SRP Technical Guidance Training: Capping of Sites Undergoing Remediation

Thursday, November 20, 2014

Greg Neumann – NJDEP/BEERA
Howard Nichols – TRC Environmental

Welcome and Overview of SRP Technical Guidance Development

George Nicholas

Lead - DEP/SRP Technical Guidance Development

SRP Technical Guidance Committees

- Composed of 5 DEP Staff and 7 Stakeholders
- Topics Selected via meetings w/ DEP & Stakeholders (Fall 2010 / Summer 2012) or requested by Stakeholders/DEP
- Internal/External review of Final Draft
- Avg. 24 months to complete a document
- Final documents posted on SRP Website at http://www.nj.gov/dep/srp/guidance/

Round-1
15 Tech Guidance Committees

Kicked off work Summer 2010

1. Vapor Intrusion
2. LNAPL
3. Receptor Evaluation
4. Presumptive Remedies
5. IEC (Immed. Env. Concern)
6. Clean/Alternative Fill
7. Ground Water SI/RI/RA
8. Soil (4 docs; PA, SI/RI/RA, UST & Landfill)
9. Historic Fill
10. Technical Impracticability
11. MNA (Monitored Nat. Atten)
12. Conceptual Site Model
13. Analytical Methods
14. Eco Investigation
15. Attainment

Round-2
8 Tech Guidance Committees

(Round 2 - Kicked off Work September 2012)

1. Off-Site Source
2. Co-Mingled Plumes
3. Historic Pesticide Use (issued draft:
4. Capping
5. Performance Monitoring of In-situ GW Remedial Actions
6. Evaluation of GW discharges to SW
7. Child Care Centers (added spring 2013)
8. Catastrophic Events: Planning & Response at SRP sites (added January 2014)

Today's Training Session:

It is an overview of information contained in the

TECHNICAL GUIDANCE ON THE CAPPING OF SITES UNDERGOING REMEDIATION

http://www.nj.gov/dep/srp/guidance/

Webinars and Continuing Education Credits (CECs)

- Working with SRP Professional Licensing Board to issue CECs for Webinar participants

- Today's training is a "Test Model"
  - At random intervals, test questions will appear for Webinar audiences to answer
  - Webinar participants: must respond for CECs
  - Cannot issue CEC's for "groups" participating in the webinar (e.g., several people in a conference room with speaker phone/projector)

Test Your Knowledge !

For webinar participants

- Skydiving without a parachute can result in serious injury
  - ❑ True
  - ❑ False

Technical Guidance Training

Ted Toskos

LSRP Continuing Education Requirements

36 Continuing Education Credits (CECs) over 3 year LSRP license renewal period:

Minimum no. of CECs must be satisfied in these categories:

- 3 CECs Ethics
- 10 CECs Regulatory
- 14 CECs Technical

+9 CECs Discretionary

Board can require “CORE” courses

Continuing Ed Credits (CECs)

- One CEC is equivalent to 1 hour of instruction from university, college, DEP, LSRPA & other professional organizations

- Conferences Conventions Workshops 1hr = ½CEC
  - Up to 8 CECs allowed within 3 year renewal cycle
  - Changes to this policy are up to discretion of LSRP Board

- Webinar and On-Line Courses: CEC is 1:1 but exam is required

- CECs available for presentations, publications but not 1:1 credit

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Thank You

Introduction and Document Overview

Greg Neumann – NJDEP/BEERA

Capping Committee Members

- **NJDEP Staff**

  Teruo Sugihara – Chairperson
  Greg Neumann
  Paul Sanders
  Greg Giles
  Mike Burlingame
  Kathleen Kunze – Oversight Representative

- **External Stakeholders**

  Steve Chranowski – Chemistry Council of NJ
  Kenneth Hart – ELM Group
  Howard Nichols – TRC Environmental
  Elana Seelman – Langan
  Theodoros Toskos – AMEC
  George Vallone – Hoboken Brownstone/NJ Builders Assoc.

