PLACEMENT SITE PROFILE

Site No:

Site Name:	**Redwood Landfill (Formerly Known as Redwood Sanitary Landfill)**
Site Category:	Existing Re-use, Non-Tidal (End Use Site)
Site Area:	The currently active landfill area is approximately 420 acres.
Site Location:	Redwood Landfill is located on San Antonio Creek, between the Petaluma River and US Highway 101 approximately 4.4 miles north of the City of Novato in northern Marin County. Lat 38-10-30N, Long. 122-33-10W.
Site Access:	Road access to the site is via US Highway 101 and a private road. The Southern Pacific Railroad tracks are directly adjace the west side of the site. Shallow water access to the site is via San Pablo Bay, the Petaluma River and San Antonio Creek. The site is a minimum of 3,000 feet from the Petaluma River Channel.
Site Description:	Redwood Landfill is a fully permitted, operating landfill that imports material including dredged material, for use as cell liner, daily cover and cell cover. Recently this landfill has imported material from the Petaluma drying ponds and from Ports of Oakland and San Francisco via the rehandling facility at Port Sonoma-Marin. Soil amendment products are also produced at the site. The landfill also currently imports clean fill from a variety of land based sources. The landfill is currently working towards planning and permitting an expanded facility which would increase the long term material ne
Current Site Land Use:	Current site land use is sanitary landfill, soil amendment production, and related uses.
Adjoining Land Use(s):	Adjoining land uses include agricultural production, grazing and seasonal and tidal wetlands and related habitats.
Site Volume and Capacity:	The total material need for the landfill through the year 2039 is approximately 5.3 million cubic yards. Off-site sources of material are currently used, including material from a quarry located adjacent to the site. **Other sources indicate a 150,000 cubic yard annual need for daily cover and a 3 to 14 million cubic yard total need for proposed future landfill expansion. Updated information supplied by Redwood Landfill indicates an annual need of 64,000 to 87,000 cy for daily and intermediate cover. The total amount of levee and liner material required is approximately 1.0 million cy and the tot cover material required is approximately 4.3 million cy.
Estimated Site Life:	The estimated duration of this landfill operation with the proposed expansion is through 2040.
Physical Site Construction Requirements and Constraints:	The material imported for use as cell liner and levees must have a permeability of 1 x 10-7 cm/sec or less. Sand is suitable for daily cover. All material imported for levees, cell liner, daily, or intermediate cover must meet waste acceptance criteria. The landfill does not normally stockpile large amounts of daily cover.
Site References:	Personal contact with Bob Bernicci of Redwood Landfill, Inc.; LTMS-Engineering Elements of Dredged Material Rehandling Facilities, Task 7 Final Conceptual Level Design Report Cargill and Leonard Ranch Sites, by Gahagan and Bryant Associates for USACOE San Francisco District; LTMS Alternative Disposal Options, San Francisco Bay Region Final Report, by Ogden Beeman and Associates, et al., for USACOE, San Francisco District; Calif. Quad Map, Petalu River; NOAA Chart 18654.
Additional Notes:	**LTMS Alternative Disposal Options, San Francisco Bay Region-Final Report, by Ogden Beeman and Associates, et al., for USACOE, San Francisco District. As of Sept. 1991, Redwood Landfill Inc. is owned by Sanifill, Inc.

PLACEMENT SITE PROFILE

Site No: 29

Site Name:	**Bel Marin Keys**
Site Category:	Proposed Tidal Wetlands Restoration
Site Area:	The site area is approximately 1,610 acres.
Site Location:	Bel Marin Keys is located west of San Pablo Bay, southeast of the City of Novato, west of Highway 101, and north of Hamilton Army Air Field in Marin County.
Site Access:	Road access to the site is via US Highway 101, Bel Marin Keys Blvd., and various other public roads. The Southern Pacific tracks run west of this site. Shallow water access is via San Pablo Bay and Novato Creek. No direct deep water access is available to this area. The -8 foot MLLW Petaluma River Channel is located approximately 1.5 to 4 miles from this area.
Site Description:	The property associated with this site is owned by Bel Marin Keys Development Associates, Inc. (BMKDA). BMKDA plans to expand the existing Bel Marin Keys area. There may be interest in the use of dredged material to increase site elevations for habitat creation on the site. This site was permitted and received dredged materials from Novato Creek in 1987. This is not the same area that has been used for dredged material disposal in previous dredging projects at Bel Marin Keys.
Current Site Land Use:	The current site land use is agriculture, floodplain, potential residential development, and may include various seasonal and tidal wetlands and related habitat.
Adjoining Land Use(s):	Adjacent land use includes active and inactive military, agricultural, floodplain, existing and potential commercial/residential development and may include various seasonal and tidal wetlands and related habitat.
Site Volume and Capacity:	A currently proposed 700 acre tidal wetland restoration project on this site could use approximately 4.5 million cy of dredged material. Actual site capacity is dependent on the specific site design, dredged material placement rates, dredged material type and other factors.
Estimated Site Life:	Site life is dependent on the specific site design, dredged material placement rates, dredged material type and other factors.
Physical Site Construction Requirements and Constraints:	Habitat development or confined disposal for land raising with dredged material would likely require construction of levees, dikes, off-loading and return water facilities, and related support facilities. The major site constraints would likely be poor access from San Pablo Bay, environmental and institutional constraints.
Site References:	Personal contact with Larry Kerbs of Venture Development, Inc. (DBA Venture Corporation); Detailed Study of Dredged Material Land Disposal Alternatives, by Ogden Beeman & Associates et al, for USACOE, San Francisco District; Beneficial Reuse and/or Nonaquatic Disposal for Dredged Material from San Francisco Bay, Stage III, Final Draft Report, by Moffatt & Nichol, Engineers for USACOE San Francisco District, May 1993; Calif Quad. Maps, Petaluma Point and Novato; NOAA Chart 18654.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No:

Site Name:	**Delta Borrow Pits**
Site Category:	Existing Re-use, Non-Tidal
Site Area:	The Asta Pit is approximately 12 acres and the remaining useable portion of the Airport Pit is 407.6 acres.
Site Location:	These two barrow pits are located in Solano County, north of the City of Rio Vista, west of the Sacramento River, and east the Rio Vista Airport. Lat. 38-10-00, Long. 121-41-00.
Site Access:	Land access to both sites is via State Highway 12 and Church Road to Airport Road. No rail access is available to these sites The Sacramento River is close to both sites, however neither site has direct river access. Both sites have existing pipeline easements from the Sacramento River under various roads into the sites for dredged material discharge pipelines.
Site Description:	The two borrow pits (dredged material disposal and reuse areas), known as the Asta Pit and the Airport and/or Dredge are owned by the Asta Construction Company, Inc., (Asta) and by the State of California, Department of Water Resour (DWR). Both sites are currently used for storage and reuse of dredged materials. Asta Construction Company, Inc., is definitely interested in continuing to receive dredged materials that are suitable for reuse. DWR is in the process of transferring or selling some of the their property in this area to the City of RioVista for expansion of the Rio Vista Airp construction of waste water treatment facilities, and other uses. DWR indicated that they have no current plans to sell a 407.6 acre portion of their property which is used for dredged material storage and reuse. This portion of the site is currently leased for sand removal and may be put out for public bid for additional sand removal in May. DWR has not indicated if they are interested in the continued use of this site.
Current Site Land Use:	The Asta site is used for dredged material storage and reuse. The Airport site is used for dredged material storage and reuse, and portions not in current use for these purposes are leased for grazing.
Adjoining Land Use(s):	Adjoining lands are in agricultural production or are used for industrial and rural residential purposes.
Site Volume and Capacity:	The Asta Pit has a total capacity of 400,000 cubic yards and a current capacity of 390,000 cubic yards. The total capacity the Airport Pit is not known, however if the site was filled to a depth of five feet it could hold in excess of 3 million cub yards. The Airport site currently contains approximately 200,000 cubic yar of sand was placed in these pits in 1986 during Corps of Engineers maintenance dredging of the Sacramento River Deep Water Ship Channel.
Estimated Site Life:	If the sites continue to be used for dredged material storage and reuse there is no distinct limit on site life.
Physical Site Construction Requirements and Constraints:	The Asta Pit is completely ready to use. It has existing dikes, a discharge pipe, a spillway, and a sprinkler system to preclude wind migration of material. The Airport Pit has a discharge pipe and a spillway, however the site may requir dike improvement and/or construction of facilities to prevent wind migration of material prior to use.
Site References:	Personal contact with Bo McMillan of Asta Construction Company, Inc and Juan Mercado of the Department of Water Resources, Lands and Right of Way Division; Calif. Quad Map, Rio Vista; NOAA Chart 18661.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No:

