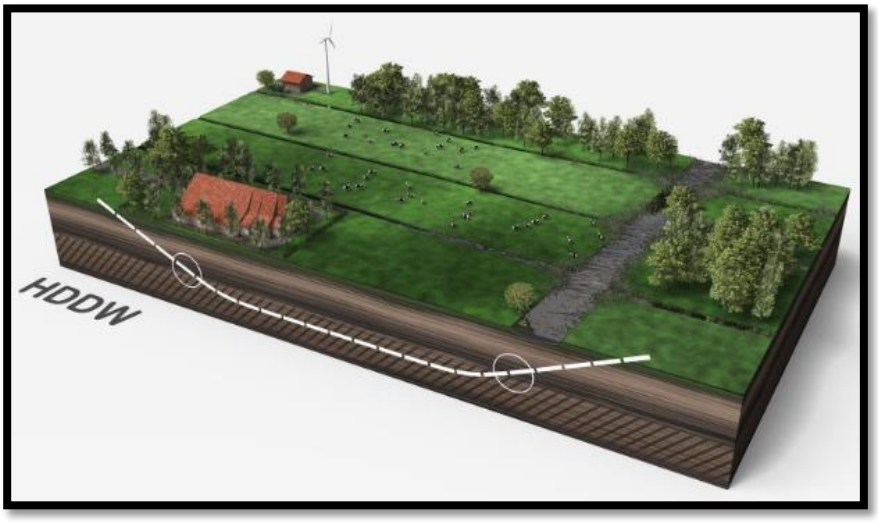
HORIZONTAL REMEDIATION WELLS

EnviroBore is here to offer a cost effective, efficient way to solve your contaminated soil problems through a more efficient proven system provided by horizontal directional drilling. When horizontal directional drilling is used to clean up underground contaminants, the impact has minimal disturbance to the environment and surrounding area. Below are several methods using horizontal directional drilling to clean up contamination.



Horizontal Well Remediation and Soil Sampling

Historically, access to contamination in the ground both above and below and in the water table has been accomplished using methods varying from vertical wells to trenching and in recent times bacteria have been pumped into contaminated areas.

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There are some significant advantages to using horizontally installed wells and monitoring equipment, such as:

- ❖ A significant increase in linear footage of screen and area affected by the well
- ❖ The number of horizontal wells installed will be significantly less than vertical methods due to the fact that a much greater area can be accessed from with a single horizontal well than a vertical well
- ❖ The ability to enter areas under buildings and other infrastructure and environmentally sensitive areas where these processes were difficult in the past
- ❖ Performing drilling and installation without interrupting the day to day processes of the client.
- ❖ Safer installation to client's employees

Horizontal directional drill technology can be used in the application of various remediation techniques. Methods such as air sparging, soil vapor extraction and in situ bioremediation will help to identify and remove contaminants that remain undiluted in the subsurface, such as spilled oil or gasoline. This technology that we offer is very useful when the contaminant plume covers a large area and has linear geometry, or when surface obstructions are present.

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Limitations of trenched wells and total earth removal include:

- Disposal or decontamination of contaminated soil may be expensive
- Potential instability from undercutting limits installation beneath buildings
- Underground utility lines may limit installation lengths since precise steering around such obstacles is not possible
- Well installation cannot proceed in hard rock
- Possibility of cross contamination or migrations of contaminate
- Loss of client's day to day operations

General limitations of horizontal wells:

- Ineffective for light non-aqueous phase liquid recovery in areas with large water table fluctuations, such as tidal zones
- Well installation depths can be limited to the strength of the beacon for locating the drill head, however more recent advances in this technology have greatly improved the ability to drill deeper and more precise

Other uses for horizontal wells:

- Placing leak detection sensors beneath solid or hazardous waste landfills
- Installing gas collection systems in landfills or similar disposal sites
- Stabilizing hillsides for mine tailings or other unstable aggregate soil masses
- Installing groundwater wells in shallow water-bearing formations for water supply
- Installation of both wells and monitoring equipment under permanent structures

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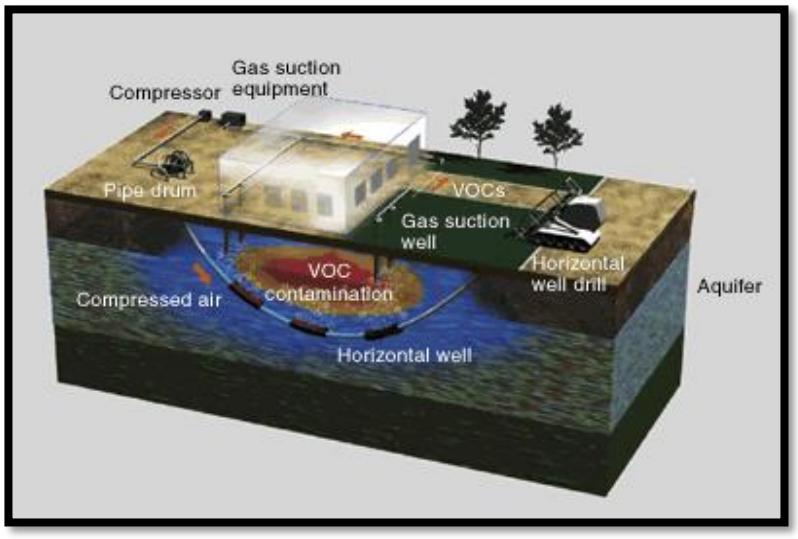
DIRECTIONAL DRILLING

