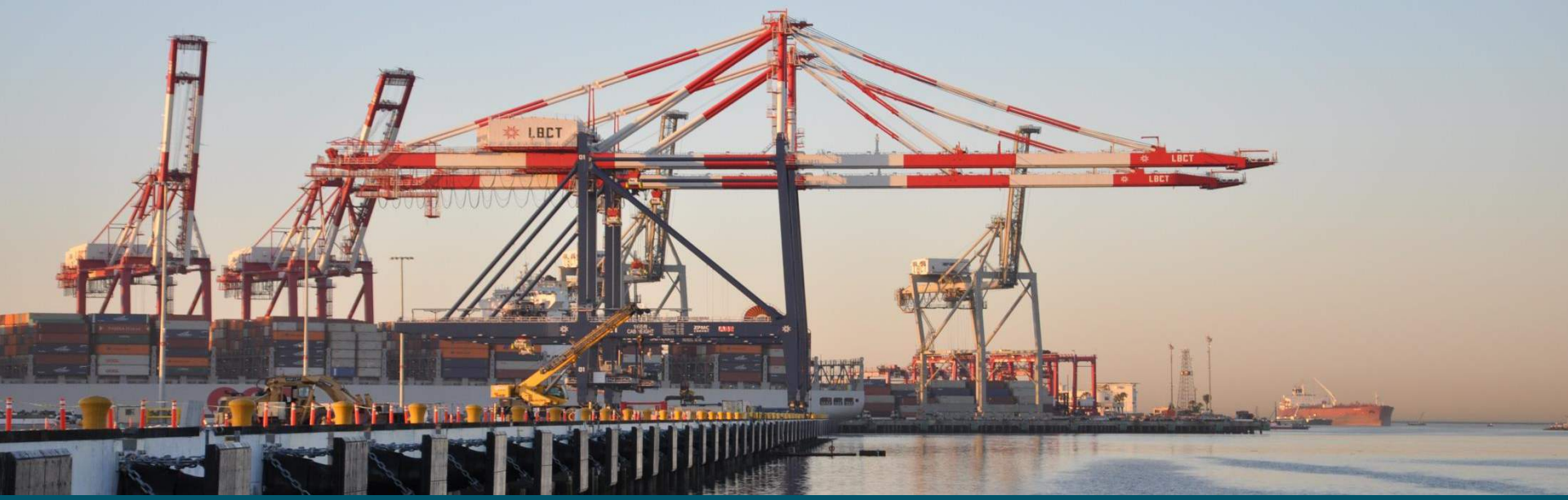

Cement Stabilization for Managing Oil-Impacted Dredged Material Planned for Disposal in a CDF

Presented by

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Dylan Porter and Matt Arms, Port of Long Beach

