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Charleston, SC
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www.HaywardBaker.com



Goal: Zero Injuries

***All accidents
are preventable***

***Job site Daily Task Analysis
Meeting to review safety issues
related to the day's tasks.***



***No repeat
occurrences***

***All Incidents investigated,
corrective actions implemented
and shared in the Weekly Safety
Update for awareness.***



***Safety
Standards***

***Safety Standards
Document***



Wick Drains for Ground Improvement in Ports & Harbors

- ◆ Introduction
- ◆ Technology
- ◆ Installation
- ◆ Project Examples



Cost Effective Ground Improvement for Ports:

- ◆ Wick drains are a cost-effective ground improvement option
- ◆ Suited to a variety of the below grade and below water soil issues
- ◆ Alternative to piles, stone columns, grouting, etc.
- ◆ Utilized to consolidate dredged material
- ◆ Installed in native, under consolidated material such as bay mud, organics, and peat

Cost Effective Ground Improvement for Ports:

- ◆ Wick drains accelerate consolidation, and
- ◆ Provide a stable building platform for:
 - ◆ Future construction of port facilities
 - ◆ Redevelopment of facilities that are no longer utilized



Ground Improvement for Key Profit Centers for Port Facilities

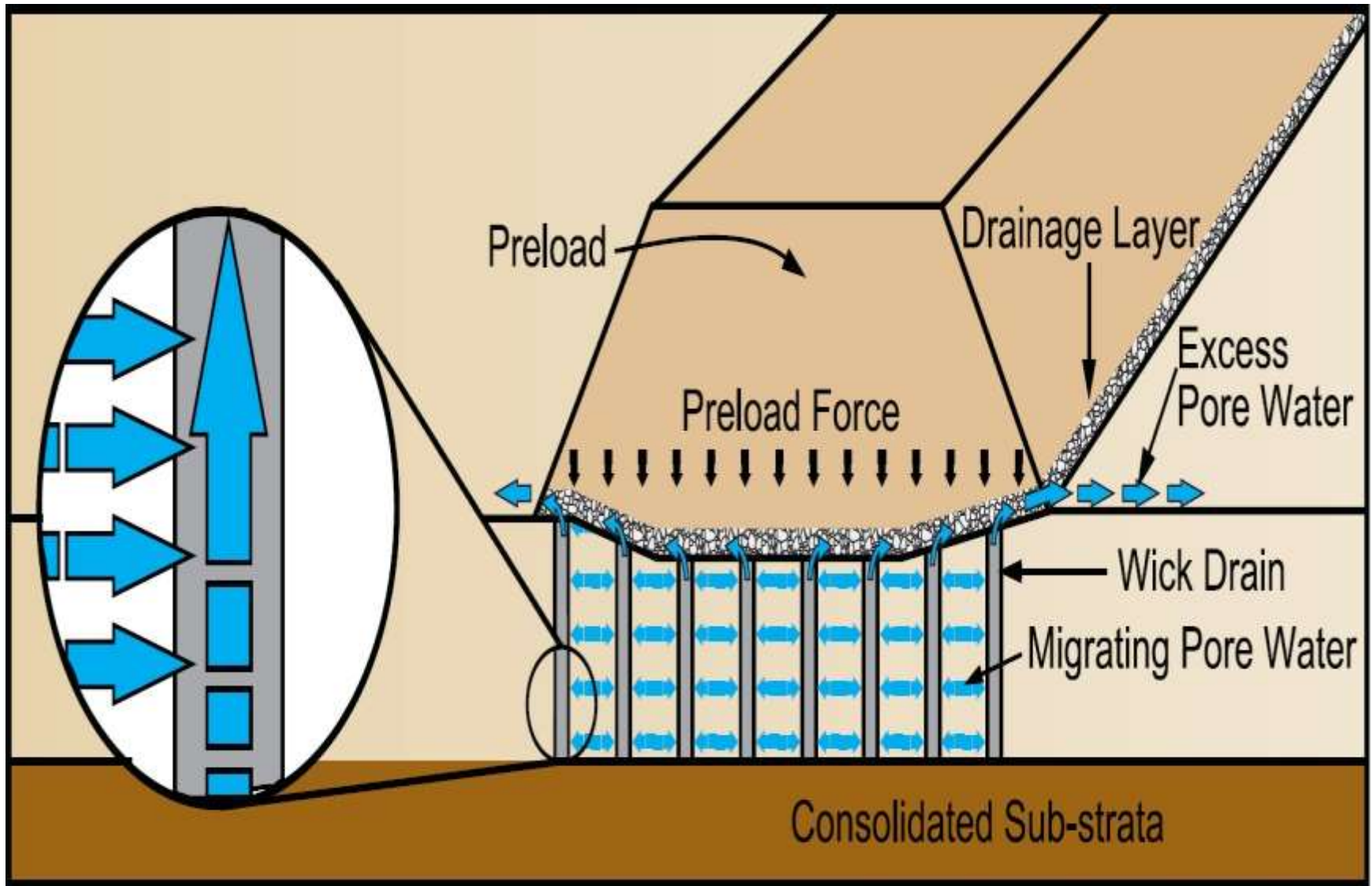
- ◆ Tanks
- ◆ Dry bulk storage
- ◆ Berths for post-Panamax ships
- ◆ Port access roads
- ◆ Transportation infrastructure

