

# DESIGN OF EVAPOTRANSPIRATION COVER SYSTEMS IN HUMID CLIMATES



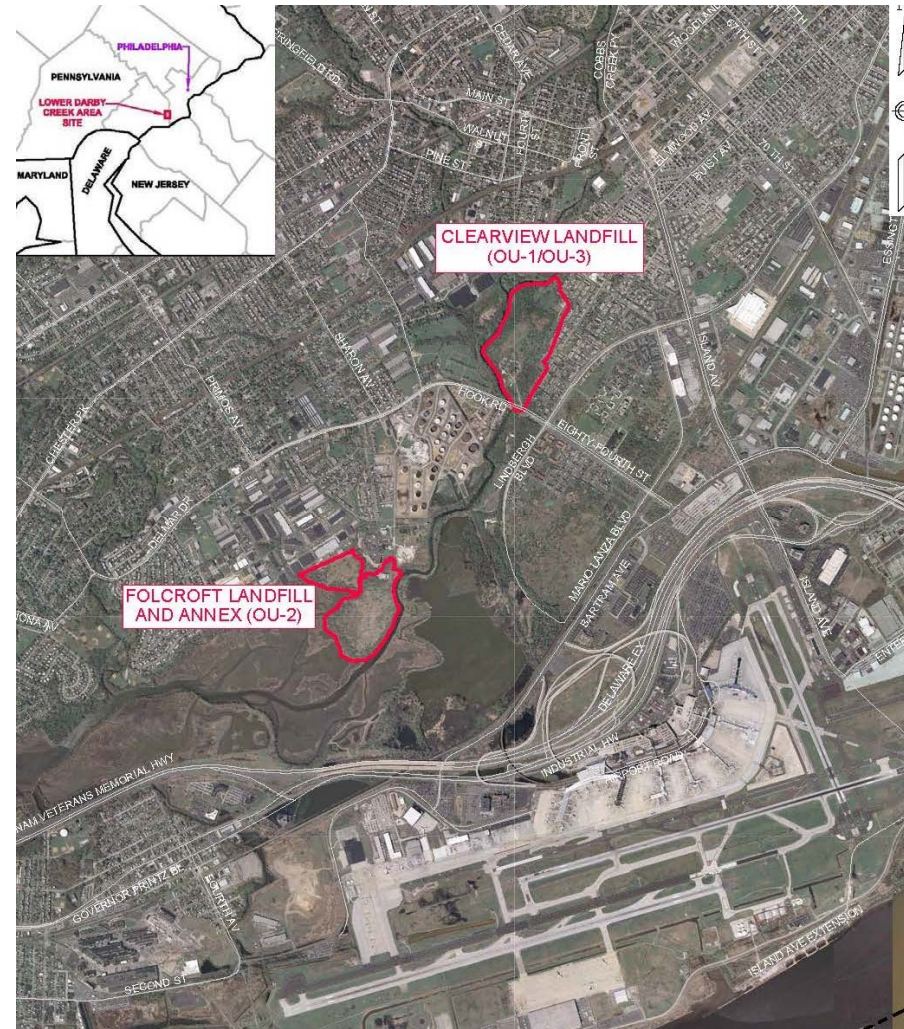
Junchul (JC) Kim, Ph.D., PE



March 29, 31 and April 1, 2021

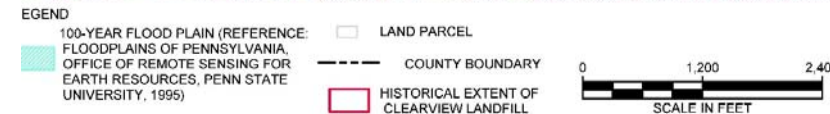
# SITE BACKGROUND

- Lower Darby Creek Area (LDCA) Site
- Placed in the National Priorities List (NPL) in June 2001
- Consists of two separate landfills and three operable units:
  - ❑ Operable Unit 1 (OU-1): Clearview Landfill – soil and waste
  - ❑ Operable Unit 2: Folcroft Landfill and Annex
  - ❑ Operable Unit 3: Clearview Landfill – groundwater
  - ❑ Operable Unit 4: Aquatic Environments
- EPA issued OU-1 Record of Decision (ROD) in September 2014
- EPA completed the OU-1 RD in December 2018
- EPA started construction of the OU-1 remedy in March 2019