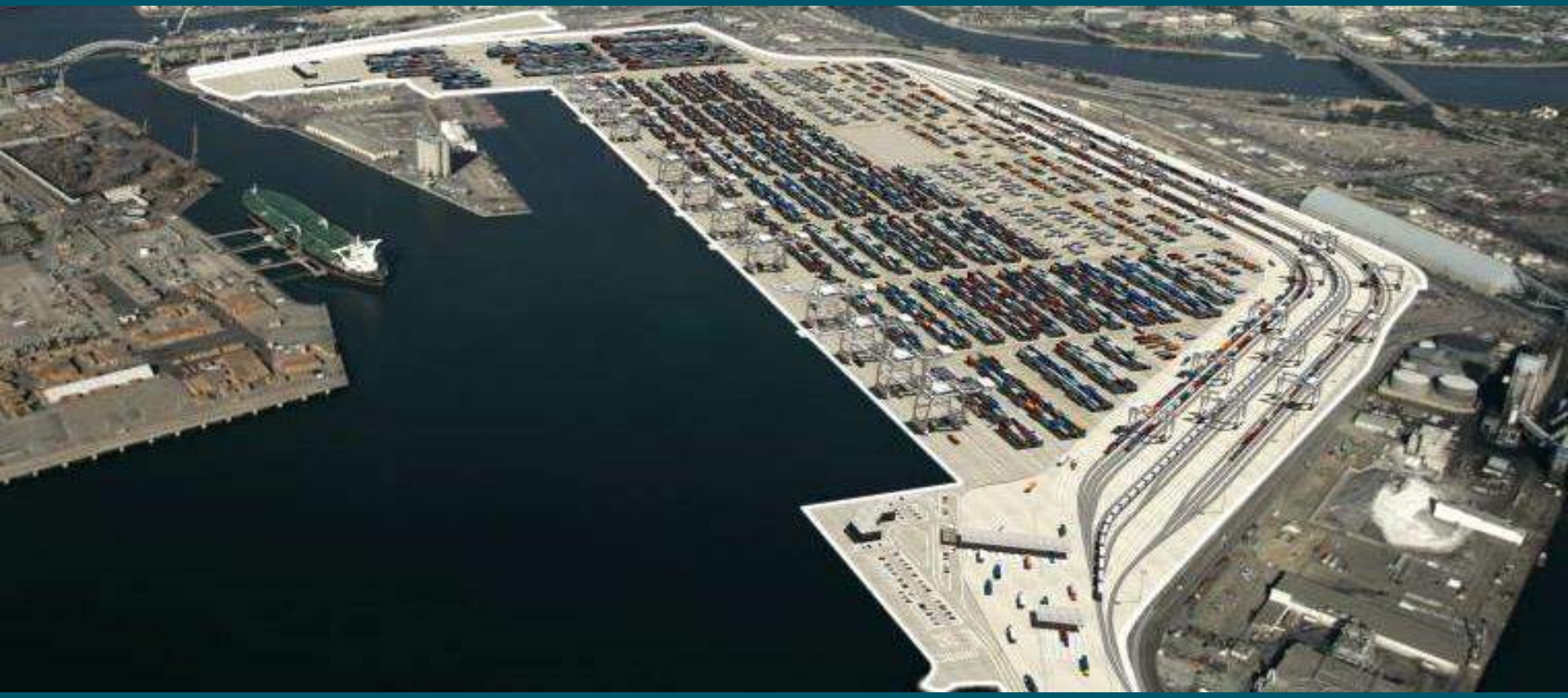
2014 Pacific WEDA Fall Conference
Seattle, Washington

October 23, 2014

Middle Harbor Redevelopment Project (Existing)

