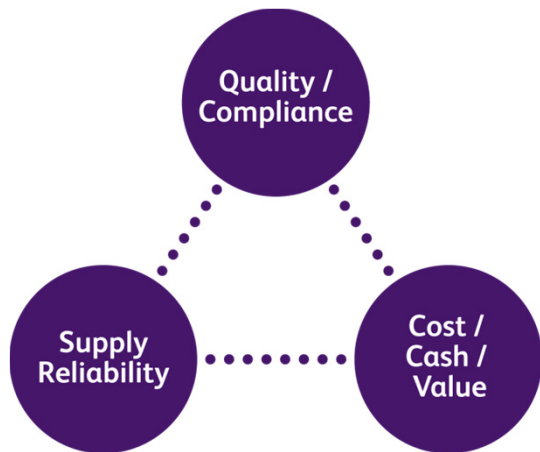




PHARMACIA & UPJOHN Tribal Lands and Environment Forum North Haven Site Visit

August 16, 2016



Compromise to quality and compliance is not an option

General Principles

- Plan with the end in mind
- Identify and engage Stakeholders early in the process
- ***Consider environmental footprint and sustainability in technology screening and remedy selection***
- To the extent possible preserve and enhance the assets of the property and create opportunities for beneficial reuse
- ***Seek opportunities to incorporate green remediation techniques in the design and implementation phase***
- Where appropriate, ensure future use is consistent with the site's location in the community and in nature

Pharmacia & Upjohn Company LLC Site

Pfizer GLOBAL SUPPLY



Pharmacia & Upjohn Company LLC Site

Pfizer GLOBAL SUPPLY

North Haven, CT

- 140 years of industrial uses
- Located adjacent to a river
- Onsite stockpiling of wastewater sludges
- Soil and groundwater are impacted



Site History

- Prior to 1830 – Undeveloped, largely wetlands
- 1830 to 1944 – Clay mining and brick manufacturing
- 1948 to 1962 – Carwin Chemical Company manufactured dyes, pigments & specialty chemicals
- 1962 – Upjohn acquired Carwin
- 1962 to 1993 – manufacture of specialty chemicals including dyes, pesticides and UV inhibitors
- 1991 to 1996 – manufacturing ceased, buildings demolished

- **Primary Causes**
 - Releases from aboveground / underground tank operations
 - Use of lagoons (former clay borrow pits) for wastewater treatment
 - Onsite stockpiling of wastewater treatment residuals/sludge
- **Resulting Site Conditions**
 - Broad range of chemical contamination in soil, groundwater and adjacent title flat sediments
 - Free phase organics (DNAPL) below groundwater in former production area
 - Impacted sludge and soil
 - Shallow groundwater impacts across the Site
 - Limited impacts below aquitard

Regulatory History

- 1989 RCRA 3013 Administrative Order (USEPA)
- 1994 RCRA 3008(h) Admin Order (USEPA)
- 1995 Connecticut Transfer Act (P&U Merger)
- 1995 Citizen Advisory Panel (First Selectman)
- 1999 RCRA CA-725 and CA-750 EI's approved (USEPA)
- 2009 RCRA 3013 Admin Order is terminated
- 2010 Remedy Decision by USEPA; CTDEEP concurred
- 2011 RCRA 3008(h) Order Updated (USEPA)

