PHYTOREMEDIATION USING *TREEWELL*® TECHNOLOGY

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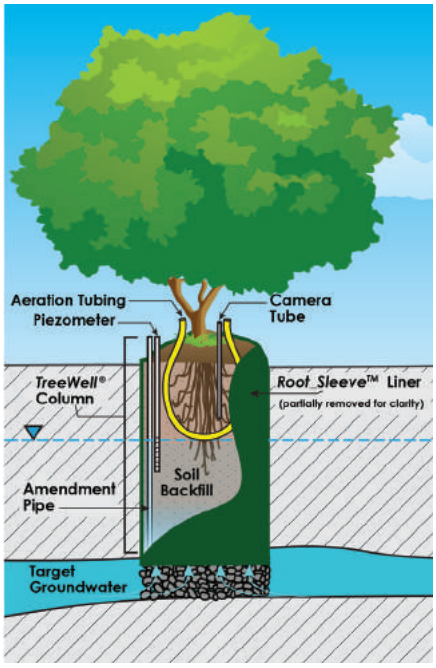
Phytoremediation, a plant-based remediation technology, offers a cost-effective alternative to more traditional remediation and containment methods. Geosyntec practitioners have decades of experience applying phytoremediation, and our broad experience enables us to use these versatile plant-based technologies as part of an integrated approach with other remedial systems, or as stand-alone technology even at locations with challenging site conditions and high contaminant concentrations.

TreeWell Technology Overcomes Limitations of Conventional Phytoremediation

Applied Natural Sciences

The effectiveness of groundwater remediation using conventional phytoremediation approaches may be limited by compacted soil conditions that impede root penetration, target groundwater that is too deep for root access, or phytotoxicity due to excessively high contaminant concentrations. Geosyntec is a licensed provider of *TreeWell* technology, an innovative phytoremediation system developed by Dr. Edward Gatliff of Applied Natural Sciences, Inc. *TreeWell* systems overcome these challenges by utilizing a specialized lined planting unit with optimum planting media that promotes downward root growth, encourages contaminant treatment, and focuses groundwater extraction from a targeted depth interval.



The *TreeWell*® System

How a *TreeWell* System Works

TreeWell technology targets groundwater normally inaccessible to plant roots and therefore out of reach for effective remediation. The *TreeWell* system uses a patented design to focus groundwater extraction from a targeted depth interval using a specialized planting unit with a *Root_Sleeve*™ liner. Targeted groundwater is drawn upward through the planting unit and into the root zone, creating a hydraulic connection between impacted groundwater and the phytoremediation system. Advanced techniques have been developed to address groundwater typically too deep for root contact, at depths greater than 50 feet below ground surface.

Once the *TreeWell* system is installed, the soil media provide excellent growth conditions for roots and microbes. In addition, the roots of the growing trees release carbohydrates, amino acids and other growth factors that encourage the colonization and proliferation of microflora in the root zone, also called the rhizosphere. The soil column and rhizosphere act as a bioreactor where microbial and plant-based remediation processes (i.e., chemical transformation) occur, which also serves to reduce possible phytotoxic effects from high contaminant levels.

Tree species utilized in the *TreeWell* system generally include those with favorable growth characteristics and high transpiration rates; however, the *TreeWell* system can also be used with native and ornamental species to fit the site-specific conditions and goals.

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Example Geosyntec Projects using *TreeWell* Technology

Phytoremediation of Mixed VOCs in Groundwater

Geosyntec conducted groundwater modeling and detailed site characterization to support evaluation of remedial options, and the selection and design of a *TreeWell* system to control VOCs in groundwater. A 65-*TreeWell* unit pilot study was installed and following the first year of monitoring, Geosyntec conducted additional groundwater modeling to support the design of the full-scale remedy. On the strength of the pilot test results and subsequent modeling, the state approved shut-down of the site's costly pump-and-treat system.

Modification of groundwater flow regime – comparison of March 2013 to November 2014

Phytoremediation of a 1,4-Dioxane, VOCs and Arsenic in Groundwater

Geosyntec designed a final remedy incorporating an impermeable barrier to isolate a 1,4-dioxane source and a *TreeWell* system to reduce COC concentrations, contain impacted groundwater, and reclaim a distressed wetland. Containment was demonstrated within the 2nd growing season, enabling shutdown of the groundwater pump-and-treat system. At the end of the 4th growing season, the plume was stable and/or shrinking. Geosyntec prepared, and the state approved, a Proposal for No Further Action with Controls.

For more information about Geosyntec's phytoremediation capabilities, please contact us:

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