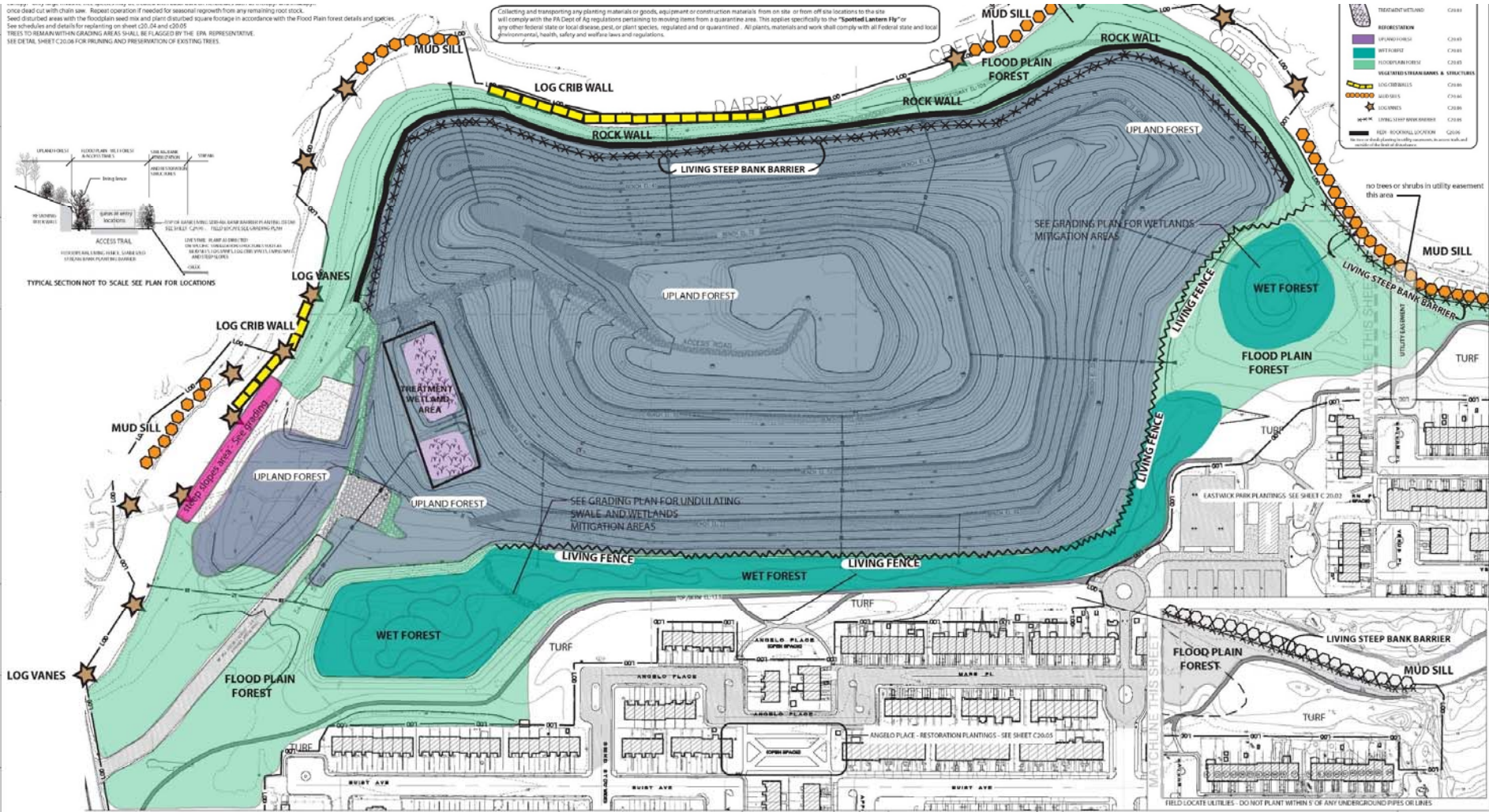


# CLEARVIEW LANDFILL

- Privately owned and operated without a permit from 1950s to 1970s by the Clearview Land Development Corporation (CLDC)
- Landfilling operations began in Delaware County and expanded to Philadelphia County
- Covered approximately 65 acres when closed in 1973
- Landfill footprint includes the landfill, the Eastwick Recreational Park (City Park), and the Eastwick neighborhood
- Surrounded by 100-year floodplain
- Adjacent to tidal creeks



