Appendix B1
Palos Verdes Shelf Pilot Project Monitoring Scope of Work

Background

The contractor is to become familiar with the monitoring sections of Palermo et al. (1999). In particular, the contractor should become familiar with the objectives of the work and the purpose (null hypotheses) of the monitoring (Chapter 5 and Appendix F). The objectives of this monitoring work are to assist in constructing, evaluating and demonstrating the ability to cap in-place, effluent affected (EA) sediments on the Palos Verdes Shelf during the pilot project. The contractor is also to become familiar with the Operations and Monitoring Plan prepared for this effort. The contractor is to review additional information collected for this Pilot Project (e.g., sediment physical and chemical data) and recommend modifications to the monitoring plan if necessary. This will include identification of needed changes to the null hypotheses. This is an experimental effort and the contractor is to build flexibility into the monitoring schedule and approaches in order to incorporate necessary adjustments in placement schedule or approaches.

Task 1. Collection of Additional Background Data and SOW Revision
Task 2. Placement Surge Video Documentation
Task 3. Hopper Dredge Operation Data
Task 4. In-hopper Sediment Data
Task 5. Flex Surveys
Task 6. Monitoring of Cell LU (Events #1 and#3a)
Task 7. Monitoring of Cell LD (Events #2 and 3b)
Task 8. Monitoring of Cell SU (Events #4 and #6a)
Task 9. Monitoring of Cell SD (Events #5 and #6b) **(Eliminated from Scope)**
Task 10. Evaluation of Bathymetry Surveying **(Eliminated from Scope)**
Task 11. Disposal Plume Transport Survey
Optional Task 12. Cap Erosion Analysis Samples
Task 13. Reporting
Optional Task 14. Water Current Monitoring

Task 1. Collection of Additional Background Data and SOW Revision

Background: The distribution of the effluent affected (EA) deposit has been studied by both the USGS and the LACSD. Conceptual cap prism design is described in Palermo et al. (1999). The Field Pilot Study Operations and Monitoring Plan (Palermo et al. 2000) recommends that the pilot project be carried out on four cells to the north-west of the outfalls. Prior to conducting the pilot project there is a need to more fully characterize these pilot cells to provide a well-defined baseline to which post-capping samples can be

compared. These investigations will be carried out in the weeks and days prior to cap placement.

Objectives:

1. Provide baseline sediment chemistry and physical characteristics in the target pilot cells.

2. Re-evaluate this scope of work in response to the new information collected, review of relevant documents provided by the Corps Project Manager, and the approved Project Work Plan (developed under a separate scope). Based on those reviews the contractor will recommend changes to this SOW.

Approach:

A. The contractor will collect 9 gravity cores or vibracores (minimum 20 cm length) from each of the four pilot cells for analysis of sediment chemistry and physical data. Note that these locations will be at points where the sub-bottom profile lanes will cross (see figure 1). Repeating these stations in the post-cap monitoring will assist in the interpretation of the sub-bottom data. Cores will be sectioned into 4 cm increments (0-4, 4-8, 8-12, 12-16, 16-20 cm). The increments will be analyzed for p,p' DDE, bulk density, and grain size. The Contractor will collect field QC samples (i.e., duplicates, ambient conditions and equipment rinsate blanks, and matrix spike/matrix spike duplicates [MS/MSDs]) using the methods and in the frequencies described in the *Draft Project Work Plan for the Palos Verdes Pilot Capping Project: Baseline Monitoring Activities* (SAIC, 2000).

B. From the nine core stations (above) the contractor will randomly select two of these stations at which a second core will be taken for each cell. Vane shear measurements will be made on these two cores for the full length of the core. Subsamples of the cores from 0-20 cm will be taken to create a composite sample on which bulk density and Atterberg limits will be determined. If the core penetrates into a visually distinctive sediment horizon (e.g., change in color, consistency or visually apparent grain size) a sample of this sediment will be taken for bulk density and Atterberg limits and up to four vane shear measurements will be taken, evenly distributed along the length of the horizon.

C. The raw data from the top 2 increments of the cores in Task A, above, will be submitted in a report to the Corps Project Manager 4 weeks after field collection. A full data report will be submitted to the Corps Project Manager 8 weeks after field collection. The data will be added to the project GIS at the time of the full report submission.

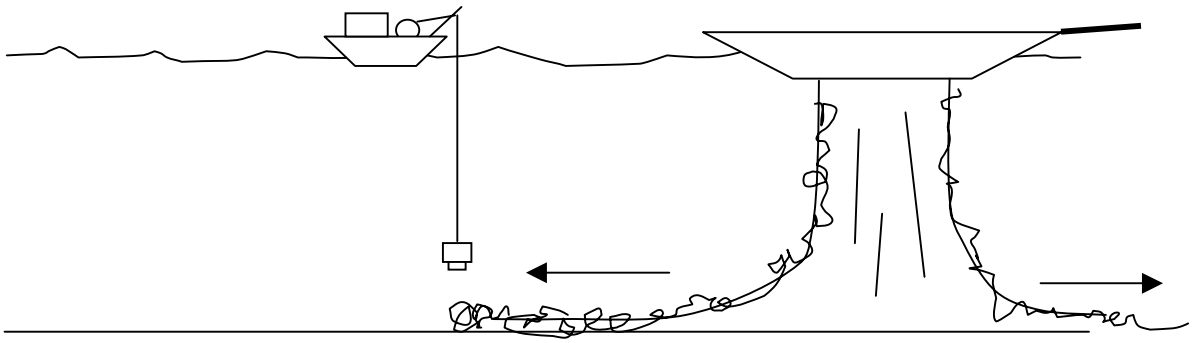
D. The contractor will perform a base-line, high resolution sub-bottom profiler and high resolution, dual frequency digital side scan survey at each of the four pilot cells (figure 3). The sub-bottom profiler should be adjusted to maximize resolution in the

top meter of the sediment column. Later surveys will be compared to these surveys as part of the tools used to assess cap thickness and distribution.

E. The contractor will evaluate the new data collected in the previous approaches, review relevant documents provided by the Corps Project Manager, and the approved Project Work Plan (developed under a separate scope). Based on those reviews the contractor will recommend changes to this SOW by reallocating survey effort within the overall level of effort already planned (including the flex surveys identified in Task 5). These changes may include modifications to the approaches, station numbers, sampling methods, and so on. The contractor may also recommend modifications to the monitoring effort beyond the existing level of effort, but these will require thorough explanation as to why they can not be achieved through reallocation of effort.

Task 2. Placement Surge Video Documentation

Objective: Provide video documentation of the bottom surge that occurs during placement of cap material during conventional placement operations.



Approach: The contractor will use a video camera to record the bottom surge as it moves past fixed points varying distances from the release point of the capping sediments. This array should be capable of operating both when resting on the bottom and suspended above the bottom from the survey vessel. The contractor will need to adjust the camera position, through field trials, based on visibility and the thickness of the surge along the bottom. This information will be used to complement the quantitative data that are being collected by bottom instrument arrays measuring current speed, suspended sediment, and other surge characteristics.

The contractor will deploy a video camera array/sled equipped with lights during initial disposal at cell LU, SU, and two other events to be determined in coordination with the Project Manager, to visually document the lateral spread of the bottom surge during placement events. The Contractor will visually document the plume varying distances from the point of sediment release (e.g., 50 m, 75m, 100m, 200m). The intent will be to illustrate the characteristics (speed, thickness) of the surge with increasing distance from the point of release out to the point where the surge is minimal or not present.

The contractor will provide an edited, annotated videotape of these placement events along with a narrative report. In addition, at least 6 video clips (30-60 second duration) will be provided in digital format for use in PowerPoint presentations or other media.

Task 3. Hopper Dredge Operation Data

Objective: The contractor will collect hopper dredge positioning data during transit to and during the cap placement operations. The contractor also will collect information on the time and rate of material discharge to monitor where sediment placement occurs.

Approach: The contractor will coordinate with the dredging contractor to install and maintain an automated electronic tracking system on the placement vessel during the pilot project operations. This system will acquire and store DGPS vessel positions at regular intervals (i.e., 10-min intervals) during loading and transit to the PV Shelf placement locations. Upon approach to the placement location(s), the system will automatically increase the rate of position recording (i.e., to 6-sec intervals). The DGPS locations of the dredge during placement will be corrected to report the center of the hopper dredge bin. Additionally, hopper dredge draft and/or tonnage data will be acquired from the dredging contractor during all placements events (updated every 10 seconds or less during placement events). This time series information will be merged with the dredge position data to yield an accurate record of placement location/volume/rate for each load. Further, for all intensively monitored placement events (single hopper placement surveys, first four loads of the interim placements), the contractor will coordinate with the dredging contractor to obtain hopper filling tonnage data.

