Analytical Transport Modelling: An Alternative to Off-Site Delineation

OBJECTIVE

Present analytical transport modelling as a defensible desktop line of evidence for deciding whether off-site intrusive delineation is recommended

CONTEXT

- Regulators require complete delineation where chemicals of potential concern (COPCs) exceed applicable guidelines
- Delineation must be extensive enough to assess all applicable pathways and receptors
- Over half of a typical downstream portfolio needs off-site delineation, often for missing information rather than potential adverse effect
- Access is constrained by rail and road corridors, utilities, third parties and worker safety



Status Quo vs. Alternative Approach

- Status Quo – intrusive off-site delineation
- Drilling driven by a regulatory checkbox instead of risk
- Access negotiation, permits, traffic control
- Schedule and cost uncertainty
- Outcome often confirms what data already indicate

- Alternate – analytical transport modelling
- Uses existing site investigation data
- Structured, reproducible and transparent
- Tests whether more drilling would change the outcome
- Focuses field effort on higher-risk issues

THE NATURAL ATTENUATION TOOL (NAT)

WHAT IT IS

- Desktop screening tool that projects contaminant transport using existing site investigation data
- Built on the Domenico (1987) groundwater transport model
- Standard CCME implementation, assumptions and default parameter values
- Consistent, fast, replicable, easy to use

WHAT IT IS NOT

- A substitute for professional judgement
- New science: the same basis used to derive Tier 1 guidelines
- A replacement for sound site characterization or complete dataset
- An absolute of site conditions

PRACTICAL IMPLICATIONS

- Off-site drilling on rail corridors and busy streets often means elevated safety risk
- Avoids access negotiation, permitting and third-party delays
- Low and no-risk sites can cease monitoring programs
- Budgets stretch further: more sites assessed
- Accelerates closure, redevelopment or divestment
- Can be used to optimize off-site drilling locations
- Can be used to demonstrate how source removal can accelerate natural attenuation



DECISION FRAMEWORK

- Is the location and nature of the release understood?
- Are plume dynamics and site characteristics sufficiently characterized?
- Do modelled concentrations show receptors protected, with a buffer distance?
- Would more off-site boreholes change the delineation outcome?



PATH TO REGULATORY ACCEPTANCE

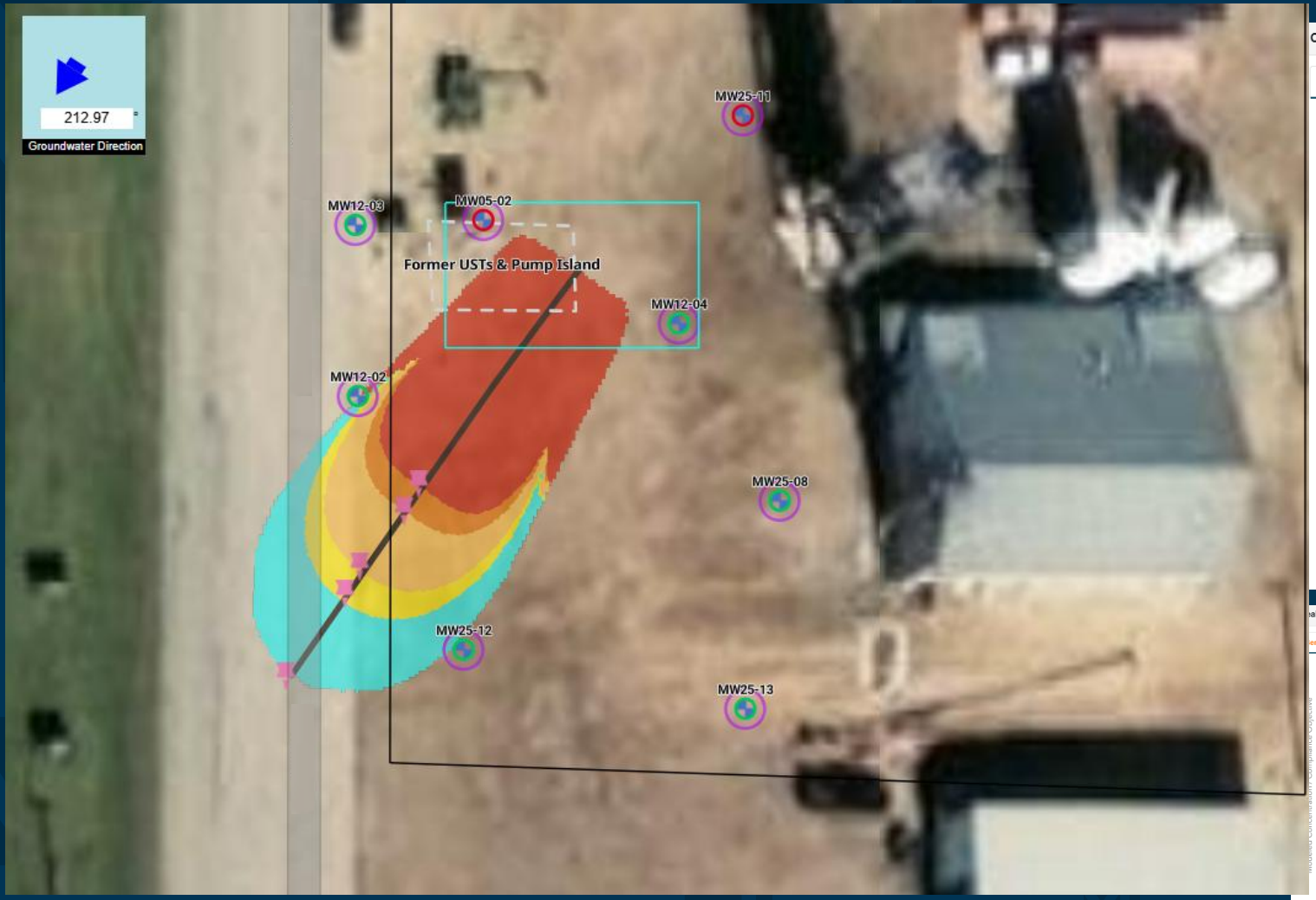
- Initial regulatory engagement before submission
- Standardized technical documentation and methodology
- Training and sign-off by a qualified professional