# OU-1 REMEDY SNAPSHOT



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# STAKEHOLDER COLLABORATION

STAKEHOLDER	RESPONSIBILITY/CONSULTATION
EPA Region 3 Biological Technical Assistance Group (BTAG)	ET Cover Design, Planting/Harvesting, Research Nursery
U.S. ARMY CORPS OF ENGINEERS (USACE)	On-site Business Relocation, Access and Easement
U.S. Fish and Wildlife Service (USFWS)	Research Nursery, In-Stream Stabilization Features Design
Pennsylvania Game Commission (PGC)	Research Nursery
EPA's Office of Solid Waste and Emergency Response (OSWER)	Incremental Sampling Methodology (ISM), Statistical Data Analyses, PAH Fingerprint

# COMMUNITY INVOLVEMENT

- Develop Community Involvement Plan (CIP)
- Develop Community Health and Safety Plan (CHASP)
- Conduct periodic community meetings with Community Advisory Group (CAG) and Technical Assistance Grant (TAG) group, and community involvement and outreach activities
- Maintain community notification system

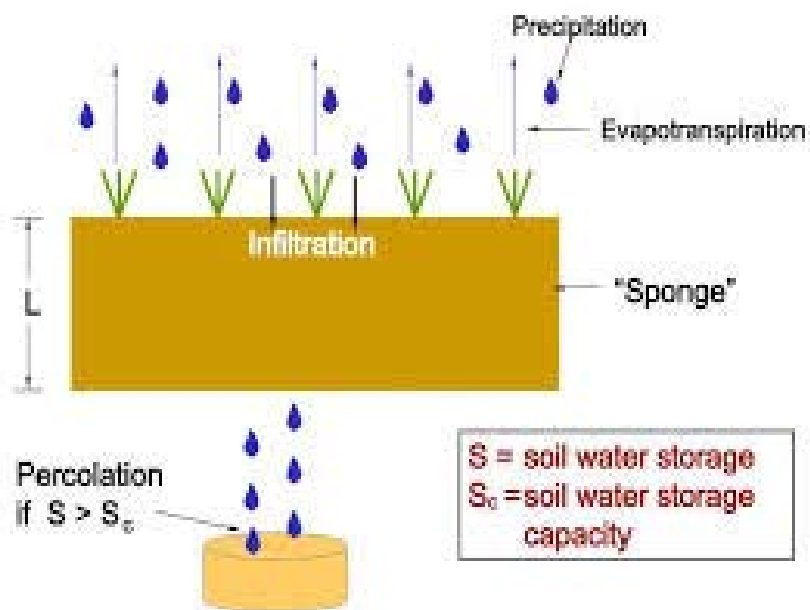


# GENERAL COVER DESIGN CRITERIA

- *Demonstration of Equivalent Standard of Performance* under CERCLA §121(d)(4)(D), 42 U.S.C. § 9621(d)(4)(D) - Permeability  $< 1.0 \times 10^{-5}$  cm/sec (RCRA Subtitle D Final Cover)
- No significant grading or disturbance
- Grading - Slope  $< 3H:1V$
- FEMA compliance: no filling within 100-year floodplain