Associated data services will include: 1) daily data updates presenting the start time/position and end time/position for each placement event, optionally on a Web Site, 2) weekly reports presenting tabular data and graphic plots of dredge sediment release positions for each event, 3) weekly updates of placement data on DAN-LA to provide the project team with access to placement results for MDFATE modeling. Additionally, the DAN-LA database will maintain a record of loading position for each load of cap material (at a minimum the start and stop positions of dredging for these loads will be recorded either by observed changes in the draft records and/or in coordination with the dredging contractor logs of dredge operation).

Task 4. In-hopper Sediment Data

Objective: Data on the physical characteristics of the sediment in the placement vessels will be needed as part of the evaluation of how well actual field results compare to the expected spread and thickness of sediments at the capping cells. Additionally, data on the chemical characteristics of sediments that may be dredged from borrow areas (e.g.,

A2 and A3) will need to be acquired for later comparison of chemical concentrations within the cap and underlying EA sediment, if borrow area sediments are used for capping.

Approach: The contractor will obtain assistance from the dredging contractor for collection of sediment samples from the hopper for the following events during the pilot cap monitoring program: 1) the first three loads of cap material transported to each cell of the capping area, 2) up to 25 of the loads during continuous capping operations, and 3) the first three loads of any cap material originating from borrow areas. For each load, three samples will be collected (one each from bow, center and stern of hopper) and composited to achieve a single composite sediment sample from each load.

The contractor will be responsible for providing sample containers, instructions to the dredging contractor for sample collection, sample custody, and laboratory analysis of geotechnical properties (grain size, bulk density, specific gravity, water content, and atterberg limits) of each composite sediment sample. Additionally, chemical analysis of p,p' DDE will be conducted for composite sediment samples from the first three loads acquired from the borrow areas. Raw sediment grain-size data from the first three loads for each cell will be provided to the Corps Project Manager within 24 hours of sample collection.

All the results will be presented in a report upon completion of the pilot cap monitoring program. The data also will be entered into the database of DAN-LA within one week as the results become available.

Task 5. Flex Surveys

Approach: In addition to the survey efforts requested in Tasks 6-9, the contractor will plan on 60 additional SPC/PVC stations, 20 additional sediment cores (all for visual core descriptions, 8 for p,p' DDE sampled at three intervals as described in the Post Cap sections below), and 25 additional water samples (all for TSS, 5 for p,p' DDE). These extra samples will be used to augment, as needed, the surveys already planned in Tasks 6-9 or to conduct separate supplementary surveys during the course of the placement operations. This will permit maximum survey flexibility and allow immediate investigation of areas of uncertainty. Collection of these additional samples will be at the request of the Corps Project Manager and may be based on recommendations of the contractor.

Task 6. Monitoring of Cell LU (Landward – upstream) (Events #1 and #3a)

Background: This portion of the project will involve the **conventional placement** of hopper loads of sediment from the Queen's Gate entrance channel. Initially, the placement vessel will be directed to the center point of the capping cell that has been denoted as the landward and upstream cell (LU). Following the first placement, approximately 7 days will be provided for collection and analysis of the monitoring data before any additional placement occurs (figure 2). Once the data have been assessed,

additional placement will occur with the intent of creating a 15 cm cap over the entire cell.

Objectives

Objective 1: Assess the thickness and lateral distribution of capping sediments during placement operations.

Objective 2: Assess plume TSS and p,p' DDE concentrations and extent for two hours following hopper placement.

Objective 3: Assess extent of surge during placement operations.

Objective 4: Assess mixing of cap sediments with the in-situ sediments.

Objective 5: Evaluate monitoring approaches.

Approach

A. Baseline Survey. The contractor will conduct a 25 station pre-placement sediment profile camera/plan view camera (SPC/PVC) survey at the cell named LU(#1) (Figure 1). Three replicate photographs will be obtained from each station (75 photographs total) for full analysis of infaunal successional status and sediment physical conditions.

B. Single Hopper Placement Survey **(Event #1).**

i.) Prior to the first placement event the contractor will deploy at least four (4) and preferably five (5) bottom-moored arrays (see figure 4) consisting of a recording current meter [Nortek Aquadopp current meters (see www.NortekUSA.com for more information) or equivalent (the contractor's ARRESS tripods are acceptable] and a self-recording OBS gage. One of these arrays will also be outfitted with an upward-looking ADCP to augment assessment of plume behavior. Three of these arrays will be deployed in a transect down slope of the planned placement point at distances of 75, 150, and 250 meters. The fourth will be placed up slope 75 meters from the planned placement point. The fifth current meter can be placed either 150 m upslope or adjacent to the inner most downslope current meter to verify the Aquadopp and ARESS current meters are producing comparable results. The array at 150 m downslope will have the upward looking ADCP. The instruments will be set to record at frequency such that accurate reliable data can be produced at a frequency of 1 hz if possible. The contractor will retrieve the instruments after the placement event, download, and analyze the data to assess the surge from sediment placement. The raw data from the hour around the

cap placement event will be graphed and provided to the Corps Project Manager within 48 hours of array retrieval.

ii.) The contractor will use acoustic Doppler current profiler (ADCP) and optical back scatter (OBS) equipment to map the location and extent of the plume created by the placement of cap material for two hours. The contractor will take up to 27 water samples for total suspended solids (TSS) analysis and 6 samples for total (combined particulate and dissolved) p,p' DDE. The p,p' DDE samples will be taken in the centroid of the plume within 2 meters of the bottom (where concentrations can be expected to be greatest) at 5, 20, 40, 60, 90, and 120 minutes after placement. Prior to the placement event the contractor will take 3 background samples from within 2 meters of the bottom. Samples will be analyzed for total p,p' DDE and TSS.

iii.) After the placement event the contractor will conduct a 37 station sediment profile camera/plan view camera survey at the cell (Figure 1). One photograph will be obtained from each station, though triplicates will be obtained at 4 randomly selected stations. These photographs will be analyzed for thickness of cap material and evidence of mixing or erosion of the EA sediments.

iv.) The contractor will take gravity cores at 5 stations (figure 1). The contractor will randomly select these 5 stations from among the 37 SPC/PVC stations in the previous task. Four of the five will be selected from inner stations expected to have cap accumulation and one selected from the outer stations expected to be free of cap. These cores will be used as an independent check on the SPC measurements. Cores will be extracted, vertically split, photographed, and visually described within 24 hours of collection to assess the thickness of cap material and the degree of mixing between the cap and EA sediment. The contractor will also collect sufficient cap material from either one core or a composite of the cores and analyze the sample for grain size distribution and bulk density.

v.) The contractor will conduct a high resolution, dual frequency digital side-scan survey over the cell to assess distribution of cap sediment. Preliminary results on cap distribution will be provided to the Corps Project Manager within 24 hours of survey completion.

C. Interim Placement Surveys (Creation of 15cm Cap) **(Event #3a).**

i.) Prior to the next series of four placement events the contractor will deploy at least four (4) bottom-moored arrays (see figure 4) consisting of a recording current meter [Nortek Aquadopp current meters (see www.NortekUSA.com for more information) or equivalent] and a self-recording OBS gage. One of these arrays will also be outfitted with an

upward-looking ADCP to augment assessment of plume behavior. Three of these arrays will be deployed in a transect down slope of the planned placement point at distances of 75, 150, and 250 meters. The fourth will be placed up slope 75 meters from the planned placement point. The fifth current meter can be placed either 150 m upslope or adjacent to the inner most downslope current meter to verify the Aquadopp and ARESS current meters are producing comparable results. The array at 150 m downslope will have the upward looking ADCP. The instruments will be set to record at frequency such that accurate reliable data can be produced at a frequency of 1 hz if possible. The contractor will retrieve the instruments once the four placement events have occurred, download, and analyze the data to assess the surge from sediment placement. The raw data from the hour around the cap placement events will be graphed and provided to the Corps Project Manager within 48 hours of array retrieval.

ii.) The contractor will map the location, concentration, and extent of the plume created by the placement of cap material of the second and third placement for two hours. The contractor will repeat the approach used for the Single Hopper Placement Survey.

iii.) The contractor will conduct two 14 station sediment profile camera/plan view camera surveys, one after the predicted number of loads to create a 10 cm cap have been placed at the first disposal point, and the second two thirds of the way through the 15 cm cap placement (figure 1). One photograph will be obtained from each station, though triplicates will be obtained at 2 randomly selected stations. These photographs will be analyzed for thickness of cap material and evidence of mixing or erosion of the EA sediments.

iv.) The contractor will take gravity cores at 5 stations (figure 1), one after the predicted number of loads to create a 10 cm cap have been placed at the first disposal point, and the second two thirds of the way through the 15 cm cap placement. Cores will be extracted, vertically split, photographed, and visually described as for the Single Hopper Placement Survey. The contractor will also collect sufficient cap material from either one core or a composite of the cores at the first interim survey and analyze the sample for grain size and bulk density.