Sustainability & Greener Remediation Strategies

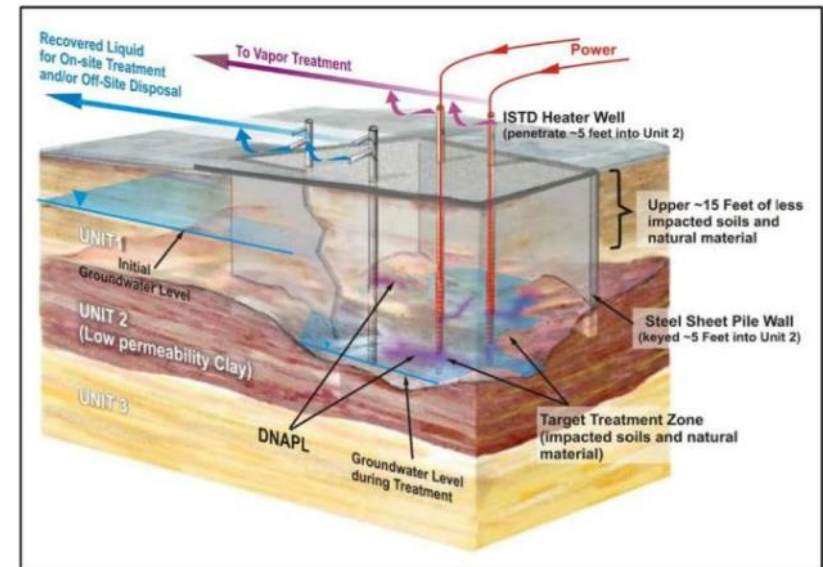


- Through life-cycle analysis and green remediation, conserve resources, reduce pollutants, and achieve cleanup goals
 - Reduce air emissions and GHG emissions
 - Minimize waste generation; minimize offsite treatment and disposal
 - Use water to replenish onsite wetlands
 - Conserve energy through OM&M optimization
 - Consider remedy component substitutions to lower carbon footprint
 - Enhance onsite natural resources (or prevent further degradation)
 - Consider in-situ remedies over ex-situ remedies that consume less energy and pose less exposure to contaminants

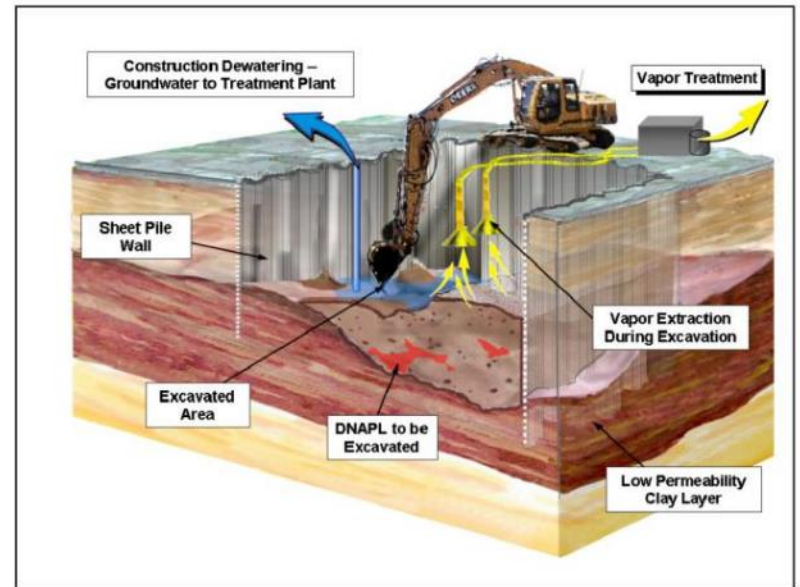
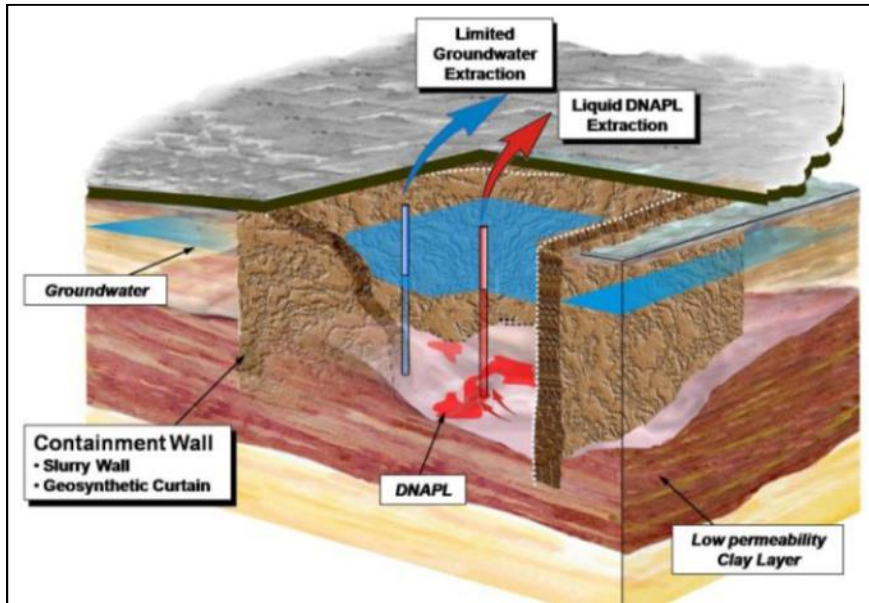
Sustainability in the Feasibility Study Phase