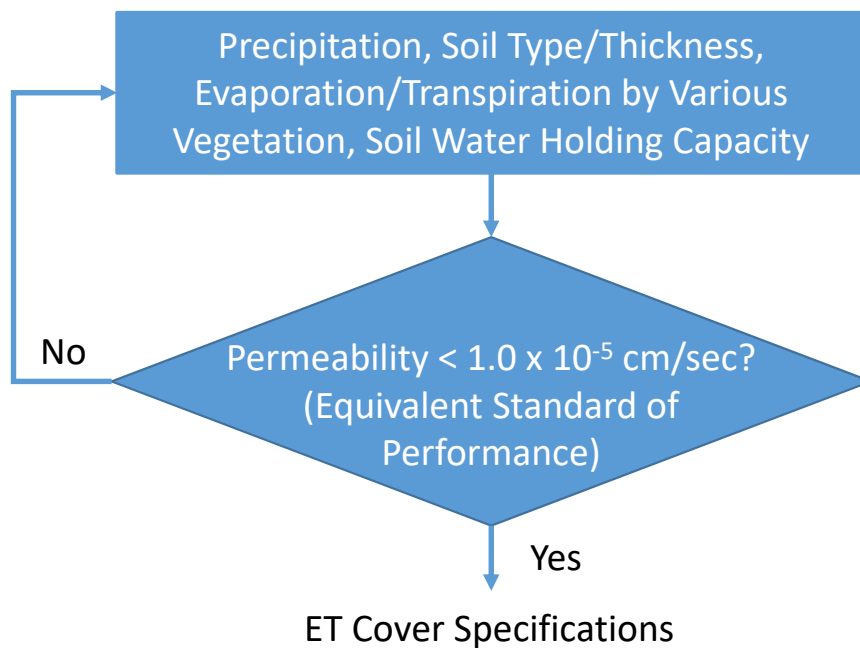
# PRINCIPLE OF ET COVER - WATER BALANCE

## How Does ET Cover Work?



(from University of Texas at Arlington)

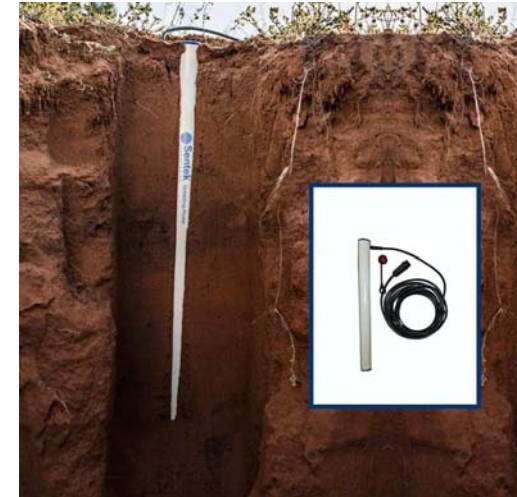
## Water Balance Model (Geostudio® VADOSE/W™)





# ET COVER PERFORMANCE MONITORING

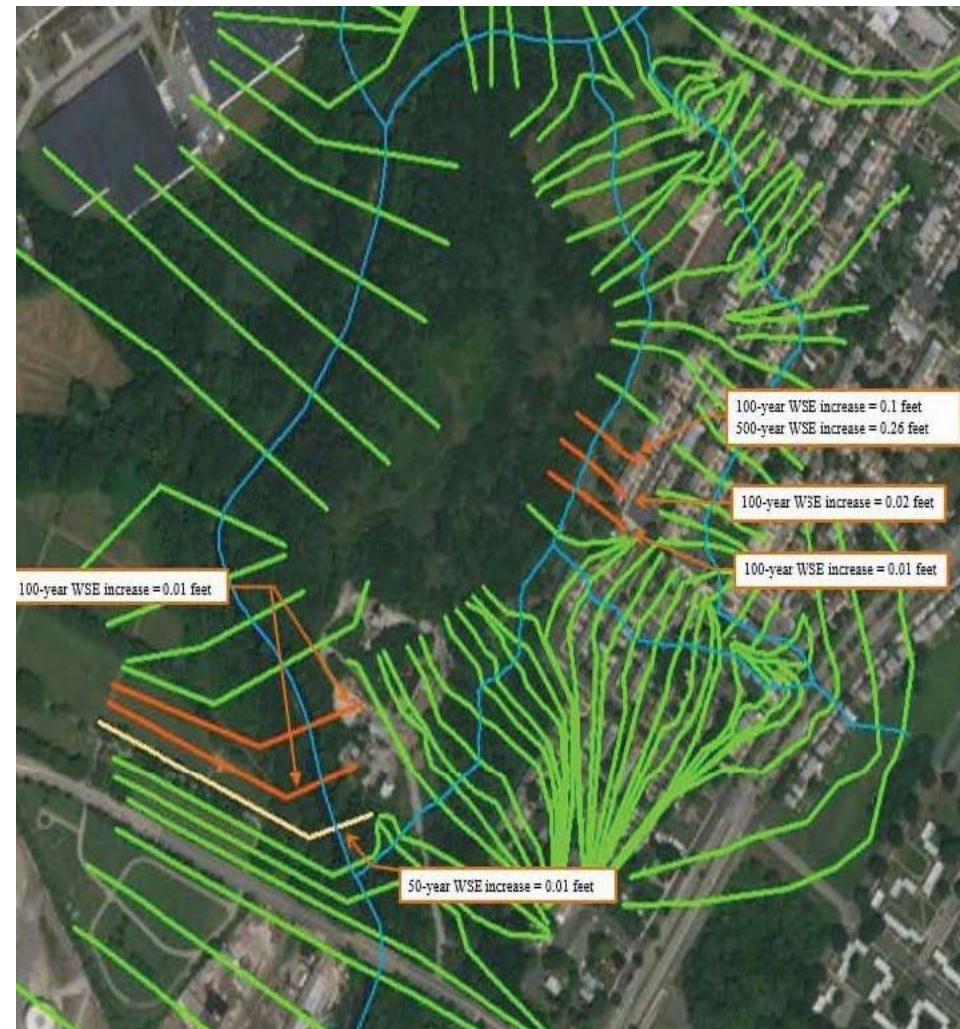
- Operational and functional (O&F) criteria
  - ❑ Percent (%) areal coverage with native and/or planted woody species using Google™ aerials or drone
  - ❑ Leaf area index (LAI) and canopy closure using LI-COR® LAI-2200C Plant Canopy Analyzer
  - ❑ Soil volumetric water content using time domain reflectometry (TDR) probe
- Field survey for survival rate and desirable plant community



