SCREENING AND REDUCTION OF HISTORIC DREDGING RECORDS

The accuracy of data used for this estimate is limited by a number of factors including:

- The reported quantities were recorded in different ways, such as in-place yardage from surveys, disposal area surveys, hopper dredge bin counts, estimates based on approximate production rates, and dredge scow counts;

- prior to recent regulatory permitting and reporting requirements, many project volumes were very rough estimates, especially for small and/or private projects. Over dredging (non-pay) quantities were not likely to be recorded on any project since most records were only for the purpose of financial accounting;

- the records reported include all types of dredging activities, such as new construction and deepening projects, as well as existing project maintenance activities;

- modern electronic methods of hydrographic surveying may produce more precise data than older methods.

The dredging quantities for the 30 projects in Table 1 include all available records of dredged material removed for new work (original construction and deepening) and maintenance work. To utilize these historic dredging records in developing a projection of future maintenance dredging requirements in the Bay Region the new work quantities must be removed.

The records for all 30 projects were screened for any quantities in the last 25 years that were clearly indicated to be a result of new work and these quantities were removed from the data. The result of this process is shown in Table 2. The lines highlighted in bold and italic in Table 2 indicate the areas from which new work dredging was deleted. The years are indicated in parentheses in the project name column.

A limited number of project records indicated dredging activities during a particular year and did not indicate a new work vs. maintenance breakdown. For these projects the following assumptions were used:

- For the Low-Range Estimate the entire quantity dredged that year was removed from the summation;

- for the Mid-Range Estimate 50% of the quantity dredged that year was removed from the summation;

- for the High-Range Estimate the entire quantity dredged that year was included in the summation.

The result of this analysis, presented in Table 2, is that the historic average annual maintenance dredging quantity for all 30 projects investigated in this study range from approximately 6.45 to 6.69 million cubic yards per year.

Table 2. Historic San Francisco Bay Region Maintenance Dredging Quantities (New Work Quantities Removed)

Project No.	Project Name	Years Covered By Dredging Records	Low Range Total Dredged Quantity (CY)	Low Range Average Annual Dredged Quantity (4) (CY)	Mid Range Total Dredged Quantity (CY)	Mid Range Average Annual Dredged Quantity (4) (CY)	High Range Total Dredged Quantity (CY)	High Range Average Annual Dredged Quantity (4) (CY)
	New Work = (Year of New Work)							
1	New York Slough (1)	-	-	-	-	-	-	-
2	Suisun Bay Channel	55-90	5,291,042	151,173	5,291,042	151,173	5,291,042	151,173
3	Concord NWS	57-81	670,335	27,931	670,335	27,931	670,335	27,931
4	Suisun Slough Channel	12-90	2,833,877	36,332	2,833,877	36,332	2,833,877	36,332
5	*Mare Island Strait ('82 & '83)*	*55-93*	*57,820,419*	*1,521,590*	*57,820,419*	*1,521,590*	*57,820,419*	*1,521,590*
6	Mare Island Naval Shipyard	55-90	14,484,444	413,841	14,484,444	413,841	14,484,444	413,841
7	Napa River	62-88	1,652,575	63,561	1,652,575	63,561	1,652,575	63,561
8.a	Petaluma River (Across the Flats)	41-88	2,998,445	63,797	2,998,445	63,797	2,998,445	63,797
8.b	Petaluma River (Channel)	37-88	2,898,665	56,837	2,898,665	56,837	2,898,665	56,837
9	*Pinole Shoal (82)*	*57-91*	*9,270,814*	*243,969*	*9,270,814*	*243,969*	*9,270,814*	*243,969*
10	*Richmond Inner/Outer Harbor ('85)*	*55-93*	*23,826,271*	*627,007*	*26,579,992*	*699,473*	*29,333,712*	*771,940*
11	Point Molate NFD	56-92	2,689,877	74,719	2,689,877	74,719	2,689,877	74,719
12	Chevron (2)	-	-	-	-	-	-	-
13.a	San Rafael Creek (Across the Flats)	42-91	1,502,838	30,670	1,502,838	30,670	1,502,838	30,670
13.b	San Rafael Creek (Channel)	31-91	1,431,977	23,866	1,431,977	23,866	1,431,977	23,866
14	Treasure Island NS	70-85	763,713	50,914	763,713	50,914	763,713	50,914
15	Port of San Francisco (2)	-	-	-	-	-	-	-
16.a	*San Francisco Bar (San Francisco Harbor) ('75)*	*75-93*	*10,211,382*	*567,299*	*10,926,832*	*607,046*	*11,642,282*	*646,793*
16.b	San Francisco Harbor (Islais Creek and San Francisco Airport Channel)	55-86	2,170,787	70,025	2,170,787	70,025	2,170,787	70,025
17	USCG, Yerba Buena Island (2)	-	-	-	-	-	-	-
18	*Oakland Harbor ('74 & '92)*	*31-92*	*35,162,440*	*576,433*	*35,573,138*	*583,166*	*35,983,835*	*589,899*
19	Alameda NAS	59-92	21,978,188	666,006	21,978,188	666,006	21,978,188	666,006
20	Redwood City	31-93	18,132,293	292,456	18,132,293	292,456	18,132,293	292,456
21	Hunters Point NSY	72-89	838,163	49,304	838,163	49,304	838,163	49,304
22.a	San Leandro Marina (Main Access Channel) (3)	-	-	-	-	-	-	-
22.b	San Leandro Marina (Interior Access Channels)	78-89	717,429	65,221	717,429	65,221	717,429	65,221
23	Moffett Field NAS	69-92	231,859	10,081	231,859	10,081	231,859	10,081
24	Oakland NSC	56-91	4,413,204	126,092	4,413,204	126,092	4,413,204	126,092
25	Larkspur Ferry Channel (2)	-	-	-	-	-	-	-
	ARCO (2)	-	-	-	-	-	-	-
27	Unocal (2)	-	-	-	-	-	-	-
28	Shell Oil (2)	-	-	-	-	-	-	-
29	Exxon (2)	-	-	-	-	-	-	-
30	*Summary of Other Small Projects ('86)*	*55-93*	*24,245,075*	*638,028*	*24,245,075*	*638,028*	*24,245,075*	*638,028*
	Average Annual Quantities;			***6,447,151***		***6,566,097***		***6,685,043***

