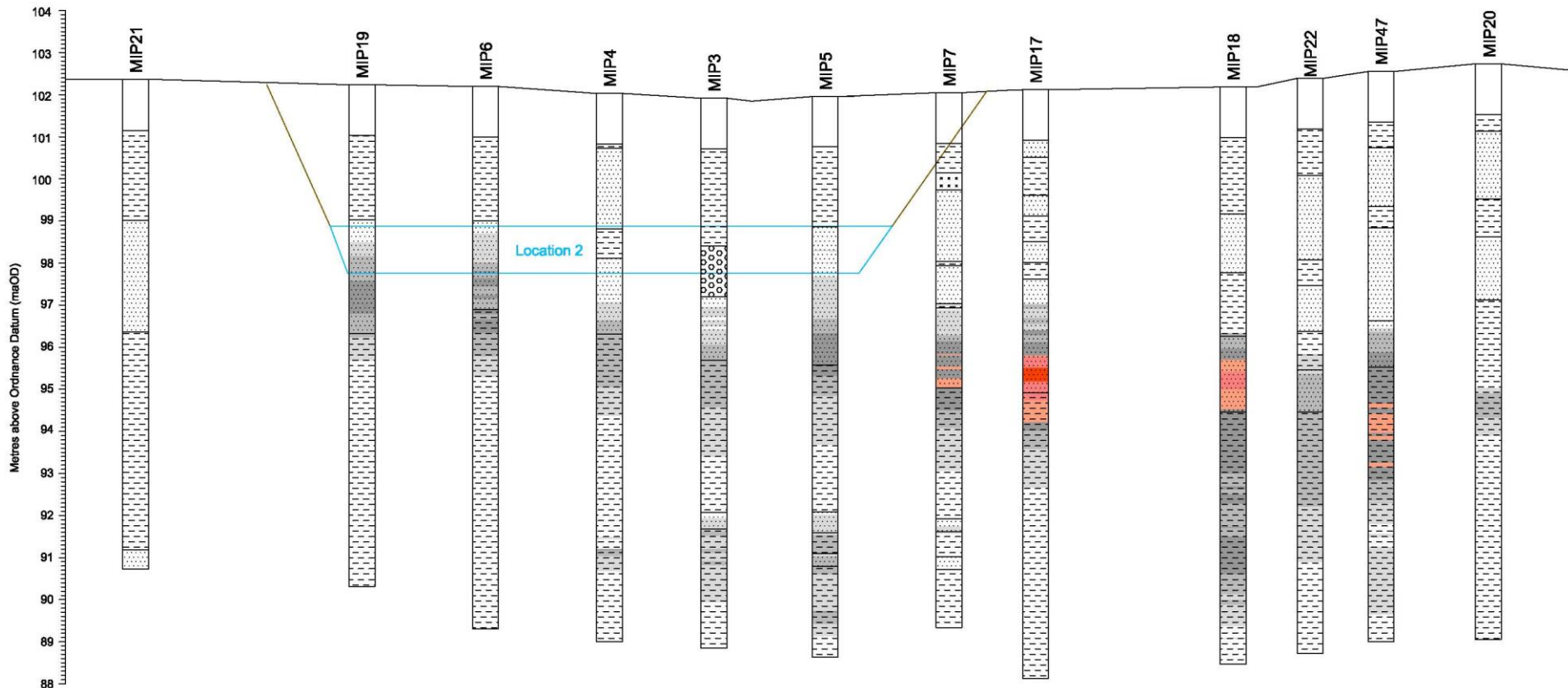















Site Investigation - MIP







-  100mV
-  250mV
-  500mV
-  750mV
-  1000mV
-  1250mV
-  1500mV
-  Clayey SAND or SAND
-  Sandy CLAY or CLAY
-  Silty SAND
-  Gravely SAND or GRAVEL



Groundwater Monitoring

- Groundwater is often a key receptor and pathway for chlorinated solvent projects
- Groundwater sampling and analysis remains one of the most useful datasets
- Groundwater datasets have been the prime mechanism to understand the status of plumes at AWE

