CONSTRUCTION OF THE CAMPBELL SHIPYARD SEDIMENT REMEDIATION PROJECT, SAN DIEGO, CALIFORNIA

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ABSTRACT

A contract for remediation of sediments at the former Campbell Shipyard site in San Diego (as described in the earlier presentation) was awarded by the Port of San Diego (the Port) in the early summer of 2005. Key design elements and specification approaches for the project were discussed in the preceding paper and presentation. This presentation focuses on the most significant developments associated with those facets of construction accomplished to date, and looks ahead to the remaining construction tasks planned for the summer/fall of 2006.

Prior to capping, targeted areas were dredged in order to maintain sufficient post-capping water depths for continued navigational operations at the adjacent Tenth Avenue Marine Terminal (TAMT), and to achieve post-capping depths suitable for construction of an eelgrass habitat area and a rock revetment along the seawall. Sediments were temporarily stockpiled on land and trucked to a local landfill for disposal.

Cap construction posed a challenging set of construction conditions. Placing of each of the cap's various layers needed to be completed in such a way as to avoid disturbance or damage to the underlying, previously-placed layers. Furthermore, cap construction near TAMT needed to be closely coordinated with shipway traffic maneuvering into and from the terminal, since tugboat propeller wash forces could disrupt previously placed capping materials. The selection of cap placement technique was left to the contractor's discretion, subject first to approval of a documented capping plan, followed by demonstration of their approach through construction of an initial "pilot cap" area.

Material for the sand cap was excavated from nearby Grand Caribe Island. This was an example of incorporating beneficial reuse into the project, as the Grand Caribe excavation represented the first stage of a separate Port project to create an intertidal marshland at that site.

Keywords: Contaminated sediment, capping, dredging, dewatering, sediment management, landfill disposal, marine structures, habitat restoration.

INTRODUCTION

The Port of San Diego (the Port) was required by the California Regional Water Quality Control Board (RWQCB) to remediate contaminated sediments at the former Campbell Shipyard site. As was discussed in the previous presentation ("Design of the Campbell Shipyard Sediment Remediation Project"), the selected remedial alternative was to cap the sediments in-place in such a way as to prevent migration of the contaminants into the marine environment.

Construction of this project involved a complex sequence of demolition, debris removal, sediment dredging, and installation of a multi-component sediment cap. Details of the design process are presented in a separate precursor paper, entitled "Design of the Campbell Shipyard Sediment Remediation Project, San Diego, California." This

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paper discusses the main highlights to date of the construction project, and describes how the project's performance-based specifications were used, along with the project team's flexibility, to develop, approve, implement and oversee construction elements.

At this time of this writing (April 2006), the construction has not been fully completed. The initial steps – demolition, debris removal and dredging – were in their final stages, with the various elements of the capping work scheduled to begin in May.

The following describes the overall sequence of construction operations required for the project:

- Removal of California hazardous waste and free product from former shipways area, as a precursor to contract award.
- Demolition of abandoned shipway ramps and removal of significant debris items from sea floor.
- Reconstruction of the mole pier.
- Dredging of eelgrass habitat area and area adjacent to Tenth Avenue Marine Terminal (TAMT), with upland disposal of dredged sediments.
- Construction of cap layers for the isolation cap and the eelgrass habitat cap (foundation rock, cap geotextile, base cap, gravel filter and armor/revetment rock).
- Construction of rock revetments along seawall and protective rock berm around eelgrass habitat area.
- Installation of monitoring stations and habitat features.

Construction Management Team

The project was administered and managed by the Port of San Diego. The Port acted as project construction manager and provided day-to-day inspection services. The consulting firms that comprised the design team were retained to provide construction engineering consultation and to provide general management support as needed. Diver inspection services were performed by the Port, and supplemented by divers from the technical consultation team for more specific technical needs.

CONTRACTING AND PRELIMINARY WORK

Bidding and Contractor Award

The Port of San Diego put the project out to bid in April 2005. In order to make the Port's bid processes more efficient and economical, the contract documents for the Campbell Shipyard sediment construction work were packaged with two other, independent Port-designed projects: maintenance dredging at the National City Marine Terminal (NCMT), and berth deepening at the nearby TAMT. Both were included as additive bid items, their possible award being contingent on the bid prices received.