(1) Included in Suisun Bay Channel
(2) Included in Summary of Other Small Projects
(3) Included in San Leandro Marina (Interior Access Channel)
(4) Average Annual Dredged Quantity = (Total Dredged Quantity)/(Year of Most Recent Record-Year of First Record)
CY =Cubic Yards

There are three additional major factors that will likely have a significant effect on future maintenance dredging quantities:

- Several projects have dedicated disposal sites (sites only used for a specific project). Depending on the life of these dedicated disposal sites, these projects may or may not require other disposal sites in the next fifty years;

- estimating the regional changes in regulatory requirements, hydrological events, and other related factors that will affect the quantity of dredged material requiring disposal sites over the next fifty years;

- estimating the effects on maintenance dredging quantities from the currently planned and potential future military base closures.

Dedicated Disposal Sites

Four projects currently have existing dedicated disposal sites. These projects are the San Francisco Bar Channel, the Napa River Channel, the Petaluma River Channel, and the San Leandro Marina Channels.

Material dredged from the San Francisco Bar Channel is placed in the SF-8 unconfined aquatic disposal site located south of the Bar Channel. SF-8 is a dispersive site located within the littoral drift zone and will likely continue to be used for a significant period of years. Therefore, the Bar Channel is not likely to require other disposal sites within the LTMS 50 year planning period and the quantities from this project were removed from the data.

The disposal sites for the Petaluma River and San Leandro Marina Channels are currently used as rehandling facilities. Dredged material placed in these sites is removed and used as landfill cover. It is not known if these rehandling operations will continue for the next fifty years. Additionally, the long term capacity of the disposal sites for the Napa River Channel are unknown.

To account for the unknown future disposal site requirements for the Petaluma River, Napa River and San Leandro Marina Channels the following assumptions are used:

- For the Low-Range Estimate the entire quantity from all three projects was removed from the summation;

- for the Mid-Range Estimate 50% of the quantity from all three projects was removed from the summation;

- for the High-Range Estimate the entire quantity from all three projects was included in the summation.

Regional Changes Over Time

As shown in Tables 1 and 2, the dredging records cover varying time spans over an 82 year period, from 1912 through 1993. Records covering differing time spans are influenced by hydrologic events and human factors (land use, water regulation, etc.) not common to each set of records.

Changes in regulatory requirements in the last 25 years have been significant and have had a distinct effect on dredging practices in the region. The future changes in regulatory requirements and the effect of those changes on regional dredging practices is unknown.

To compensate for these factors, only the last 25 years of historical dredging data are used (1967 through 1993). This data will have common hydrological conditions and will more closely reflect modern regulatory requirements.

Military Base Closures

Current plans for military base closures in the Bay Region include Mare Island Naval Shipyard, Treasure Island Naval Station, Hunters Point Naval Shipyard, Moffatt Field Naval Air Station, and Alameda Naval Air Station. The potential for reduction of dredging at military installations in the Bay Region due to base closure is highly dependent on the future use of these facilities. Various future uses for these bases are proposed, however no distinct future uses or dredging requirements are currently known. To estimate the potential change in dredging quantities from the currently planned base closures the following assumptions were used:

- For the Low-Range Estimate the entire quantity from all five projects was removed from the summation;
- for the Mid-Range Estimate 50% of the quantity from all five projects was removed from the summation;
- for the High-Range Estimate the entire quantity from all five projects was included in the summation.