Site Name:	**Richmond Dry Docks**
Site Category:	Proposed Re-use, Non-Tidal (Confined Disposal)
Site Area:	The combined total dry dock area is approximately 7.0 acres.
Site Location:	All five dry docks are located at the United States Naval Reserve Shipyard at Point Potrero, adjacent to the Richmond Inner Harbor Channel. Lat. 37-54-20N; Long. 122-20-47W.
Site Access:	Road access to the site is via US Highway 580, Cutting Blvd, through the Port of Richmond. Rail spurs from the Southern Pacific Lines run directly to the site. Deepwater access is via the -35.0 foot MLLW Richmond Harbor Entrance Channel.
Site Description:	The site consists of five cement lined dry docks. The site has been proposed as a pre-existing facility ideal for the placement of contaminated dredged material. Three docks are 575 feet long, 100 feet wide, and 36 feet deep (measured down from pier level of +18 feet MLLW). The other two dry docks are 748 and 587 feet long, 100 wide, and 36 feet deep (measured down from pier level of +18 feet MLLW), with an additional 88 foot wide, 12 foot deep sump running the length of the docks.
Current Site Land Use:	The Manson Construction Company currently leases the site from the Port of Richmond. The Manson Construction Company currently uses the site for storage and maintenance of dredging equipment.
Adjoining Land Use(s):	The site is bounded by the Port of Richmond cargo loading terminals to the north, and Point San Pablo to the West. Two small craft marinas and waterfront housing are located on the westerly end of Point San Pablo.
Site Volume and Capacity:	The five drydocks have an actual capacity of approximately 460,000 cubic yards (cy) when filled to the adjacent pier level. However, some material has most likely accumulated in the basins, reducing the actual available volumes. Given the historic use of the facility, any material present in the docks may be contaminated and may not be removed. Diking of the entire area above the +18 foot MLLW level could significantly increase the available volume by allowing the entire area including the adjacent docks, to be covered by additional dredged material. (A 10-foot berm covering an assumed area of 15 acres could contain approximately an additional 250,000 cy).
Estimated Site Life:	Site life is dependent on the specific site design, dredged material placement rates, dredged material type, and other factors.
Physical Site Construction Requirements and Constraints:	Unloading equipment may need to be constructed at the site. The terms of the Manson Company's lease are unknown, as is the local policy regarding the placement of material at the site.
Site References:	LTMS for Dredged Material in San Francisco Bay Region, Technical Report Series, Alternative Disposal Options San Francisco Bay Region, Final Report, Jan. 1992 USACOE; Calif. Quad Maps, Richmond and San Quentin; NOAA Chart 18649.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No: 33

Site Name:	**Suisun Marsh Duck Clubs-Family Duck Club**
Site Category:	Proposed Re-use, Non-Tidal (Levee Rehabilitation)
Site Area:	The property appears to consist of approximately 170 acres.
Site Location:	The Family Duck Club (also known as the Family Club) is located slightly west of Suisun Slough, approximately 8 miles southwest of Suisun City in Solano County. Lat. 38-08-00N, Long 122-05-30W.
Site Access:	Road access is via Interstate Highway 680 to a frontage road on the east side of 680 north of the Lake Herman Road exit, then east on Pierce Road, then north on a private road. The Southern Pacific Railroad tracks are located border the west side of the property. Water access is via Suisun Bay, the -8 foot MLLW Suisun Slough Channel and Goodyear or Cordelia Sloughs which both appear to have depths greater than 8 feet.
Site Description:	This property is located inside the Suisun Resource Conservation District. The property appears to be a managed wetland and/or duck club. The quad map shows 4 to 5 structures at the extreme southwestern edge of the property. There appear to be 4 or more major ponds on the property. The property is bounded by the Southern Pacific Railroad tracks on the west, Cordelia Slough on the northeast and Goodyear Slough on the southeast. It is assumed that the potential use for dredged material at this site would be habitat enhancement.
Current Site Land Use:	Current site land use appears to be managed wetland.
Adjoining Land Use(s):	Adjoining land use appears to be wetlands and managed wetlands.
Site Volume and Capacity:	No information was found on the site volume or capacity.
Estimated Site Life:	No information was found on the estimated site life.
Physical Site Construction Requirements and Constraints:	No information was found regarding construction requirements. The site constraints would include limited water access to the site due to water depth and channel width.
Site References:	Suisun Resource Conservation District map provided by Toni Dynan of the Suisun Resource Conservation District; Calif. Quad Map, Fairfield South; NOAA Chart 18656.
Additional Notes:	Property owner listed as Bernard Baylocq. Attempts to contact the property owner and the USACOE, San Francisco District's personnel who were reportedly familiar with the site were unsuccessful.

PLACEMENT SITE PROFILE

Site No:

Site Name:	**East Carbon Development Corporation, Utah**
Site Category:	Proposed Re-use, Non-Tidal, and Confined Disposal
Site Area:	The total site area is 2,400 acres.
Site Location:	East Carbon City, Utah. Lat. 39-40-00N, Long. 110-28-30W.
Site Access:	The site has no water access. Road access from the Bay area is via Interstate Highways 80 and 15 and State Highways 89 123 in Utah. The preferred access to the site is via the site rail spur that connects the site to both the Southern Pacific and Santa Fe Railroad tracks.
Site Description:	The site is a permitted and operating commercial confined waste disposal facility located in high desert country in eas Utah. Facilities at the site include 29 waste cells that are 2,200 feet by 1,000 feet with 40 foot high dikes. The averag annual precipitation at the site is 12 inches and the pan evaporation is 47 inches, therefore leachate is not a problem. site is above a 1,500 foot shale layer with no potable water below.
Current Site Land Use:	The site is currently a commercial waste disposal facility.
Adjoining Land Use(s):	Unknown uses of similar high desert country.
Site Volume and Capacity:	The site capacity is approximately 190 million cubic yards. The East Carbon Development Corporation has discussed t potential construction of a dedicated cell for dredged material. Transportation cost to this site could be $30 to $40 per t The dredged material could be wet or dry. There is no need for cover materials at this facility.
Estimated Site Life:	The actual site life is dependent on filling rates. The site is currently permitted and operating.
Physical Site Construction Requirements and Constraints:	Material is delivered directly to the pre-existing site by rail spur. Each daily delivery is covered with six inches of co until the individual cell capacity is reached, at which point the cell is covered with 2 feet of protective cover and a 4 mil plastic liner. Above the liner, 2 more feet of cover is placed and planted with native plants.
Site References:	East Carbon Development Corporation, ECDC Environmental, Project Description.
Additional Notes:	Mr. William Gay, ECDC local office, 220 Montgomery Street, San Francisco, CA 94104, phone (415) 421-2044. California imposed waste fees are waived on material disposed of out of state.

PLACEMENT SITE PROFILE

Site No: 35

Site Name:	**Tri-City Sanitary Landfill**
Site Category:	Existing Re-use, Non-Tidal (End Use Site)
Site Area:	The total site area is 378 acres. The total landfill area is 225 acres, which is subdivided into 3 parcels of 115, 90, and 20 acres respectively.
Site Location:	The site is located at 7010 Auto Mall Parkway in the city of Fremont in Alameda County. Lat. 37-31-00N, Long.121-58-30W.
Site Access:	The site has no water access. Site road access is via U.S. Route 880 to Auto Mall Parkway. The Southern Pacific Railroad line lies immediately adjacent to the east side of the site.
Site Description:	The site is classified as a Class III landfill, permitted to accept municiple solid waste from the cities of Fremont, Newark, and Union City.
Current Site Land Use:	The site is a permitted solid waste disposal facility.
Adjoining Land Use(s):	Adjoining land uses is predominantly agriculture and light industrial.
Site Volume and Capacity:	Approximately 11 milion cubic yards (cy) of material is in place, with 4 million cy of remaining capacity in the 115 acre parcel. The landfill can accept 200,000 cy of material per year for daily cover from any source. Disposal material can only be accepted from the cities of Fremont, Newark, and Union City.
Estimated Site Life:	The 115 acre parcel is projected to reach capacity by 2001.
Physical Site Construction Requirements and Constraints:	None.
Site References:	Renee Yielding, Tri-Cities Recycling and Disposal Facility, 7010 Auto Mall Parkway, Fremont CA, 94538. Calif. Quad Map, Niles.
Additional Notes:	The 115 acre parcel is the only active landfill on the site. The other two parcels may not be developed due to prohibitive cost. Material from San Leandro Marina has been used as final cover (clay cap) at the Tri-Cities Landfill 115 acre parcel.

PLACEMENT SITE PROFILE

Site No:

Site Name:	**Tubbs Island**
Site Category:	Proposed Tidal Wetlands Restroration and Re-use, Non-Tidal
Site Area:	The total Island area is approximately 2,800 acres. The northern portion is approximately 960 acres, the middle portion is approximately 1,590 acres, and the southern tip is approximately 260 acres.
Site Location:	Tubbs Island is located directly north of San Pablo Bay, east of Sears Point, west of Skaggs Island, and south of Camp Ot Island in Sonoma County. Lat. 38-09-30N, Long. 122-25-30W.
Site Access:	Road access to the site is via State Highway 37, which bisects the Island, and various private roads. There is no rail access the Island, however the Southern Pacific Railroad tracks are located just east of the Island. Shallow water access to the Is is via San Pablo Bay and Sonoma Creek. The Petaluma River Channel, with a depth of -8 feet MLLW, lies within 5,000 to 10,000 feet of the southern portions of the Island.
Site Description:	Tubbs Island is bordered by San Pablo Bay on the south, Sonoma Creek on the east, Tolay Creek on the west and the E Branch of Tolay creek on the north. The northern portion of the Island, above State Highway 37 is privately owned and agricultural production. The middle portion of the Island is owned by the City of Vallejo who uses a portion of the land sludge disposal and also leases agricultural land. The US Fish and Wildlife Service owns 80 acres at the southern end the middle portion of the Island and is interested in returning that area to tidal wetland. The extreme southern tip of the Island is tidal wetlands. LTMS site rankings listed this site as active in the first pass and inactive in the second pass.
Current Site Land Use:	The northern and middle portions of the Island are in agricultural production and used for sludge disposal. Seasonal wetlands may exist on portions of this area. The southern tip of the island is tidal wetlands.
Adjoining Land Use(s):	Adjoining land uses include agricultural production, tidal wetlands and mud flats, naval facilities and a raceway locate Sears Point.
Site Volume and Capacity:	The site capacity is dependent on specific site plans. No estimated site capacities were located in the references.
Estimated Site Life:	Project duration and site life are dependent on the specific site plans. No plans or estimated site life was identified in t references.
Physical Site Construction Requirements and Constraints:	Physical site constraints for dredged material placement include limited water access and other related factors. Power lines crossing the northern part of the Island may require protection or raising. Dredged material placement would lik require the construction of dikes, off-loading and return water facilities and related support facilities.
Site References:	Personal discussion with Betsey Radtke of USF&WS; Beneficial Reuse and/or Nonaquatic Disposal for Dredged Material from San Francisco Bay, Stage III, Final Draft Report, by Moffatt & Nichol, Engineers for USACOE San Francisco District, May 1993; Calif. Quad Maps, Sears Point and Petaluma Point; NOAA Chart 18654.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No: 37