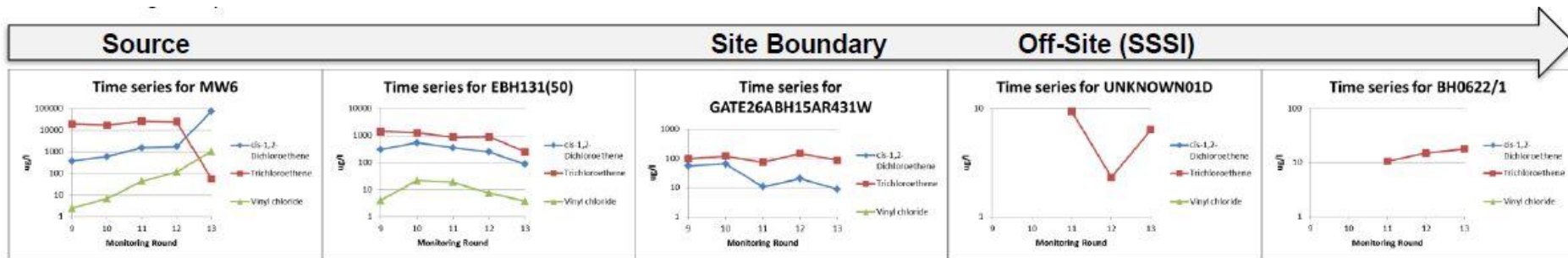


Figure 5: Representative Time Series Graphs



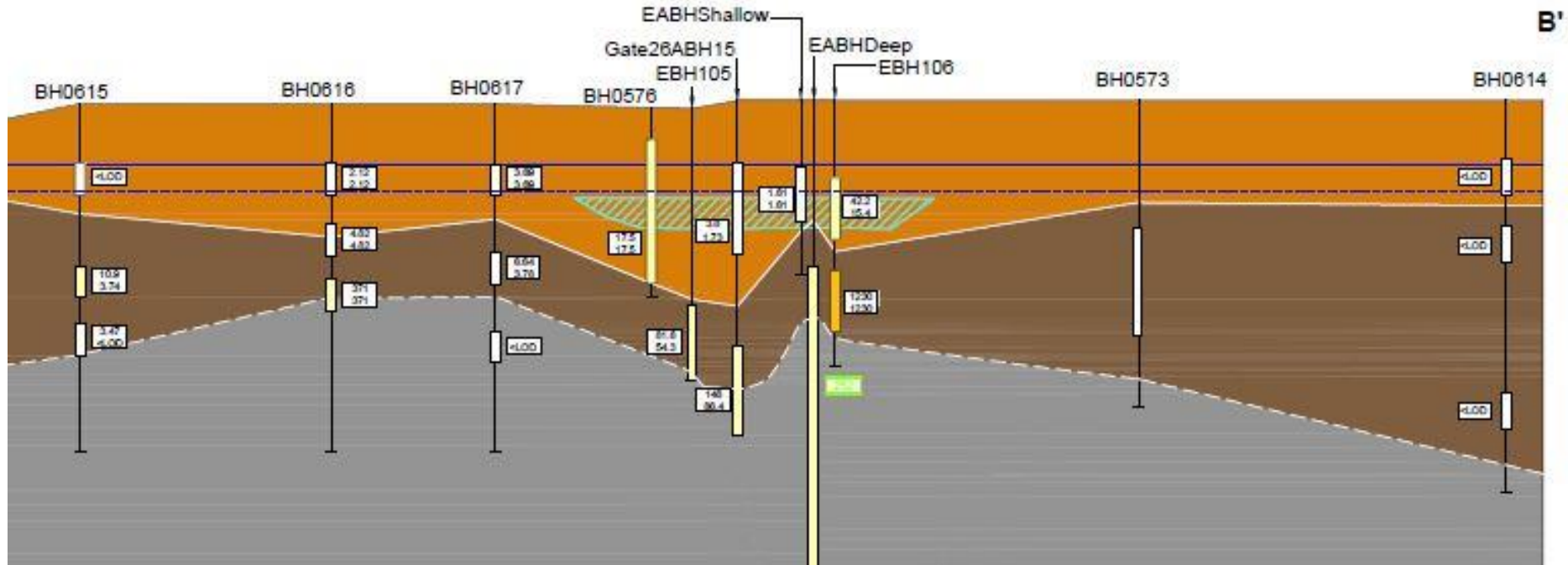
Borehole Installations

- A key consideration of groundwater monitoring relates to the borehole design and sampling method
- AWE have been characterising their chlorinated solvent issues since 1990s, and approaches and techniques have changed;
- On the AWE sites there are:
 - 19mm, 50mm, 75mm and 100mm installations;
 - Short targeted screens and long screens;
 - Single, nested and multi-level installations (CMT)
- Make best use of what is there, add the right borehole dependent on the objectives and CSM