D. Post Cap Monitoring

i.) After the placement event the contractor will conduct a 37 station sediment profile camera/plan view camera survey at the cell (Figure 1). One photograph will be obtained from each station, though triplicates will be obtained at 4 randomly selected stations. These photographs will be

analyzed for thickness of cap material and evidence of mixing or erosion of the EA sediments.

ii.) The contractor will conduct a sub-bottom, chirp acoustic profile of the capping cell to assess cap thickness. The survey should consist of 3 longitudinal transects and 7 cross sections (figure 1).

iii.) The contractor will collect 9 gravity cores or vibracores from the capping cell. These cores will penetrate at least 20 cm into the EA sediment. The cores will be split, photographed, visually described, and sampled. Particular attention should be given to the condition of the transition between the EA and cap sediments. Sediment grain size, bulk density, vane shear, specific gravity, water content, atterberg limits (if sufficient fines), and chemistry samples will be taken from four of these cores (randomly selected from the nine). Samples will be taken at the sediment/water interface (top of core), 3 cm and 7 cm above the interface/mixed layer and 4 cm and 8 cm below the interface/mixed layer. The "7 cm" and "8 cm" samples will be archived. The "0, 3 and 4 cm" samples will be analyzed for the physical parameters listed above and p,p' DDE.

iv.) The contractor will conduct a high resolution, dual frequency digital side-scan survey over the cell to assess distribution of cap sediment. Preliminary results on cap distribution will be provided to the Corps Project Manager within 24 hours of survey completion.

Task 7. Monitoring of Cell LD (Landward, downstream) (Events #2 and #3b)

Background: This portion of the project will involve the **spreading placement** of a single hopper load of sediment from the coarse sediment borrow site. The placement vessel will be directed to the capping cell that has been denoted as the landward and downstream cell (LD). Following placement of the first hopper load in this cell, approximately 7 days will be provided for collection and analysis of the monitoring data, though if the data from the first LU event provides good confirmation of predictions, placement Event #3a will begin during this 7 days (figure 2). Once the data have been assessed, additional placement of several hopper loads will occur **(Event #3b),** with the intent of creating a thicker cap, using this method.

Note if the direct pump-out through the drag arm option is exercised, the dredged material will be injected at a depth of approximately 20-22 m. The exit velocity will be approximately about 1 m/sec, indicating the dredged material will reach the bottom in cell LD in 30 seconds.

Objectives: As in described for Task 6.

Approach

A. Baseline Survey. The contractor will conduct a 25 station pre-placement sediment profile camera/plan view camera survey at the cell named LD(#2) (Figure 1). Three replicate photographs will be obtained from each station (75 photographs total) for full analysis of infaunal successional status and sediment physical conditions.

B. Single Hopper Placement Survey **(Event #2).**

i.) Prior to the first placement event the contractor will deploy at least four (4) bottom-moored arrays and preferably five (5) (see figure 4) consisting of a recording current meter [Nortek Aquadopp current meters (see www.NortekUSA.com for more information) or equivalent] and a self-recording OBS gage. One of these arrays will also be outfitted with an upward-looking ADCP to augment assessment of plume behavior. Three of these arrays will be deployed in a transect down slope of the planned placement point at distances of 75, 150, and 250 meters. The fourth will be placed up slope 75 meters from the planned placement point. The fifth current meter can be placed either 150 m upslope or adjacent to the inner most downslope current meter to verify the Aquadopp and ARESS current meters are producing comparable results. The array at 150 m downslope will have the upward looking ADCP. The instruments will be set to record at frequency such that accurate reliable data can be produced at a frequency of 1 hz if possible. The contractor will retrieve the instruments after the placement event, download, and analyze the data to assess the surge from sediment placement. The raw data from the hour around the cap placement event will be graphed and provided to the Corps Project Manager within 48 hours of array retrieval. If the spreading occurs as planned, there will be no bottom surge associated with the particle settling. Also the path the dredge takes will be quite long. Therefore the need for the bottom mounted current meters and OBS gages will be primarily to document the negative, i.e., to show that in fact individual particle settling did occur.

ii.) The contractor will use acoustic doppler current profiler (ADCP) and optical back scatter (OBS) equipment to map the location and extent of the plume created by the placement of cap material for two hours. For this scenario, the ADCP will be used to estimate the fall velocity of the individual particles and estimate the point at which they impact the bottom. For surface spreading using a cracked hull, a 0.2 mm particle should reach the bottom in 45 m of water in about 30 minutes. A 0.3 mm particle should reach the bottom in 45 m of water in about 15 minutes. A 0.4 mm particle should reach the bottom in 45 m of water in about 11 minutes. The contractor will take up to 27 water samples for total suspended solids (TSS) analysis and 6 samples for total (combined particulate and dissolved) p,p' DDE. The p,p' DDE samples will be taken

in the centroid of the plume within 2 meters of the bottom (where concentrations can be expected to be greatest) at 5, 20, 40, 60, 90, and 120 minutes after placement. Prior to the placement event the contractor will take 3 background samples from within 2 meters of the bottom. Samples will be analyzed for total p,p' DDE and TSS.

iii.) After the placement event the contractor will conduct a 37 station sediment profile camera/plan view camera survey at the cell (Figure 1). One photograph will be obtained from each station, though triplicates will be obtained at 4 randomly selected stations. These photographs will be analyzed for thickness of cap material and evidence of mixing or erosion of the EA sediments.

iv.) The contractor will take gravity cores at 5 stations (figure 1). Four will be selected randomly from among the SPC stations in the cell and one randomly selected from among the SPC stations outside the cell. Cores will be processed and analyzed for visual descriptions, grain size and bulk density as in previous tasks.

v.) The contractor will conduct a high resolution, dual frequency digital side-scan survey over the cell to assess distribution of cap sediment. Preliminary results on cap distribution will be provided to the Corps Project Manager within 24 hours of survey completion.

C. Interim Placement Surveys. **(Event#3b) Eliminated from Scope for monitoring, though the placement will occur**

D. Post Cap Monitoring

i.) After all placement events the contractor will conduct a 37 station sediment profile camera/plan view camera survey at the cell named LD(#2) (Figure 1). One photograph will be obtained from each station, though triplicates will be obtained at 4 randomly selected stations. These photographs will be analyzed for thickness of cap material and evidence of mixing or erosion of the EA sediments.

ii.) The contractor will conduct a high resolution, dual frequency digital side-scan survey over the cell to assess distribution of cap sediment. Preliminary results on cap distribution will be provided to the Corps Project Manager within 24 hours of survey completion.

Task 8. Monitoring of Cell SU (Seaward, Upstream) (Events #4 and #6a)

Background: This portion of the project will involve the **conventional placement** of hopper loads of sediment from the Queen's Gate channel. The placement vessel will be directed to the center point of the capping cell that has been denoted as the seaward and

upstream cell (SU). Following placement of the first hopper load in this cell, approximately 6 days will be provided for collection and analysis of the monitoring data, during which time other placement may occur concurrently (figure 2). Once the data have been assessed, additional placement (no more than several hopper loads) will occur with the intent of creating a 15 cm cap at this point, only. Full capping of the entire cell will not occur at this time.

Approach: The contractor will repeat all surveys conducted for cell LU during the placement of cap at this cell **with the exception of Tasks C(i) and C(ii) which will not be performed for cell SU and only one survey will be done under each of tasks C(iii) and C(iv) about two thirds of the way through creation of a 15 cm cap at a single disposal point.**

Task 9. Monitoring of Cell SD (Seaward, Downstream) (Events #5 and #6b)

Task Eliminated from Scope

Task 10. Evaluation of Bathymetry Surveying

A. **Task Deleted from Scope**

Task 11. Disposal Plume Transport Survey

Background: Potential transport of suspended solids towards regional kelp forests is a concern. An assessment as to whether plumes would reach these locations and their extent and level of turbidity if they reach the kelp forests is needed.

Objectives: The contractor will contact local experts to determine the known location of the kelp forests nearest to the pilot demonstration area. The contractor will determine and map the extent and concentration of plume suspended sediments in the upper water column during expected on-shore transport events.
Approach:

1. The contractor will contact local experts to determine the location and extent of kelp forests near to the pilot study area. The contractor will acquire or develop a GIS data layer to contain this information.

2. The contractor will use an acoustic and physical methods (drogues) to map the location and extent of the upper water column plume (upper 30 m) created by the placement of cap material for two hours. This will be accomplished 3 separate times during the period of the pilot study when placement of finer cap sediments are being placed in the Landward cells. This will also occur when oceanographic conditions are expected to move the surface waters towards shore. The contractor will select these times in coordination with the Corps Project Manager. The contractor will take up to 27 water samples for total suspended solids (TSS) analysis in each plume to assist in mapping plume concentration.

Optional Task 12. Cap Erosion Analysis Samples

Background: The potential for the cap to be susceptible to erosion is one of the concerns that has been raised with the planned capping. One means of evaluating this possibility, will be to take samples of the in-place cap and test them in an erosion flume. The contractor will be responsible for collection of the samples for delivery to the analytical labs as specified. The actual testing of these samples is not a responsibility of the contractor under this scope of work.