Site Name:	**Camp Islands (Camp 2 Island and Camp 3 Island)**
Site Category:	Proposed Tidal Wetlands Restoration
Site Area:	Camp 2 Island is approximately 760 acres and Camp 3 Island is approximately 1,450 acres.
Site Location:	Camp 2 Island is located approximately 2 miles south of Schellville and directly north of Wingo in Sonoma County, Lat. 38-13-00N, Long. 122-26-00W. Camp 3 Island is located directly southeast of Camp 2 Island and directly northwest of Skaggs Island in Sonoma County, Lat. 38-12-00N, Long. 122-25-00W.
Site Access:	Road access to both Camp 2 and Camp 3 Islands is via State Highway 121 to an unnamed road leading south from the Highway 121 and 12 junction. The Southern Pacific Railroad tracks bisect Camp 2 Island and run directly west of Camp 3 Island. Shallow water access to both Islands is via San Pablo Bay, Sonoma Creek, and various slough channels. No direct deep water access is available to Camp 2 or 3 Islands.
Site Description:	Camp 2 Island is bounded by Sonoma Creek, Railroad Slough, Steamboat Slough, and Third Napa Slough. Camp 3 Island is bounded by Sonoma Creek, Second Napa Slough, and Third Napa Slough. Both Islands are primarily in agricultural production. The California Department of Fish and Game is interested in acquiring Camp 2 Island and creating nontidal habitat within the Island. Dredged material could potentially be used for interior dikes or land from sculpting. The acquisition of Camp 2 Island is currently on hold due to funding and cost considerations. The US Fish and Wildlife Service and other agencies are in the preliminary stages of acquiring Camp 3 Island for habitat creation.
Current Site Land Use:	Both Islands are primarily in agricultural production.
Adjoining Land Use(s):	Adjoining land uses include agricultural production, managed wetlands, grazing lands and naval communication facilities.
Site Volume and Capacity:	The site capacity is dependent on specific site plans. No estimated site capacities were located in the references.
Estimated Site Life:	Project duration and site life are dependent on the specific site plans. No plans or estimated site life was identified in the references.
Physical Site Construction Requirements and Constraints:	Physical site constraints for dredged material placement include limited water access and other related factors. Dredged material placement for habitat creation would likely require the construction of dikes, off-loading and return water facilities and related support facilities.
Site References:	Personal discussions with Betsy Radtke of USF&WS, Jim Swanson of CDF&G, Melody Deninger of the State Coastal Conservancy, Joan Vilms of Sonoma Land Trust, and others; Calif. Quad Map, Sears Point; NOAA Chart 18654.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No: 3

Site Name:	**North Point Property**
Site Category:	Proposed Tidal Wetlands Restoration
Site Area:	The total area of this property is approximately 2,000 acres.
Site Location:	North Point Property is located directly north of San Pablo Bay, west of Sears Point, west of Tubbs Island and east of Leonard Ranch and Sonoma Baylands in Sonoma County. Lat. 38-08-30N, Long. 122-28-00W.
Site Access:	Road access to various portions of this property is via State Highway 37, Lakeville Highway, and Reclamation Road, all of which bisects or are directly adjacent to the property and various private roads on the property. Rail access is via the Southern Pacific Railroad tracks which bisect a portion of the site. Shallow water access to the Island is via San Pablo Bay. The Petaluma River Channel, with a depth of -8 feet MLLW, lies within 2,500 feet of the southern edge of this property.
Site Description:	From north to south, this property extends from the shore of San Pablo Bay across diked baylands and up into the Sonoma Mountains. Leonard Ranch and Sonoma Baylands adjoin portions of the western edge of the property. LTMS site ranking listed this site as active in the first pass and inactive in the second pass. Various agencies are currently interested in acquiring this property for habitat creation/restoration and other public trust uses.
Current Site Land Use:	This property contains areas currently in agricultural production, grazing lands and may contain areas of seasonal wetlands
Adjoining Land Use(s):	Adjoining land uses include agricultural production, grazing, tidal wetlands and mud flats, and a raceway located at Sears Point.
Site Volume and Capacity:	The site capacity is dependent on specific site plans. No estimated site capacities were located in the references.
Estimated Site Life:	Project duration and site life are dependent on the specific site plans. No plans or estimated site life was identified in the references.
Physical Site Construction Requirements and Constraints:	Physical site constraints for dredged material placement include possible disruption of existing drainage facilities and other related factors. Power lines crossing the property may require protection or raising. Dredged material placement would likely require the construction of dikes, off-loading and return water facilities, and related support facilities.
Site References:	Personal discussion with Laurel Marcus of the California State Coastal Conservancy; Beneficial Reuse and/or Nonaquatic Disposal for Dredged Material from San Francisco Bay, Stage III Final Draft Report, by Moffatt & Nichol, Engineers for USACOE San Francisco District, May 1993; Calif. Quad Maps, Sears Point and Petaluma Point; NOAA Chart 18654.
Additional Notes:	

PLACEMENT SITE PROFILE

Site No: 39

Site Name:	**Bair Island**
Site Category:	Proposed Tidal Wetlands Restoration
Site Area:	The entire Island apears to be approximately 3,000 acres.
Site Location:	Bair Island is located in South San Francisco Bay across Redwood Creek from the Port of Redwood City in San Mateo County. Lat. 37-34-30N, Long. 122-12-30W.
Site Access:	Water access to this site is via San Francisco Bay and the Federal Redwood City Harbor Channel (Redwood Creek). There is no road or rail access to Bair Island.
Site Description:	Bair Island is bordered by San Francisco Bay, Redwood Creek, Steinberger Slough, and the Bayshore Freeway. Smith Slough, Corkscrew Slough and Deepwater Slough bisect portions of Bair Island. Inactive salt evaporator ponds cover approximately 70% of the west side of Bair Island, and large part of the remaining southeast portion of Bair Island is in the San Francisco Bay National Wildlife Refuge. Portions of Bair Island are owned by the US Fish and Wildlife Service, California Department of Fish and Game, and a private International Corporation. Previous LTMS studies list this site as infeasible and do not define the proposed site boundaries or the type of project (confined upland, wetland enhancement etc.). Internal levees (1983) and a nesting platform (1987) were constructed as least tern nesting habitats.
Current Site Land Use:	The current site land uses are inactive salt evaporator ponds and tidal wetlands.
Adjoining Land Use(s):	Adjoining land uses include active and inactive salt evaporators, residential and commercial development, the Bayshore Freeway and tidal wetlands surround the Island.
Site Volume and Capacity:	The US Fish and Wildlife Service indicated that they currently think that the inactive salt evaporator ponds could be restored to tidal wetlands without using dredged material. Aerial photos indicate that the pond bottoms still retain slough channels and other marsh features and a previously restored site on the Island developed by natural sedimentation in less than 15 years after tidal action was restored.
Estimated Site Life:	The estimated site life is unknown, however the potential for the use of dredged material for habitat restoration at this site appears low.
Physical Site Construction Requirements and Constraints:	The physical site construction requirements and constraints are unknown, however power lines do cross portions of Bair Island and access appears to be limited to water access only.
Site References:	Personal contact with Jeanne Takekawa of the San Francisco Bay National Wildlife Refuge; Detailed Study of Dredged Material Land Disposal Alternatives, by Ogden Beeman & Associates et al., for USACOE, San Francisco District; Calif Quad. Map, Redwood Point; NOAA Chart 18651
Additional Notes:	No current nesting by least terns, however Bair Island is used extensively by other rare and endangered species including the California Clapper Rail, the Black Rail, the Salt Marsh Harvest Mouse, and the Salt Marsh Wandering Shrew.