# FLOOD STUDY

- The Clearview Landfill is surrounded by the 100-year floodplain and adjacent to a floodway in the creek.
- The minimum requirement from the Federal Emergency Management Agency (FEMA) is to demonstrate that the RD and RA will not create adverse conditions in or around the floodplain or floodway during storm events.
- Hydraulic model (HEC-RAS) for pre- and post-construction conditions at 10-, 50-, 100, 500-year\* storm events

(Potential impact due to sea level rise per an advisory for federal actions per the guidelines for Executive Orders 11988 and 13690)



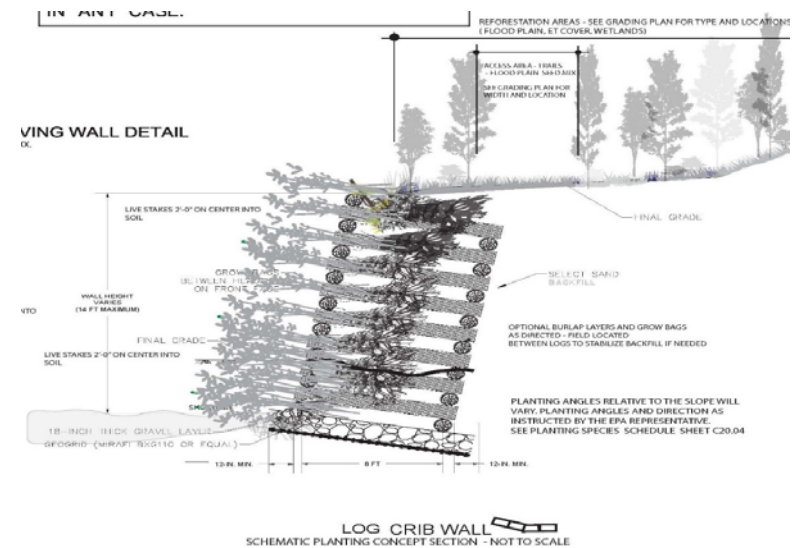
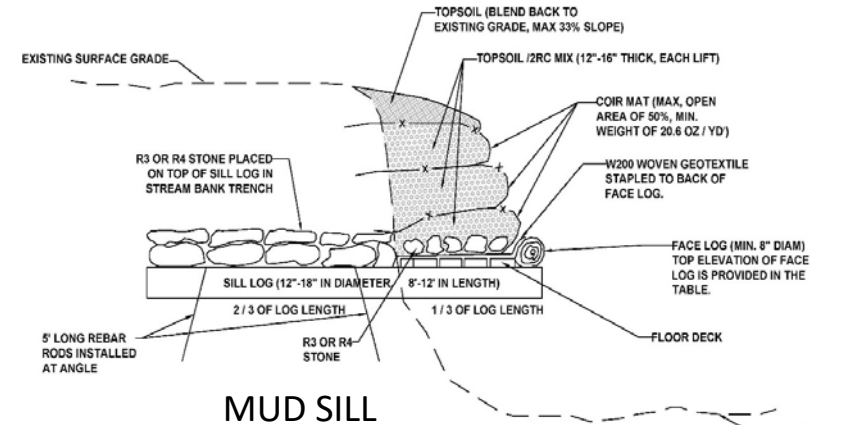
# RESEARCH NURSERIES