Objective: Collect sediments for evaluation of the relative erosion potential of the in-place cap sediments.

Approach

A. After the completion of all other post-capping pilot surveys identified in this scope the contractor will collect sediment samples from near the center of cells LU and SU. At each of the two cells, the contractor will collect 120 liters of sediment using a Smith- McIntyre Grab and 3 cores (5 to 9 cm diameter by minimum 60 cm long, maximum 100 cm long). The 120 liter samples will be stored in sealed 12-liter buckets. Each bucket will be labeled to indicate location of samples.

B. The buckets and two cores from each of the two sites will be palletized and shipped to:

Dr. Rich Jepsen
Department of Energy
Sandia National Laboratory
4100 National Parks Highway
Carlsbad, NM 88220
(505) 234-0072
rajepse@sandia.gov

A brief letter will be submitted at completion of task to document samples collected including Latitude, Longitude, Area, Date, Time, and Water Depth at sample locations. The cores should remain upright and be padded to reduce vibrations. The samples should not be frozen and should be kept between 4 and 20 degrees centigrade. The cores should be split into 20 cm sections prior to shipping, and recapped and sealed.

One core from each site and a second copy of the letter documenting the sample locations, etc., should be sent to:

Dr. Marian Rollings
USAERDC
3909 Halls Ferry Rd.
Vicksburg, MS 39180-6199

ATTN: CEERD-GP
(601) 634-2952
rollingm@wes.army.mil

Task 13. Reporting

A. The contractor will provide daily updates via phone, e-mail, or fax to the Corps Project Manager during the operational portion of the Pilot capping. Weekly project meetings will be held with the Corps Project Manager to discuss progress and issues.

B. Within 3 weeks of the completion of monitoring the contractor will provide a cruise report to the Corps Project Manager. This report should provide a log of monitoring operations and a compilation of the data that are immediately available (qualified, as appropriate, regarding their preliminary or final validated status).

C. The contractor will prepare a detailed report (divided into chapters as appropriate) evaluating the results of the surveys. Methods used and data produced will be presented and analyzed. The report will address the objectives of the work and the purpose (null hypotheses). This report will include identification of needed changes to the null hypotheses, evaluation of the monitoring and operational approaches used, and recommendations. The contractor will produce both a final and draft report. The report will include an Executive Summary, Table of Contents, List of Figures, List of Tables, Introduction, Methods, Results, Discussion, Recommendations, References, Index, and Appendices. Ten copies of the draft report will be delivered to the Corps Project Manager 10 weeks following completion of all field work. The report will be delivered both in paper format and on electronic disk in MSWord 97 SR-2 format. Six (6) weeks following receipt of comments from the Corps Project Manager, the contractor will submit a ten copies of the final report. In addition to the paper and MS Word versions, the final report will also be submitted in PDF format on CD-ROM.

D. All data will be entered into the project GIS/Database and submitted to the Corps Project Manager on CD-ROM at the time of draft report submission.

Optional Task 14. Water Current Monitoring

Objective

Document the water current behavior in the area of the pilot capping cells for a 30 day period during the cap placement operations. These data will be used as input for hindcast modeling that may be done following the pilot project as part of the evaluation of field observations.

Approach

The contractor will deploy a bottom-moored, upward-looking ADCP on the Palos Verdes Shelf at a location near the pilot cells in coordination with the Project Manager. This instrument will be programmed to collect water column current data in multiple horizons (4 minimum) for a 30 day deployment period during the time that active placement of cap is occurring. If a shorter deployment period is sufficient, the Corps Project Manager will coordinate this change with the contractor. Data will be burst sampled on a minimum of an hourly basis. At a minimum the unit will be serviced once during the deployment period to assure the equipment is operating, unless for a shorter deployment period this is viewed as unnecessary during coordination with the Corps Project Manager. Sampling rates, horizons, and service schedule will be finalized and coordinated with the Project Manager. Data will be incorporated into the overall project report described in Task 13.

Palermo, M., P. Schroeder, Y. Rivera, C. Ruiz, D. Clarke, J. Gailani, J. Clausner, M. Hynes, T. Fredette, B. Tardy, L. Peyman-Dove, and A. Risko. 1999. Options for In Situ Capping of Palos Verdes Shelf Contaminated Sediments.

Palermo, et al. 2000. Field pilot study of in situ capping of Palos Verdes Shelf contaminated sediments – Operations and Monitoring Plan.

Lee, H. J. (1994). "The distribution and character of contaminated effluent-affected sediment, Palos Verdes Margin, Southern California," Expert Report.

Figure 1.

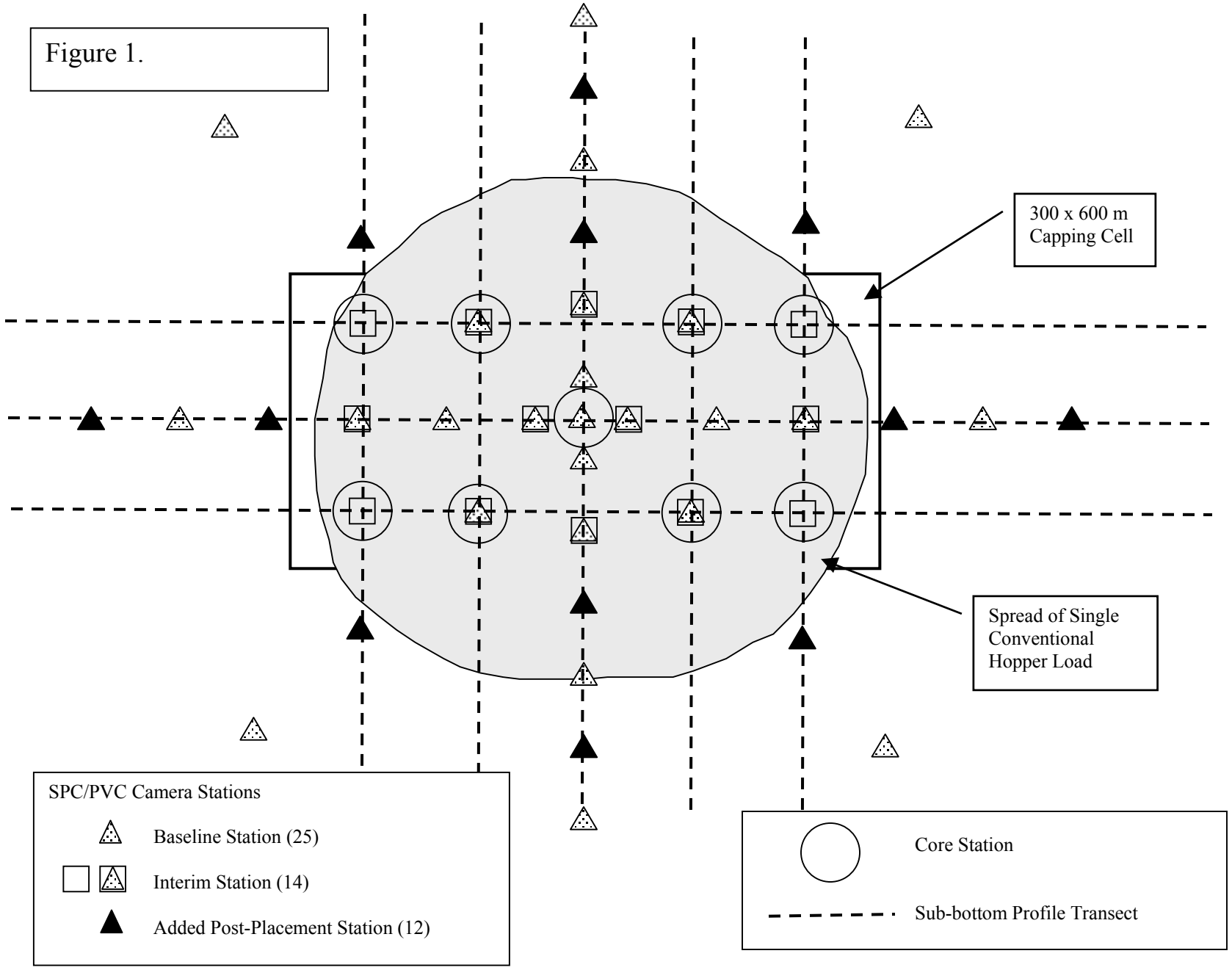

300 x 600 m
Capping Cell
Spread of Single
Conventional
Hopper Load
SPC/PVC Camera Stations
Baseline Station (25)
Interim Station (14)
Added Post-Placement Station (12)
Core Station
Sub-bottom Profile Transect

Figure 2.