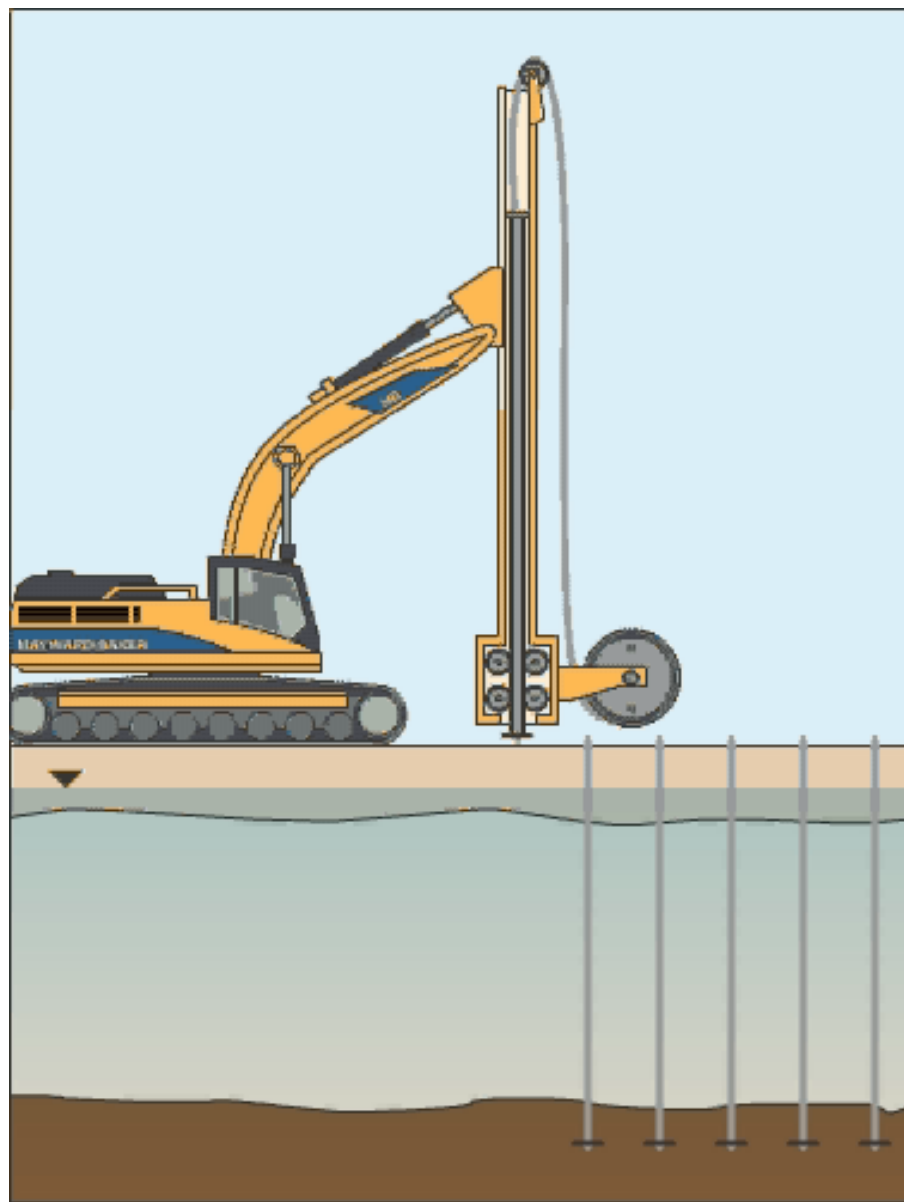


Vertical Prefabricated Drain Technology



PREFABRICATED VERTICAL DRAINS (PVD or Wick Drains)





The Product:

- ◆ Wick Drains are a plastic band shaped conduit
- ◆ Approximately 4 inches wide by ¼ inch thick
- ◆ Composed of a poly strip with drainage channels wrapped in a filter fabric



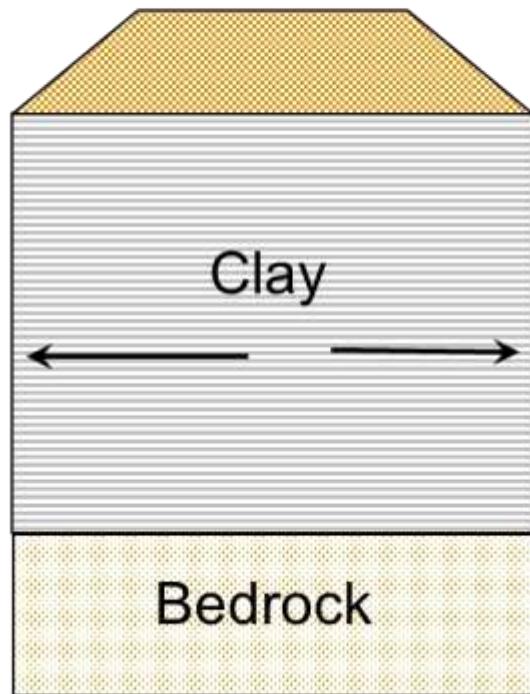
Wick Drains, a.k.a.

- ◆ Prefabricated Vertical Drains (PV drains, PVD's)
- ◆ Strip Drains
- ◆ Synthetic drains
- ◆ Band Drains
- ◆ Wicks