Considered sustainability in the feasibility study and remedy selection process

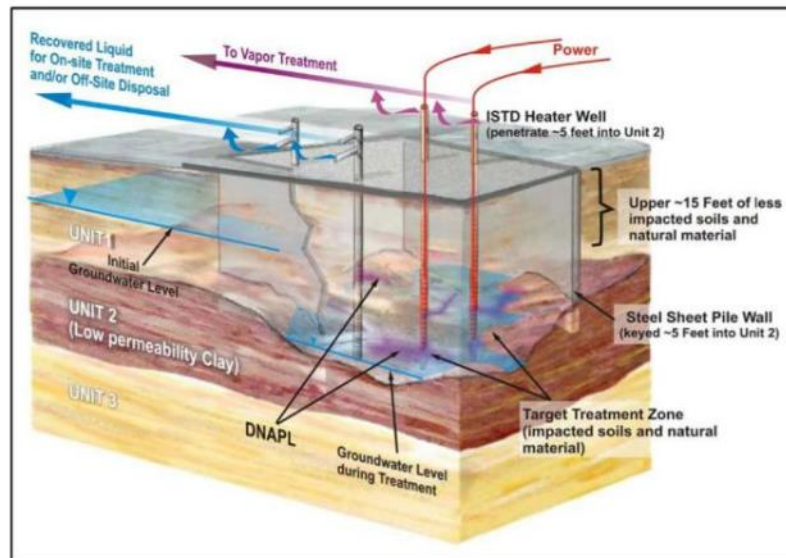
- Overall chemical mass removal
- Nuisances to community
- Remediation worker safety
- Compare carbon footprint of technologies and long-term O&M
- Use resources efficiently with focus on sustainability
- Beneficial reuse of Site
- Public support for remedy



Three Alternatives to Treating DNAPL



CMA 3: Liquid Extraction



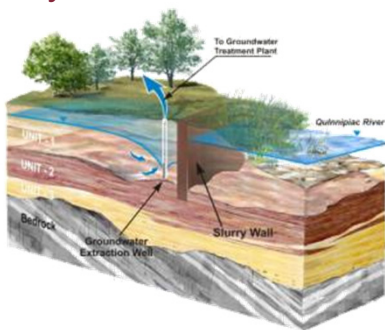
CMA 4: In-Situ Thermal Remediation

CMA 5: Excavation and Disposal

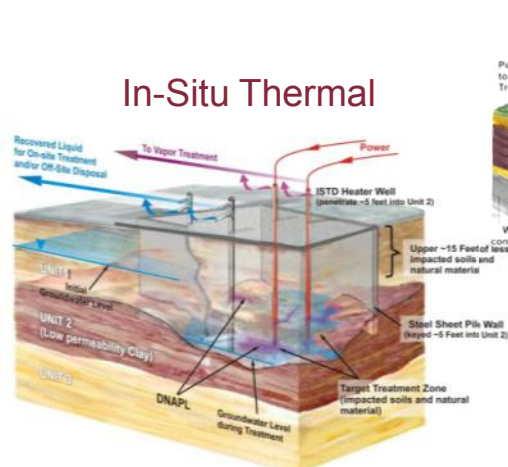
CMS Alt 4 Selected Remedy

- CMS Alt 3 had the lowest total CO₂ emissions
- CMS Alt 4 had slightly higher total CO₂ emissions than CMS Alt 3, but achieved a greater reduction of toxicity, mobility and volume
- CMS Alt 5 had significantly higher total CO₂ emissions without any substantial benefits and more worker risks