In June 2005, three bids were received on the project. As low bidders, Traylor Pacific was awarded the contract. Bid pricing was within the Port's allowable funding, such that the Port was able to also award the two additive bid projects at NCMT and TAMT.

Early Action: Removal of Hazardous Waste from Shipways Area

Prior to commencement of the sediment remediation, an early action contracted by the Port involved partial demolition of the former shipways area and localized excavation and removal of free petroleum-based product known to exist in the area. Contract documents for the Campbell Shipyard sediment project indicated the fact that some material would be removed from this area prior to contract award, although at the time of bidding the full extent of free product removal was not known, so this portion of the contract required flexibility.

As the free product removal progressed, extents of the deposits were found to be more extensive than expected, so it also became necessary to remove some of the south mole pier as well (Figure 1). This in turn necessitated a modification to the project design and to the contractor's work scope. A key element of the project design was to stabilize the mole pier structure and retain its pre-existing geometry. This goal remained even after part of the mole pier had been demolished for the free product removal. The timing of the free product excavation was such that the total extent of mole pier removal was not known until after award of the sediment remediation contract, so the corresponding change in the contract's scope needed to be done as a change order.

Figure 1. Condition of shipways area and mole pier following free product removal.

The sediment project team considered the option of fully removing the mole pier, but ultimately decided against that option as it would have resulted in additional demolition and disposal costs, and would still require construction of some sort of protective barrier for the eelgrass habitat area in its place. Therefore, the design was modified to include reconstruction of the mole pier to its originally planned dimensions. This activity is discussed briefly later in the paper.

DEMOLITION AND DEBRIS REMOVAL

As was discussed in the earlier paper on project design, the abandoned shipways structures needed to be demolished and the underlying soils dredged, so that the area could be lowered to the depths necessary to construct an eelgrass habitat area at shallow subtidal elevations. In addition, previously identified debris items were called out for removal by the contractor – specifically, those that protruded significantly above the seabed and could therefore interfere with cap construction or function.

The contract documents identified specific features and items for demolition and removal, some of which had been removed during the precursor free product removal work described previously. All features that remained after that work were then demolished and removed by the sediment remediation contractor (Figure 2).

Figure 2. Demolition and debris removal underway (note partially excavated mole pier in foreground).

Generation of Sediment

During this process, a significant amount of accompanying sediment was brought up with the debris (Figure 3). In some cases, the amount of accompanying sediment exceeded (by as much as a factor of two) the tonnage of the demolition debris itself.

Figure 3. Barge load of debris shows accompanying sediment.

The Contractor had made arrangements with the nearby Otay Landfill in Chula Vista for disposal of site sediments and debris. The landfill accepted dredged sediments as alternate daily cover, for a reduced tipping fee, contingent on the sediment passing the “paint filter” test. The landfill also accepted debris as solid waste, under a separate waste manifest.

Additional Debris Encountered

As demolition was completed in various areas, the Port conducted diver and side-scan sonar surveys to assess whether there was any remaining debris to be removed. These surveys did reveal additional debris items on seafloor

(Figure 4) that were large enough to hinder cap placement and function, and thus warranting removal. The contractor was required to remove these additional debris features under a change order.

Photo 3 - steel rail, 27 in. vertical.

Figure 4. Example of debris requiring removal (diver photograph).

SEAWALL AND MOLE PIER REPAIR AND RETROFIT

As mentioned previously, the mole pier needed to be reconstructed since much of it had been removed during the hazardous waste removal operations. Figure 5 shows the new sheet piling installed around the mole pier's perimeter, and the rock fill that was used to backfill the areas that had been excavated earlier for free product removal.

Figure 5. Mole Pier reconstruction underway.

During construction, a previously unanticipated element of seawall repair became necessary, as dredging of the shipways area exposed concrete seawall panels that were out of alignment, forming exposed "gaps" in the seawall.

A method of repair was designed in which the out-of-alignment panels would be temporarily removed and then replaced in an aligned position. At the time of this writing, that repair work had not yet occurred.

