

# Application of Knowledge Gained and Tools Developed at the Bemidji Site to a Crude Oil Spill Site in Cass Lake, MN

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# Cass Lake, MN Crude Oil Spill Site



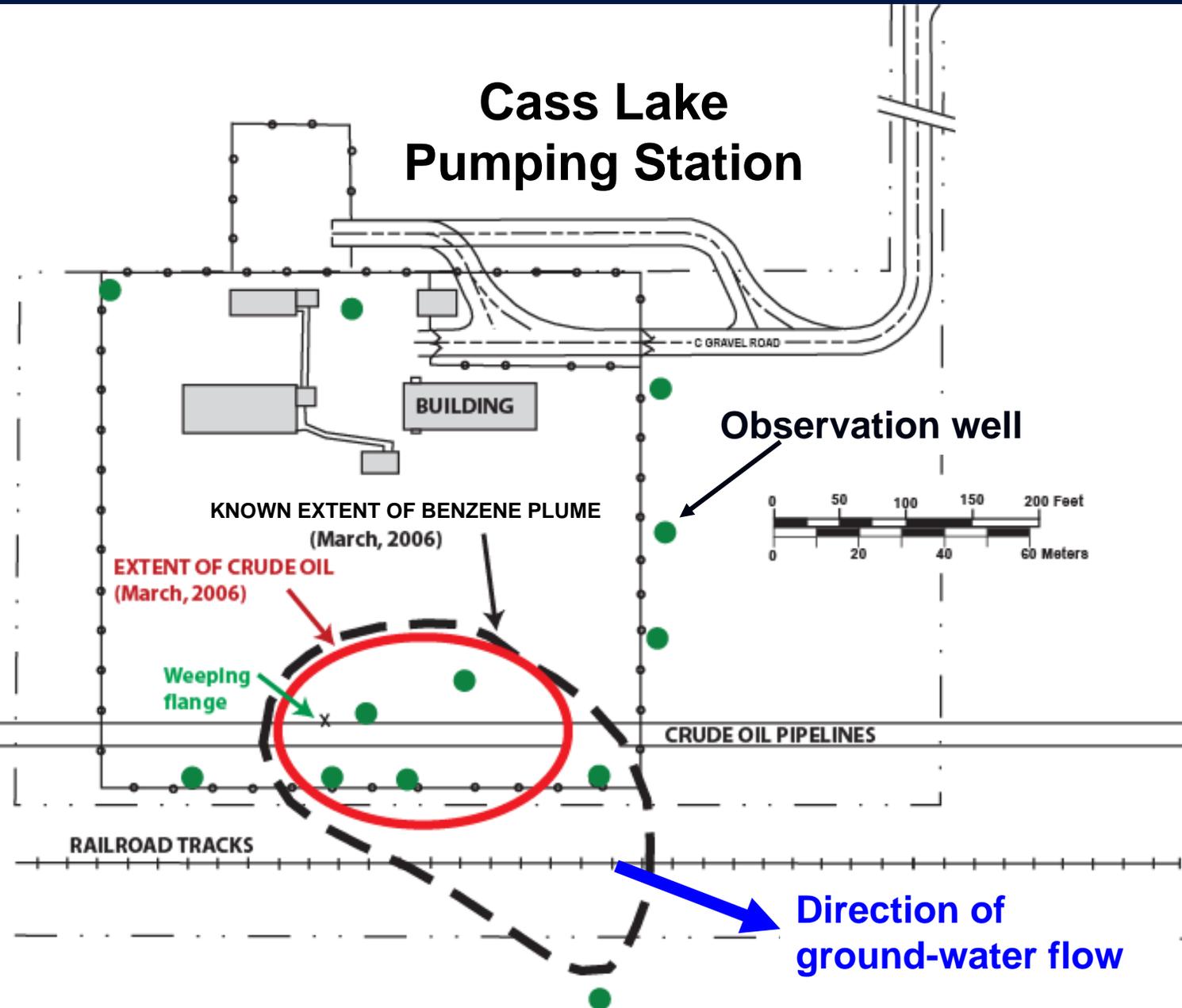
- ❖ Located in north-central Minnesota
- ❖ Unconfined sand and gravel aquifer
- ❖ Groundwater flow is to southeast
- ❖ Velocity ~ 6 m/yr



● ← Domestic well



# Prior Knowledge of Plume Extent



# *Study Objectives*

- **Characterize the three-dimensional extent of the dissolved plume of BTEX (benzene, toluene, ethylbenzene, and xylenes)**
- **Evaluate the long-term outlook for natural attenuation of BTEX in the aquifer**
- **Compare with intensely studied USGS “Bemidji” site.**

# *Study Approach*

- Conduct reconnaissance of the dissolved hydrocarbon plume – using a push-probe technique to investigate a series of vertical profiles at increasing distance down gradient
- Use field gas chromatograph (GC) to quantify BTEX concentrations
- Obtain aquifer core material for microbial population characterization (MPN) and solid phase iron measurements
- Install permanent monitoring wells

# ***Cass Lake – Bemidji comparisons***

- **Lateral flow rate at Cass Lake reduced by a factor of 3.**
- **Both plumes are about the same length, but Cass Lake plume is more narrow.**
- **Benzene attenuation rate at Cass Lake is reduced about a factor of 4, but overall BTEX concentrations are much reduced.**
- **Cass Lake microbial populations much reduced.**
- **Cass Lake oil is more weathered.**
- **Temperature increases were found in both plumes (see Warren and Bekins poster)**

# *Concluding remarks*

- **Methanogenesis is well established at the Cass Lake site.**
- **Use of the push probe and field GC BTEX analysis was crucial to discovery of the plume.**