Reduced dredging requirements at Mare Island Naval Shipyard would likely reduce dredging requirements for the Mare Island Straight channel. The Mare Island Straight Channel would likely require maintenance at some future time to maintain access to the Napa River Channel. To estimate the potential change in dredging quantities from the Mare Island Straight Channel the following assumptions were used:

- For the Low-Range Estimate 50% of the quantity was removed from the summation;
- for the Mid-Range Estimate 25% of the quantity was removed from the summation;
- for the High-Range Estimate the entire quantity was included in the summation.

The effect of the changes described above to the historic dredging records is shown in Table 3. The result of this analysis is that the historic average annual maintenance dredging quantity for the last 25 years of record in the Bay Region ranges from 3.22 to 4.96 million cubic yards per year.

Table 3. Historic (1967 to 1993) San Francisco Bay Region Maintenance Dredging Quantities
(New Work, Dedicated Disposal Sites, and Selected Base Closures Removed)

Verifiable New Work = (Year of New Work)
Dedicated Disposal Sites = ("#")
Base Closures = ("%")

Project No.	Project Name	Years Covered By Dredging Records (Only >1967)	Low Range Total Dredged Quantity (CY)	Low Range Average Annual Dredged Quantity (4) (CY)	Mid Range Total Dredged Quantity (CY)	Mid Range Average Annual Dredged Quantity (4) (CY)	High Range Total Dredged Quantity (CY)	High Range Average Annual Dredged Quantity (4) (CY)
1	New York Slough (1)	.	.	.	.	.	.	.
2	Suisun Bay Channel	67-90	3,086,202	128,592	3,086,202	128,592	3,086,202	128,592
3	Concord NWS	67-81	352,445	24,284	352,445	14,685	352,445	14,685
4	Suisun Slough Channel	69-90	697,625	31,710	697,625	8,944	697,625	8,944
5	*Mare Island Strait ('82 & '83) (%)*	*67-93*	*16,215,255*	*426,717*	*24,322,883*	*640,076*	*32,430,510*	*853,434*
6	*Mare Island Naval Shipyard (%)*	*67-90*	*0*	*0*	*4,639,488*	*132,557*	*9,278,976*	*265,114*
7	Napa River (#)	*67-88*	0	0	415,946	15,998	831,891	31,996
8.a	Petaluma River (Across the Flats)	69-88	1,539,539	76,977	1,539,539	76,977	1,539,539	76,977
8.b	*Petaluma River (Channel) (#)*	67-88	0	0	708,198	13,886	1,416,395	27,772
9	*Pinole Shoal ('82)*	67-91	4,197,943	167,918	4,197,943	167,918	4,197,943	167,918
10	*Richmond Inner/Outer Harbor ('85)*	67-93	14,690,566	544,095	17,444,287	646,085	20,198,007	748,074
11	Point Molate NFD	67-92	2,062,577	79,330	2,062,577	79,330	2,062,577	79,330
12	Chevron (2)	.	.	.	.	.	.	.
13.a	San Rafael Creek (Across the Flats)	69-91	944,627	41,071	944,627	41,071	944,627	41,071
13.b	San Rafael Creek (Channel)	69-91	165,874	8,294	165,874	8,294	165,874	8,294
14	*Treasure Island N.S. (%)*	*70-91*	*0*	*0*	*381,867*	*26,457*	*763,713*	*50,914*
15	Port of San Francisco (2)	.	.	.	.	.	.	.
16.a	*San Francisco Bar (San Francisco Harbor) (#)*	.	.	.	.	.	.	.
16.b	San Francisco Bar (Islais Creek and San Francisco Airport Channel)	67-86	1,191,618	59,581	1,191,618	59,581	1,191,618	59,581
17	USCG, Yerba Buena Island (2)	.	.	.	.	.	.	.
18	*Oakland Harbor ('74 & '92)*	67-91	8,410,555	336,422	8,821,253	352,850	9,231,950	369,278
19	*Alameda NAS (%)*	*67-92*	*0*	*0*	*8,231,894*	*304,885*	*16,463,788*	*609,770*
20	Redwood City	67-93	5,072,048	195,079	5,072,048	195,079	5,072,048	195,079
21	*Hunters Point NSY (%)*	*72-89*	*0*	*0*	*419,082*	*24,652*	*838,163*	*49,304*
22.a	*San Leandro Marina (Main Access Channel) (3) (#)*	.	.	.	.	.	.	.
22.b	*San Leandro Marina (Interior Access Channels)(#)*	78-89	0	0	358,715	32,610	717,429	65,221
23	*Moffett Field NAS (%)*	*69-92*	*0*	*0*	*115,930*	*5,040*	*231,859*	*10,081*
24	Oakland NSC	67-91	3,521,201	140,848	3,521,201	140,848	3,521,201	140,848
25	Larkspur Ferry Channel (2)	.	.	.	.	.	.	.
26	ARCO (2)	.	.	.	.	.	.	.
27	Unocal (2)	.	.	.	.	.	.	.
28	Shell Oil (2)	.	.	.	.	.	.	.
29	Exxon (2)	.	.	.	.	.	.	.
30	*Summary of Other Small Projects ('86)*	*67-93*	*24,064,284*	*962,571*	*24,064,284*	*962,571*	*24,064,284*	*962,571*
	Average Annual Quantities;			3,223,489		4,077,986		4,964,848