PLACEMENT SITE PROFILE

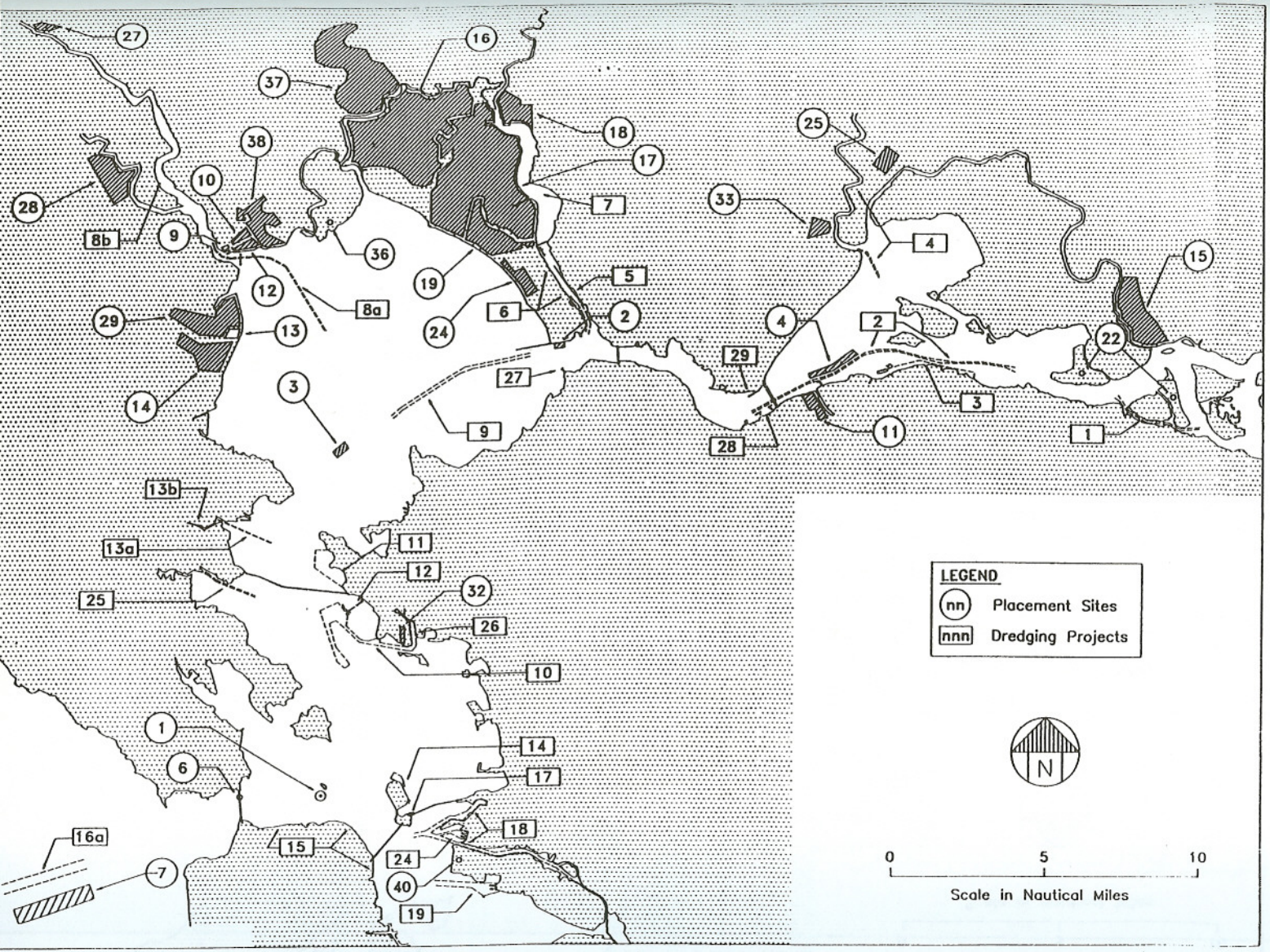
Site No: 40

Site Name:	**Alameda Naval Air Station**
Site Category:	Proposed Re-use, Non-Tidal, and Confined Disposal
Site Area:	The total land area is approximately 1,500 acres. The seaplane basin has a surface area of approximately 100 acres.
Site Location:	Naval Air Station Alameda (NAS Alameda) is located adjacent to San Francisco Bay on the western side of Alameda Island in the City of Alameda and Alameda County with the extreme western edge in the city and county of San Francisco. Lat. 37-46-30N, Long. 122-18-30W.
Site Access:	Road access is via State Highway 17 and the Webster Street tubes under the Oakland/Alameda Estuary. Rail Access is via the Alameda Belt Line tracks connecting to military tracks on NAS Alameda. Water access to the site is via San Francisco Bay and the NAS Alameda entrance channel and also via the Oakland Inner Harbor Channel in the Oakland/Alameda Estuary. All of these channels provide deep water access.
Site Description:	NAS Alameda is an active Naval Air Station with aircraft carrier docks, land based airport, seaplane basin, support facilities, housing, and other related facilities. This base is slated for base closure and will become available for other uses after closure. There may be areas of the base that could be used for dredged material disposal or dredged material rehandling such as the seaplane basin which could be closed off from the Bay and used for confined dredged material disposal. The large paved areas associated with the runways and approach areas could be utilized for dredged material rehandling operations.
Current Site Land Use:	This site is an active Naval Air Station with related facilities.
Adjoining Land Use(s):	Adjoining land uses to the north are military, to the northeast and east are the commercial and residential areas of Oakland and Alameda, and to the south and west is San Francisco Bay.
Site Volume and Capacity:	The capacity of any areas used would be dependent on the specific site plan and operational considerations. The seaplane basin could hold approximately 4.0 million cubic yards.
Estimated Site Life:	The site life would be dependent on the specific site plan.
Physical Site Construction Requirements and Constraints:	Construction requirements for a rehandling facility on this site would include containment levees and interior dikes, a barge off-loading system, dredged material discharge pipeline, effluent control pond and return water structures, and related support and maintenance facilities. Construction of a confined disposal area in the seaplane basin would require closing of the entrance channel and possible removal of existing docks and related structures. The limiting factor to the future use of this facility for dredged material will be the future use of this military facility after base closure.
Site References:	Calif. Quad Map, Oakland West. NOAA Charts 18650 and 18649.
Additional Notes:	

DREDGING PROJECT AND PLACEMENT SITE LOCATION MAPS

Dahagan and Bryant Associates, Inc.

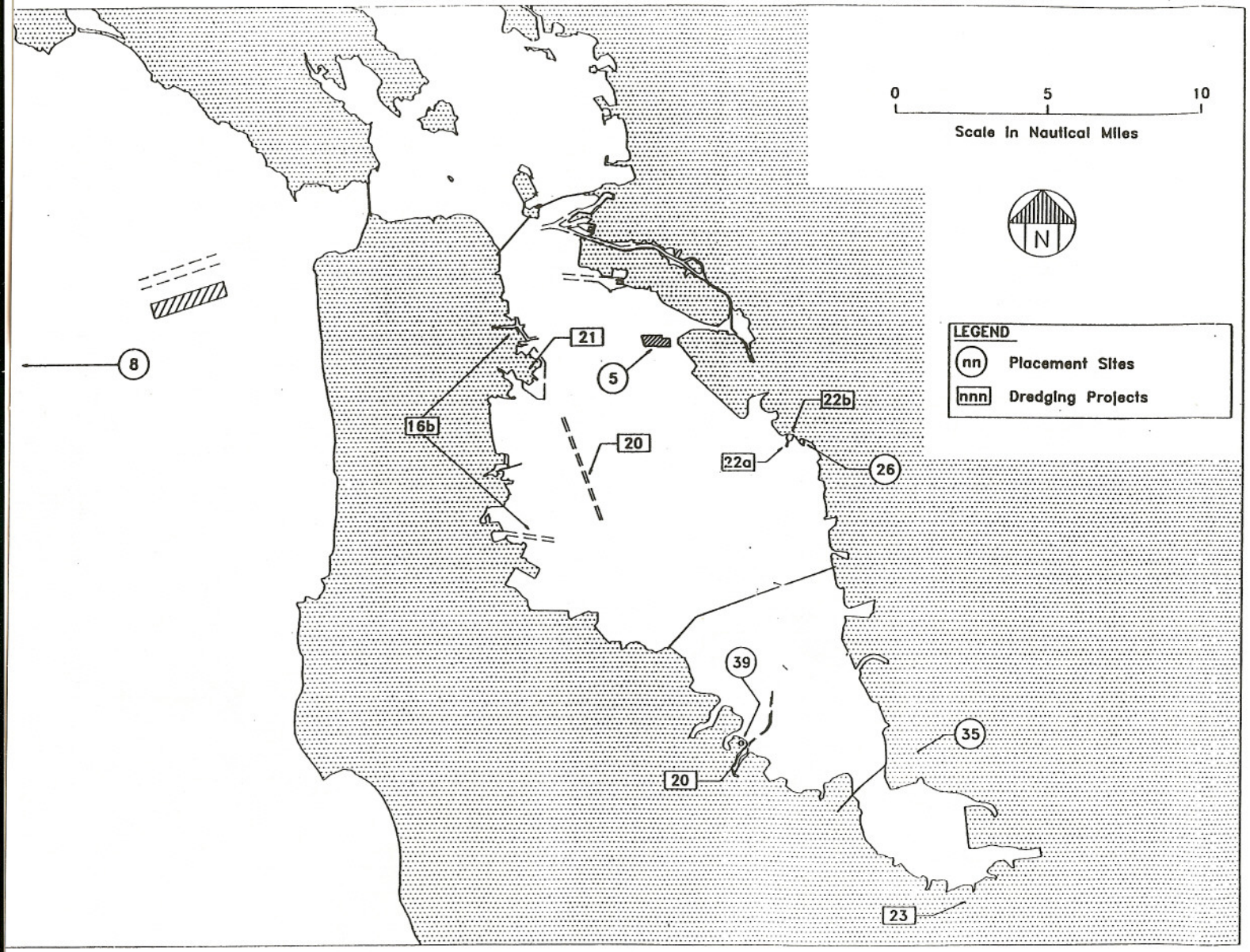
San Francisco Bay Region LTMS Location Map — North Bay