Task Name	Planned Start	Duration in Days	Planned Finish
Baseline Monitoring	4/30/0	91	7/30/0
Event #0	7/1/0	4	7/5/0
Event #1 LU Convent./Fine	7/6/0	0	7/6/0
Monitoring #1	7/6/0	7	7/13/0
Event #2 LD Spreading/Coarse	7/14/0	0	7/14/0
Monitoring #2	7/15/0	7	7/22/0
Event #3A LU Fine to 15cm	7/17/0	15	8/1/0
Monitoring #3A	7/17/0	18	8/4/0
Event #4 SU Convent./Fine	7/20/0	0	7/20/0
Monitoring #4	7/20/0	6	7/26/0
Event #5 SD Spreading/Coarse	7/22/0	0	7/22/0
Monitoring #5	7/22/0	3	7/25/0
Event #3B LD Coarse +cm	7/27/0	3	7/30/0
Monitoring #3B	7/27/0	5	8/1/0
Event #6A SU Fine to 15cm	8/2/0	15	8/17/0
Monitoring #6A	8/2/0	18	8/20/0
Event #6B SD Coarse +cm	8/18/0	3	8/21/0
Monitoring #6B	8/18/0	5	8/23/0

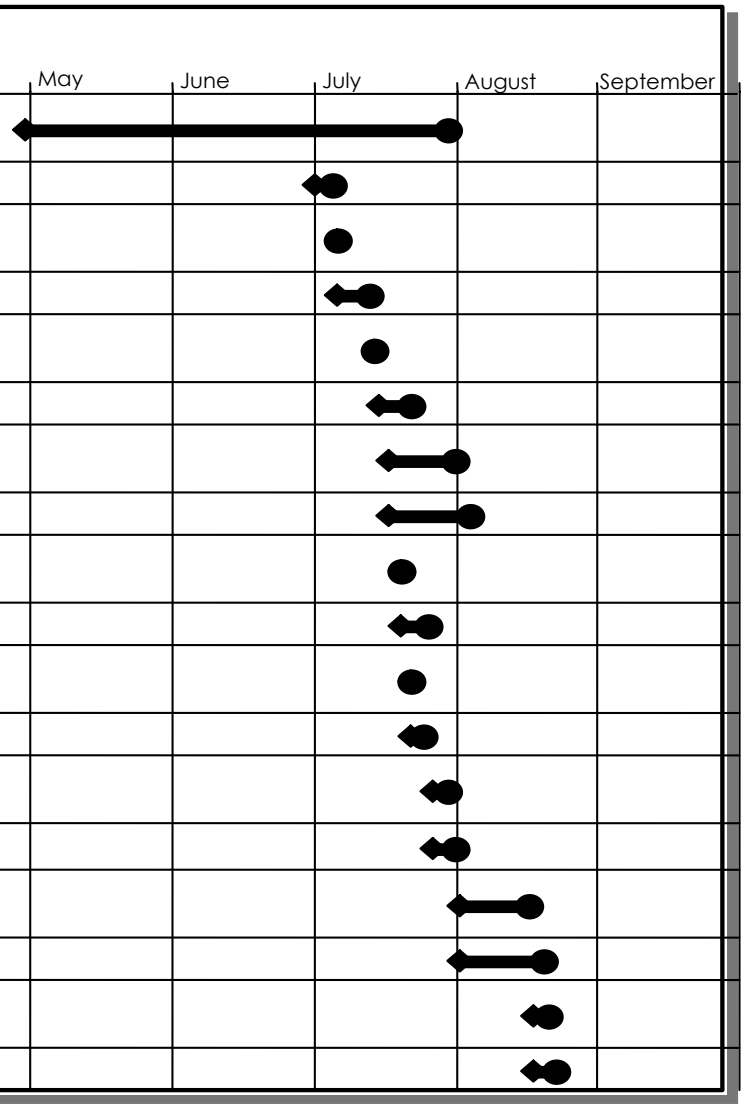
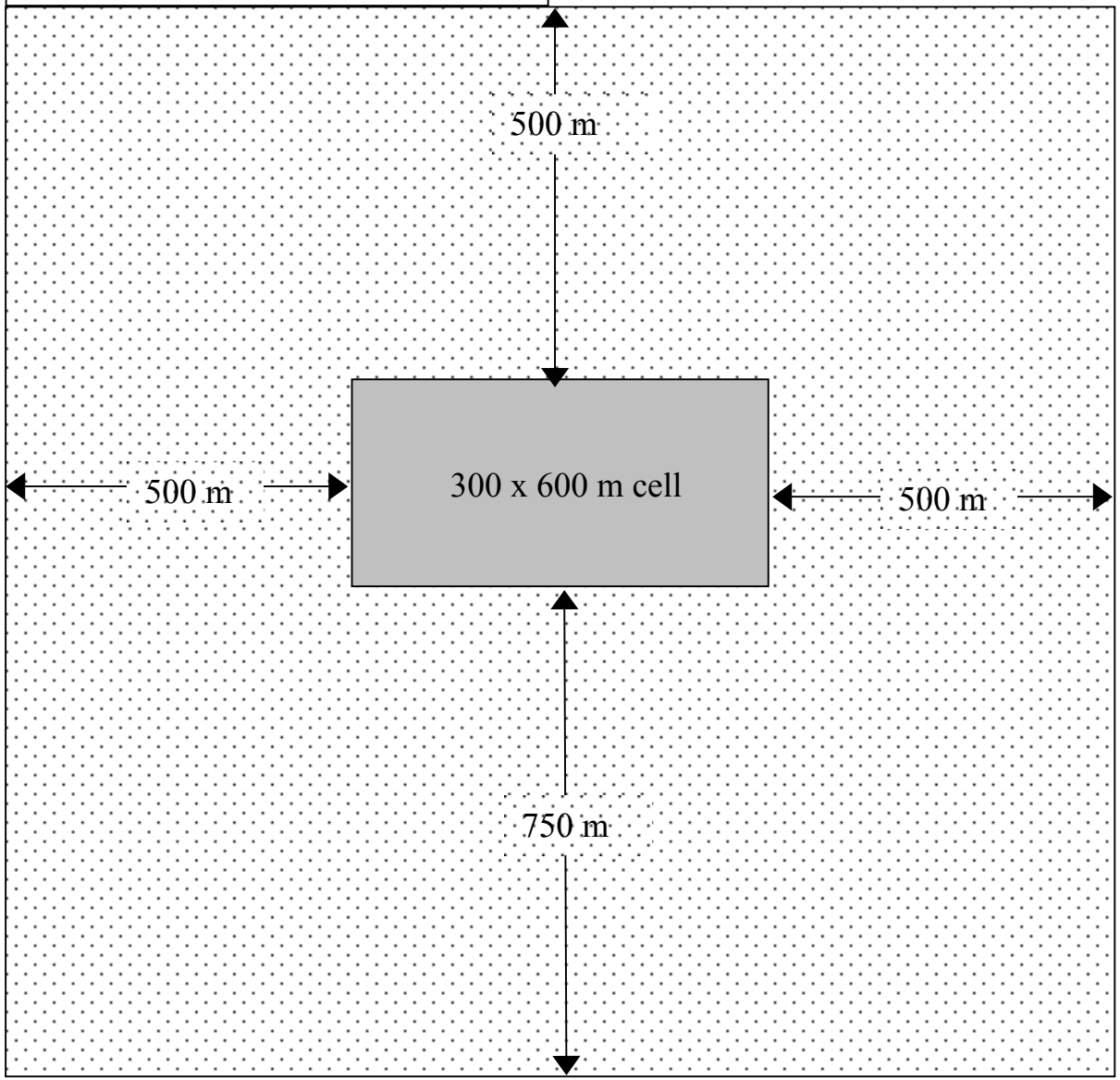


Figure 2. Conceptual Pilot Project Time Line.

Figure 3. Side-scan survey area.