(1) Included in Suisun Bay Channel
(2) Included in Summary of Other Small Projects
(3) Included in San Leandro Marina (Interior Access Channel)
(4) Average Annual Dredged Quantity = (Total Quantity Dredged)/(Year of Most Recent Record-Year of First Record)
CY =Cubic Yards

ESTIMATE OF FUTURE NEW WORK DREDGING QUANTITIES

During the pre-work meeting for Task 1, the LTMS EIR/EIS Writing Team requested that estimated quantities for all proposed future deepening projects within the LTMS study area be developed. It was suggested that the U.S. Army Corps of Engineers, San Francisco District be contacted for information relative to projects within the Bay Area, and that the Port of Stockton be contacted regarding the proposed future deepening of the Stockton Ship Channel.

The U.S. Army Corps of Engineers, San Francisco District, Project Management Division, was contacted regarding all current and proposed deepening projects within the San Francisco Bay Region. Information was provided relative to four proposed deepening projects: The Port of Oakland Phase II; John F. Baldwin Phase III; Port of Richmond; and San Francisco Harbor.

The Port of Stockton, was contacted and indicated that the U.S. Army Corps of Engineers, Sacramento District is starting a feasibility study on deepening the Stockton Ship Channel. The Port of Stockton indicated that projected project depths may be from -38 to -42 feet MLLW. Deepening the Stockton Ship Channel will also require deepening the Suisun Bay Channel (Avon to New York Slough) within the LTMS study area. Conceptual level estimates for this deepening project were calculated and ranged from 2.7 to 6.2 million cubic yards. For this study, the average of these quantities, 4.5 million cubic yards, is used.

Table 4. Summary of Future New Work Dredging Quantities

Project Name	Proposed Start Date	Projected Quantity (million cubic yards)
Port of Oakland Phase II	1994	5.7
John F. Baldwin Phase III	1997	11.0
Port of Richmond	1996	2.0
San Francisco Harbor	2001	1.0
Port of Stockton (Avon to New York Slough)	2010+	4.5
	Total Quantity of Projected New Work	**24.2**

The currently proposed future deepening projects may not accurately reflect the total quantity of new work dredging that will occur in the Bay Region in the next 50 years. However, there currently is no data available to develop a more precise estimate of the future new work dredging. Therefore, the following assumptions were used:

- For the Low-Range Estimate it was assumed that 50% of the projected new work quantity would be dredged;
- for the Mid-Range Estimate it was assumed that 100% of the projected new work quantity would be dredged;
- for the High-Range Estimate it was assumed that 200% of the projected new work quantity would be dredged.

PROJECTED SAN FRANCISCO BAY REGION DREDGING QUANTITY ESTIMATE

The goal of this analysis is to refine the current LTMS dredged material quantity estimate of 400 million cubic yards over 50 years or 8 million cubic yards per year.

To accomplish this goal two estimates were developed:

- The Low-, Mid-, and High-Range estimates of the average annual maintenance dredging quantities as shown in Table 3, and;
- the Low-, Mid-, and High-Range estimates of future new work dredging quantities as discussed in the previous section.

Table 5 presents the results and combination of these two estimates.

The sum of these combined estimates is the Projected San Francisco Bay Region Dredging Estimate. In Summary the results of this estimate are:

- **Low-Range Estimate - 3.47 million cubic yards per year**
- **Mid-Range Estimate - 4.56 million cubic yards per year**
- **High-Range Estimate - 5.93 million cubic yards per year**