Purpose of Guidance

- To define a cap
- To describe various types of caps:
  - Low Permeable
  - Permeable
  - Sediment

  } upland setting

- To discuss factors and limitations to consider when selecting a cap
- To determine which caps are most favorable based on the remedial issues posed by the site
- NOT INTENDED TO DETERMINE IF CAPPING SHOULD BE SELECTED AS A REMEDY

Assumptions

- The RI process (PA, SI, RI, Receptor Eval.) is complete.
- Containment (lateral movement of contamination) is not the focus of the document.
- Site-specific information is available and accurate (professional judgement).
- Capping remedy must comply with NJAC 7:26e-5.1 *"the person responsible for conducting the remediation shall treat or remove free product and residual product to the extent practible, or contain free product and residual product when treatment or removal is not practible."*

Cap Definition

- A cap is barrier located over contaminated media that mitigates exposure.
- Capping remedy must be protective of Human Health and the environment.

Compliance with Regulatory Requirements - Permits

- Cap is an engineering control – requires a Soil Remediation Permit pursuant to ARRCS
- Permits/Rules – site-specific:
  - TSCA Rules – PCBs
  - Ecological Habitat – ACOE Nationwide permit
- Freshwater Wetlands/Waterfront Development, Flood Hazard Zone Permits.
- Local County or Twp. Permits – Soil Conservation Permits

Need for permits is site-specific - investigator responsible for compliance with NJAC 7:26E 1.1(b)2.

Administrative Requirements

- Caps are engineering controls
- Deed Notice required when soil is left in place > unrestricted use standards.
- Deed Notice requirements found in NJAC 7:26C-7 ARRCS
- Soil Remediation Permit – see Remedial Action Permits for Soils Guidance (NJDEP 2010).

Presumptive Remedies

- Presumptive and Alternative Remedy Technical Guidance (NJDEP 2013)
- Covers remediation initiated after May 7, 2010 where new construction or change in use is proposed for residential purposes, licensed childcare centers, public/private/charter schools.
- Remedial action at these facilities must be an unrestricted use, presumptive or alternative remedy pursuant to the above guidance.
- The Capping guidance shall not be used to circumvent guidance on presumptive remedies – intent of this guidance is to cover receptor groups not covered by Presumptive Remedy Guidance.

Technical Factors

- Contaminant properties – type, distribution, concentration
- Media properties – physical stability, particle grain size & organic content may influence contaminant mobility, bearing capacity, veneer stability (slopes).
- Hydrology – depth to water table, season fluctuations, storm water management (impermeable caps).

Regulatory Factors

- Receptors – cap design needs to include an assessment of exposure pathways and receptors.
- Primary exposure pathways are dermal contact, ingestion, and inhalation.
- Environmentally Sensitive Natural Resources – presence of ESNRs requires careful evaluation and adherence to regulations outside of SRP (i.e,. Land Use Regulation Program).
  - COCs in ESNRs require evaluation pursuant to N.J.A.C. 7:26E 1.16 and 4.8 and NJDEP Ecological Evaluation Technical Guidance.
  - Capping is not an assumed remedy for Historic Fill present in ESNRs.
- Current and future land use

Responsible Party Factors

- Green and Sustainable (G&S) Remediation – NJDEP encourages the use of G & S practices (NJAC 7:26E 1.9)...USEPA Clean and Green Policy

- Cost $$$ - material, labor, engineering design…must also consider RFS/FA, remedial action permits costs (deed notices, biennial certifications, monitoring, maintenance etc.)