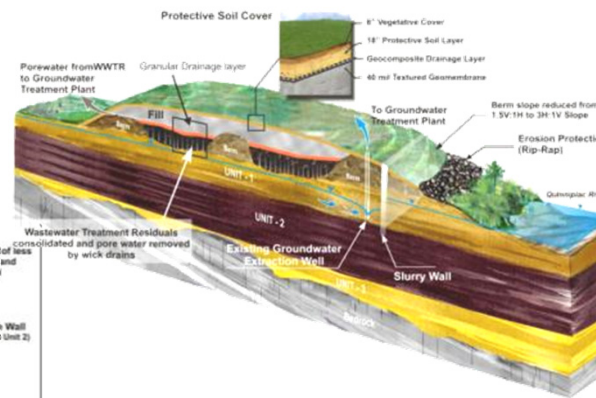
Hydraulic Barrier Wall



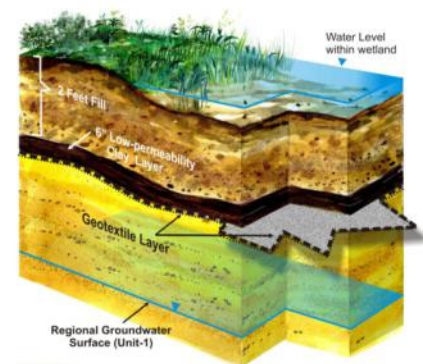
In-Situ Thermal



Consolidation and Capping



Constructed Wetlands



Corrective Measures Study (CMS) Alternative Evaluation



Remedy evaluation

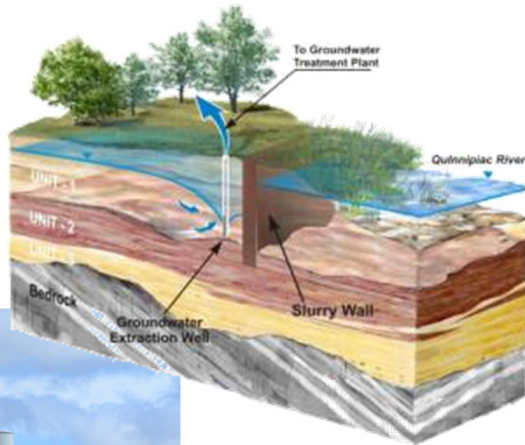
- Evaluated technologies and Site-wide alternatives
- Considered green remediation, ecological revitalization, minimizing community impacts and future reuse
- Stakeholder input and carbon foot print evaluated

CMS Alternative 4 Selected

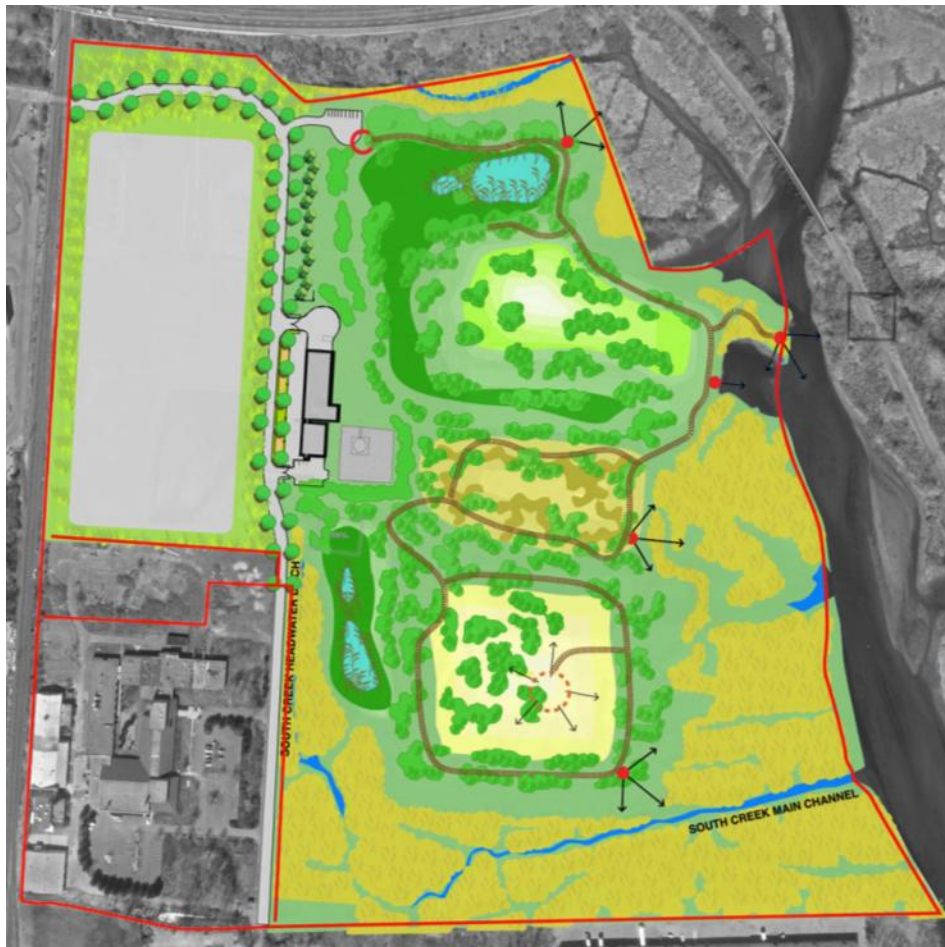
- High chemical mass removal
- Less impacts to community
- Greater beneficial reuse of Site
- Lower carbon footprint compared to alternatives with similar mass removal
- Reduced long-term groundwater pumping (and carbon footprint)
- Strong public support for Site-wide remedy