TABLE 5. PROJECTED SAN FRANCISCO BAY REGION DREDGING QUANTITY			
QUANTITY TYPE	LOW RANGE ESTIMATE [CUBIC YARDS/YEAR]	MID RANGE ESTIMATE [CUBIC YARDS/YEAR]	HIGH RANGE ESTIMATE [CUBIC YARDS/YEAR]
HISTORIC MAINTENANCE AND NEW WORK (1)	6,840,213	6,840,213	6,840,213
REMOVAL OF HISTORIC NEW WORK (1)	-393,062 (-100% of all new work)	-284,116 (-50 % of selected new work)	-155,170 (-0% of selected new work)
ESTIMATED RANGE OF HISTORIC MAINTENANCE DREDGING	6,447,151	6,556,097	6,685,043
REMOVAL OF DEDICATED DISPOSAL SITES & BASE CLOSURES (2)	-3,223,662	-2,478,111	-1,720,195
PROJECTED MAINTENANCE DREDGING	3,223,489	4,077,986	4,964,848
ADDITION OF PROJECTED NEW WORK DREDGING (3)	242,000 (+50%)	484,000 (+100%)	968,000 (+200%)
TOTAL	**3,465,489**	**4,561,986**	**5,932,848**
ROUNDED TOTAL	**3,470,000**	**4,560,000**	**5,930,000**
50 YEAR PROJECTED TOTAL DREDGE MATERIAL VOLUME	**173,500,000**	**228,000,000**	**296,500,000**

Notes

(1) For projects with separable new work quantities, the entire quantity was deleted in all estimate ranges. For records without separable quantities, 100%, 50%, and 0% of the entire annual reported volume was removed for the low, mid, and high range estimates, respectively (Table 3).

(2) For projects with dedicated disposal sites, and military base closures, 100%, 50%, and 0% of the quantities were removed; with the exception of the San Francisco Bar which was entirely removed (ocean disposal only), and the Mare Island Straits which had 50%, 25%, and 0% removed, since it is known that this dredging will not cease entirely with the closure of Mare Island Naval Shipyard (Table 3).

(3) See Table 4 and subsequent paragraphs.

PROJECTED QUANTITY ESTIMATE OF UNSUITABLE DREDGED MATERIAL

Previous estimates of the amount of unsuitable dredged material (material unsuitable for dispersive aquatic disposal in San Francisco Bay or the Pacific Ocean) that will require dredging generally range from 10% to 20% of all material dredged.

The LTMS Implementation Work Group - Containment Site Task Committee developed an estimate of 10 million cubic yards of unsuitable dredged material over the next 10 years, or 1.0 million cubic yards per year, which fits within the above range.

The limited evaluation performed by GBA in the LTMS Report "*Analysis of Remediation Technologies for Contaminated Dredged Material*", October 1993, also fell within the above range.

In the absence of more accurate data, the current assumption that from 10% to 20% of all material dredged is unsuitable for unconfined aquatic disposal will be used to estimate the projected range of dredged material quantities that will be unsuitable.

Using 10% of the Low-Range Estimate from Table 5 for the Low-Range Estimate of annual unsuitable material quantity and using 20% of the High-Range Estimate from Table 5 for the High-Range Estimate of annual unsuitable material quantity results in the following:

- **Low-Range Estimate of Unsuitable Material - 350,000 cubic yards per year;**
- **High-Range Estimate of Unsuitable Material - 1.18 million cubic yards per year.**

RECOMMENDATION FOR IMPROVING FUTURE REGIONAL DREDGING ESTIMATES

In order to improve estimates for the expected future dredging quantities in the Bay Region, the following steps are suggested as a minimum level of effort:

- Ensure that future dredging quantities are recorded in a consistent manner (i.e., cut measure);
- coordinate with all port authorities to refine long term new work and maintenance dredging quantity estimates based on there individual long term plans;
- coordinate with the project sponsors of projects with existing dedicated disposal sites to assess their potential long term requirements for future disposal in non-dedicated sites;
- coordinate with agencies proposing future uses for military bases scheduled for closure to refine future new work and maintenance dredging quantity estimates for these facilities;
- coordinate with regulatory and resource agencies to assess the future effects of their plans and goals on dredging of all Bay Region projects, on a project specific basis.

DREDGING PROJECT PROFILES

DREDGING PROJECTS PROFILES LIST

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
8. Petaluma River
    a. Across the Flats (deep water to mile 0.0)
    b. Mile 0.0 to E. Washington Street Bridge
9. Pinole Shoal
10. Richmond Harbor
11. Point Molate NFD
12. Chevron
13. San Rafael Creek
    a. Across the Flats (deep water to mile 0.0)
    b. Mile 0.0 to Grand Ave./Francisco Blvd. Bridge
14. Treasure Island NS
15. Port of San Francisco
16. San Francisco Bar
17. USCG, Yerba Buena Island
18. Oakland Harbor
19. Alameda NAS
20. Redwood City
21. Hunters Point NSY
22. San Leandro Marina
    a. Main Access Channel (deep Water to mile 0.0)
    b. Interior Access Channel (mile 0.0 to mile 0.4)
23. Moffett Field NAS
24. Oakland NSC
25. Larkspur Ferry Channel
26. ARCO
27. Unocal
28. Shell Oil
29. Exxon
30. Summary of "other (small) projects" from *S.F. Bay Dredging Records 1985-1993*