DREDGING

Sediment was dredged using a toothed clamshell bucket and loaded directly onto flat-deck barges (Figure 6). Daily dredging rates were typically on the order of 153 to 229 cubic meters (200 to 300 cubic yards) per day, although the production rate increased to as much as 765 cubic meters (1,000 cubic yards) per day while dredging the area closest to TAMT, where the cut thickness was greatest (over 3.3 meter (10 feet)).

Figure 6. Dredging equipment in action.

The crane was equipped with a real-time GPS unit which fed directly to a real-time display on a monitor in the operator's cab, showing the crane and bucket position at all times. This data collection system produced output showing the positions of all bucket activities throughout a day's time, which were regularly submitted to the Port with the Contractor's daily reports (Figure 7).

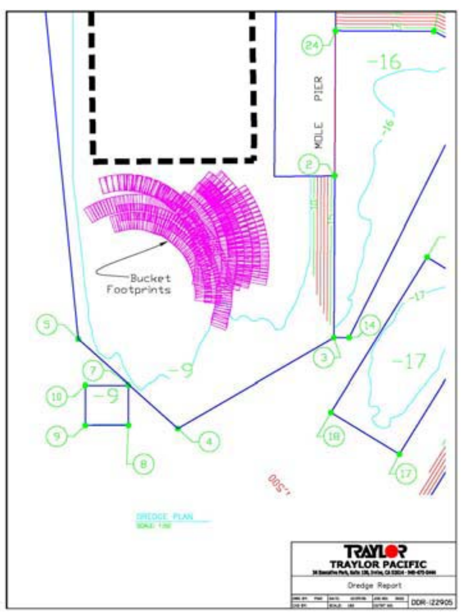

Figure 7. Example plot of dredging bucket activity throughout a day's time.

Dewatering and Sediment Management

The barges had been equipped by the contractor with enclosures constructed with K-rail barriers (Figure 8). Sediment was permitted to drain from the barge directly into the Bay, through filter fabric-lined gaps under the rails, provided that water quality criteria were met at all times. To date, no water quality violations have been recorded (see section on Environmental Protection).

Figure 8. Barge being loaded with sediment and debris.

The Contractor established a sediment stockpiling and dewatering area over an approximately 0.6 hectare (1.5 acre) area on the adjacent project uplands (Figure 9). This area was lined and surrounded on three sides by K-rail barriers. Recently filled barges pulled up alongside this area and offloaded using a land-based crane, into the stockpiling and dewatering area (Figure 10). A spill apron was constructed at the offloading point to protect Bay waters from sediment that may drop off during transfer.

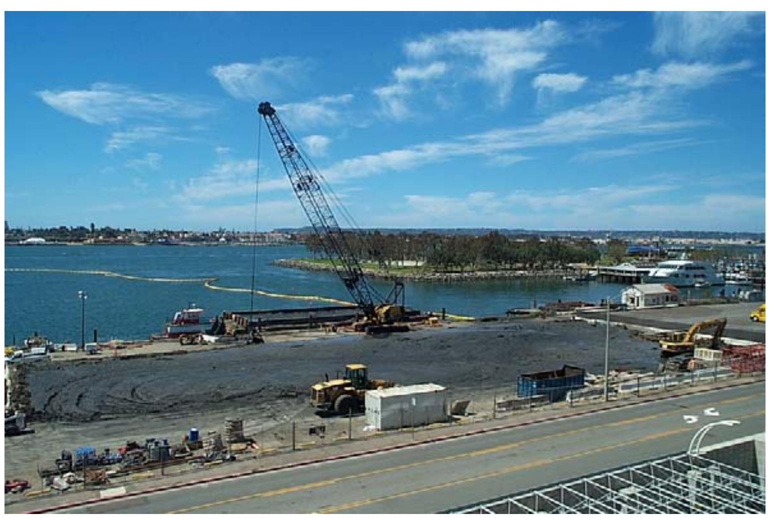

Figure 9. Sediments being loaded from flat-deck barge into stockpiling area.

Figure 10. Offloading dredged sediment from barge into stockpiling area.

As was discussed previously, the Otay Landfill in Chula Vista accepted site sediment for disposal, provided that it was sufficiently dewatered to pass the “paint filter” test. Sediments were typically stockpiled within this area for a time period of 2 to 5 days, during which time it was regularly reworked using a rubber-tired front end loader to facilitate air-drying (Figure 11). This physical drying technique ended up being sufficient, as the landfill accepted all truck loads of material. As a result it was not necessary for the contractor to add any dewatering additives to the sediment.

