



***PHYTO-INTEGRATED*TM Remediation**

Expanding Phytoremediation

**- Combining Engineering,
Treatment Media, & Vegetation -**

**Edward Gatliff, Ph.D.
Applied Natural Sciences, Inc.**

**Mike Mueller
PeroxyChem**

**Frank Volkering, Ph.D.
Tauw bv**



New Perspective on Phytoremediation

- ▶ **Misconceptions about Phytoremediation of Groundwater**
 - Results are inconsistent
 - Has limited applications (shallow aquifers)
- ▶ **Engineered Phytoremediation**
 - **The *TreeWell*[®] Technology Solution** –
 - Confidently predict hydraulic effects
 - Assured remedial impact on **soluble** contaminants
 - Treat groundwater up to **30 meters deep (and more)**
 - Targets specific horizons over a wide range of conditions
 - Limits/Eliminates
 - phytotoxicity – via bioreactor effect
 - surface/rainwater confounding & irrigation needs

TreeWell Technology

- Basic Approach

**Borehole
excavated to the
horizon of interest**



**Root_Sleeve™ liner to be
placed in the hole**



**Root_Sleeve liner installed
after safety platform is
placed over the hole -
aeration & other tubing**



**Hole is backfilled with
topsoil & selected**



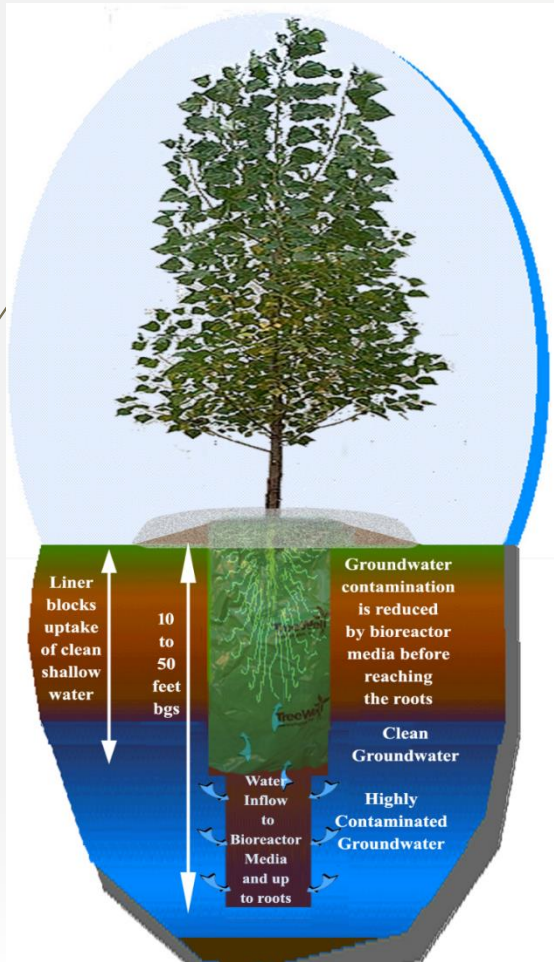