February 6, 1995

DREDGING PROJECT PROFILE

Project No: 1

me:	**New York Slough-Federally Authorized Project**
oject Owner/Sponsor:	The Port of Stockton
'roject scription:	New York Slough consists of a 400-foot wide portion of the Suisun Bay Channel extending from mile 13 of the Suisun Bay Channel, around Browns and Winter Islands, to the San Joaquin River. Project depth for the channel is -35.0 feet MLLW. This project is authorized as part of the Federal Suisun Bay Channel project.
roject Location:	Located in Suisun Bay and New York Slough, north of the city of Pittsburg, in Contra Costa County.
ax. Project Depth:	-35.0 Feet MLLW
Classification of Work:	Maintenance
aterial Quantity:	The only records* that specifically indicate dredging in New York Slough show that 21,000 cy of material was removed in 1990. Other maintenance dredging and deepening is not recorded separately from dredging records in the Suisun Bay Channel.
Sediment Grain Size Distribution:	Classified as greater than 80% sand.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records do not indicate how many dredging events in the Suisun Bay Channel included the dredging of New York Slough. Sedimentation is primarily dependent on hydrologic events.
Method(s) of Dredging:	Typically, maintenance dredging is done by hopper dredge. Project deepening to -35.0 feet MLLW in the mid 1980's was done by hydraulic pipeline dredge.
Historical Disposal Method:	Disposition of dredged material from maintenance dredging (as part of Suisun Bay Channel) has been approximately 80% open water disposal and 20% confined upland disposal. The mid 1980's deepening was confined upland disposal. Material was placed at Praxis-Pacheco, Simmons Island, Winter Island, and possibly at other sites. The special open water sites are not known, however it is assumed that the Suisun open water site was used.
Historical Dredging Season:	Maintenance dredging is normally done in conjunction with other Federal projects. Delta Smelt, Salmon, other fisheries, and environmental concerns may limit the dredging season in the future.
Potential for Reduction of Dredging:	The location of the Channel within New York Slough has been shifted in the recent past to take advantage of existing deep water. This may be an acceptable method for reducing required maintenance dredging in the future. Coordination with local sand mining could potentially reduce maintenance dredging frequency and/or cost.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, Management Strategy for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Map; Antioch North; NOAA Chart 18656.
Additional Notes:	Material quantities taken from: *USACE, San Francisco District, O & M Project Management Branch, dredging records and LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990 USACE, San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. The Port of Stockton is currently working with Contra Costa County to convert the sponsorship of the project to Contra Costa County.

DREDGING PROJECT PROFILE

Project No:

Name:	**Suisun Bay Channel-Federally Authorized Project**
Project Owner/Sponsor:	The Port of Stockton is the sponsor of the portion above Avon.
Project Description:	The project consists of a 13-mile long, 300-foot wide channel with a project depth of -35.0 feet MLLW, extending f Head Point to New York Slough. An additonal 250-foot wide channel with a project depth of -20.0 feet MLLW, ex mile 3.0 near Seal Island, for access to the Concord Naval Weapons Station.
Project Location:	Carquinez Straits, Suisun Bay, New York Slough, and the mouth of the San Joaquin River in Contra Costa a Counties.
Max. Project Depth:	**-35.0 Feet MLLW** — **Classification of Work:** **Maintenan**
Material Quantity:	Between 1955 and 1990, a total of 5,291,000 cy of material was removed, with an average annual volume of approximately 151,000 cy (these quantities include material dredged in New York Slough, and in addition d include the quantities from the mid-1980's deepening of Suisun Bay Channel)**.
Sediment Grain Size Distribution:	Classified as greater than 80% sand.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1955 to 1990 show an average dredging frequency of one event every 1.3 years. **Sedimenta 0.5 to 2; 4 to 12 inches/yr. Side shoals accrete at 3 to 15 inches/yr. **Average dredging rates: 1955-1990, 1 cy/yr; 1955-1970, 240,000 cy/yr; 1980-1982, 125,000 cy/yr; 1982-1990, 70,000 cy/yr.
Method(s) of Dredging:	Typically, maintenance dredging is done by hopper dredge, however clamshell dredges have also been used deepening to -35.0 feet MLLW in the mid-1980's was done by hydraulic pipeline dredge.
Historical Disposal Method:	From 1955 through 1967, a total of 2,537,500 cy was disposed of at the Suisun Bay disposal site. From 196 1970, 792,500 cy of material was disposed of at upland disposal sites. In 1972, 50,000 cy of material was di at an upland site. In 1973, 101,500 cy of material was disposed of at the Suisun Bay disposal site. From 197 1981, 1,224,500 cy of material was disposed of at the Suisun Bay disposal site. In 1982, 99,500 cy of mater disposed of at an upland site. From 1982 through 1993, 676,000 cy of material was disposed of at the Suisu disposal site.
Historical Dredging Season:	Maintenance dredging is normally done in conjunction with other federal projects. Delta Smelt, Salmon, a fisheries' concerns may limit the dredging season in the future.
Potential for Reduction of Dredging:	**Possible methods for reduction of dredging include: Channel realignment, relocation of disposal site, opt of dredging practices, and/or coordination with sand mining operations in the area.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LT Management Strategy for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE Quad Maps, Antioch North, Vine Hill and Honker Bay. NOAA Chart 18656. **Reduce Dredging Requirement Fina LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.
Additional Notes:	Material quantities taken from; USACE, San Francisco District, O & M Project Management Branch, dredging reco Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D). San F Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. Dredging records dating back to 1919 are in the LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, but were not included prior due to significant changes in the hydrology of the San Francisco Bay Estuary in the early 20th Century. Reduce Dre Requirement Final Report, LTMS, Phase II, Task 3, W.E. C, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, S Francisco District.