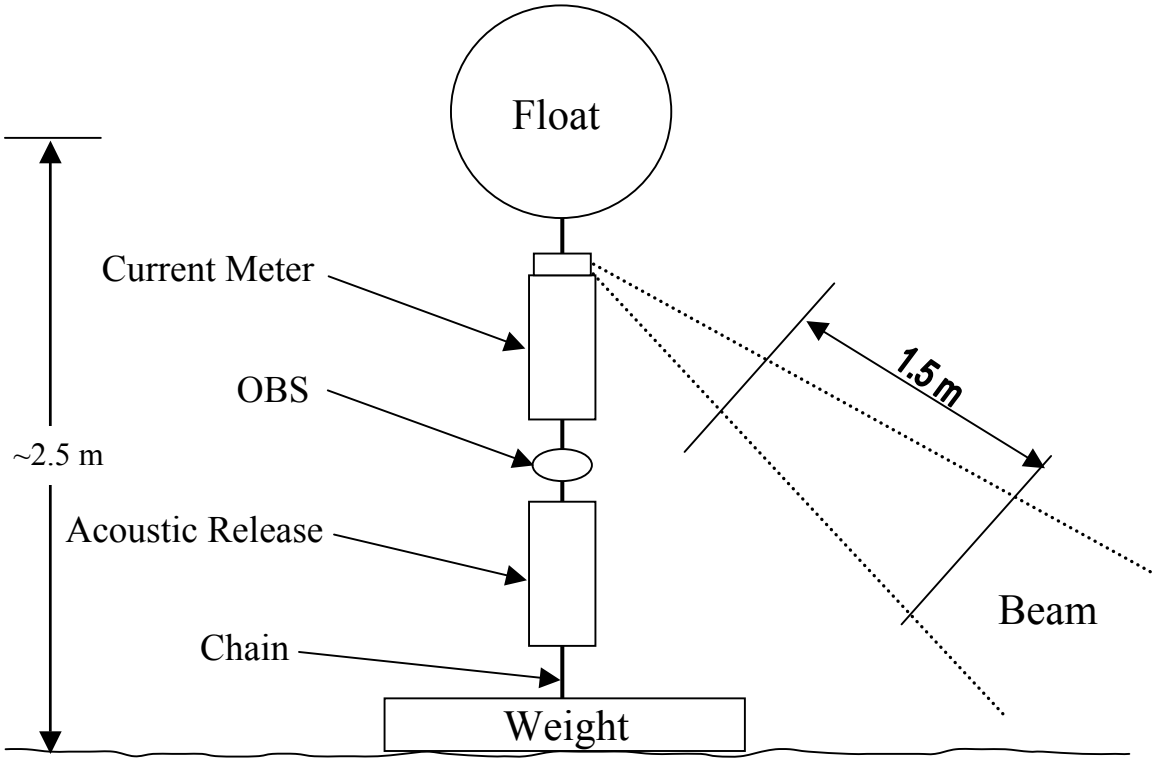


Figure 4. Schematic of Bottom Array.

Appendix B2
Supplemental
Palos Verdes Shelf Pilot Project Monitoring Scope of Work

Background

The gravity coring approach used during the August and September 2000 surveys on the Palos Verdes shelf pilot capping cells appears to have resulted in disturbance to the samples to a larger degree than was anticipated. There may be several reasons for this observation (e.g., equipment bow wake, consolidation state of cap, shell hash in cap, type of core catcher utilized), but collecting additional core data to support the other survey work is recognized as a priority by the project team. For this reason additional cores will be taken to aid in assessing cap thickness and establishing the existing chemical profiles in the caps. To accomplish this task, a different coring device will be used.

These cores will not necessarily be targeted at the intersection points of the sub-bottom profile lanes as specified in the earlier work, as preliminary analysis of those data has suggested that discrimination of cap thickness with sub-bottom data was not possible. Instead, the coring effort will be focussed on attempting to measure cap thickness where the sediment profile camera (SPC) showed the cap to be thicker than the camera penetrated. Initially though, some sampling will occur at stations where cap thickness is known from SPC samples to assess the ability of the core to provide relatively undisturbed samples.

A vibracore has been determined by the PV Team to be the only corer likely to provide cores of sufficient length to penetrate through the cap (up to 45 cm cap thickness) and into EA sediment at all stations and introduce less disturbance than the gravity core did. A box corer will not be likely provide sufficient penetration beyond 25-30cm and it will also collect much greater sediment volumes that will need to be specially handled and disposed. Additionally, a box core will disturb the cap to a much greater degree where these samples are taken because of its large areal size and the disturbance by the closing spade, which must swing through the sediment column. Both corers have potential to introduce artifacts, so comparison of these corers at selected locations will be performed to help better understand these differences.

Experience from the summer monitoring program suggests that identification of the cap/EA interface may be quite difficult for cores taken in cells LU and SU, where the visual sediment characteristics of these two materials are quite similar. This difficulty complicates the sampling of core horizons above, below, and within the transition zone. To eliminate any interpretive bias for sample interval selection, a consistent regular interval method (i.e., 4 cm increments) is preferred. While this method may result in some samples straddling the interface, this horizon can be noted in the sampling logs where visually obvious.

Objectives

1. Evaluate and document the ability of the vibracore to take relatively undisturbed samples and make adjustments in sample procedure to try and improve performance.

2. Measure and map cap thickness in cells LU, SU, and LD using the most effective means available.

3. Evaluate the chemical and physical characteristics of the cap material to assist in assessing cap success and the baseline post-cap condition. Some of these data (e.g., bulk density of cap) will also be used in ongoing model refinement efforts being conducted by the Corps of Engineers' Environmental Resource and Development Center (ERDC) in Vicksburg, MS.

4. Compare the effectiveness with which samples are taken with both a vibracore and box core to assess potential coring artifacts.

Approach
The following paragraphs describe the approach to be used by the contractor in performing the supplemental coring work. This approach is also presented as a flow chart in Figure 1, and the different types of cores to be collected are summarized in Table 3.

1. **Evaluate Vibracore Method**: The contractor will be prepared to take samples using a vibracorer. The contractor will test the vibracorer at a minimum of five stations, defined below, to provide assurance that the core device can produce a representative sample of the cap and underlying upper layer of the effluent-affected ("EA") contaminated sediment. The contractor, in coordination with a Corps of Engineers representative who will participate in the survey, should evaluate whether the cores are able to penetrate through the cap material and a minimum of 20 cm into the EA sediment and whether the coring appears to introduce any apparent artifacts into the sediment stratigraphy (surface disturbance due to a bow wake, drag down of cap material, etc.).

   The contractor, in consultation with the Corps of Engineers personnel, will be prepared to change the approach to coring, to include the use of different core catchers or the absence of a core catcher. Coring without a core liner is also an option, but such an approach would be logistically difficult and would likely require a second mobilization, and it is therefore not included in this scope of work.

   Vibracore Test #1: Three of the initial five vibracore test stations should be taken from locations where sediment stratigraphy has been well documented using sediment profile imaging (SPI). Because the cap and EA sediment stratigraphy from SPI photos is very clear in cell LD (see figure 2), two of these three test stations should be conducted in this cell. Stations I05 and I08 are recommended for this effort. The third station should be done in cell SU at I13, because the stratigraphy is known from SPI photos. For these three vibracore station locations, the following factors will be used to assess the success of coring: (1) core recoveries of at least 50 cm (caps are less than 20 cm thick at these stations, so this will result in the EA penetration need of 20 cm) and (2) cores that provide visual descriptions comparable to previously collected SPI photos from the selected stations. To be similar to the SPI photos the cores should have (1) cap thickness within ±20% of the replicate SPI photo lower and upper cap thickness range (to be calculated by the contractor) and (2) sharp transitions from the cap to the EA sediment that occur over less than 4 cm. All cores will be split, photographed, and visually described. Particular attention should be given to the condition of the transition between the EA and cap sediments.

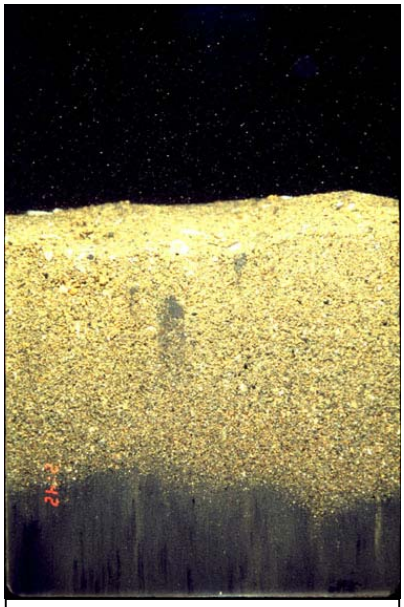


Figure 2. SPI photo from station LDI05 after 9 placement events.

   Vibracore Test #2: The contractor will test the vibracore at two stations where thicker cap is expected to determine whether the vibracore can penetrate the full cap thickness. This will be done at LU stations I06 and I10. The following factor will be used to assess the success of coring: (1) core recoveries of at least 70 cm (the cap is expected to be less than 50 cm thick at these stations, so this will result in the EA penetration minimum of 20 cm. All cores will be split, photographed, and visually described. Particular attention should be given to the condition of the transition between the EA and cap sediments.

   The contractor will transport the five test cores described above to the shore site for processing and assessment. The contractor will proceed with step 4 (box cores) until the test cores can be processed and assessed.

   If the vibracores from Test #1 meet the SPI photo comparison criteria, the contractor will continue with step 2 below, using the vibracore sampler. In the event that the cores from vibracore Test #1 do

not meet the above comparison to the SPI photos, the deviations will be noted, and the investigation will proceed with the vibracore to collect the samples described in step 2 below. If extreme disturbance is noted in the Test #1 cores (e.g., interface disturbance extending over more than 8 cm) or cap thickness is consistently not within the expected range (considering all test locations), then in step 2 below LU stations O09, I02, I14, I16, I17, I18, I19, I20, I21and all SU and LD stations will be sampled with the box core (instead of a vibracore) and subsampled with hand coring (see step 4 below).