Trees are planted



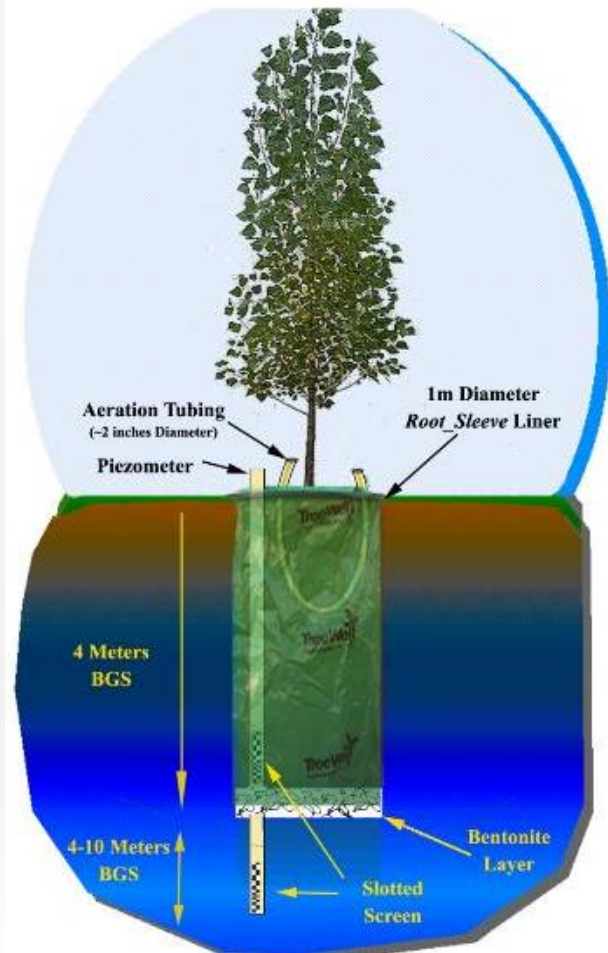
TreeWell Technology

- Design Options

Hydraulic and/or Bio-Barrier

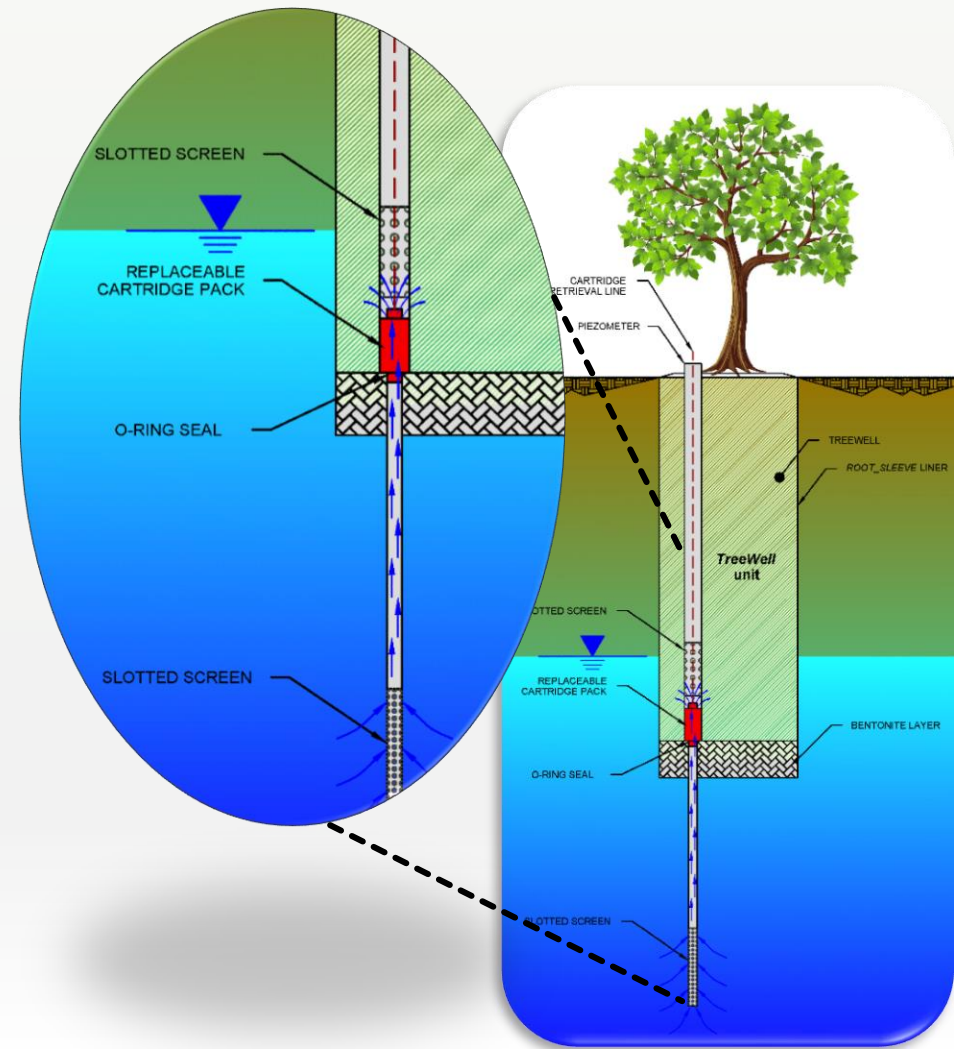


Deep Groundwater Target



Phyto-Integrated™ Remediation “Straw” system w/replaceable cartridge

- ▶ Tree removes GW in closed system creating a hydraulic head
- ▶ GW flows into the lower piezometer screen at targeted horizon
- ▶ GW flows up through amendment cartridge for:
 - treatment (**Proprietary ISCR Reagents** for CVOCs/ pesticides/oxidized metals, or
 - sorption (metals & compounds such as PFAS)
- ▶ Treated GW enters closed system through upper screen for use by tree



Request for Demonstration Sites

➤ Required characteristics:

- Groundwater plume that needs to be remediated
- Sufficient space and time for phytoremediation approach
 - Type 1: Groundwater contamination with **CVOCs, PFAS, Metals**
 - Type 2: Groundwater with deep contaminated layer (**including fractured bedrock strata**)

➤ Benefits

- Lower life-time cost
- Lower maintenance
- Passive/active system that improves with time
- **Green**, sustainable and effective technology

➤ Questions?