- Two research nurseries were established during the RD (one on-site and another off-site)
- Pennsylvania Game Commission (PGC) offered the state game land in New Tripoli, PA
- Technical support from EPA R3 Biological technical Assistance Group (BTAG) and U.S. Fish and Wildlife Service (FWS)



# STREAM RESTORATION

- Collaboration with U.S. Fish and Wildlife Service (FWS) and EPA Biological Technical Assistance Group (BTAG)
- Greener cleanups and sustainability considerations for stream stabilization and restoration

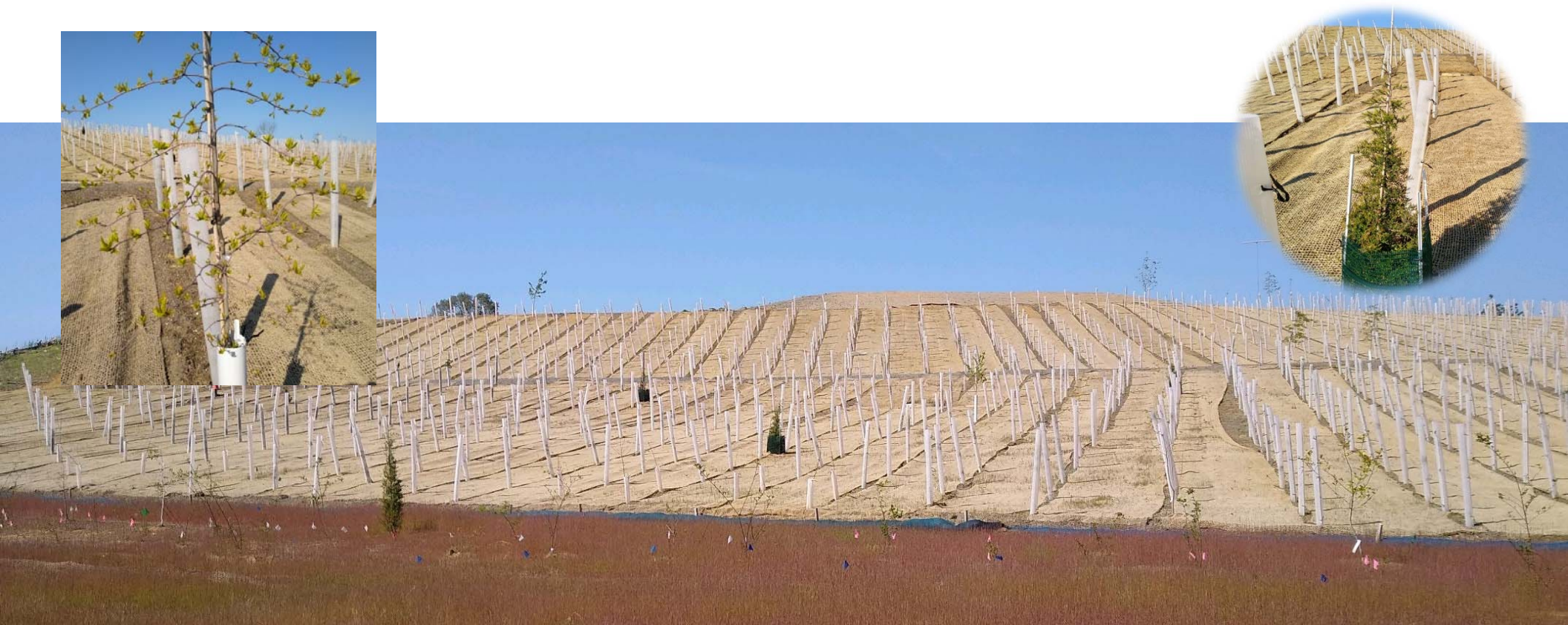


# OU-1 REMEDIAL ACTION IN PROGRESS



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# ET COVER CONSTRUCTION



# RESIDENTIAL YARD REMOVAL

- EPA commenced residential yard removal action in August 2017 and continued under OU-1 RA
- Remove surface soil (top 2 feet) exceeding cleanup goals of site contaminants of concern
- 157 homes and 2 open spaces were remediated to date



# STREAM RESTORATION



MUD SILL



CRIB WALL



# QUESTIONS?

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