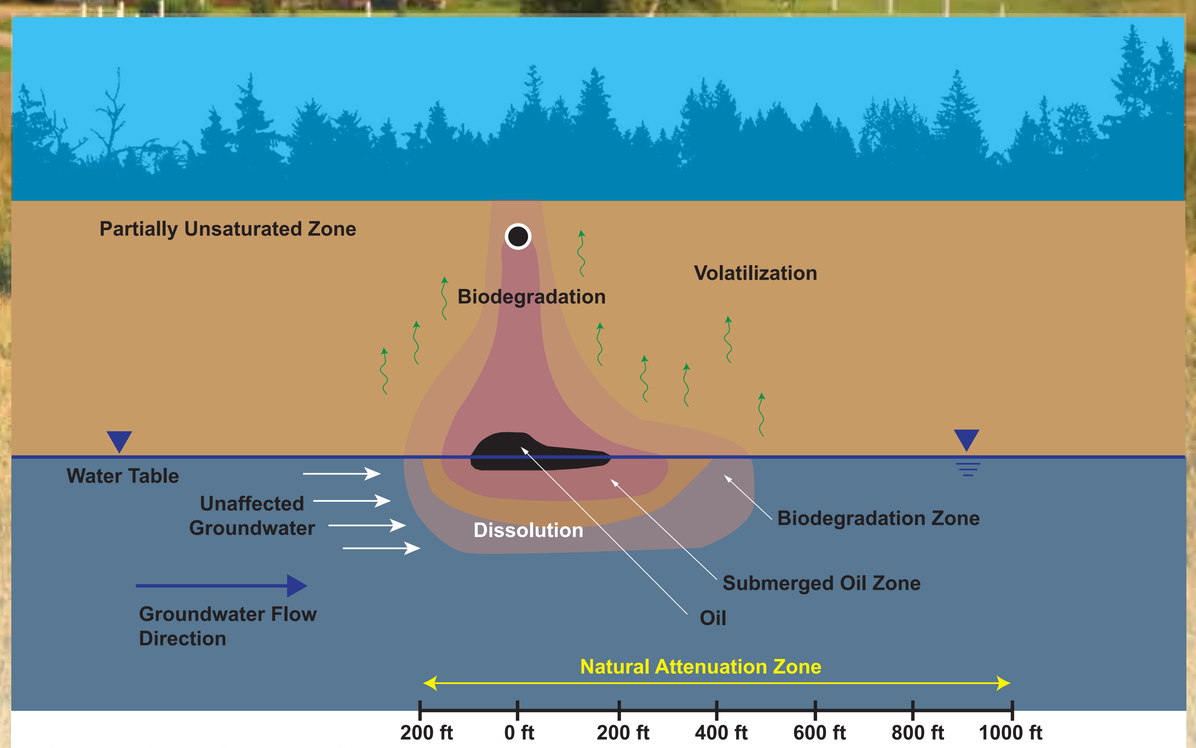
Evaluating Pinhole Releases

A pinhole leak is defined as a slow and small leak of oil from the proposed pipeline, or its remote facilities (e.g., valve sites) that might not be immediately detected by the leak detection systems.

Potential environmental effects of pinhole leaks are being evaluated qualitatively through review of publically available scientific papers, comparison to similar case studies, and assessment of how natural resources might be affected. Factors being used in the evaluation include the potential volume of the release, the length of time for detection, and the types of effects on groundwater and soils.

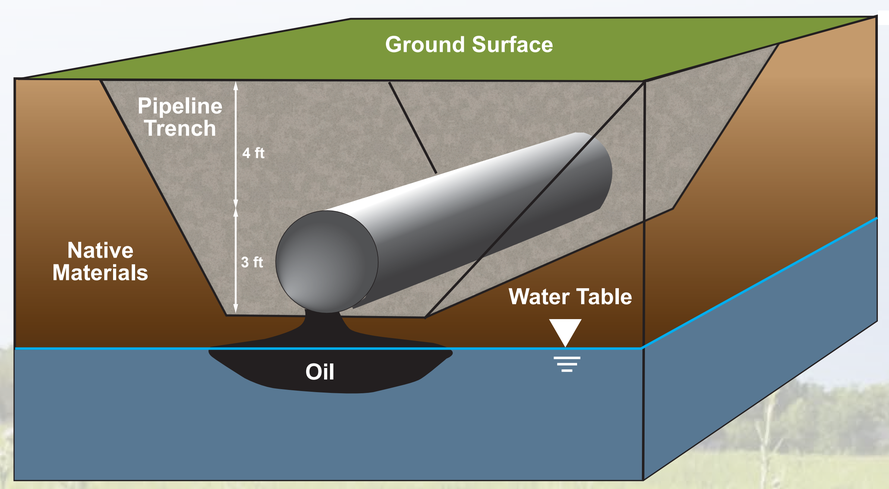


Subsurface Oil Fate Processes

(Modified from ASTM, 2006)

Characteristics of Pinhole Releases

In most cases, oil from a pinhole leak would likely either be quickly discovered through visual inspection or remain within or near the pipeline trench where it could be contained and cleaned up after discovery. However, a pinhole leak may result in a release of sufficient volume to affect groundwater.