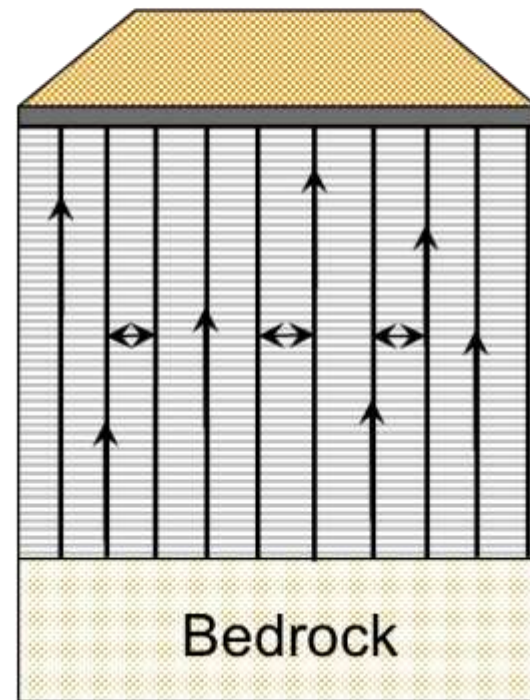


The General Idea

Without Drains

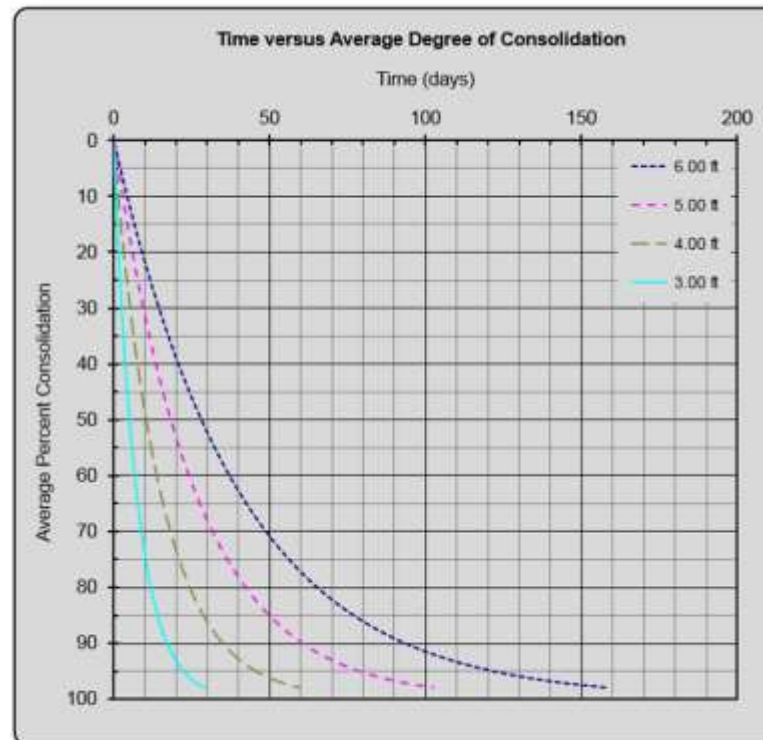


With Drains



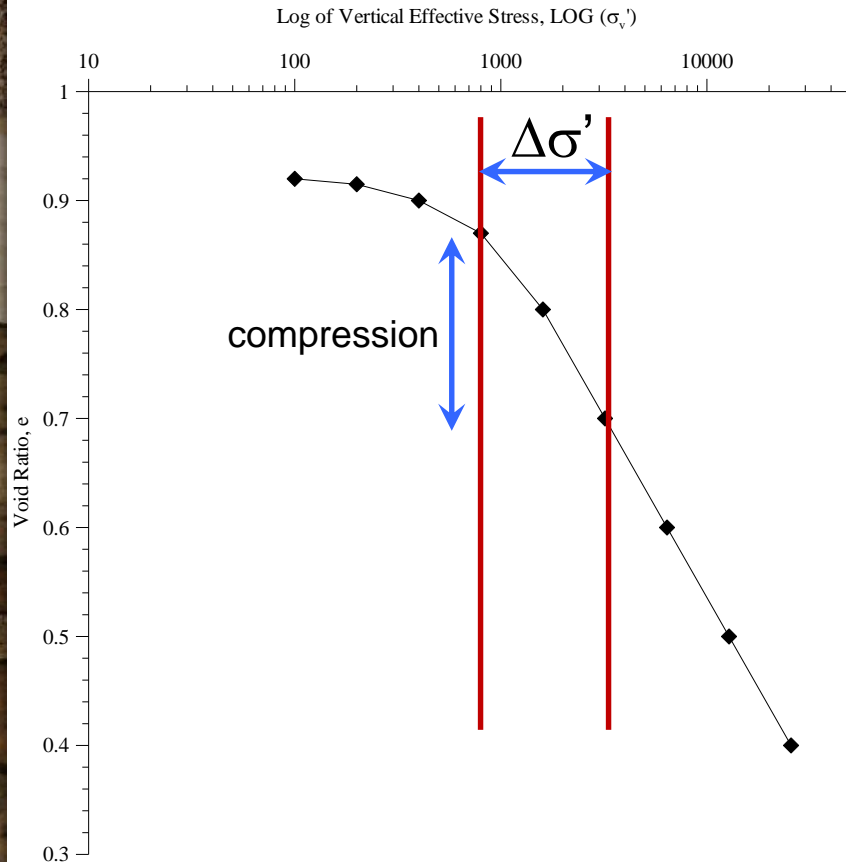
Radial Consolidation Theory

- ◆ Barron-Hansbo equation
- ◆ Dissipation Curves

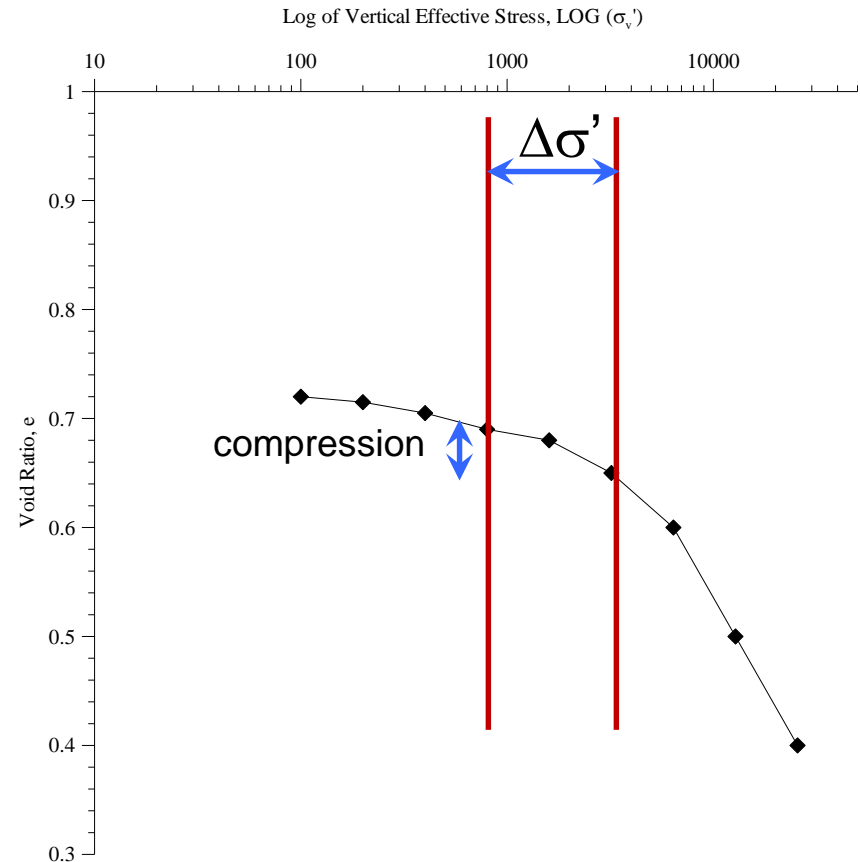


Preloading with wick drains

During preloading



During actual loading



Vertical Wick Drain Installation Process



Installation Methods

- ◆ Static Push
- ◆ Vibratory Energy
- ◆ Preparatory drilling
 - ◆ Data Acquisition









Vibratory Energy



Pre-augering or Pre-drilling

Predrill requirement:







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Geotechnical Construction



Data Acquisition- for QA & Quantity Tracking

- ◆ Drain #
- ◆ Time
- ◆ Penetration Depth
- ◆ Penetration resistance
- ◆ Location