Additional BMPs during remedy implementation

- Managed drill cuttings, sediment dredge spoils, and excess soil from grading under on-site caps, rather than off-site disposal
- Used ground granulated blast furnace slag – a repurposed manufacturing byproduct - for hydraulic barrier wall construction; avoiding the use of bentonite, a natural resource
- The subsurface cut-off wall component reduced long-term groundwater extraction rates by more than 50%
- Using local labor and labs when possible to reduce daily transportation



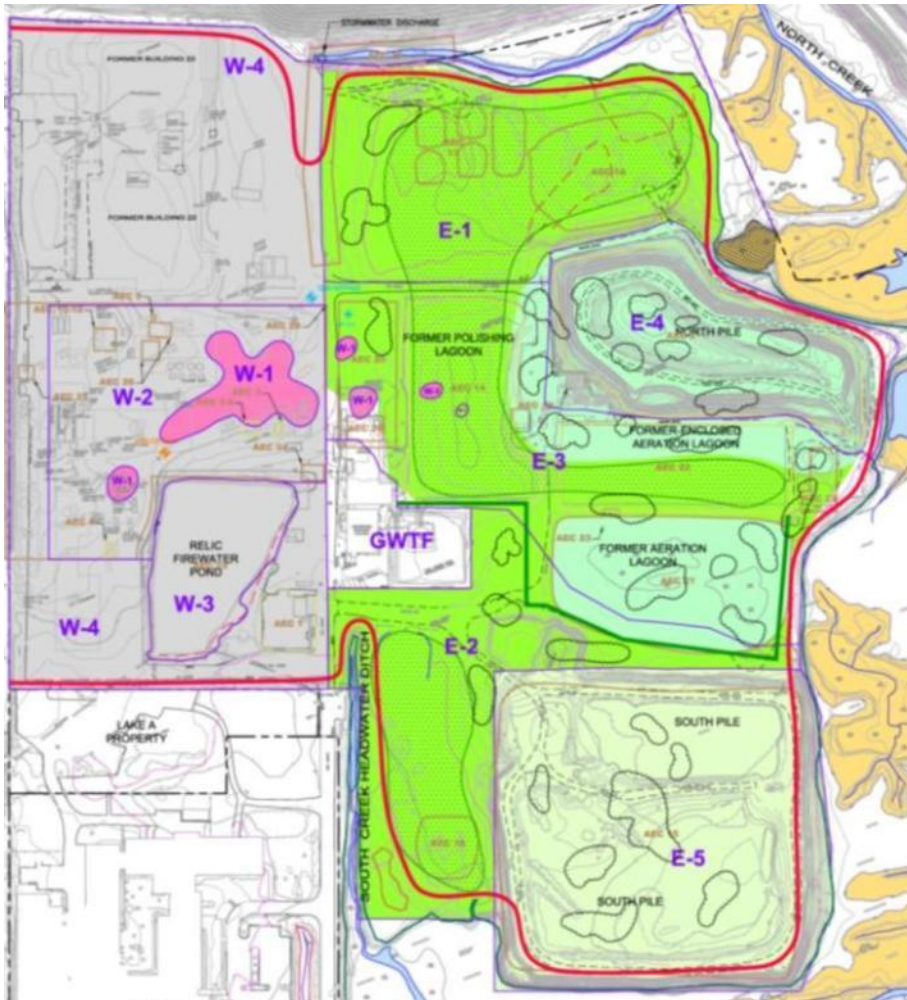
Economic Green BMPs



Economic BMPs

- Local buying commitment
- Local job creation
- Market based and stakeholder driven re-use planning process
- Redevelopment opportunities