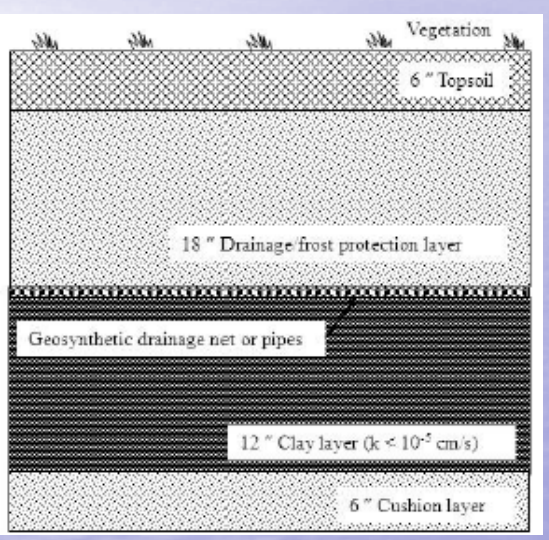
- Community Acceptance /Aesthetics

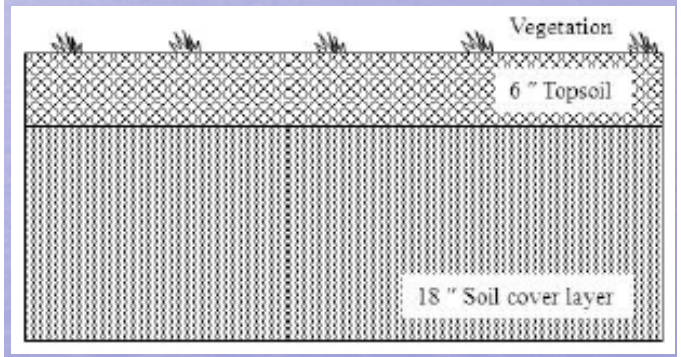
Questions?

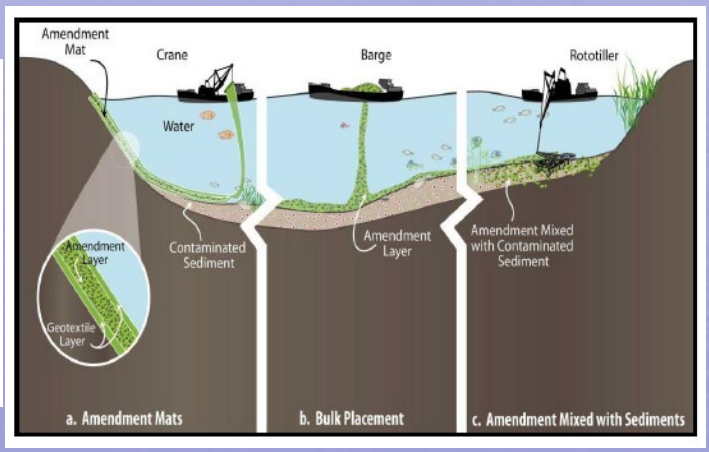
Low Permeability Caps and Permeable Caps

Howard Nichols – TRC Environmental

Classes of Cap Types







Low Permeability **Permeable** **Sediment**

Low Permeability Caps

- A low-permeability cap is one that minimizes the transmission of water or vapor, and thus contaminants, through its structure.
- Water Transmission: Prevent the percolation of water through contaminated soils.
- Vapor Transmission: Prevent vapors from escaping capped area or entering into a structure

Low-Permeability Cap Components

Cap Components Typically Include:

- Soil Protection Layer
  - Not present in all caps
  - Promotes runoff, erosion control, drainage
- Low Permeability Layer
  - Primary component
  - Compacted clay, geomembranes, geosynthetic clay liners, asphalt, concrete
- Geotextiles
  - Can be placed above, below or on both sides of low permeability layer

Design Considerations

- Design considerations includes but are not limited to:
  - Effectiveness
  - Compatibility with:
    - Current and future site uses
    - Surrounding land use
    - Nature of contaminants
  - Duration – Contaminants and cap material
  - Storm water management
  - Surface slopes

Cap Installation

- Documented design considering all factors
  - Designed to meet capping objectives
- Installed according to design
  - Knowledgeable contractor
  - As-built figures, surveys
- Quality Control and Inspections
  - **Base material preparation**, protective layer installation
  - Testing of low permeability material (10^{-5} cm/sec), compaction, and integrity

Low-Permeability Cap O&M

- Routine inspections are important to ensure cap is functioning as designed
  - Testing for water or vapor transmission
  - Off-site impacts (increased runoff)
- Frequency and techniques are dependent on capping materials and site setting
- Assess the need for repairs
  - Routine repairs (small scope)
  - Major repairs (large and infrequent)
  - Should be included in financial assurance