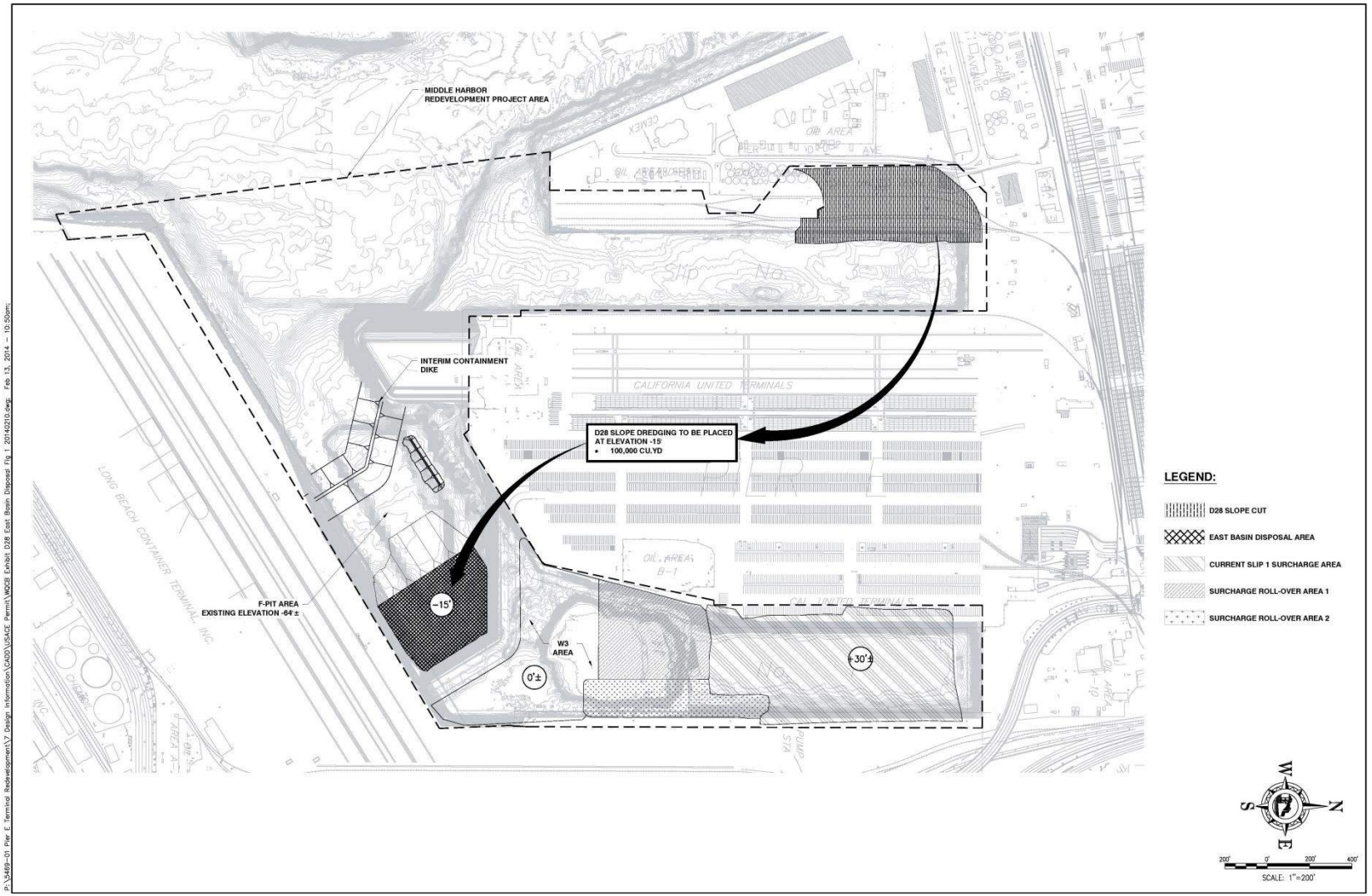
- Consolidate two irregular older facilities into one efficient, 345-acre, rectangular-shaped terminal

Middle Harbor Redevelopment Project (Completed)



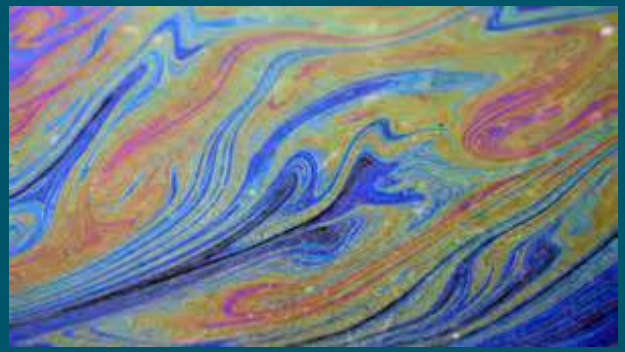
- Construction will occur in two phases, each with multiple stages, over a 10-year period

The Middle Harbor Redevelopment Site



Oil Timeline of Events

- April 2013
  - Oil sheen first encountered along D28 cut
  - Stop work ordered by the Port
  - Developed BMPs with Coast Guard to manage sheen
    - Absorbent pads and booms in water and barge
    - Disposal to fill site behind containment dike after "cleaning" to keep isolated from F berth
  - Dredging resumed within 7 days
  - PTS Services added to construction team to provide 24/7 services during dredging of D28



Oil Timeline of Events

- April 2014
  - Dredging D28 cut Manson encountered free product oil
  - Old, heavy, weathered material mixed with 1,100 cy of sand
  - Exceeded capabilities of existing BMPs
  - Dredging suspended immediately
  - Port CM started looking for solutions

BMPs Considered

- Potential options considered removing the oil from the barge or hauling to a waste facility for disposal
  - Removal of oil using a vacuum truck
    - Ineffective after 3 days of pumping and remixing in barge
    - Costs and schedule delays not manageable
  - Upland disposal
    - Required permitting and constructing an offloading area
    - Securing a contract for waste disposal
    - Loss of sandy material from the fill site
    - Estimated costs of $300,000 per barge for disposal
  - Binding of oil with amendments