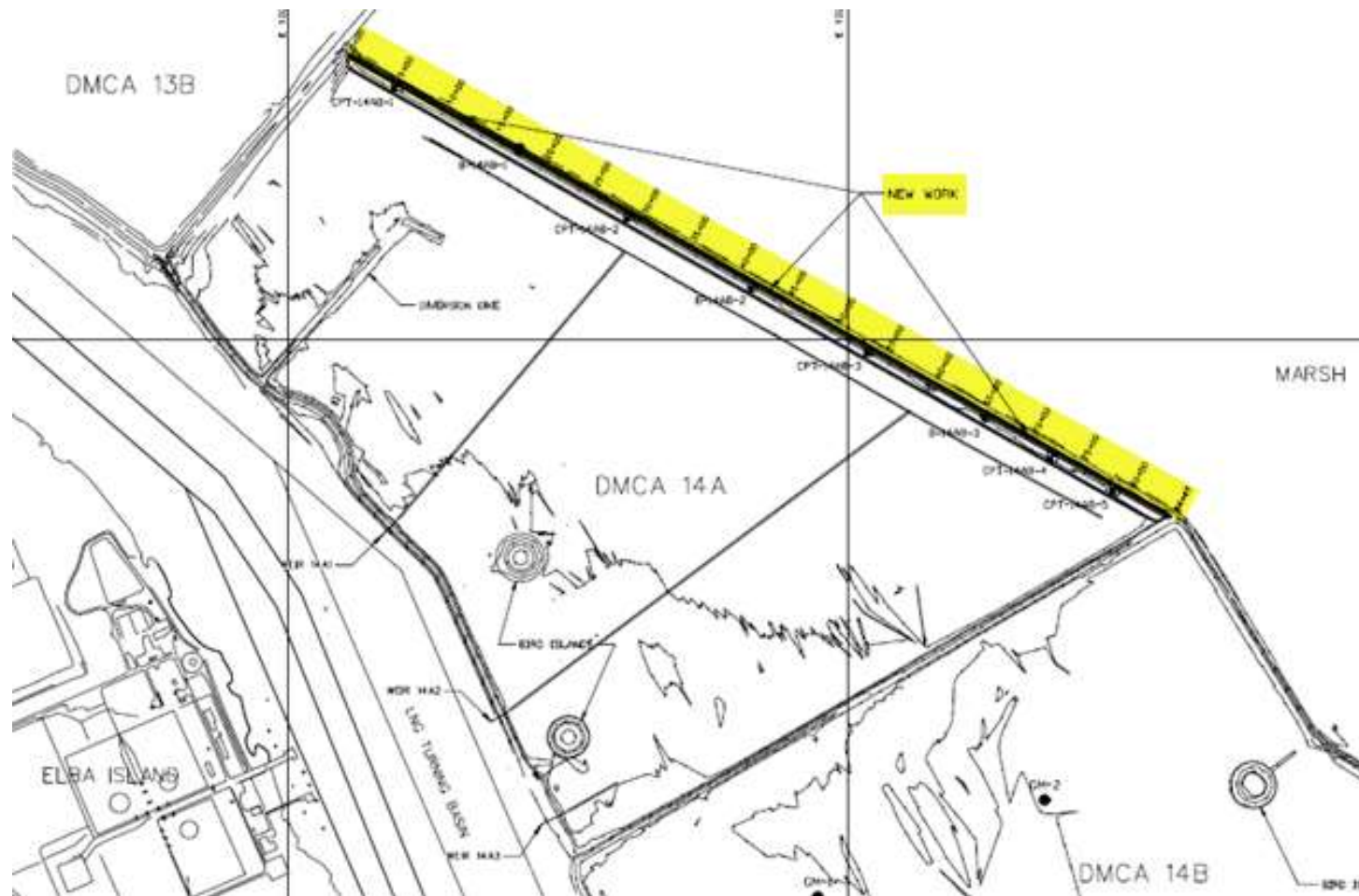
PORT SPECIFIC APPLICATIONS IN VERTICAL WICK DRAIN TECHNOLOGY

Ground Improvement for Dredged Material Containment

- ◆ Facilities are running out of capacity
- ◆ Dike raisings are commonly performed
- ◆ DM can be built on with GI treatment
- ◆ Wick drains are frequently used in this application

Savannah Army Corps, DMCA, SC





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Geotechnical Construction



Cox Creek DMCF, Baltimore, MD





Infilling of New Bulkheads

- ◆ New port berth facilities are constructed by walling off upland or aqueous area
- ◆ Wick drain installation can improve underlying strata prior to berth construction
- ◆ Reduces future settlement
- ◆ Strengthens soil within the system