Key Components of EPA Approved Remediation



- Groundwater control and treatment, long-term operations

East Side Components

- Sediment removals, tidal wetlands mitigation
- Eastern side consolidation, protective barriers, ecological enhancements

West Side Components

- Thermal desorption to treat the most impacted area
- Western side protective barrier



Initial upgrades to existing Groundwater Treatment Plant

- COMPLETE (2012-2013)

Perimeter Hydraulic Barrier Wall

- COMPLETE (2013)

Expansion of Groundwater Extraction System

- COMPLETE

Final retrofit of existing GWT Plant

- 2016



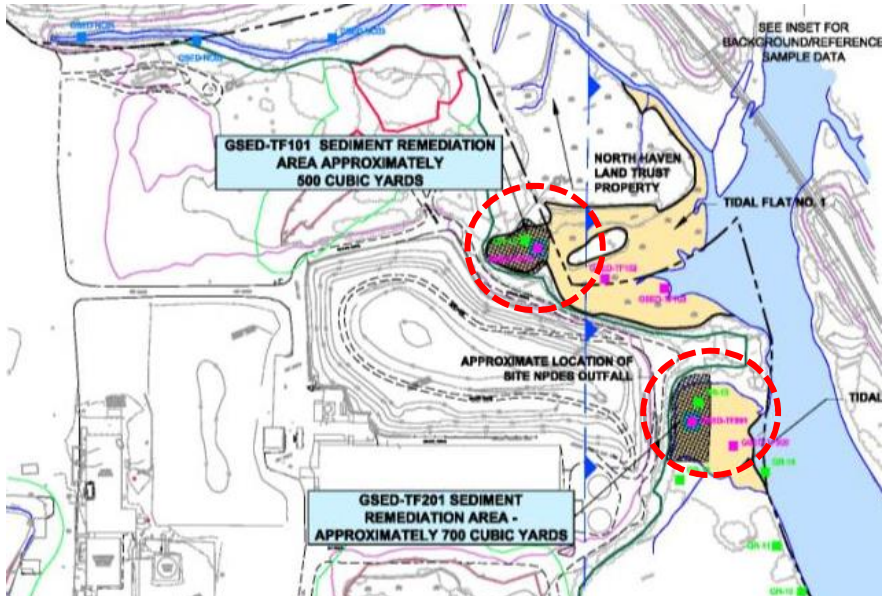
Sediment Removals

Sediment Removals

- COMPLETE (2013-2014)