Oil Amendment

- Previously developed and demonstrated for CSTF
- Project needs during active construction
  - Cost-effective amendment
  - Constructible and acceptable by the contractor
  - Minimal schedule impacts
  - Oil remains bound after placement in CDF; however, could not solidify in barge
  - Acceptable to the agencies

Bench-Scale Pilot Study

- Study objectives
  - Use cement- and non-cement-based additives
  - Multiple test concentrations
  - Simulate barge mixing using excavator or clamshell bucket
  - Test for leaching in seawater
  - Consider potential for delays between treatment and disposal

Bench-Scale Pilot Study

- Study design
  - Sample preparation
    - Used 5-gallon HDPE buckets
    - Each contained approximately 6 inches of dredged sediment
    - 1-3 inches of overlying water
    - Layer of oil
  - Binding agents
    - Portland cement
    - Crudesorb (CETCO Corp.)
  - Concentrations ranging from 2-10%
  - Monitor for 48 hours

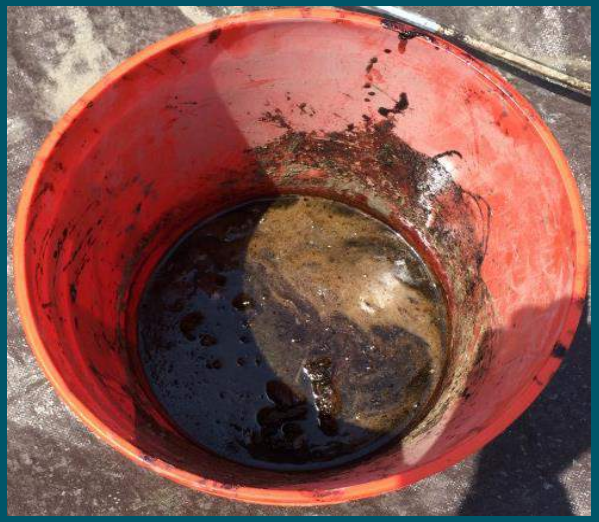
Bench-Scale Pilot Study

- 2% by weight, dry Portland cement (Type II/V)
- 5% by weight, dry Portland cement (Type II/V)
- 3% by weight, dry Portland cement (Type II/V), and increased overlying water levels to between 2 and 4 inches to evaluate the need for dewatering prior to mixing in the amendment
- 10% by weight, dry Crudesorb
- 5% by weight, dry Crudesorb
- 4% by weight, Portland cement (Type II/V) as a slurry, minimal overlying water

Bench-Scale Pilot Study Results

- Both 3% and 5% Portland cement amendments sufficiently bound oil
- Maintained binding ability for 48 hours
- Amended material combined with raw seawater to simulate the release of amended material produced no sheen
- 4% cement as a slurry was easier to mix and retained binding capacity
- Removing overlying water prior to amendment resulted in less cement to achieve binding
- None of the treatments below 5% resulted in solidified product