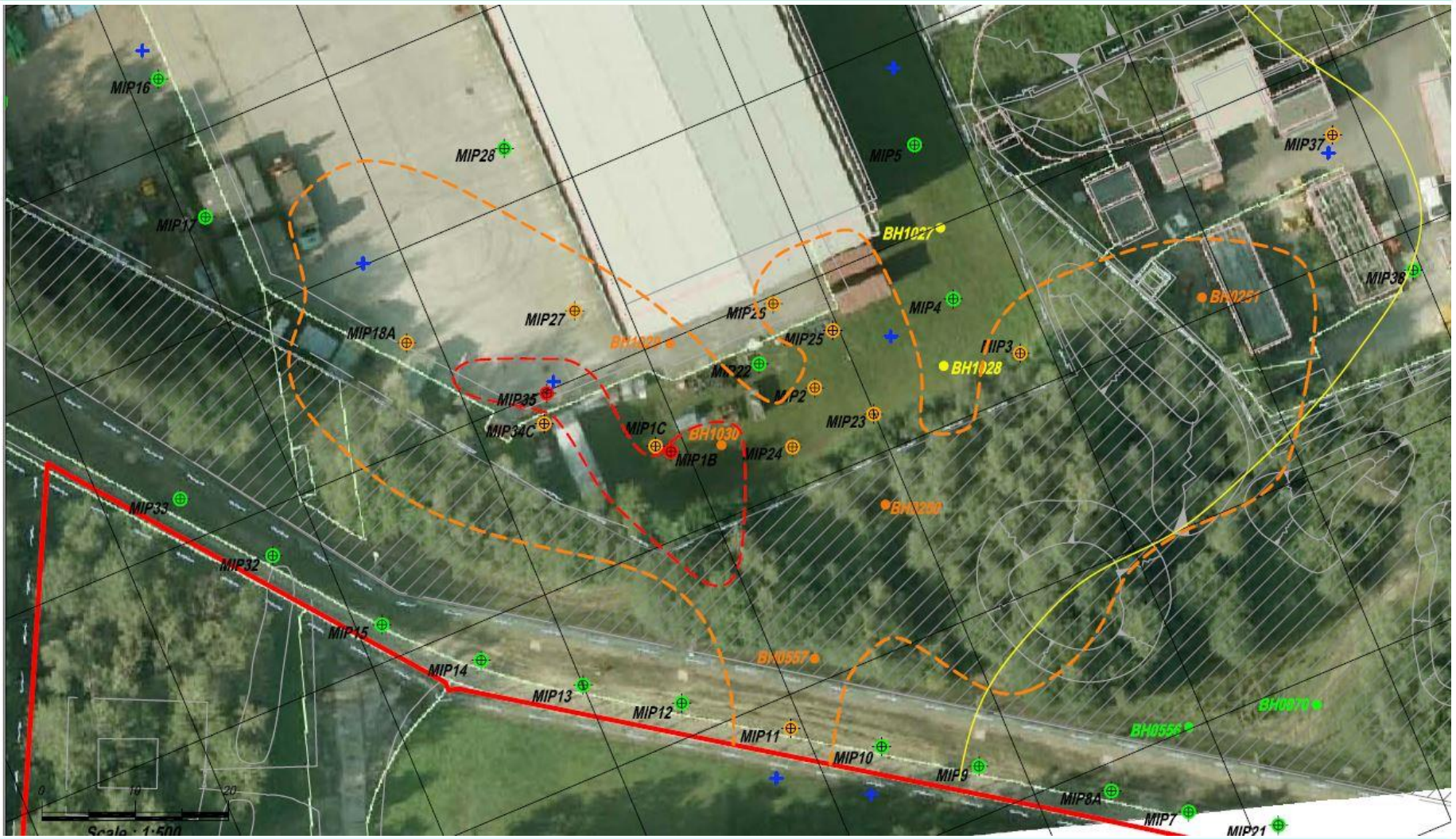




Groundwater Monitoring & Different Installs

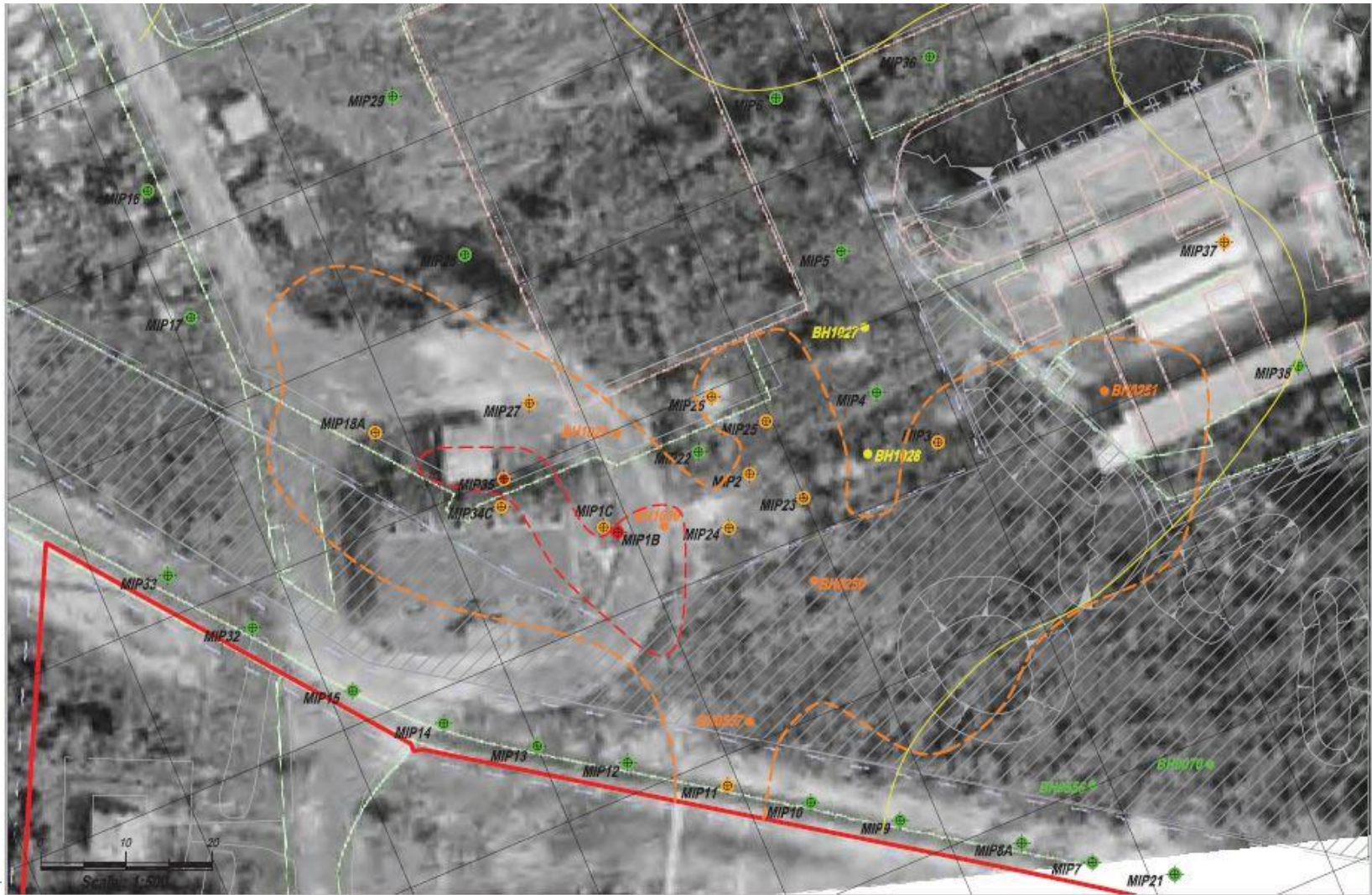


Multiple Lines of Evidence Approach