Placement Sites	
No.	Description
1.	Alcatraz (SF-11)
2.	Carquinez Strait (SF-9)
3.	San Pablo Bay (SF-10)
4.	Suisun Bay
6.	Golden Gate Site, north tower
7.	San Francisco Bar Channel (SF-8)
9.	Port Sonoma-Marin Marina
10.	Leonard Ranch
11.	Praxis-Pacheco
12.	Sonoma Baylands
13.	Hamilton Field: Antennae Field
14.	Hamilton Field: Habitat Creation
15.	Montezuma Wetlands
16.	Skaggs Island
17.	Cargill Salt Division (west evaporator ponds)
18.	Cargill Salt Division (east crystallizer ponds)
19.	Cullinan Ranch
22.	Upper Suisun Bay Sites, Chipps Isl. & Winter Isl.
24.	Mare Island
25.	Pierce Island
27.	Petaluma River Drying Ponds
28.	Redwood Sanitary Landfill
29.	Bel Marin Keys
32.	Richmond Dry Docks
33.	Suisun Marsh Duck Clubs - Family Duck Club
36.	Tubbs Island
37.	Camp Islands
38.	North Point Properties
40.	Naval Air Station Alameda

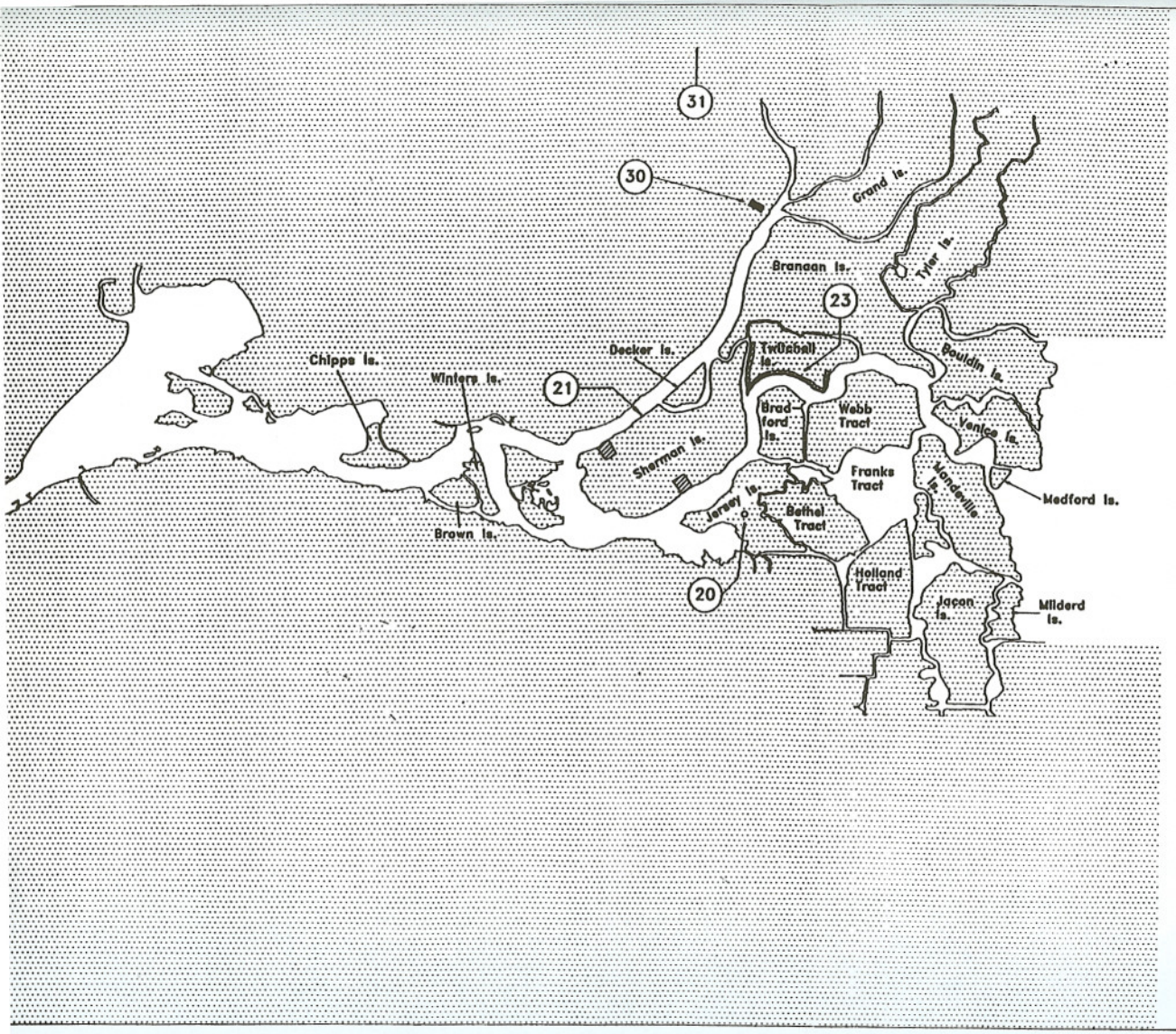
Dredging Projects	
No.	Description
1	New York Slough
2	Suisun Bay Channel
3	Concord NWS
4	Suisun (Slough) Channel
5	Mare Island Strait
6	Mare Island NSY
7	Napa River
8a	Petaluma River, Across the Flats
8b	Petaluma River, Mile 0.0 to Washington Street
9	Pinole Shoal
10	Richmond Harbor
11	Point Molate NFD
12	Chevron (Richmond Long Wharf)
13a	San Rafael Creek, Across the Flats
13b	San Rafael Creek, Mile 0.0 to Grand Ave.
14	Treasure Island NS
15	Port of San Francisco
16a	San Francisco Harbor (San Francisco Bar)
17	USCG, Yerba Buena Island
18	Oakland Harbor / Port of Oakland
19	Alameda NAS
24	Oakland NSC
25	Larkspur Ferry Channel
26	ARCO
27	Unocal
28	Shell Oil
29	Exxon

San Francisco Bay Region LTMS Location Map – South Bay



Dredging Projects	
No.	**Description**
16b	San Francisco Harbor (Islais Creek and San Francisco Airport Channel)
20	Redwood City
21	Hunters Point NSY
22a	San Leandro Marina, Main Access Channel
22b	San Leandro Marina, Interior Access Channel
23	Moffett Field NAS

Placement Sites	
No.	**Description**
5	Bay Farm Is. Borrow Pit
8	102 General Use Site (and U.S. Navy 103 Site)
26	San Leandro
35	Tri City S. F.
39	Bair Island



Placement Sites	
No.	Description
20	Jersey Island
21	Sherman Island (rehandling site)
23	Other Sacramento – San Joaquin Delta Levee Sites – (Twitchell Island Demo).
30	Delta Barrow Pits (Information from BCDC)
31	Yolo County Central Landfill
34	East Carbon Development Corp., Utah

APPENDIX F

Proposed Overall LTMS Sediment Classification Framework

APPENDIX F

Proposed Overall "LTMS Sediment Classification Framework"

As a basis for the establishment of regulatory guidance more specifically tailored to dredged material placement in upland environments, the LTMS agencies have developed a comprehensive Sediment Classification Framework that describes the suitability of dredged material for different kinds of disposal options, based on the degree of contamination. Under this system, the least contaminated material is (chemically) suitable for the broadest range of disposal options, while the most contaminated material (meeting established hazardous waste criteria) must receive very specific handling. Table F-1 presents this Sediment Classification Framework. It shows the general relationship between material that is "suitable for unconfined aquatic disposal" (SUAD material) or "not suitable for unconfined aquatic disposal" (NUAD material), and the various existing solid waste categories that apply to upland disposal or reuse. Table F-2 also shows how these categories relate to the three "classes" of landfills.

It is important to understand that the Sediment Classification Framework does not represent new regulation. Rather it is a presentation, in one place, of how the existing laws, policies, and definitions affecting dredged material disposal relate to each other. However, the Sediment Classification can serve as a useful basis for development of more consistent dredged material management policies, particularly with respect to testing and approval of material proposed for placement in upland disposal or reuse sites, such as existing landfills. The following paragraphs discuss the categories of material in the Sediment Classification Framework shown in Table F-1.

UNRESTRICTED MATERIAL: SUAD. Unrestricted material is sediment that has been determined to be suitable for unconfined aquatic disposal (SUAD) or any potential reuse option provided that the salinity and geophysical characteristics of the material are compatible with the proposed disposal option. This material is *chemically* and *biologically* suitable for any reuse option. As long as the material is also *physically* compatible with the proposed disposal option, the material can be considered an "inert waste." It is assumed that greater than 80 percent of all the material to be dredged on a yearly basis will fall within this unrestricted SUAD category. However, if the material is proposed to be disposed into a potentially incompatible environment (i.e., marine sediments into a fresh water habitat), special precautions may need to be implemented and the RWQCB may need to consider the material a "designated waste" and issue Waste Discharge Requirements (WDRs). SUAD material is suitable for reuse in landfills as cover, liner, berm, or cap material, as cover material in wetlands projects, or as capping material at CAD sites (depending on engineering characteristics).