Bench-Scale Pilot Study Results



Prior to Amendment

4% Cement Slurry Immediately After Mixing

24 hours Post Amendment with Seawater

Bench-Scale Pilot Study Results

5% Crudesorb
Immediately After Mixing

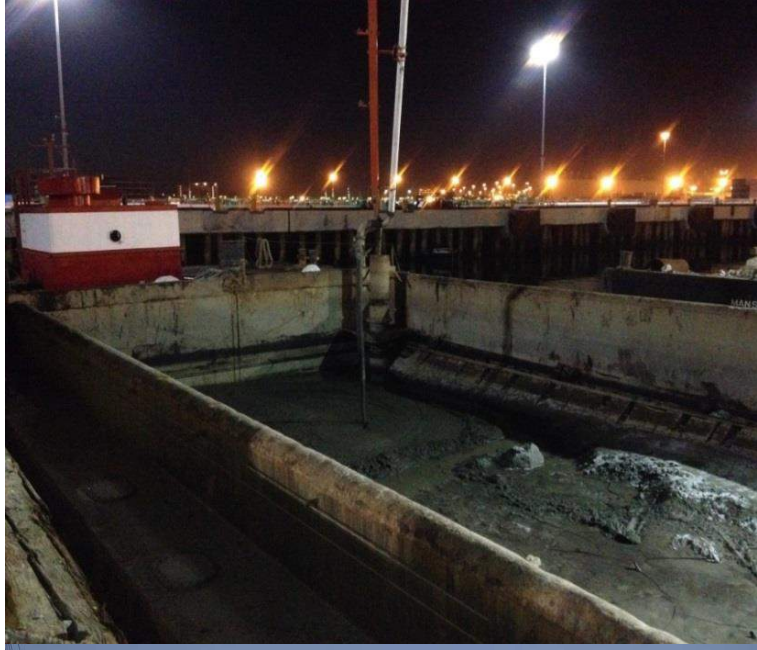
5% and 10% Crudesorb
24 hours After Mixing

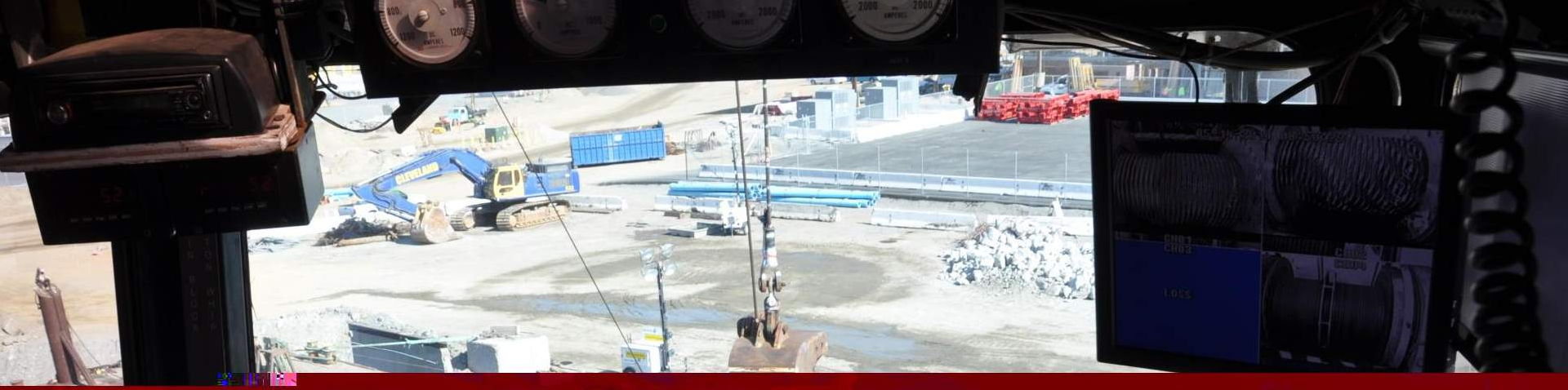
POLB Middle Harbor Sediment Amendment

Full-Scale Field Pilot Study

Full-Scale Field Pilot Study

- 100 cy of cement slurry was added to 1,100 cy of impacted sediment
  - 3% by weight of cement
- Sediment and cement slurry was mixed
  - 7-cy clamshell bucket
  - 30 to 60 minutes