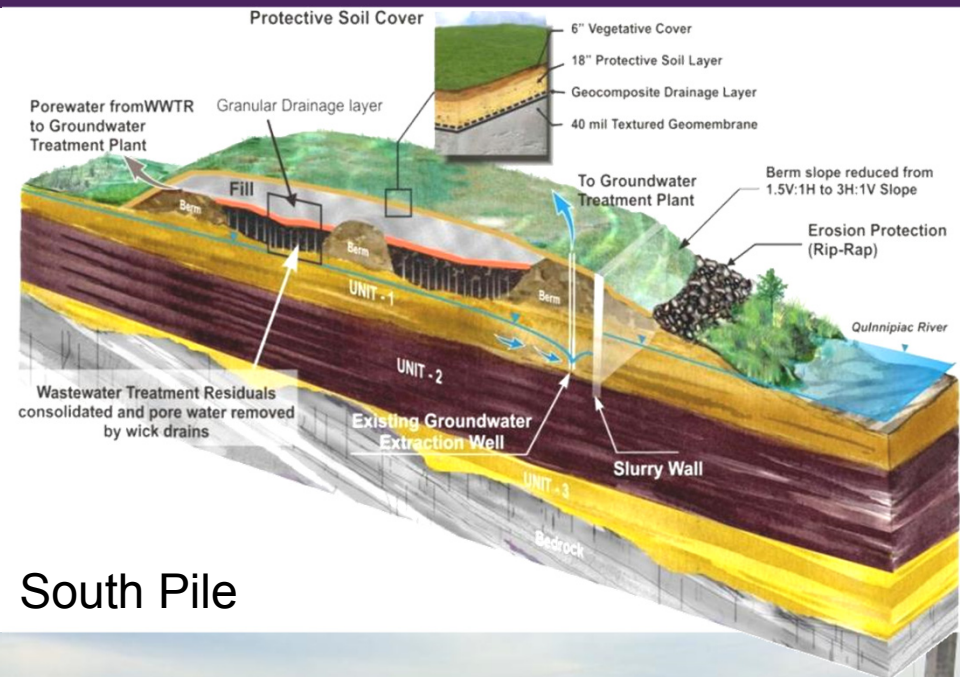
Tidal Wetland Mitigation

- 2014 - 2015



East Side Consolidation, Stabilization, Covers

- Consolidation of residuals
- Low permeability cover system
- Ecological enhancements (native upland meadow and shrubs)
 - **COMPLETE**



Eastern FAL



East Side Consolidation, Stabilization, Covers



- Reuse of onsite soil for grading below caps thus avoiding unnecessary import of offsite clean fill
- New cover system completed
- Final cover and planting