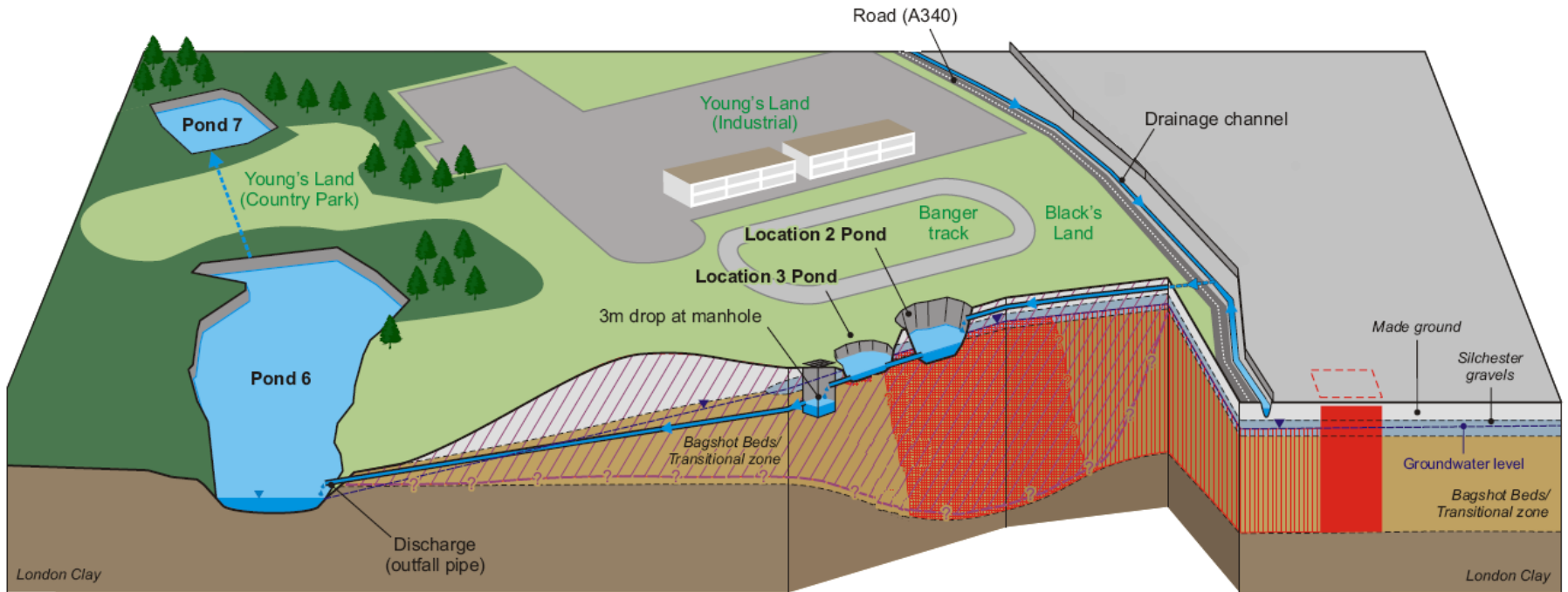


Multiple Lines of Evidence Approach





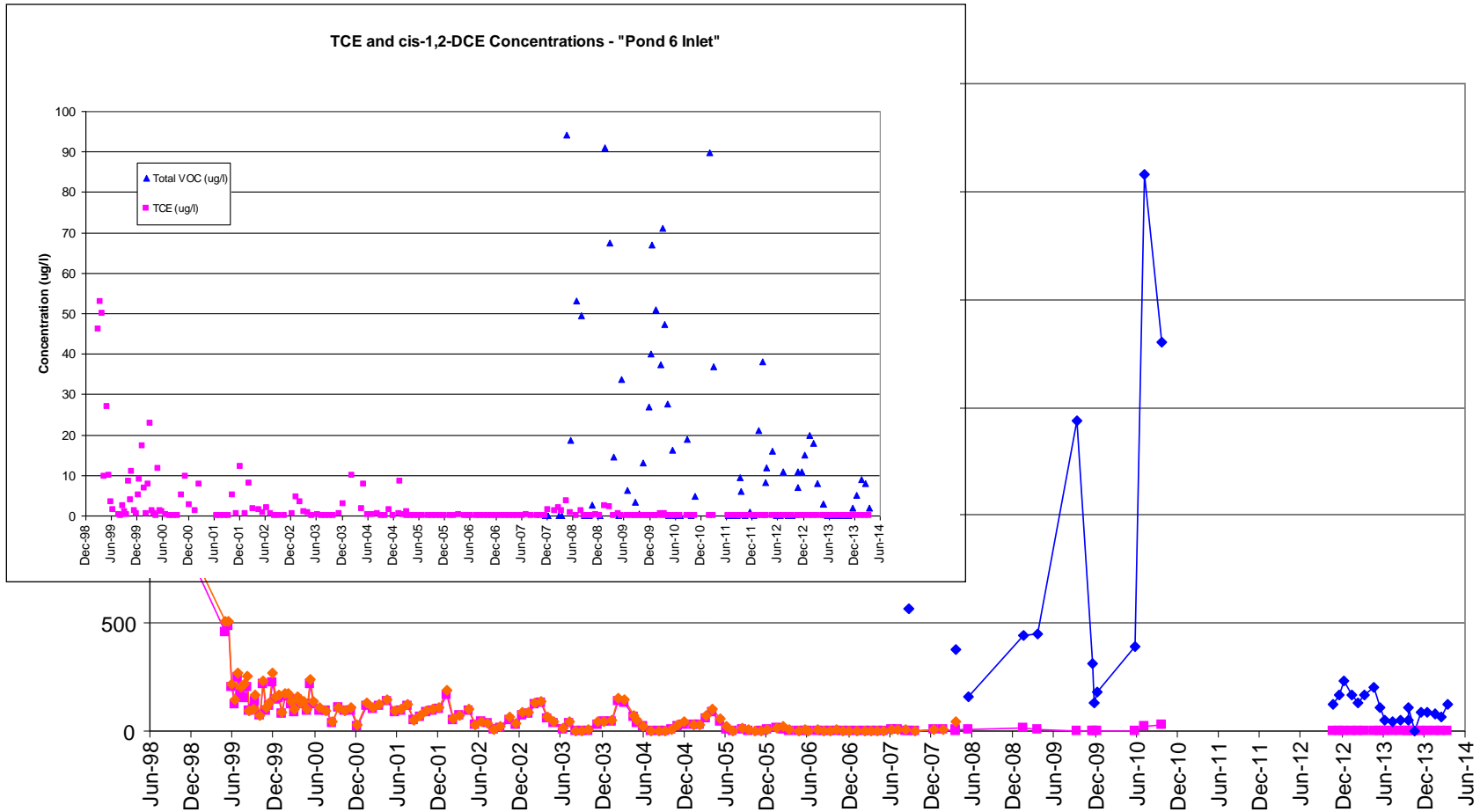
Consider the 'FULL' dataset





Consider the 'FULL' dataset

Chlorinated Solvents - Pond "Location 2"





Summary

- A Clients perspective:
 - Phased approach - DNAPLs can be complex
 - Possibly a long time scale
 - Continuity of project team

- A Contractors perspective;
 - Lines of Evidence;
 - Consistent project team with a highly collaborative approach