Low-Permeability Cap O&M

- Inspections should include assessments of:
  - Incompatible human activities (digging, gardening, etc.)
  - Burrowing animals
  - Deep rooted vegetation
  - Surface settlement
  - Erosion control
  - Desiccation and cracking, UV degradation (synthetics)
  - Migration of pore water into the cap
  - Diffusion of contaminants through the cap
  - Vandalism
  - Trapped gas below the cap

Landfill Closure Caps

- RCRA, TSCA and NJDEP Hazardous Waste Regulations and Solid Waste Regulations
- Regulations can be very prescriptive for cap construction
- May require modeling to develop cap thickness
- Typically involve multiple layers

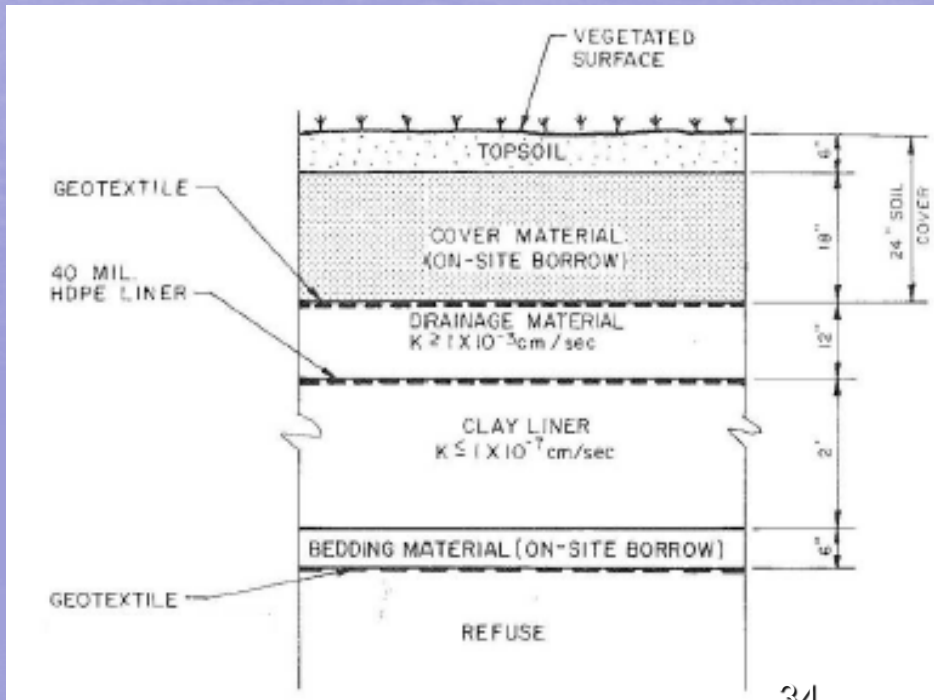


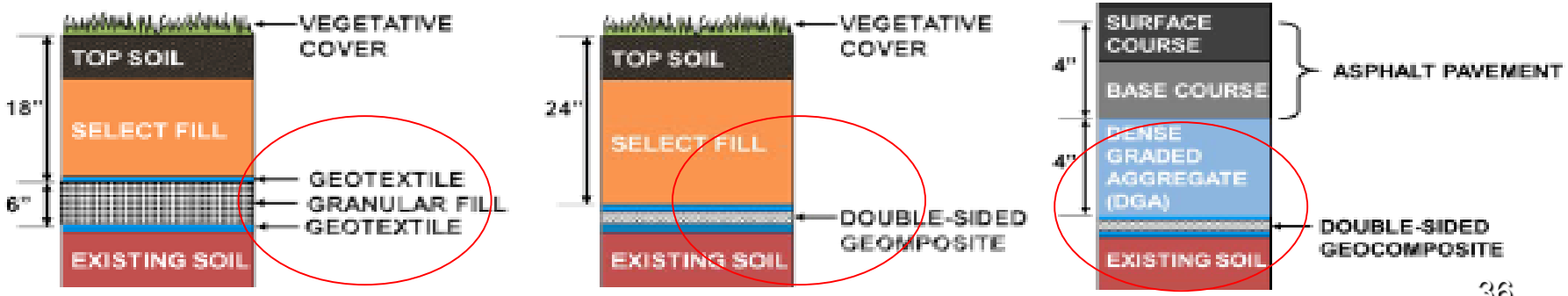
Figure 1b – Typical Section of Cap on Top of Landfill (Cannonie, 1

Structure Caps

- Includes building slabs, asphalt and other large concrete structures
- Low permeability layer is usually exposed, may require more frequent inspection and repairs
- Will require proper installation and sub-grade materials/placement to ensure proper performance for both functions (Structure and Cap)
- Vapor mitigation/collection/venting may be required below the cap.