NUAD MATERIAL, CATEGORY I. NUAD Category I sediments have low background concentrations of contaminants but have been determined to be incompatible with unrestricted disposal solely due to low aquatic bioassay survivorship. Occasionally, dredged materials fail biological testing for a variety of reasons that are unrelated to the potential for adverse upland or wetland impacts. Being unsuitable for unconfined aquatic disposal based on aquatic bioassays alone does not automatically mean that the material cannot safely be disposed in other locations or that it must be treated as a process waste or a hazardous waste. Instead, this category of material must simply be disposal at a site that will isolate it from sensitive biological receptors in the aquatic environment. If the material is placed into such a site (i.e., landfills, construction projects), no further testing is needed because the risk that the material poses has been properly managed. NUAD Category I material is therefore suitable for reuse in landfills (Class III, II, and I) as cover, liner, or berm material, and for disposal in wetland or CAD sites as non-cover material.

NUAD MATERIAL, CATEGORIES II AND III. In contrast to NUAD Category I material that has low background levels of contaminants, NUAD Category II and III material has elevated chemistry. These categories of dredged material require additional analyses to determine the extent of the risk associated with placing the material in a proposed upland or wetland environment. Depending on the proposed disposal option, elevated concentrations of contaminants identify material as NUAD Category II or III. NUAD Category II material has elevated levels of contaminants, but they are in a relatively non-soluble or non-mobile form such that the

Table F-1. LTMS Sediment Classification Framework

Material Classification	*Into Physically Compatible Environments*	*Disposal Option*	*SFRWQCB Action*	*Decision Basis*[b]	*Additional Tests Required Beyond Aquatic Testing*	*Sampling Frequency*[c]
Suitable for UAD, In-Bay or Ocean	yes	Ocean	Certification	NA	None	NA
	yes	In-bay	Certification	NA	None	NA
	yes	Wetland creation (cover)	Certification	NA	None	NA
	yes	CAD cover	Certification	NA	None	NA
	yes	Landfill construction/reuse	Certification	NA	None	NA
	yes	Construction	Certification	NA	None	NA
	no	Construction	WDR(e)	Salt discharge	Salt leachate testing	50,000
	yes	Levee (brackish water environment)	Certification	TBD	TBD	TBD
	no	Levee (freshwater environment)	WDR(e)	TBD	TBD	TBD
NUAD Category 1	yes	Landfill construction	WDR(f)	Bioassay	None	NA
	yes	Wetland non-cover	Certification	Bioassay	None	NA
	yes	CAD non-cover	Certification	Bioassay	None	NA
	no	Construction	WDR(e)	Bioassay	Salt leachate test	50,000
NUAD Category 2	yes	Landfill disposal Class III	WDR(f)	Chemistry	WET1/TCLP/(d)	3,000/3,000/50,000
	yes	Landfill disposal Class I	WDR(f)	Chemistry	WET1/TCLP/(d)	3,000/3,000/50,000
	yes	Landfill construction	WDR(f)	Chemistry	WET1/TCLP	3,000/50,000
	yes	Wetland non-cover	Certification	Chemistry	WET2/Elutriate tests	3,000/50,000
	yes	CAD non-cover	Certification	Chemistry	WET2/Elutriate tests	3,000/50,000
	no	Construction	WDR(e)	Chemistry	WET1/salt leachate	3,000/50,000
NUAD Category 3	yes	Landfill construction	WDR(e)	Chemistry	WET1/TCLP/(d)	3,000/3,000/50,000
	yes	Landfill diposal Class I	WDR(e)	Chemistry	WET1/TCLP/(d)	3,000/3,000/50,000
	yes	Landfill diposal Class I	WDR(e)	Chemistry	WET1/TCLP/(d)	3,000/3,000/50,000
	yes	CAD non-cover	Certification	Chemistry	WET2/Elutriate tests	3,000/50,000
	no	Construction	WDR(e)	Chemistry	WET1/Salt leachate	3,000/50,000
Hazardous Waste	yes	Landfill disposal Class I	Hazardous waste	Chemistry	WET1/TCLP/(d)	Landfill requirements

Notes: (a) Physically Compatible Environment: Salinity regime of the dredge material is similar to the salinity of the surface or groundwater of the disposal site.

(b) Decision Basis: Reason why material was found to be incompatible with unrestricted disposal.

(c) Sampling Frequency: The number of cubic yards of dredge material per sample analysis. The minimum number of samples required for chemical analysis is three. Tests are required only for the contaminants that exceed background concentrations by one standard deviation. Additional tests may be required if the variance of the three samples is unacceptably high.

(d) Minimum 50 percent solids and no free-standing water using EPA Method 9095.

(e) WDR: Waste Discharge Requirement for a Designated Waste.

(f) WDR: Waste Discharge Requirement for a Nonhazardous Solid.

WET1: Waste Extraction Test using citric acid extraction method for metals in excess of Bay background concentrations.

WET2: Waste Extraction Test using deionized water extraction method for metals in excess of Bay background concentrations.

TCLP: Threshold Concentration Leachate Procedure for organic contaminants in excess of Bay background concentrations.

NA: Not applicable.

Table F-2. Relationship of LTMS Sediment Classification to Disposal and Reuse Options

Landfill Disposal and Reuse Options						
Sediment Classification (a)	***Landfill Disposal Options***	***RWQCB Classification (b)***	***DTSC Classification***	***Reuse Acceptability (c)***	***Regulatory Action***	***Agency Jurisdiction***
Suitable for UAD In-Bay or Ocean	Class I Class II	Inert solid waste	Non-hazardous	yes yes	WDR or waiver	3,6,7
NUAD Category 1	Class III			yes		
NUAD Category 2		Non-hazardous solid waste				
NUAD Category 3	Class I Class II	Designated waste		yes (e)	Approval pursuant to WDR	3,7
Hazardous Waste	Class I	Hazardous waste	Hazardous waste	no		3,10
Aquatic Disposal and Reuse Options						
Sediment Classification (a)	***Disposal Options***	***RWQCB Classification (b)***	***DTSC Classification***	***Reuse Acceptability (d)***	***Regulatory Action***	***Agency Jurisdiction***
Suitable for UAD In-Bay or Ocean	Wetland or CAD cover	Inert solid waste	Non-hazardous	yes	Permits	1,2,3,4, 5,8,9
NUAD Category 1	Wetland or CAD non-cover			yes	Permits	1,2,3,4, 5,8,9
NUAD Category 2		Non-hazardous solid waste				
NUAD Category 3	Wetland or CAD non-cover (a)	Designated waste		yes	Permits	1,2,3,4
Hazardous Waste	NA	Hazardous waste	Hazardous waste	no	NA	NA

Notes:
a. Determined after both aquatic tests and any required subsequent testing. UAD = unconfined aquatic disposal; NUAD = not acceptable for unconfined aquatic disposal.
b. Based on Marschack 1989 (currently under modification to address Chapter 15 Subtitle D Landfills).
c. Contingent on grain size acceptability and State Integrated Waste Management Board reuse approval.
d. Non-cover CAD and wetland material is considered reuse when coupled with habitat creation.
e. May be suitable for beneficial reuse depending on contaminants and landfill criteria for reuse.
1. U.S. Army Corps of Engineers (Section 10 Rivers and Harbors Act/Section 404 CWA/MPRSA).
2. U.S. Environmental Protection Agency (Section 404 CWA/MPRSA).
3. Regional Water Quality Control Board (State Water Code/CCR Title 22 and 23).
4. Bay Conservation and Development Commission (MacAteer-Petris Act).
5. California Department of Fish and Game.
6. Integrated Waste Management Board (State Integrated Waste Management Act).
7. County Local Enforcement Agency.
8. National Marine Fisheries Service (Endangered Species Act).
9. U.S. Fish and Wildlife Service (Endangered Species Act).
10. Department of Toxic Substances Control (CCR Title 22 and 23).

material is suitable for specific reuse options. NUAD Category III has elevated levels of contaminants that are shown to be soluble or mobile, or that can become soluble or mobile with time and therefore must be more rigorously managed. Category III material would be suitable for fewer reuse options than Category II material. For example, Category III material would only be suitable for confined disposal or use as construction materials if the use of the material renders the material inert or permanently sequestered.

Category III material may in some cases also be suitable for treatment processes that could increase the number of disposal or reuse options that would be appropriate. However, it should be noted that such materials would not be appropriate for unconfined aquatic disposal after treatment. Under most circumstances, Category II and III material would require confined upland disposal into an approved landfill. The most likely option for disposal of untreated NUAD Category III material would be a Class II or California Subtitle D landfill. However, some of this material may be suitable for disposal into a Class III landfill or as CAD non-cover material. Evaluations will be needed on a case by case basis to determine when this would be appropriate. It is estimated that less than 5 percent of all sediments dredged on a yearly basis would fall into this category.