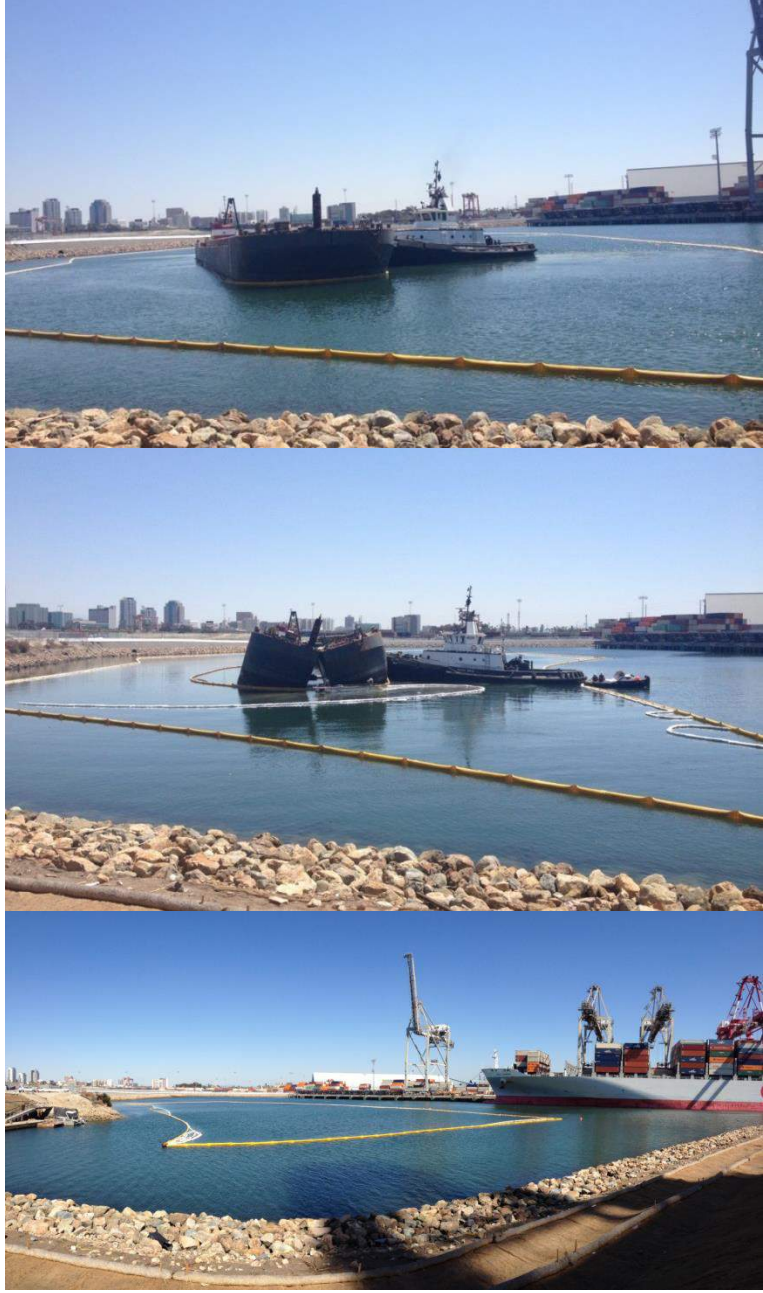


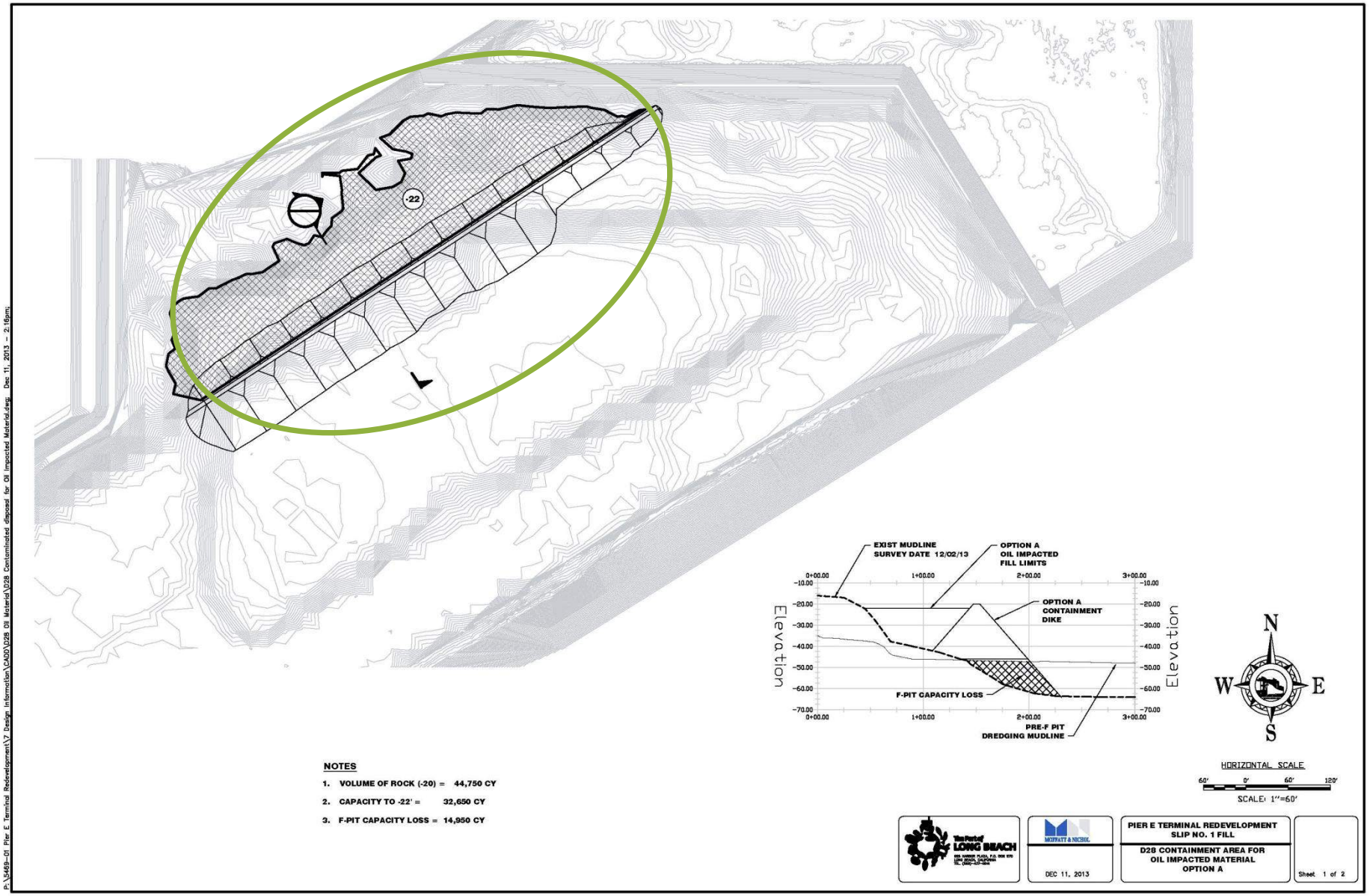

RIELAND
LOSS


VALHALLA

Full-Scale Field Pilot Study

- After mixing, five samples collected from both ends of barge
  - Sent to laboratory for elutriate analysis
- Barge was delivered to East Basin fill area
  - BMPs in place prior to barge arrival
  - Oil response team immediately mobilized for light oil sheen





NOTES

1. VOLUME OF ROCK (-20) = 44,750 CY
2. CAPACITY TO -22' = 32,650 CY
3. F-PIT CAPACITY LOSS = 14,950 CY

The Port of LONG BEACH

MOFFATT & NICHOL

DEC 11, 2013

PIER E TERMINAL REDEVELOPMENT
SLIP NO. 1 FILL

D28 CONTAINMENT AREA FOR
OIL IMPACTED MATERIAL
OPTION A

Sheet 1 of 2

P:\5469-01 Pier E Terminal Redevelopment\7 Design Information\CADD\D28 Oil Material\D28 Contaminated disposal for Oil impacted Material.dwg; Dec 11, 2013 - 2:16pm;

Full-Scale Field Pilot Study

- Water quality monitoring
  - 24 hour post placement
- Visual monitoring
  - For 48 hours post placement

Pilot Study Analytical Results

- Elutriate testing on amended sediment
- Water column monitoring
  - Standard monitoring at project boundary
- Metals, PAHs, total petroleum hydrocarbons
- All measured values below standards

Full-Scale Field Pilot Study – Round 2

Full-Scale Field Pilot Study – Round 2

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Full-Scale Field Pilot Study – Round 2

Full-Scale Field Pilot Study Conclusions

- Amending dredged material with cement slurry was effective for binding oil within sediments
- Minor oil sheen observed after treatment was consistent with routine disposal events
- Water quality monitoring and elutriate testing confirm the successful binding of oily materials
- Removing standing water prior to treatment most effective
- Costs per barge for cement treatment is $25,000 plus equipment rental

Questions/Discussion