North Pile



East Side Ecological Restoration

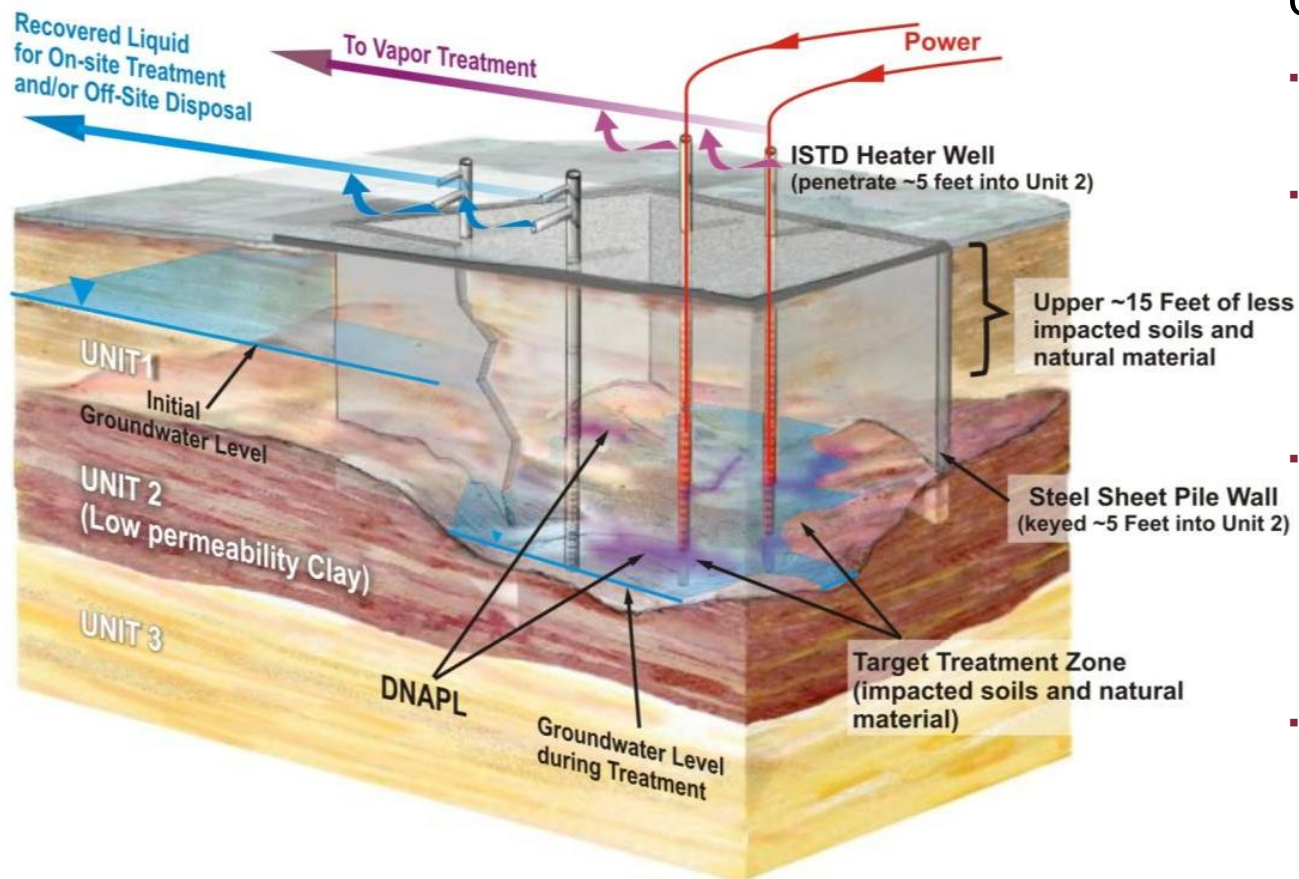
Pfizer GLOBAL SUPPLY



- Ecological restoration and Tidal Wetland Mitigation
- Creation of 6+ acres of new freshwater wetland habitat
- 2014/2015 - planting and subsequent monitoring / maintenance



DNAPL Remediation



In-Situ thermal desorption

- High energy use balanced by high mass removal
- Minimize worker/community exposure of sub-surface soil and groundwater impacts
- Aggressive remediation of NAPL impacts within in a reasonable timeframe (6 months of treatment operation)
- Ability to remediate a wide range of Chemicals of Concern at high concentrations (VOC, SVOC, chlorinated compounds, PCB)

Community Outreach Approach



- 2003 - Pfizer Inc acquired Pharmacia Corporation, parent company of Pharmacia & Upjohn Company LLC
- Share Future Vision Alternatives with Stakeholders (business, recreational, educational, environmental, regulatory & local government) – “Begin with the End in Mind”
- Demonstrate that the preferred remedy is compatible with future land use
- Creation of video for consistent presentation
- Promote Interactive Meetings, Fact Sheets, Newspaper Articles, Open Houses, and Website (www.upjohnnorthhaven.com)

EPA Recognition of Achievements







United States Environmental Protection Agency

Technology Innovation and Field Services Division

Contaminated Site
Clean-Up Information

Technologies

Contaminants

Issues

Strategies & Initiatives

Vendors & Developers

Training & Events

Additional Resources

[CLU-IN](#) | [Strategies & Initiatives](#) | [Green Remediation Focus](#) | [Profiles of Green Remediation](#) | [Pharmacia & Upjohn Company LLC Site](#)

Green Remediation Focus

Pharmacia & Upjohn Company LLC Site, North Haven, Connecticut
RCRA Corrective Action

Cleanup Objectives: Provide long-term protection of human health and the environment by remediating soil, sediment, and groundwater impacted by past releases of manufacturing wastes, wastewater, and wastewater treatment residuals, including contaminants such as volatile organic compounds, polychlorinated biphenyls, and lead. The remedy for this 78-acre site, located along the Quinnipiac River in south central Connecticut, involves upgrade of the existing groundwater extraction system (GWES), installation of a perimeter groundwater hydraulic barrier wall, excavation and onsite consolidation of impacted soils and sediments, construction of low permeability and protective soil barrier cover systems, in situ thermal remediation (ISTR) for dense non-aqueous phase liquids (DNAPL) removal, extensive ecological restoration, and preparation of a portion of the site for future commercial/light industrial redevelopment opportunities.

Green Remediation Strategy: The strategy focuses on: (1) conducting a quantitative analysis of the carbon footprint of remedial activities, and identifying opportunities to reduce the footprint, (2) incorporating green remediation best management practices such as re-using onsite soil, sediment, and debris generated during remedy construction, (3) revitalizing the site's ecological systems in a manner that complements the Quinnipiac River ecosystem, and (4) integrating the community's vision for future use. Key studies and findings affecting the strategy include:

IMAGE GALLERY

Click on images below for details



Aerial View of Site



Results of Carbon Footprint Analysis



Staying Connected

+ f t in e

t f in









CT DEEP GreenCircle Sustainability Award GLOBAL SUPPLY

- Project recognized for its sustainability and green remediation initiatives



- One of 59 nominees
- One of 15 award winners
- One of 4 businesses recognized

USEPA Citizen Award

Citizens' Advisory Panel

- David Monz, Chairman
 - Annette Gattilia*
 - Rico Gattilia
 - Miriam Brody
 - Hugh Davis
 - Joelle Innocenti
 - Tom Roberts
-
- Annette worked tirelessly from late 1970's until her recent death (April 28, 2014) to effect the Site remedy.



QUESTIONS?