HAZARDOUS WASTE. Hazardous Waste is material that has been determined to be inconsistent with unrestricted disposal and under further testing has been determined to be either a State or Federal Hazardous Waste as described in the California Code of Regulations, or the *Federal Register*. This material would only be suitable for disposal into Class I landfills. Sites that contain sediments with hazardous levels of contaminants are not routinely dredged, and instead may become the focus of remedial action evaluations.

In some cases, sediments with hazardous levels of contaminants are required to be capped with clean material and remain in place. Conversely, it may be required that sediments with hazardous waste concentrations be removed if they represent a continuing source of contamination with environmental or human health implications, and capping would not be practical or effective. In either case, a site-specific evaluation is required to determine which approach is appropriate. It is estimated that less than 1 percent of all dredged materials would fall within the hazardous waste category. A waiver to the regulations would be required before hazardous wastes dredge materials could be treated.

Testing and Test Frequencies for Upland Placement under the Proposed "LTMS Sediment Classification Framework"

TYPES OF TESTING. Under the proposed LTMS Sediment Classification Framework, no additional testing would be required for upland placement of dredged material designated as SUAD, or NUAD Category I material. In order to determine if dredged material is NUAD Category II or NUAD Category III, additional testing would be required for the specific contaminants detected as having elevated concentrations during preliminary tests. This additional testing is needed to determine whether the contaminants are or could become soluble and mobile.

The Waste Extraction Test (WET), using the citric acid extraction method, may be required for upland disposal of material with concentrations of metals in excess of ambient (background) concentrations. The WET test simulates the acidic conditions that could occur in landfills. Under acidic conditions, some contaminants such as heavy metals could become soluble and therefore more available.

The Threshold Concentration Leachate Procedure (TCLP) method would be required for upland disposal of material with concentrations of organics in excess of ambient concentrations. The TCLP test also simulates the acidic conditions that could occur in landfills. A database of upland disposal projects would be developed to help determine, for future project comparisons, the concentrations of organic contaminants that could solubilize under landfill conditions. Based on the results, the proposed testing frequencies (discussed further below) for some upland testing may be reduced.

Leachate tests may be required for confined aquatic disposal of material with contaminant concentrations that exceed ambient (background) levels. Leachate tests give an estimate of what contaminants could become available in the aquatic environment during disposal. This test is more representative of aquatic disposal

operations, and conditions in the aquatic environment, than would be simulated using only the WET method.

Ambient (background) sediment chemistry levels are determined through the RWQCB Regional Monitoring Program (RMP), and other data. The current ambient sediment chemistry concentrations are representative of relatively unpolluted areas of the San Francisco Bay (see section 3.2.3.3). The database used to determine background concentrations does not include areas with direct input of contaminants from point or non-point sources. The database will evolve with time, and may be modified to include sediment data from dredged material that has been approved for Unrestricted Disposal.

TESTING FREQUENCIES. High-frequency testing, in the range of one sample per 20 cy, is often required for upland soils excavation projects due to the potential risks associated with high concentrations of volatile organic compounds, and due to the heterogeneity of the contaminants in the soil (SW-846). Compared to many terrestrial soils, dredged sediments have much lower concentrations of contaminants and tend to be very homogeneous. Therefore, the sampling frequency required for dredged material proposed for upland placement is usually much less than that for soil remediation projects. In many cases, sampling conducted for aquatic disposal of dredging projects is adequate for determining if there are problems that will require further investigation prior to permitting upland disposal. In particular, testing conducted for aquatic disposal is generally sufficient to determine which constituents are of concern in terms of upland disposal. Final testing can then be tailored to the specific contaminants that are present in the dredged material, and that are relevant for the specific disposal site. In most cases, additional testing for upland placement or reuse should only be required for contaminants that exceed low existing background concentrations in the Bay.

Where additional testing of dredged material is needed for upland placement, the agencies will generally require that it be based on 3,000 cy units, with a minimum of three samples (Table F-1). Three thousand cy is roughly equivalent to a typical barge load of dredged material, and thus is generally feasible to handle separately from the rest of a project if necessary. Additional tests may be required if the variance of the three samples is unacceptably high. Specific guidance on sampling frequencies and types of tests required for each type of upland disposal option will be outlined in the Regional Implementation Manual (RIM).

Additional testing frequency requirements for confined aquatic disposal are proposed to be one composite sample per 50,000 cy (Table F-1). Further tests could be required if initial elutriate tests detect soluble constituents at concentrations of concern for the specific CAD site. The results generated through elutriate testing should be compared to applicable water quality standards rather than background sediment concentrations or STLC action levels. The issue of most concern for confined aquatic disposal of NUAD Category II or III material is the appropriate method of placing the material into the CAD site to avoid or minimize water quality effects.

APPENDIX G

Confined Aquatic Disposal (CAD) in San Francisco Bay — General Discussion of Environmental Impacts and Issues

DEPARTMENT OF THE ARMY
WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS
3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

REPLY TO
ATTENTION OF

CEWES-EP-D (70-1r) 17 May 1995

MEMORANDUM FOR Commander, USAE District, San Francisco, ATTN: CESPN-PE (Mr. Richard Stradford), 211 Main St., San Francisco, CA 94105-1905

SUBJECT: DOTS Request for Assistance

1. Enclosed is the response (encl 1) to your DOTS request for assistance in evaluating a Confined Aquatic Disposal (CAD) proposal in the San Francisco Bay Long-Term Management Strategy (LTMS) document. This response was developed by Dr. Michael Palermo of the Environmental Laboratory.

2. We appreciate your interest in the DOTS Program, and if you need further assistance, please contact Dr. Palermo (601-634-3753).

FOR THE DIRECTOR, ENVIRONMENTAL LABORATORY:

Encl

THOMAS R. PATIN, PE
Manager, Dredging Operations
Technical Support

CF: wo/encl
M. Palermo, EED

CEWES-EE-P 4 May 95

MEMORANDUM FOR Tom Patin, PM/DOTS

SUBJECT: DOTS Request 95-011, CAD Considerations for San Francisco Bay LTMS

1. Attached is a white paper requested by CESPN regarding considerations for Contained Aquatic Disposal in San Francisco Bay. This paper is intended as input to the San Francisco Bay LTMS Environmental Impact Statement.

2. This paper incorporates comments received from CESPN on an earlier draft. If there are questions, please call me at 601-634-3753.

MICHAEL R. PALERMO, PhD, PE
Research Civil Engineer
Environmental Engineering Division
Environmental Laboratory

Routing:
C/EED; Palermo EED

16 May 95

CONTAINED AQUATIC DISPOSAL (CAD) IN SAN FRANCISCO BAY- GENERAL DISCUSSION OF ENVIRONMENTAL IMPACTS AND ISSUES

by Michael R. Palermo
U.S. Army Engineer Waterways Experiment Station

A. Introduction and Description of Contained Aquatic Disposal

Purpose and Scope

The purpose of this white paper is to provide a discussion of technical issues concerning the potential use of contained aquatic disposal (CAD) as an alternative for disposal of contaminated dredged material in San Francisco Bay. This paper is intended as input to preparation of an Environmental Impact Statement for the San Francisco Bay Long Term Management Strategy and was prepared for the U.S. Army Engineer District, San Francisco, under the Dredging Operations Technical Support (DOTS) Program by the U.S. Army Engineer Waterways Experiment Station. The paper includes a definition of CAD, a discussion of the technical issues for design and implementation of a CAD alternative, a summary of CAD experiences in other regions of the U.S. and internationally, a conceptual assessment of the applicability of CAD for conditions in San Francisco Bay and a generic list of potential environmental impacts associated with CAD. More detailed technical guidance on CAD is being jointly prepared by the Corps of Engineers and the Environmental Protection Agency (Palermo, et al in preparation).

Background

Approximately 7 million cubic yards are dredged in San Francisco Bay annually for maintenance and improvement of navigation channels. In addition, there are anticipated dredging requirements related to remediation projects for contaminated sediments. Over the long term, there will be a need to dispose of large volumes of contaminated material in the San Francisco Bay area, perhaps between 10 and 20 percent of total dredging needs. The estimated requirement is approximately 10 million cubic yards over the next ten years. For purposes of this report, contaminated sediments are defined as those found to be unsuitable for unrestricted open water disposal (either ocean or in-Bay) because of potential

contaminant impacts, and clean materials are defined as those found to be acceptable for such disposal. A number of alternatives are being examined for disposal of contaminated material to include Contained Aquatic Disposal (CAD).

Definition of CAD

Subaqueous dredged material capping is the controlled accurate placement of contaminated material at an open water site, followed by a covering or cap of clean isolating material. Contained aquatic disposal (CAD) is a form of subaqueous capping with provisions for lateral confinement to minimize spread of the materials on the bottom (e.g. placement in bottom depressions, or behind subaqueous berms).

Two possible types of CAD sites are the primary focus for San Francisco Bay: 1) borrow pits or depressions, and 2) constructed subaqueous fills. The placement of dredged material in depressions or borrow pits which have been deepened in the past or for creation of shallow water fills behind berms can also be managed and designed as a beneficial use application. Establishment of submerged aquatic vegetation or similar shallow water habitat is an obvious candidate for beneficial use of the completed CAD fill.