Figure 11. Rehandling within sediment stockpiling and dewatering area.

The sediment (and all debris generated during the dredging process) was sent to the landfill in lined trucks.

Otay Landfill posed restrictions on their weekly acceptance rates, depending on each week’s anticipated waste stream and the landfill’s need for cover material. During periods of greater production rates, these restrictions occasionally limited the contractor’s ability to continue dredging due to limited space on site for sediment stockpiling. There were also occasions where rainy weather caused temporary closures of the landfill to sediment. In some cases this led the contractor to stop dredging operations temporarily since their stockpiling area was at capacity.

CAPPING

At the time of this writing, capping activities have not yet started. A Capping and Rock Placement Plan was submitted by the contractor in April, which described the contractor's intended methodologies for the capping work. As was discussed in the previous presentation, the specifications for capping work were typically performance-based, such that it was the Contractor's responsibility to determine the most appropriate method for cap construction – provided that the individual cap layers were successfully installed to the minimum required thicknesses, without any disturbance or damage.

Proposed Cap Placement Methods

The Contractor proposed to place each layer of the cap – foundation rock, sand cap, filter gravel and armor rock – using a skip box. The intention was to load the skip box with a known tonnage of material, position it over a known location, and slowly "sweep" the box while releasing materials into the water to cover a defined area. For placement of sand and gravel, the skip box would be suspended above the water surface so that it could be viewed by the crane operator. For placing armor rock, the specifications limited the rock drop height to no more than ten feet in order to minimize the potential for damage to the previously placed sand and gravel layers.

Demonstration of Capping Methods with Pilot Cap Section

The first capping activity was construction of a "pilot cap" section over a limited area of the site. This was required as a means for the contractor to demonstrate that their methods would result in a successful product.

Cap Inspection Techniques

Inspection of the various cap layers would require the assimilation of several sources of data, to give the Port the best possible understanding of the cap layer thickness and coverage. The Contractor is required to perform daily progress bathymetric surveys. These daily surveys are intended to show changes in bathymetry and overall coverage. They would not, however, necessarily indicate if the required minimum thicknesses were being met, for two reasons. First, the accuracy of the surveys was generally on the order of 15.2 to 30.5 cm (6 to 12 inches) for elevations, and the cap layers were each one to two feet thick. Second, another potential source of inaccuracy was the fact that placement of cap material would likely cause some consolidation settlement of the underlying sediment, so simply comparing bathymetry before and after material placement could under-represent the actual thickness achieved. Therefore, the Port planned to use two other sources of information in evaluating cap placement, as follows:

- Tracking measurements of total material quantities placed and the areas over which they were distributed. This would provide a general coverage rate that could be compared to mass and thickness requirements.
- Diver observations of recently placed materials. A regular series of points would also be probed, to determine actual placed thicknesses of sand cap.

ENVIRONMENTAL PROTECTION

As was stipulated in the project's Waste Discharge Requirements from the RWQCB, all dredging and capping activities were required to be surrounded at all times by a double set of silt curtains. The size, type and arrangement of the silt curtains was left to the Contractor's discretion, subject to the Engineer's approval, and provided that water quality criteria were met at all times. The Contractor deployed their double silt curtains in a large semicircular area that encompassed much of the site, so as to minimize repositioning the curtains as equipment moved around within the site.

The Port conducted water quality monitoring on a daily basis during in-water construction activity. Monitoring was conducted just outside the silt curtain enclosure and included observation and measurement of turbidity levels at the water surface and at mid-depth below the surface. The criterion for water quality was that turbidity (Figure 12) could not be more than 20 percent higher than 'background' turbidity measurements.

The Contractor's operations and silt curtain usage had been successful at meeting water quality requirements, through the time of this writing.

In some cases early on during demolition and debris removal from along the seawall, minor amounts of sheen and potential product were noted on the water surface. In these cases, the contractor immediately informed the Port, and an environmental cleanup subcontractor was called out to the site to contain and remove the product and sheen. Skimmer pumps and absorbent pads were used for removal of visible sheen, with an oil absorbent boom in place for spill containment (Figure 13).