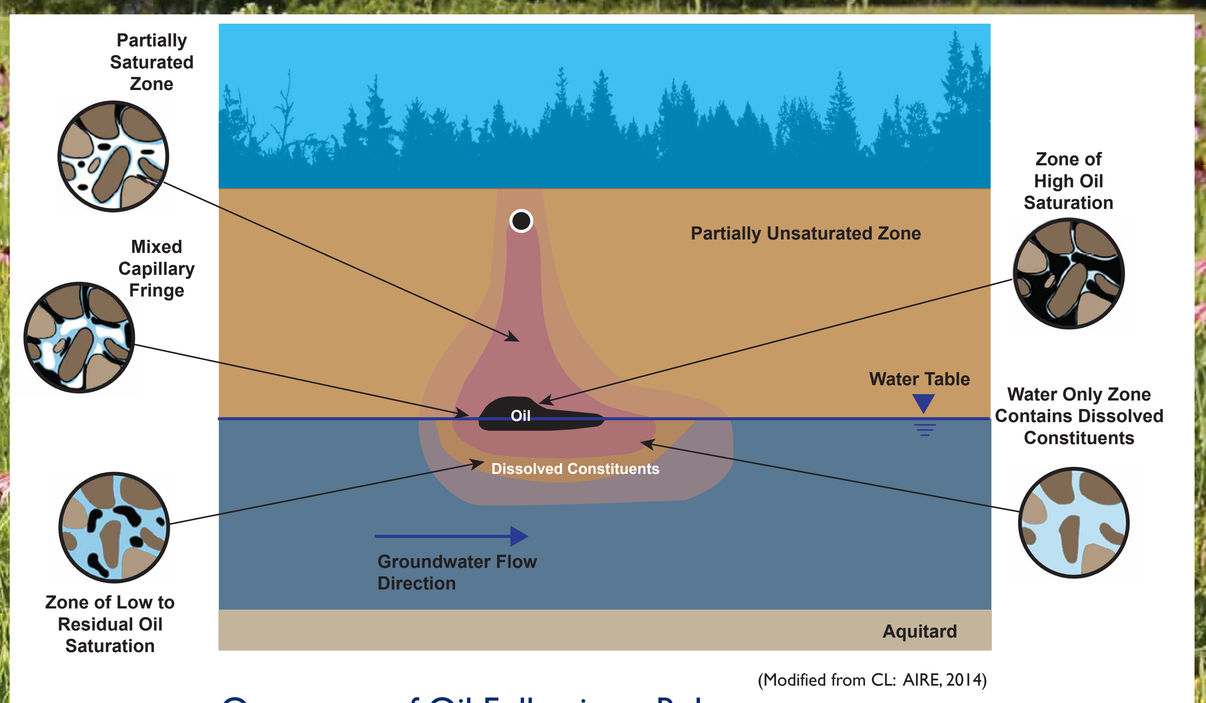


A mathematical model is used to estimate how much oil may be released from leaks that go undetected for longer periods of time (Exponent, 2013). The model estimates the maximum leak rate that oil make soak into the soil around the pipeline trench. In most cases, these rates are relatively low. For example the oil infiltration rate within a 3-foot diameter footprint is predicted to be approximately 1.5 gallons per day.

Fate and Transport of Oil

The potential for oil from a pinhole leak to reach groundwater is related to how much oil is leaked, how easily the oil flows, the type of soil, and the depth to groundwater.

After oil leaks into the environment, natural processes may act to reduce the amount of oil or limit how far it will travel. These processes as a whole are termed natural attenuation. Natural attenuation takes place in unsaturated soil and in groundwater, through the processes of volatilization, dissolution, dispersion, adsorption to soil particles, and biodegradation. Whether in soil or groundwater, the processes involved in natural attenuation are the same, although the relative significance of each process can vary by location.



(Modified from CL: AIRE, 2014)

Occurance of Oil Following a Release

Environmental Susceptibility

The greatest concerns for effects to the natural environment and human uses are anticipated to be associated with an oil leak in an environmentally sensitive area, such as shallow groundwater, natural seeps and springs, rivers, streams, lakes, or an area near water supply wells.

Much of the groundwater along the proposed and alternative routes is separated from the surface by soil types above the aquifers that inhibit downward migration of water, such as clay. However, shallow groundwater in sand and bedrock is also present along the proposed route and route alternatives. Subsurface soil types, the depth to the water table, and the proximity to sensitive areas listed above are being evaluated to assess the potential susceptibility of the environment to a pinhole leak.

Recovery from Oil Effects

A range of techniques are available to identify, contain, capture, and remove oil from a pinhole leak, including excavating affected soil and pumping oil that is floating on the water table. These techniques are designed to stop the movement of oil in the subsurface, and minimize its effects on groundwater. After the initial cleanup is complete there are a number of methods that may be used to cleanup groundwater, if it is needed, including: pumping, cleaning groundwater in place, and/or natural attenuation.