Other forms of subaqueous capping such as level bottom capping (LBC) or capping within the context of nearshore containment (i.e. terminal development or closure of dead end slips, old graving docks, etc.) are also possibilities. Level bottom capping is simply capping at sites with their natural bathymetry without provisions for lateral containment. Nearshore containment is similar to CAD except that the existing shoreline or shoreline structures provide the means for lateral containment. If the capped fill remains sub-tidal, the technical considerations for nearshore containment are the same as for an open water CAD site. However, if the nearshore containment fill after capping is above the high tide elevation, the site should be considered a confined (diked) disposal facility (CDF), and the site should be designed and its potential impacts evaluated as for any CDF. In-situ capping of contaminated sediments for purposes of remediation is basically LBC, but does not involve dredging or placement of contaminated sediments, and is not discussed in this report. An illustration of the CAD and LBC is shown in Figure 1.

Project requirements

Any CAD site within San Francisco Bay is envisioned as a multi-user site. Such a site must be capable of handling a range of sediment types from a range of projects. The Containment Sites Committee has developed a planning level estimate of 10 million cubic yards for the volume of contaminated sediments which will require dredging over the next ten years.

B. Technical Issues for Implementation

Design Issues for Capping

Capping is a contaminant control measure to prevent impacts associated with potential benthic toxicity or benthic bioaccumulation. However, capping involves placement of a material at an open water site which has been tested and determined to be unsuitable for conventional open water disposal. There are several issues which therefore must be carefully considered within the context of a capping project design. These include:

a. Potential water column impacts during placement - assessment should consider evaluation of potential release of contaminants to the water column, evaluation of potential water column toxicity, and evaluation of initial mixing. Elutriate test procedures for water quality, water column bioassay tests, and computer models for dispersion and mixing are available to address these requirements. The mass loss of contaminants during placement (fraction dispersed off-site and remaining uncapped) may also be predicted using these same tests and models.

b. Efficacy of cap placement - assessment should consider available capping materials, dredging methods for placement of both contaminated material and cap material, and compatibility of site conditions, material physical properties, and dredging and placement techniques. Guidance on selection of appropriate methods and compatibility with site conditions and material properties and computer models for mound development and spreading behavior are available.

d. Long term cap integrity - assessment should consider the need for physical isolation of contaminants, potential bioturbation of the cap by benthos, consolidation of the sediments, long term contaminant losses due to advection/ diffusion, and potential for physical disturbance of the cap by currents, waves and other forces such as anchors, ship traffic, ice, etc. Test procedures for

contaminant isolation and consolidation, and computer models for evaluation of long term contaminant diffusion and resistance to erosion are available.

Each of these issues must be appropriately addressed by the project design.

The Design Process

A CAD project should be treated as an engineered project with carefully considered design, construction, and monitoring to ensure that the design is adequate. Contaminated sediments must be placed at the CAD site with acceptable levels of dispersion and the cap required to isolate the contaminated material from the environment must be successfully placed and maintained for a CAD project to be successful.

Guidelines have been developed for planning, designing, implementing, and monitoring capping projects, and these guidelines should be considered for CAD projects. The design process for a CAD project includes characterization of both contaminated and capping sediments, selection of an appropriate site, selection of compatible equipment and placement techniques, prediction of material dispersion during placement, design for the required capping sediment thickness, evaluation cap stability against erosion and bioturbation, and development of a monitoring program. The description of technical issues associated with CAD in the following paragraphs is patterned after the more general description of design requirements for capping projects developed by the USACE and EPA (Palermo 1991a; Palermo, et al in preparation).

Considerations for Site Selection

Bathymetry and site geometry, current and wave environments, water depths, bottom sediment characteristics, and operational requirements such as distance from dredging areas, sea state, etc. are major considerations in selecting an appropriate site for CAD. In general, a dredged material capping or CAD site should be in a relatively low-energy environment to reduce the potential dispersion during placement of contaminated materials and to reduce potential for later erosion of the cap (Palermo 1992).

Bathymetry forming a natural depression or site geometry such as an excavated borrow pit will tend to confine the material and reduce potential for dispersion and erosion of material. A constructed subaqueous fill would require a subaqueous dike or structure to provide the lateral confinement necessary for CAD.

Water column currents affect the degree of dispersion during placement . Of more importance are the bottom currents which could potentially cause resuspension and erosion of the mound and cap. The effects of storm-induced waves on bottom current velocities should also be considered.

The deeper the water depth at the site, the greater the potential for water entrainment and dispersion during placement. However, deeper water depths also generally provide more stable conditions on the bottom with less potential for erosion. Water depths within San Francisco Bay vary from zero at the Bay's edges to nearly 300 feet under the Golden Gate Bridge. But the average water depth is approximately 6 feet, so water depths at and surrounding the potential sites are not of particular concern, and are well within the experience base for capping projects. Numerical models for evaluation of dispersion and spread and for sediment transport and erosion can aid in evaluation of alternative sites.

Siting considerations which are specific to a borrow pit or constructed subaqueous fill include:

a. the site should be large enough to provide the needed capacity
b. the pit or fill should be sufficiently deep and wide to effectively contain the spread of contaminated dredged material during the placement process
c. the site location should not interfere with navigation traffic or other activities within the bay
d. the location should not be in or near an area with sensitive resource
e. the site should be surrounded by water of sufficient depth such that barges will have a safe approach for placement of dredged material

Characterization of Contaminated Sediment

Prior to placement of contaminated materials from any specific dredging project in the CAD site, the material must be characterized from a physical, chemical, and biological standpoint. Physical characteristics are of importance in determining the behavior of the material during and following placement at a capping site. In-situ volume (to be dredged), in-situ density (or water content), plasticity indexes, and grain size distribution for each project considered are needed for evaluations of dispersion during placement and long-term stability and resistance to erosion. Additional engineering tests for volume change during placement and long term consolidation are needed to determine the volume occupied within the CAD site by each project. Some chemical and biological characterization of the contaminated sediment will normally be performed as a part

of the overall evaluation for suitability for open water disposal (EPA/USACE 1991 and EPA/USACE in preparation).

Selection and Characterization of Capping Sediment

Unlike the contaminated sediment, the capping sediment used in a capping project may be a matter of choice. For economic reasons, a capping sediment is usually taken from an area which also requires dredging. If this is the case, there may be a choice between projects, and scheduling of the dredging is an important consideration. In other cases, removal of bottom sediments from areas adjacent to the capping site may be considered. Removal of material to create CAD cells and stockpiling for later use in the capping operation can also be considered.

The capping sediment should be characterized as described above for the contaminated sediment. However, the capping sediment must be one which is acceptable for in Bay disposal (i.e. a "clean" sediment). For a multi-user site as such that under consideration for San Francisco Bay which would be used on a repetitive basis, sources of suitable capping material should be identified in advance.

A multi-user site also requires close coordination between potential project users with respect to scheduling and sharing of costs and resources. It may not be necessary to cap each deposit of contaminated material prior to placement of contaminated material from the next project, depending on the level of contamination and the time interval between projects. It may be possible to schedule several small dredging projects which involve placement of contaminated sediments so that the materials are placed concurrently or consecutively with little delay. In this way, a single capping layer could be used to isolate contaminated sediments from several projects, with considerable potential for cost savings and potential conservation of CAD site capacity.

Equipment and Placement Techniques

A variety of equipment types and placement techniques have been used for capping projects. Conceptual illustrations of the equipment types potentially applicable to capping are shown in Figure 2.

An important factor in placement of the contaminated material at a CAD site is reducing water column dispersion during placement. Mechanical dredging with transport and placement by barge would be one option, since placement of mechanically dredged material from barges usually results in a discharge which

quickly descends to the bottom with little dispersion. However, hydraulic placement of the contaminated material by pipeline or placement by hopper dredge are acceptable methods for CAD sites since the spread of the material will be limited by the lateral confinement at the site. Specialized equipment and placement techniques can also be considered to increase control during placement and reduce potential dispersion and spread of contaminated material during placement. These might include use of submerged diffusers or submerged discharge points for hydraulic pipeline placement, hopper dredge pumpdown with diffuser, or gravity-fed tremie for mechanical or hydraulic placement (Palermo 1991c).

The major design requirement in selection of equipment and placement of the cap is the need for controlled accurate placement and the resulting density and rate of application of capping material. In general, the cap material should be placed so that it accumulates in a layer covering the contaminated material. The use of equipment or placement rates which might result in the capping material displacing or mixing with the previously placed contaminated material should be avoided. Specialized equipment and placement techniques can be considered to increase control of capping material placement. The movement of submerged diffusers, submerged discharge points, split-hull barges, or tremies can be controlled to spread capping material over an area to a required thickness (Sumeri 1989, Palermo 1991c).

Controlled and accurate placement of both the contaminated and capping material is an integral part of a successful capping project. State-of-the-art equipment and techniques should be employed to ensure accurate placement. Taut-moored buoys, mooring barges, various acoustical positioning devices, and computer assisted, real-time helmsman's aids should be considered. Diligent inspection of operations to ensure compliance with specifications is essential.

Dispersion of Contaminated Sediment

An evaluation of potential water column impacts should be conducted for each project. Such an evaluation may involve comparison of predicted water column contaminant concentrations with water quality standards or predicted water column dredged material concentrations with bioassay test results.

Use of available mathematical models to predict the water column dispersion and mixing would be an integral part of such evaluations (EPA/USACE 1991 and Johnson 1990). In addition, the prediction would indicate what portion of the