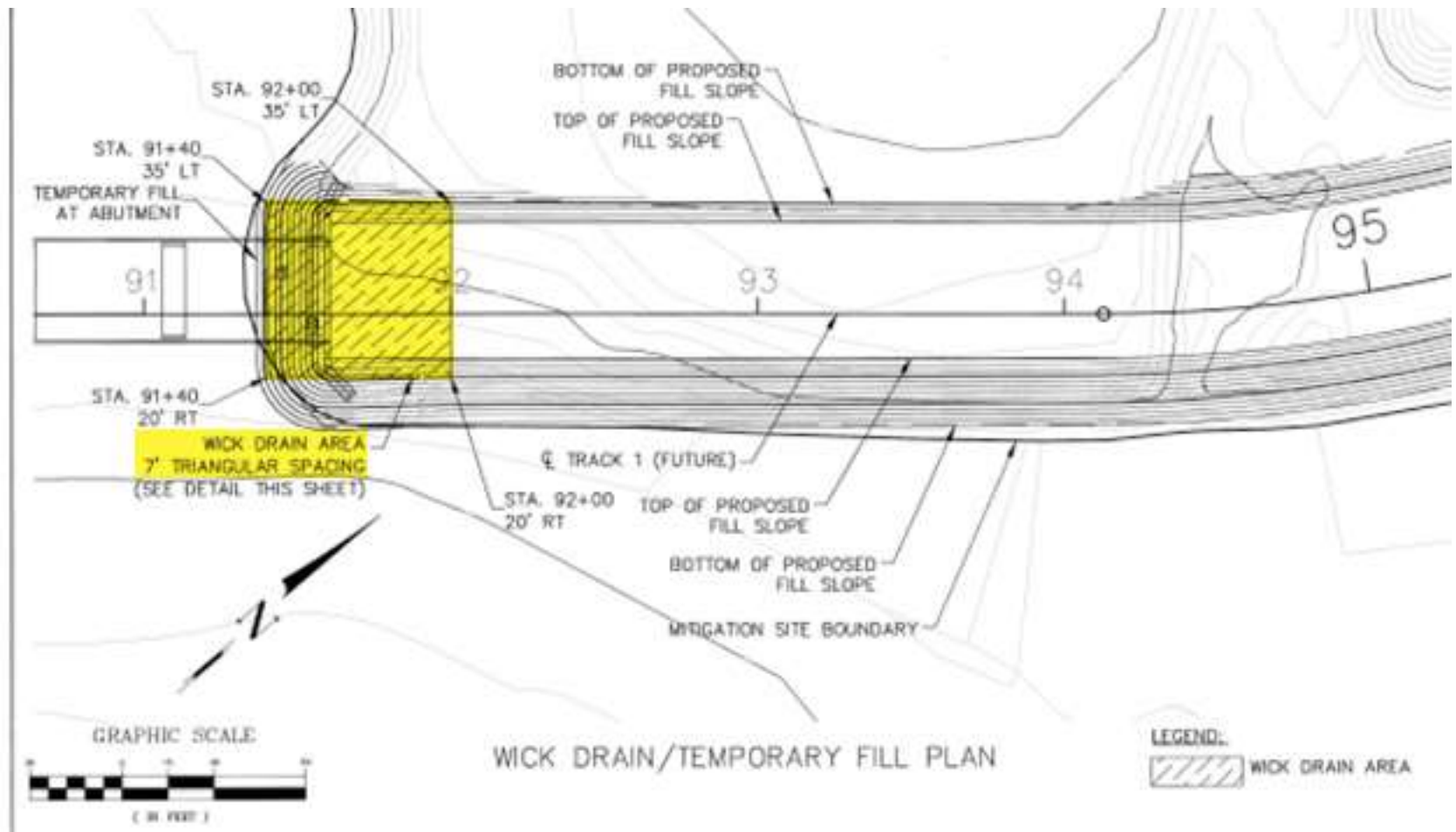




Port Transportation

- ◆ Poor soils under bridges, rail, and roadways
- ◆ Ground improvement utilizing wick drains is an economical treatment
- ◆ Expedites construction sequence
- ◆ More economical option

Mobile, AL ICTF Bridge



New Rail Line to Port







SCPA – Columbus St. Terminal



Rail Spur – NE Expansion



Elevation Increase for Sea level Protection

- ◆ Ports are increasing site grade elevations
- ◆ Compliance with FEMA regulatory flood plain mandates along the coast
- ◆ Grade increase causes increased stress on the typically low strength underlying strata
- ◆ Wick drains can be installed to accelerate settlement and strength gain

Site Elevation Increase for Kalmar Nyckel Tall Ship Visitor Center, Wilmington, DE