If the vibracores from Test #2 meet the penetration criterion, the contractor will use the vibracore at LU stations I02, I06, I07, I09, I10 and I14, which are all in the central portion of the cell. These cores will be split, photographed, and visually described, and then subsampled for chemical and physical analysis per Table 2 below.

2. **Continue with Selected Coring Method**: Once the contractor, in consultation with the Corps of Engineers representative, has assessed the vibracore method performance as discussed above, a series of cores will be taken from cells LD, LU, and SU. The contractor will take three cores in cell LD (the contractor may elect to use the cores taken in step 1 above, if feasible, as part of this task). In addition to taking cores at the LD stations I05 and I08, the contractor will take one more core from station I11 (see Table 1). The contractor will take cores from 13 stations at cell LU (O09, I02, I06, I07, I09, I10, I14, I16, I17, I18, I19, I20, and I21). The contractor will also take cores at six stations in cell SU (I01, I05, I08, I10, I14, and I15). The cores will penetrate at least 20 cm into the EA sediment. All cores will be split, photographed and visually described. Particular attention should be given to the condition of the transition between the EA and cap sediments.

Table 1. Planned Physical and Chemical Samples from Vibracores

Cell	Cores for Visual Assessment	Cores for Chemistry and Physical Analysis	Approx. # of 4 cm Intervals	Analyses per Core	Total Analyses	Approx. # of Archived Samples
LD	3	2	5	3	6	4
LU	13	6	12	6	36	36
SU	6	4	12	6	24	24
Flex					10	-10
			Total		76	54

3. **Analyze Core Samples**: Two cores from LD, six cores from LU, and four cores from SU (see Table 2 below) will be sampled for sediment grain size, bulk density, vane shear, specific gravity, water content, and chemistry. Samples for analytical analysis will be taken every 4 cm to a maximum of 48 cm (where the cap/EA interface is patently clear sampling need only extend to two full horizons below the interface). Starting at the surface sample (0-4 cm) every other sample (0-4, 8-12, 16-20, 24-28, 32-36, 40-44 cm) will be analyzed for the physical parameters listed above and p,p' DDE. All other samples (e.g., 4-8 cm, 12-16, 20-24, 28-32, 36-40, 44-48 cm) will be archived. The contractor will be prepared to conduct analyses on up to 10 of the samples slated for archiving. Selection of these samples will be made in consultation with the Corps of Engineers representative(s). Atterberg limit (if sufficient fines) samples will be taken from the third LD core (I11), the two other SU cores, and four of the LU cores (see Table 2). The Contractor will collect field QC samples (i.e., duplicates, ambient conditions and equipment rinsate blanks, and matrix spike/matrix spike duplicates [MS/MSDs]) using the methods and in the frequencies described in the *Draft Project Work Plan for the Palos Verdes Pilot Capping Project: Interim and Post-Cap Monitoring* (SAIC, 2000).

4. **Collect Box Core Samples**: The contractor will also take box cores from cell LD: stations I08, I11 and cell LU: stations O09, I16, I17, I18, and I19 for comparison to the vibracores. The box corer should have a minimum penetration capability of 25 cm. Box cores will be sub-sampled on deck with a hand-pushed core tube. All cores will be split, photographed, and visually described. Particular attention should be given to the condition of the transition between the EA and cap sediments.

Table 2. Vibracore Sampling Details by Cell

Cell	Station to Sample	Analyses V, C, A*		Cell	Station to Sample	Analyses V, C, A*
LD	I05	V, C		**LU (cont.)**	I17	V, C
	I08	V, C			I18	V, A
	I11	V, A			I19	V
LU	O09	V			I20	V, A
	I02	V, C			I21	V, C
	I06	V, C		**SU**	I01	V, C
	I07	V, A			I05	V, C
	I09	V, C			I08	V, C
	I10	V, A			I10	V, A
	I14	V, C			I14	V, C
	I16	V			I15	V, A

*V = Visual Analysis; C = Chemical/Physical Analyses, A = Atterberg Limit Samples

Reporting

A. Before work is initiated, the *Draft Project Work Plan for the Palos Verdes Pilot Capping Project: Interim and Post-Cap Monitoring* (SAIC, 2000) ("PWP") will be modified by the contractor as described below to include the requirements and specifications related to this supplemental monitoring event and approved for use by the EPA and USACE. Revisions to the PWP will include the following:

1. Overview: add short section describing the nature and purpose of the additional coring survey (with the understanding that this task is part of the summer monitoring program);

2. DQOs: add text to existing sediment coring section and summary table that will reflect the objectives and approach for supplemental coring as discussed in this SOW;

3. FSP: add text to appropriate sections regarding vibracore and box core sample collection and processing;

4. QAPP: add text to appropriate sections regarding core collection and processing:

5. SOPs: prepare new SOP for vibracoring and box coring (can modify existing gravity core SOPs to extent possible); and

6. HSP: add any additional issues not covered by existing material to appropriate sections.

The contractor will incorporate these revisions into the existing PWP and issue revision pages. Draft and final versions of the revision pages will be prepared and distributed by the contractor. The final versions will incorporate comments on the draft versions received by the contractor from the project team.

B. Within 3 weeks of the completion of monitoring the contractor will provide a cruise report to the Corps of Engineers Project Manager. This report should provide a log of monitoring operations and a

compilation of the data that are immediately available (qualified, as appropriate, regarding their preliminary or final validated status). Additionally, as soon as reliable estimates of cap thickness from the coring are available, the sample number, location (northing and easting), and thickness (in centimeters) will be provided to ERDC staff in an Excel spreadsheet format.

C. The contractor will prepare a detailed report evaluating the results of the survey. Methods used and data produced will be presented and analyzed. The report will address the objectives of the work and the purpose (null hypotheses). This report will be prepared for incorporation into the overall Pilot Study report as a separate chapter. Ten copies of the draft chapter will be delivered to the Corps of Engineers Project Manager 10 weeks following completion of all field work. The report will be delivered both in paper format and on electronic disk in MSWord 97 SR-2 format. Following receipt of comments from the Corps of Engineers Project Manager, the contractor will incorporate the chapter into the overall Pilot Study final report. In addition to the paper and MS Word versions, the final report will also be submitted in PDF format on CD-ROM.

D. All data will be entered into the project GIS/Database and submitted to the Corps of Engineers Project Manager on CD-ROM at the time of draft report submission.

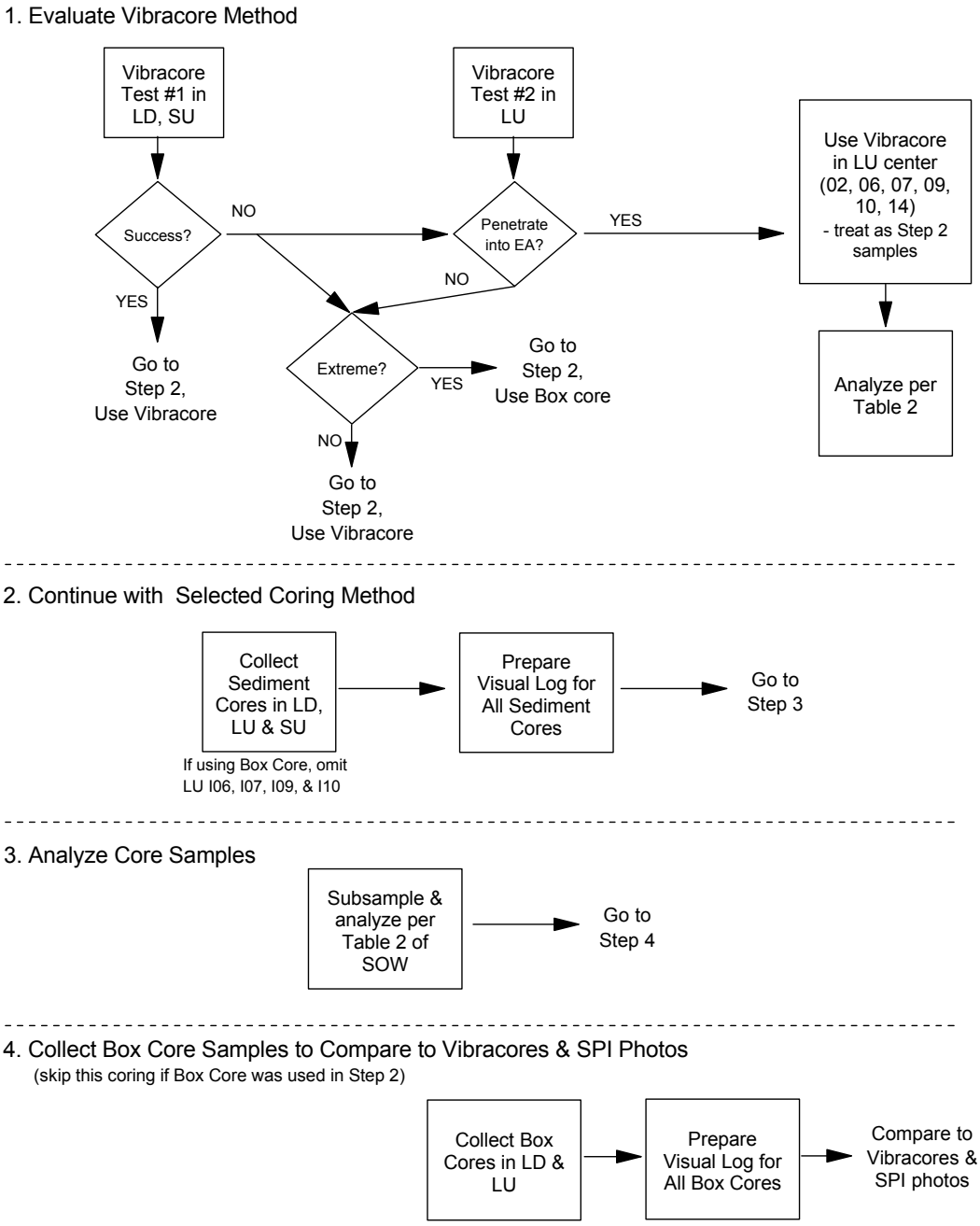
Table 3. Summary of Planned Coring Activity