Capillary Break

- Used to prevent upward migration of dissolved phase contamination through capillary rise.
- Can be constructed of coarse grain materials or geosynthetics
- Can be incorporated into permeable or low-permeability caps
- Primarily related to hexavalent chromium



Vapor Barriers

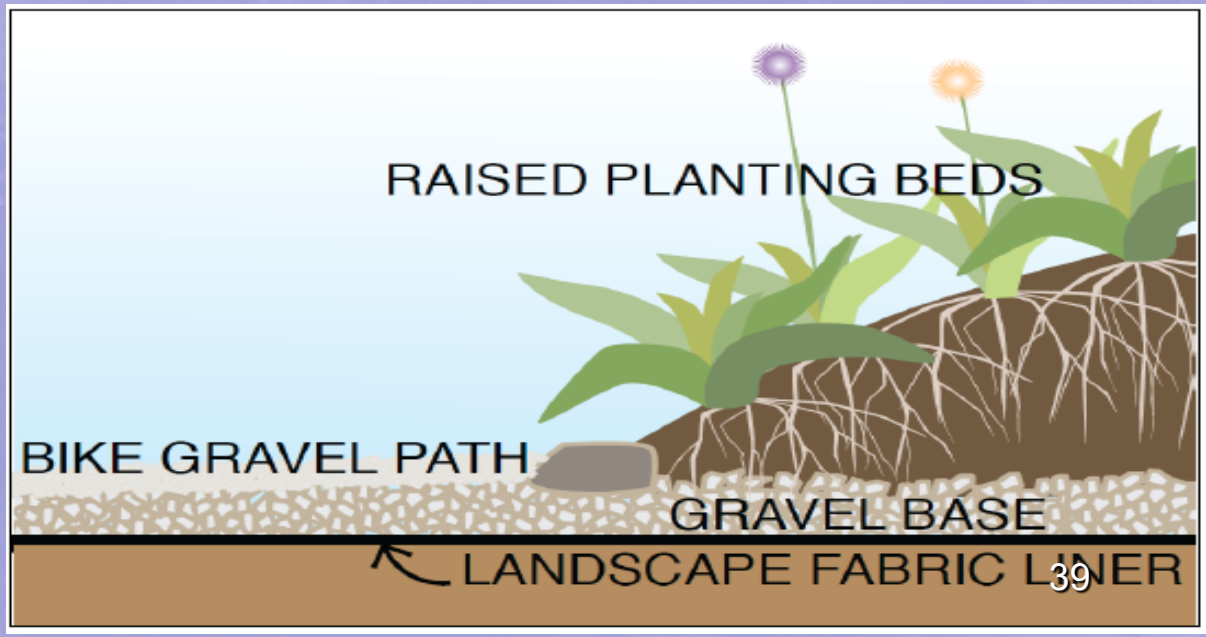
- Used to prevent the migration of vapor phase VOCs through a cap
- Capping guidance document focuses on external/outdoor use
  - Indoor use related to vapor intrusion is discussed in the NJDEP Vapor Intrusion Technical Guidance Document (2013).
- Typically installed with plastic liners (HDPE or similar) or fluid-applied rubberized asphalt emulsion.