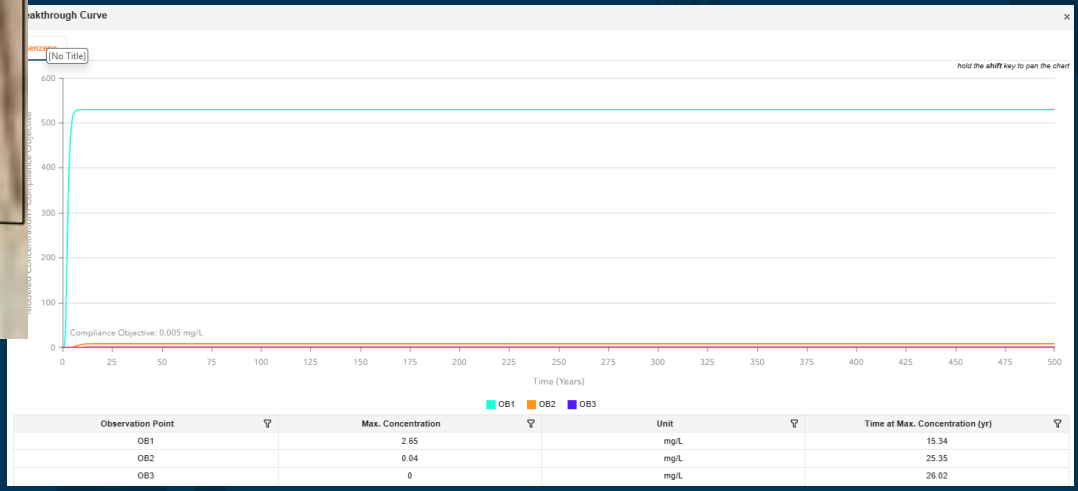
WHAT THE NAT MODEL PRODUCES

- Inputs: chemical distribution in soil and groundwater, stratigraphy and hydrogeology
- Projected plume footprint on the landscape
- Concentrations at receptors and points of compliance
- Length of time concentrations remain above compliance objectives
- Extrapolation beyond the measured dataset and into the future









LEGEND

- Monitoring Well
- Property Boundary/APEC Boundary
- Observation Point
- Monitoring Well Added to Centreline
- Former Infrastructures/APECs
- Source Area

Sample Concentration (mg/L)