DREDGING PROJECT PROFILE

Project No: 3

Name:	**Concord Naval Weapons Station (Port Chicago)-U.S. Navy Project**
Project Owner/Sponsor:	United States Navy
Project Description:	This project is accessed from the Suisun Bay Channel. Between Seal Islands and the West Dock, the project is dredged to a depth of -22.0 feet MLLW. An adjoining area off the Lightering Pier is dredged to a depth of -14.0 feet MLLW. The basins adjacent to the three Concord Naval Weapons Station piers are dredged to a depth of -32.0 feet MLLW.
Project Location:	Suisun Bay, City of Port Chicago; Contra Costa County.
Max. Project Depth:	-32.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	Between 1957 and 1981, a total of 670,500 cy of material was removed, with an average annual volume of approximately 28,000 cy.
Sediment Grain Size Distribution:	Portions of the channel are classified as sand. Areas near the shore facilities are classified as silt, and clays.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1957 to 1981 show an average dredging frequency of one event every 1.8 years. The U.S. Navy is currently planning to dredge in 1994 and 1995.
Method(s) of Dredging:	Maintenance is normally by hopper or clamshell dredge.
Historical Disposal Method:	Between 1957 and 1967, all material was disposed of at open water sites. In 1969, all material was disposed of at the South Bay site. From 1974 through 1981, all material was disposed of at the Alacatraz site (SF-11).
Historical Dredging Season:	3rd Qtr, Delta Smelt, Salmon, and other fisheries' concerns may limit the dredging season in the future.
Potential for Reduction of Dredging:	The trend towards base closure of other Navy facilities in the San Francisco Bay Area may have a future affect on this facility.
Site References:	Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. NOAA Chart 18656. Plans and Specifications; Western Division, Naval Facilities Engineering Command, San Bruno CA. Calif. Quad Maps, Antioch North, Vine Hill and Honker Bay. NOAA Chart 18656.
Additional Notes:	Material quantities taken from: Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project N

Name:	**Suisun Slough Channel-Federally Authorized Project**
Project Owner/Sponsor:	City of Suisun
Project Description:	The project consists of an approximately 13-mile long channel extending from Suisun Bay, up Suisun Slough, to S The channel entrance is 200 feet wide, tapering to between 100 to 125 feet wide along the length of the channel. T depth is -8.0 feet MLLW. The project includes a 1,400 by 150-foot harbor and a 600 by 275-foot turning basin in City, both with project depths of -8.0 feet MLLW.
Project Location:	In Suisun Slough, from Suisun Bay to Suisun City; Solano County.
Max. Project Depth:	-8.0 Feet MLLW
Classification of Work:	Maintena
Material Quantity:	Between 1912 and 1990, a total of 2,834,000 cy of material was removed, with an average annual volume approximately 36,500 cy.
Sediment Grain Size Distribution:	The Bay access channel contains some sand and the slough channel is silt, clay, and mud. (Initial dredging commenced in 1912, but the material encountered was so soft that the banks could not stand with excavat placed on them. Thus, all material has been disposed of at upland sites).**
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1912 to 1990 show an average dredging frequency of one event every 4.1 years. Sedimentati dependent on hydrologic events. Recent project dredging was in 1970, 1982 and 1990, for a recent dredgi frequency of approximately one event every 10 years.
Method(s) of Dredging:	Predominantly pipeline, with occasional clamshell dredging.
Historical Disposal Method:	All material removed from the Slough Channel was disposed of at upland disposal sites. The current upla Pierce Island. The historic sites included local upland duck clubs (levee rehab) and unknown sites. Some s the entrance channel has been disposed of in the Suisun Bay site.
Historical Dredging Season:	Infrequent in recent history.
Potential for Reduction of Dredging:	Upstream control of sediment input or bank armoring are possible, however not likely to be effective. Co entrance channel dredging with sand mining operations may be possible.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. L Management Strategy for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USAC and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Vine Hill, Fairfield South and Ho NOAA Chart 18656.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging re LTMS, Management Strategy for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 199 San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Req Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francis