Permeable Caps

- Engineered cap that allows for the exchange of water and vapor between the subsurface and the environment above the cap
- Suitability is discussed in Section 3.2 of Guidance Document
- Vegetated/Landscape Caps
- Evaporation/Transpiration Caps
- Phytoremediation Caps

Permeable Cap Components

- Optional cover layer
- Permeable layers in all cap types
- Separation/Demarcation Layer
- Finished surface can vary for different cap types
  - Vegetated
  - Gravel surface
  - Permeable pavement



Permeable Cap Design Considerations

- Thickness must be sufficient
  - Protect against direct contact
  - Weathering and erosion
  - Site use (current and future)
- Depth to water/changes in water balance
- Geotechnical requirements
- Can incorporate existing site surfaces
- Can be used in wetlands settings
- Clean corridor for utility access

Permeable Cap Installations

- Document construction conforms with design
  - Surveys, as-built drawings
  - Quality control testing
- Appropriate Material selection
  - Alternative and Clean Fill Guidance Document for SRP Sites (NJDEP 2011)
- Establish Vegetation
  - Appropriate top soil
  - Monitoring plan

Permeable Caps – O&M

- Inspection to ensure cap thickness is maintained
  - Erosion channels
  - Slope failures/maintenance
  - Burrowing animals and toppled plants
  - Ruts from vehicle traffic
- Timing should reflect increased use or seasonal changes
- Suitability with surrounding land use should be routinely checked

Vegetative/Landscape Caps

- Can support a variety of plant types from grass to wetlands to upland plantings
- Will require maintenance to ensure vegetative cover is sufficient to prevent erosion
- Regular inspections for toppled vegetation, exposed roots and underlying soils with re-plantings as necessary
- Burrowing animals need to be controlled.

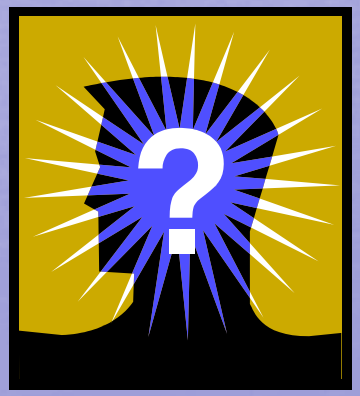
Evaporation and Transpiration Caps

- Used to regulate percolation into the underlying contaminated medium
- Modeling is required to assess water balance – equating precipitation, surface runoff, evaporation and uptake from plants (transpiration)
- Design should consider climate, soil type/thickness and selected vegetation

Phytoremediation

- Similar to vegetative caps, however selected plants are used to remove or immobilize contaminants from the subsurface
- Various phytoremediation technologies exist and are appropriate for different contaminant types using different plant species
- ITRC (Interstate Technology and Regulatory Council) provides extensive information on Phytoremediation. Guidance docs can be accessed at http://itrcweb.org/Guidance

Questions?



Sediment Caps

Greg Neumann – NJDEP/BEERA

Sediment Caps

- Sediment caps are increasingly being used as a remedial option.
- Sediment remedies require careful evaluation due to the dynamic nature of aquatic environments.
- Sediment remedies may have to address multiple trophic level receptors.
- Remedies must ensure achievement of Remedial Action Objectives for as long as the contaminants remain at levels of concern.

Sediment Caps (cont'd)

- The need for any sediment remedial action must be determined pursuant to NJAC 7:26E 1.16 and 4.8 as well as the NJDEP Ecological Evaluation Technical Guidance.
- A conventional cap - used to provide a barrier between impacted sediments and the overlying surface water.
- An amended cap – a cap designed to provide treatment and/or increased sequestration of contaminants.
- A sediment cap represents an engineering control – institutional controls and post-remedial monitoring required.

Design Consideration & Data Needs

- **Site conditions, more than any other factor, will dictate the feasibility of capping.**
- Critical that adequate data exist to effectively design and construct a cap.
- Site characteristics influence all phases of capping project (design, construction, monitoring).
- Data needs (USEPA 2005):
  - Physical
  - Sediment
  - Contaminant
  - Land and Waterway Use

Physical Factors

- Hydrodynamics/Erosion: cap must be resilient to erosion
- Deposition Rate: natural capping
- Water depth: preserve navigability and flood control
- Slope Stability: excessive loading
- Sediment bearing capacity: ability of sediment to support the load of a cap. Thin lift placement.
- Advective GW Flux: ground water to surface water discharge, measurement of contaminant flux must be evaluated to ensure adequate control.