Cell	Station	Step 1			Step 2		Step 4
		Initial Test #1	Vibracore Test #2	Vibracore Samples #1A (Pass Test 2)	Samples #2 if Vibracore	Samples #2 if Box Core	Samples #4 with Box Core
LD	I05	x			x*	x	
	I08	x			x*	x**	x
	I11				x	x**	x
LU	O09				x	x**	x
	I02			x	x*	x	
	I06		x	x*	x*		
	I07			x	x*		
	I09			x	x*		
	I10		x	x*	x*		
	I14			x	x*	x	
	I16				x	x**	x
	I17				x	x**	x
	I18				x	x**	x
	I19				x	x**	x
	I20				x	x	
	I21				x	x	
SU	I01				x	x	
	I05				x	x	
	I08				x	x	
	I10				x	x	
	I13	x					
	I14				x	x	
	I15				x	x	

x* = use previously collected sample, if feasible

x** = use box core from step 4, if feasible

Figure 1. Flow Chart for Supplemental Coring



Additional Placement & Monitoring Activities

Palos Verdes Pilot Cap Monitoring Project
(Plan developed September 6, 2000)

A. Pump-out of Queens Gate material while traveling through Cells LU, LC and LD

Objective

During material placement via mid-depth pump-out of material from a moving hopper dredge, determine:

1. Whether EA sediments are resuspended to a lesser or greater degree than during other placement techniques (e.g., spreading or conventional release).
2. The thickness and spatial extent of the footprint of cap material following the single-placement pump-out event.

Placement Schedule

Pump-out will begin at 11 AM PDT on Friday, September 8. SAIC will contact NATCO at 8 AM PDT that morning to confirm this placement time.

NATCO Operations

Dredge approximately 1200 cu yds of Queens Gate material. Collect one sediment sample from the hopper and provide to SAIC for geotechnical analysis.

Within the pilot project area, pump out material at a constant rate as the dredge transits at a speed of approximately 2 knots along a line between the "start" position (near center of Cell LU) and "end" position (at northwest boundary of Cell LD), both of which shall be provided to NATCO by SAIC. Note that a major fraction of the material will be placed between Cells LU and LD, in the region (cell) hereafter called "LC" for "landward center".

During pump-out operations, both drag arms shall be lowered to a depth of 75-80 ft (and positioned nearly vertical), such that material will exit the drag arms in a downward/forward direction. If material is remaining in the hopper upon arrival at the "end" position, then pump-out must be terminated, and the remaining material brought back to the harbor for disposal in the normal location.

SAIC Monitoring Activities

For Study Objective 1, a field survey will be conducted during the pump-out event to monitor any near-bottom sediment plume resulting from the placement operation, as well as collect water samples for post-survey laboratory analysis of total suspended solids and DDE concentrations in the near-bottom plume. The monitoring equipment and techniques will be identical to those used for the four prior plume monitoring surveys (two in Cell LU, one in Cell SU, and one in Cell LD).

For Study Objective 2, Sediment Profile Imagery (SPI) and Plan View (PV) photography will be used to determine the thickness of cap material placed along the pump-out line. On Thursday, September 7, 18 "baseline" SPI/PV stations will be occupied in the western half of Cell LC, where it is expected that little if any cap material from Cell LU or LD is present. The baseline stations will be located on three lines: one along-axis (hopper track) line having six stations spaced at 50-m intervals; and two cross-slope lines, each having three stations upslope of the along-axis line and three stations downslope of the along-axis line. Stations will be separated by approximately 30 m along these cross-slope lines. A map showing the pump-out track and the positions of these LC baseline stations is attached.

No baseline stations will be occupied within Cell LD because the SPI/PV survey conducted in Cell LD following placement of the 9 spreading loads will constitute the "baseline" condition.

Following the pump-out operation, a "post pump-out" SPI/PV survey will be conducted in Cells LC and LD on Saturday, September 9. In Cell LC, the 18 baseline stations will be reoccupied to assess cap thickness. In Cell LD, an additional 18 stations will be occupied, with the majority of these corresponding with stations occupied during the prior survey in LD. It is anticipated that the sediment characteristics of the pumped Queens Gate material will be readily distinguishable above the coarse borrow-area cap material that now resides along the center line of Cell LD.

B. Placement of 20 additional loads of Queens Gate material in Cell LU

Objective
Place additional loads of material to increase cap thickness to approximately 45 cm in one-third to one-half of Cell LU.

Placement Schedule
Conventional placements shall begin on Sunday, September 10 and continue until 20 loads are placed in Cell LU (approximately 3 days of operations). SAIC will contact NATCO on Saturday to confirm this placement schedule.

NATCO Operations
Dredge approximately 1200-1400 cu yds of Queens Gate material for each load. Collect one sediment sample per day from the hopper and provide to SAIC for geotechnical analysis.

SAIC will provide locations for each of the 20 placement events. These events will be located in the offshore-western quadrant of Cell LU, to minimize interference with monitoring element C below. At each location, the dredge shall stop to release the load at the same rate as during prior conventional (bottom dump) placements in Cell LU.

SAIC Monitoring Activities
Post-placement monitoring will consist of: 1) sediment coring at 5 locations within the area circumscribed by the 20 placements, and 2) side-scan sonar and subbottom profiling operations across Cell LU.

The coring will be conducted on Friday, September 15, using the gravity coring device utilized on prior surveys of the capping project. Maximum weight will be added to the corer to maximize penetration through the cap, but it may not be possible to penetrate the entire cap if it exceeds 35-45 cm.

A subset of the coring locations will correspond with locations of prior cores in Cell LU. At each of the 5 coring locations, three attempts will be made to obtain a relatively long (i.e., greater than 50 cm) core; the longest core from each station will be transported to shore for processing.

Processing of the cores will consist of visual descriptions (logging) and photography; no sediment samples will be extracted from the cores for geotechnical or chemical analysis.

The side-scan sonar and subbottom profiling survey in Cell LU will be conducted on Thursday, September 14, using the same techniques and along the same lanes as occupied on the prior survey (following placement of the 45 loads) in Cell LU. The side-scan data will be used to identify the topography of the new "mound" of cap material that may be visible above the cap that existed from the initial 45 placements in Cell LU. The subbottom profile results may be useful for quantifying cap thickness across the cell, with more vertical resolution than was possible during the prior survey of the thinner (i.e., 15-cm) cap.

C. Farfield SPI monitoring of Cells LU and SU to identify the footprint boundary

Objective
Conduct additional SPI/PV stations around Cells LU and SU to delineate the farfield boundary of the cap material footprint. These data will be useful for calibration of the MDFATE model, especially for

computation of the volume within the thin (0.5-3 cm) apron of cap material that may extend hundreds of meters beyond the boundaries of the cells.

NATCO Operations
No additional placement operations are needed for this activity.

SAIC Monitoring Activities
SPI/PV photography will be used to determine the thickness of cap material along survey lanes extending from Cells LU and SU. Survey operations will be conducted on Monday, September 11, although during continual placements in the offshore-western quadrant of Cell LU (see monitoring element B above).

The survey will consist of 36 stations situated along four lines:

Line A will be directed inshore from Cell LU, with 8 stations at 25-m spacing, beginning 100 m inshore of the cell boundary,

Line B will be directed offshore from Cell SU, with 12 stations at 25-m spacing, beginning 100 m offshore of the cell boundary,

Line C will be directed southeastward from Cell LU, with 8 stations at 25-m spacing, beginning 100 m southeastward of the cell boundary,

Line D will be directed southeastward from Cell SU, with 8 stations at 25-m spacing, beginning 100 m southeastward of the cell boundary,

These stations will extend beyond the location of stations sampled during previous interim and post-cap surveys to be sure that the farfield stations extend beyond the footprint boundary.