- > 1X to 5X
- > 5X to 10X
- > 10X to 50X
- > 50X to 100X
- > 100X

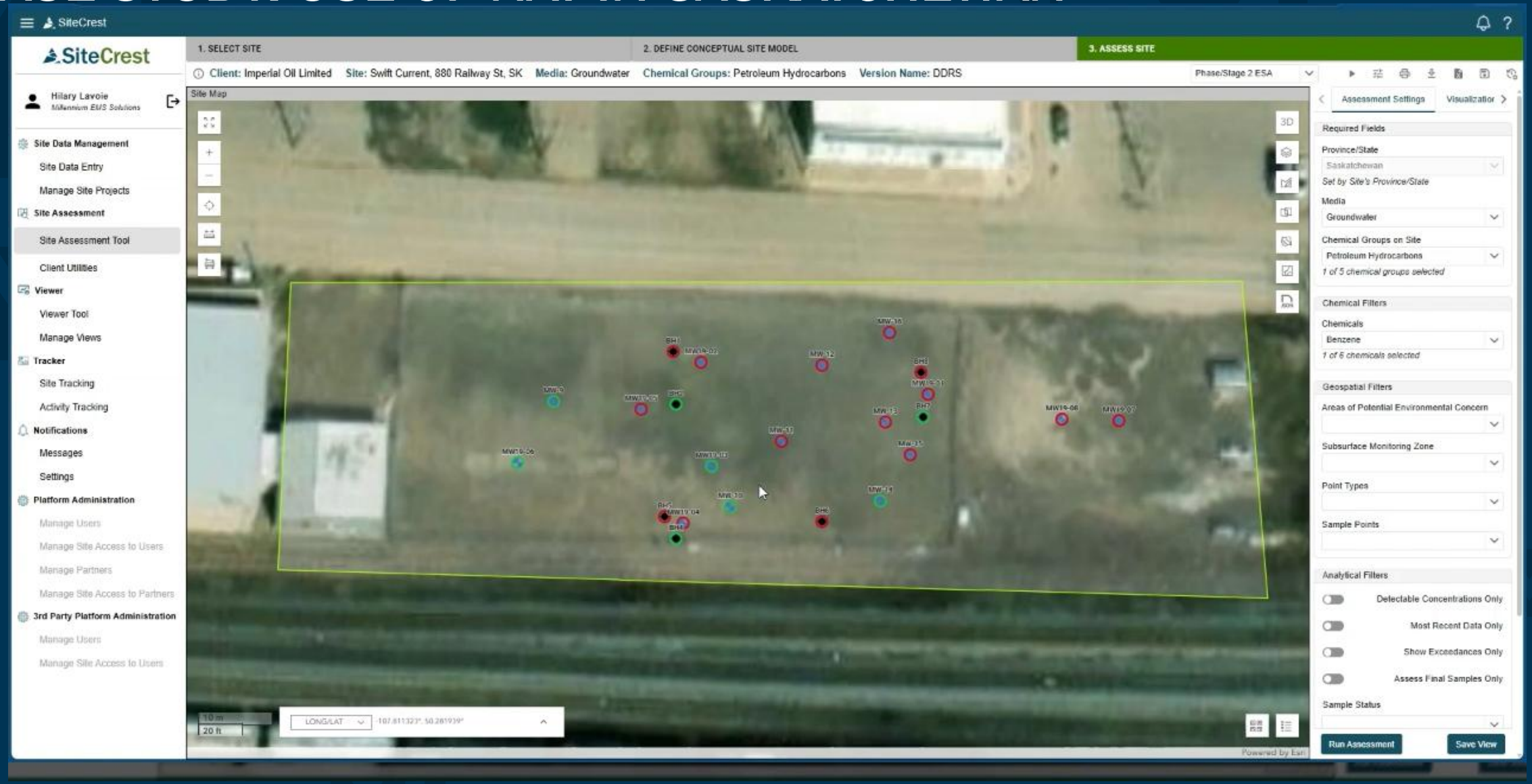
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MILLENNIUM EMS Solutions Ltd.

CASE STUDY: USE OF NAT IN SASKATCHEWAN

- Former bulk petroleum plant in Saskatchewan
- Historical soil and groundwater data imported from existing investigations
- Screened against Saskatchewan Discharge and Discovery Reporting Standards - Table 2 criteria
- Petroleum hydrocarbon constituents modelled for transport and attenuation

CASE STUDY: USE OF NAT IN SASKATCHEWAN



RESULTS ACHIEVED



- Intrusive work near utilities avoided
- Off-Site affected party confirmed to be municipality only
- Project could move forward to a Corrective Action Plan using Tier 3 Risk-based criteria
- Site can be redeveloped for industrial use

KEY TAKEAWAYS

- A defensible desktop line of evidence for off-site delineation
- Supports regulatory decisions and program efficiency
- Most valuable where access, safety or logistics constrain drilling
- Shifts effort toward higher-risk environmental issues
- Not an absolute of site conditions: conservative assumptions, simplified geometry, continuous source
- Best used to test whether further intrusive work would change the decision



THANK YOU! QUESTIONS?

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