



# GEOSIERRA TRENCHLESS PERMEABLE REACTIVE BARRIER

PASSIVE IN SITU SOLUTIONS FOR DEEP AND  
COMPLEX SITES

## OVERVIEW



# GeoSierra Trenchless Permeable Reactive Barrier Solution

Cascade Environmental offers the GeoSierra Trenchless Permeable Reactive Barrier (PRB) technology, a patented, proven solution for passive, long-term groundwater remediation.

This trenchless approach enables the installation of continuous subsurface treatment zones at depth without open excavation, making it ideal for urban environments, mixed plumes, and sites with limited access.

Using controlled hydraulic inclusion propagation (otherwise known as fracturing), the GeoSierra Trenchless PRB method creates a vertical permeable treatment wall that intercepts and remediates contaminated groundwater. This ensures predictable performance, even in heterogeneous or low-permeability formations.

Patented injection casings are stacked vertically in the target zone and aligned along an azimuth. A food grade starch gel carries reactive media into the casings and propagates vertically to adjacent casings by harnessing pore pressure relief (PPR) for precise emplacement. The PRB is built from the bottom-up coalescing each vertical panel to create a continuous treatment zone.



PRB monitoring ensures quality control by injection pressures, PPR and a voltage change of the gel which depicts a 2-D image of the propagated inclusion, confirming lateral and vertical distribution.

The technology has demonstrated effectiveness for chlorinated volatile organic compounds, metals, PFAS, and complex contaminant mixtures, supported by decades of field application across industrial, municipal, and federal cleanup programs.

## GeoSierra Trenchless PRB Key Advantages

- Trenchless PRBs for urban and mixed plumes
- Controlled emplacement for predictable results
- Targets contaminants of concern based on lithologic changes
- Wells remain in place and can be reused for reinjection
- Minimal inconvenience and disruption to site and surrounding areas
- Improved well efficiency through permeability enhancement



# How Trenchless PRBs Work

## Subsurface Characterization

Geology, groundwater flow, and plume geometry are evaluated to design the barrier alignment and emplacement intervals.

COC degradation and PRB thickness are confirmed by column testing and probabilistic modeling.

## Controlled Hydraulic Fracturing

Engineered vertical fractures are created at depth to form coalesced, permeable pathways that follow the intended treatment plane.

## Reactive Media Emplacement

Zero valent iron, activated carbon, or custom blends are injected into the fractures to create a continuous, permeable treatment zone.

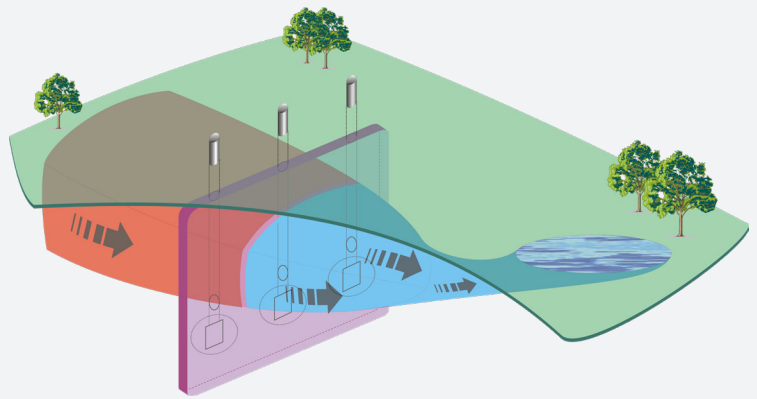
A food grade guar is the carrier fluid for the media. During injection, it's crosslinked to create a non-Newtonian fluid, ensuring suspension of the media.

## Verification & Monitoring

Cascade confirms barrier continuity and groundwater flow using advanced QA/QC methods to ensure predictable long-term performance.

Active resistivity measures fracture geometry by signal changes of the carrier fluid, using downhole receivers installed parallel to the PRB.

Hydraulic pulse testing uses existing wells to confirm the PRB has minimal impact on site hydrogeology through short duration fluid injections.



## Key Markets Served

- Environmental consultants
- Engineering firms
- Industrial and manufacturing facilities
- Chemical and petrochemical sites
- Oil and gas industry
- PFAS-impacted sites
- Government and municipal programs
- Utilities and infrastructure
- Brownfields and redevelopment
- PRP groups and trust organizations
- Pharmaceutical
- Public and private utilities
- Coal Combustion Residual Sites
- Municipal clean water supply companies

## CONTACT US

Your path to effective, low-impact groundwater remediation starts here. Cascade's team is ready to support feasibility evaluations, design development, and full-scale installation of our GeoSierra trenchless PRB technology.

Whether you're exploring options, need technical guidance, or want to discuss a specific site, we're here to help.



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# CASCADE

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