Sediment Factors

- Bioturbation – benthic organisms move sediment as a result of borrowing/feeding. Depth of activity control contaminant migration.
- Benthic Community Structure – supports fish and wildlife. Re-colonization.

Waterway Use Factors

- Background Sources: effectiveness of capping can be offset by continued deposition of contaminated sediment to cap surface.
- Access: staging and processing cap material
- Existing/Future Conditions/Infrastructure:
  - Piers/Bulkheads
  - Navigation channels
  - Recreational Use

Danforth boat Anchor

Piers/Bulkheads

Contaminant Factors

- Horizontal/Vertical Extent: vertical extent may play major role in determining cap thickness
- Contaminant type: relative mobility, NAPLs (if impracticable to remove), ebullition – transport of contamination through gas migration

Conventional Caps

- Physically isolate sediments from water column and prevent suspension and sediment transport; isolate contaminant local biota.
- Typically constructed of sand
- Capping material must be tested as per NJDEP (2011) Alternative and Clean Fill Guidance for SRP Sites.
- Grain size and other geotechnical parameters needed to evaluate long-term stability.
- May include installation of boundary and armoring layers.

Amended Caps

- Include additional layers to prevent contaminant migration.
- Address highly mobile contaminants.
- May not be appropriate where source areas have not been remediated or where groundwater flux rates are high.
- Granular Activated Carbon (Sedimite/AquaGate), organoclays, apatite, zero valent iron, reactive core mats.
- Bench scale studies needed to determine amount of reactive media required, proportion to other components, and to estimate life-span of reactive media.
- USEPA 2013 – *Use of Amendments for In Situ Remediation at Superfund Sites*

Monitoring

- USEPA (2005) "Monitoring should be required as part of any capping project design. The main objective of monitoring a sediment cap is to ensure that the cap is placed as intended and is performing basic functions as required to meet RAOs."
- Sediment caps are located in dynamic environments, and are subject to forces that have the potential to undermine integrity to a *higher degree* than upland caps.
- Important to establish baseline data against which to measure remedy effectivness.
- 3 Monitoring Phases:
  - Construction
  - Performance
  - Remedial Goal/Long Term

Construction Monitoring

Is the cap constructed as designed?

- Sediment coring or bathymetry surveys may be utilized to assess cap thickness.
- May also include monitoring during cap placement (i.e., monitoring of suspended sediment levels in the water column during cap placement).

Performance Monitoring

Is the remedy mechanism performing as designed?

- Capping material remain in place after significant storm events
- Surface sediment concentrations in compliance with clean-up goals.

Remedial Goal/Long Term Monitoring

Is the remedy achieving risk reduction?

- Long term monitoring provides an assessment of the extent to which the sediment remedy is achieving RAOs.
- Direct measurements of risk reduction (i.e., biological tissue concentrations)
- Indirect measurements (sediment, surface water, pore water concentration reductions).

Institutional Controls

A sediment cap, like any engineering control, must remain intact to be protective for as long as the contaminants remain at concentrations of concern.

- Sediment caps will require a Soil Remedial Action Permit.
- The Remedial Action Permit for Soil will contain:
  - 1) A monitoring plan to ensure the cap remains protective
  - 2) A Deed Notice to ensure these areas are not disturbed in the future
  - 3) financial assurance
- Additional information can be found in the NJDEP's (2010) *Remedial Action Permits for Soils Guidance* document

Deed Notices

- If a sediment cap is located within the property boundary of a site (riparian rights establish Lot/Block parcels), a Deed Notice must be established pursuant to N.J.A.C. 7:26C -7.2(b)1.
- If cap boundaries extends onto another entity's property that has riparian rights, a Deed Notice must be established pursuant to N.J.A.C. 7:26C-7.2(b)1. The off-site property owner *must be willing to accept the Deed Notice.*
- If cap boundaries extend to areas owned by the State of NJ and no deed for the property exists; documents must be prepared in lieu of a Deed Notice pursuant to N.J.A.C. 7:26C-7.2(b)2iii. The State of NJ *must be willing to accept the equivalent of a Deed Notice.*

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Questions ????