Grade Increase Above Sandy Flood Level in Sayreville, NJ



4' grade increase at new Fedex Warehouse, Trade Point Atlantic, Sparrows Pt. MD

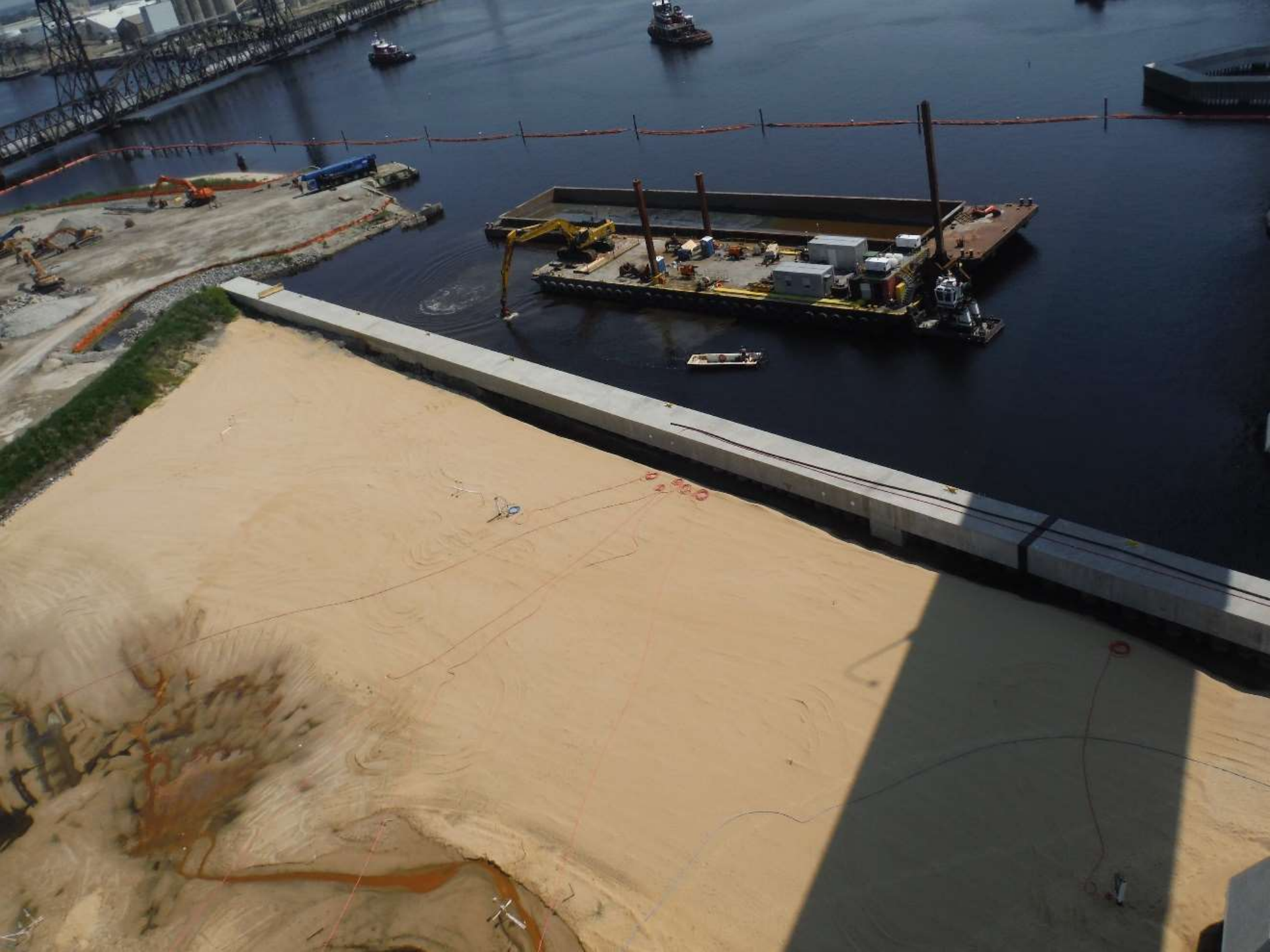


Environmental Remediation

- ◆ Similar to standard port berth creation
- ◆ Environmentally impacted sites may utilize wick drains to accelerate consolidation, and
- ◆ Allow pore water to be collected and treated
- ◆ Vacuum extraction may be applied

Atlantic Wood Superfund Site, Portsmouth, VA







Wick Drains Installed over Water

◆ Barge access









Summary

- ◆ If time allows and surcharge fill is available, wick drains are a very economical and efficient method of ground improvement
- ◆ Viable option vs. other foundation or ground improvement techniques
- ◆ Improves soft sediments underlying many port facilities
- ◆ A simple, quick process with great, proven results

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