Horizontal Well Extraction Methods

Soil Vapor Extraction

Soil vapor extraction is a technology that utilizes a vacuum to extract contaminants from saturated zones for treatment and disposal. This technology is much more efficient for removal of volatile organic compounds and some semi-volatile organic compounds such as gasoline and other solvents.

Due to the fact that a horizontal soil vapor extraction system contacts a much larger contaminated area than a single vertical well, it creates a much greater zone of influence than typically can be achieved with vertical wells. Since the soil column is not disturbed during the installation process, horizontally drilled extraction wells are more efficient and less likely to vent gas to the atmosphere. A single horizontal well will replace numerous vertical wells.



In a horizontal system, the bore acts as both the recovery and transfer line. The same pipe provides both the screened section to extract vapors and a blank section to carry the vapors back to the surface and then to a recovery area to be processed. If numerous areas are affected the pipes can be tied in to a common collection area.

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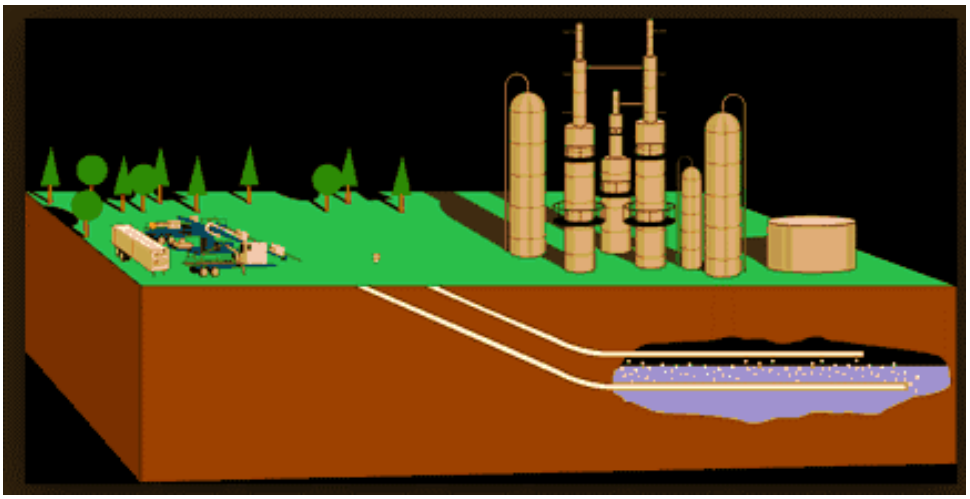
Free product recovery can often be accomplished in areas affected by floating products such as gasoline or crude oil by using horizontal wells to draw down the water table and extract the contaminates to be processed at another facility. Actual design of a recovery system will be custom designed to fit the situation, but all of the general advantages of horizontal wells can be applied to free product recovery. In some cases an extraction methods can be installed to remove both free product and soil vapor.



Soil Venting

The injection of air into the soil or groundwater at relatively low psi and volume can dramatically increase biological activity of bacteria in the soil, aiding in the removal of contaminants. This procedure, called soil venting in the saturated zone, is an efficient process that is typically more economical than Soil Vapor Extraction or conventional air sparging. Since flow rates are low, blowers and associated operating costs are less, and there is no need to treat collected contaminant-laden soil gas.

This method is becoming more popular on sites where assessments have determined that there is little threat of exposure via normal pathways, but that SOME remediation is needed. It is also useful to create a barrier against migration of contaminants off-site. A horizontal well can be installed across a migrating contaminant plume as well as non-contaminated areas, eliminating the need for expensive and ineffective pump-and-treat systems.

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Air sparging through soil can effectively increase vapor extraction. Horizontal wells provide a very effective mechanism for distributing air throughout the contaminated region. A horizontal air sparging system can be installed under a wide variety of conditions to induce more effective soil vapor extraction. Passing air through water separates lighter contaminants and mobilizes them for collection and treatment. Steam mobilizes heavier contaminants such as diesel or heavy oils, allowing collection as vapor.

Choices of materials for horizontal extraction have to be custom assembled depending on ground conditions and the contaminants in question. The choice of materials for air sparging is quite flexible, but several design factors must be considered. Groundwater extraction from a horizontal well works on the same principles as vertical water wells.

In conclusion, horizontal wells treat a much larger area, drawing contaminates from a much greater area, or an area not originally accessible. This cuts costs and equipment, producing more volume for less well.

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