Figure 12. Typical example of turbidity generated during dredging and debris removal operations. Portion of perimeter silt curtains are visible in upper right corner of photograph.

Figure 13. Oil boom deployment (near field) and silt curtains (far field).

COORDINATION WITH ADJACENT PROPERTIES

Throughout construction, the contractor was required to maintain communication with various parties, to avoid undesired impacts on construction and on the operations of others.

Tenth Avenue Marine Terminal

Daily communication was necessary between the Contractor and marine operations wharfingers at the adjacent TAMT, so that the Contractor could avoid interference with the terminal operations (Figure 13). Large container and breakbulk vessels called on the adjacent Berths 10-1 and 10-2 at regularly scheduled frequencies. During vessel berthing and departure, the contractor needed to make sure that their operations, anchor lines and silt curtain deployment did not interfere with the moving vessels or their tugboats. While dredging occurred on the south side of the project area (nearest to TAMT), the contractor had to temporarily “pull in” their silt curtains to avoid interference.

Communication and construction activities were facilitated by the TAMT’s agreement with the Port to use line hauling, rather than tug boats, to pull vessels into Berth 10-1 for a 4-month period, corresponding to dredging and capping activities. This arrangement was worked out prior to construction as a way of improving the project’s overall constructability.

Figure 13. Dredging operations and silt curtains adjacent to TAMT (with Dole vessel in berth).

San Diego Hilton Construction

The upland portion of the former Campbell Shipyard site was the location of a new Hilton Hotel development (Figure 14). Hilton construction started in the early part of 2006. During this time the Campbell Shipyard contractor was given approximately 2 acres of paved space in the northern part of the uplands area, for their staging and sediment stockpiling activities. South of this, a 12.2 meter (40 feet) wide strip of land immediately behind the seawall was shared between the Campbell and Hilton contractors. Throughout the dredging work at Campbell, and through the time of this writing, the Hilton work primarily involved site excavation and foundation work, and did not require heavy use of this shared property, so its joint use went fairly smoothly.

Figure 14. Campbell Shipyard Construction site and adjacent earthwork area for Hilton development (photo taken from top of Convention Center).

San Diego Convention Center

As a neighbor to the site, convention center representatives were kept regularly appraised of progress on the construction, and attended occasional weekly construction meetings.

Coronado Cays Homeowners Association

Excavation of base cap sand is planned for the Grand Caribe Island, an undeveloped, Port-owned parcel within the Coronado Cays residential area south of Coronado. The Port maintained a regular dialogue with the Coronado Cays Homeowners Association, to ensure that all residents were informed of the timing and nature of the excavation work. Because the excavation work from Grand Caribe was scheduled for summer, a time of maximum residence and visitation to the area, the work will be under added scrutiny from the homeowners.

PARTNERING

The project is being conducted under a partnering agreement between the Port and Traylor Pacific. Partnering includes a means by which both parties (owner and contractor) resolve to work through differences and conflict in a spirit of mutual respect, and work toward understanding. The partnering agreement also established a process for dispute resolution, using a series of "tiers" for discussion and negotiation. The first tier was the technical and construction team, who had daily involvement in the project. If this tier was unable to resolve the issue successfully, then the issue moved up to the next tier of management.

A pre-project partnering meeting was held to discuss project goals, and a mid-project meeting was planned to review progress toward those goals. Monthly partnering lunches were held for the entire team.

On a monthly basis, perceptions on the status and success of the various project goals are evaluated through a brief survey that is submitted to all the critical team members (contractor, owner and consultants) for their input.

CONCLUSIONS

The Campbell Shipyard Sediment Remediation Project is a complex and highly visible environmental cleanup project. The complexities of project design were discussed in the precursor paper. The use of performance-based (rather than method-based) specifications allowed the Contractor flexibility in developing their construction approaches, which thus far has been successful in that bid prices were competitive and within budget parameters, and the work has completed to date in accordance with the design intent and cleanup objectives. At the time of this writing, the original schedule has slipped, such that capping work had not yet been started; but the work is being accomplished without environmental degradation and is being done in a spirit of cooperation. When complete, follow-up papers will provide additional information regarding the construction process.