DREDGING PROJECT PROFILE

Project No: 5

Name: **Mare Island Strait-Federally Authorized Project**

Project Owner/Sponsor: None

Project Description: The project includes a 700-foot wide channel with a project depth of -30.0 feet MLLW, extending through Mare Island Strait and flaring into a turning basin which is generally 1,000 feet wide from former Dike No. 6 to within 75 feet south of the causeway between Vallejo and Mare Island. The project depth is -30.0 feet MLLW, except at the northerly end where the project depth is -26.0 feet MLLW. The project includes the maintenance of two approach areas to Navy piers at the southern end of Mare Island. Currently, a subset of the main channel, referred to as the 'Navy Channel', is being maintained. The Navy Channel is 600 feet wide, with a project depth of -36.0 feet MLLW, and lies along the western edge of the main channel. The depth of the Navy Channel was improved to the present depth of -36.0 feet MLLW in 1982.

Project Location: San Pablo Bay, Pinole Shoal approach to Mare Island Naval Shipyard. City of Vallejo; Contra Costa County.

Max. Project Depth: -36.0 Feet MLLW

Classification of Work: Maintenance

Material Quantity: Between 1955 and 1993, a total of 60,473,500 cy of material was removed, with an average annual volume of approximately 1,591,500 cy. The accuracy of these records is in question.

Sediment Grain Size Distribution: Material classified as silty clay.

Contamination History : None.

Frequency of Dredging and Sedimentation: Records from 1955 to 1993 show an average dredging frequency of one event every year. From the dredging records, shoaling rates of approximately 3.5 feet/year are indicated.

Method(s) of Dredging: Hopper dredges, hydraulic pipeline dredges, and clamshell dredges have been used.

Historical Disposal Method: Between 1955 and 1992, all material was disposed of in Carquinez Straits.

Historical Dredging Season: 1st Qtr.

Potential for Reduction of Dredging: The potential closure of the Mare Island Naval Shipyard may affect the need to maintain current project depths. Conversion of this facility to other uses could also affect the future maintenance dredging requirements.

Site References: Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Mare Island and Benicia. NOAA Charts 18654 and 18655.

Additional Notes: Material quantities taken from; USACE, San Francisco District, O & M Project Management Branch, dredging records, Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D). San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. Dredging records included in the LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, document disagree with those included in other records; thus records in the Phase I document dating back to 1931 are not included in the tabulations.

DREDGING PROJECT PROFILE

Project N

Name:	**Mare Island Naval Shipyard-U.S. Navy Project**
Project Owner/Sponsor:	United States Navy
Project Description:	The project consists of numerous berths, of varying lengths and widths, with project depths of between -32.0 and MLLW, and other related docks and facilities.
Project Location:	In Mare Island Strait, located between Mare Island and Vallejo; Solano County.
Max. Project Depth:	-40.0 Feet MLLW
Classification of Work:	Maintena
Material Quantity:	Between 1955 and 1990, a total of 14,484,500 cy of material was removed, with an average annual volum approximately 414,000 cy. The accuracy of these records is in question.
Sediment Grain Size Distribution:	Material classified as silty clay.
Contamination History :	Some contamination expected due to historic ship building and maintainance activities.
Frequency of Dredging and Sedimentation:	Records from 1955 to 1990 show an average dredging frequency of one event every 1.5 years. Due to conc the accuracy of the dredging volume records, the sedimentation rates have not been estimated.
Method(s) of Dredging:	Between 1955-1970, hopper, pipeline, or clamshell dredges were used. Since 1980, hydraulic pipeline dre been used.
Historical Disposal Method:	Corps of Engineers records indicate that between 1955 and 1968, and in 1970, 6,558,569 cy of material w of in Carquinez Straits. In 1969 and 1988, 1,585,300 cy was disposed of at open water sites; and from 198 1990, 5,647,575 cy of material was disposed of at upland sites. However, Navy personnel indicate that sin 1890's all material dredged has been placed in the upland disposal ponds. Therefore, the Corps of Enginee are suspect.
Historical Dredging Season:	Due to shoaling rates and depth requirements for the Shipyard, dredging has been accomplished on a year needed basis.
Potential for Reduction of Dredging:	Due to the planned closure of Mare Island Naval Shipyard, the future dredging requirements will be depe future uses of this site.
Site References:	Dredging of Various Naval Installations in the San Francisco Bay Area, Naval Facilities Engineering Command, W Division, San Bruno CA. (Bluelines). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif Map, Mare Island. NOAA Charts 18654 and 18655.
Additional Notes:	Material quantities taken from: Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, In (Appendix D) and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 7

Name: **Napa River-Federally Authorized Project**

Project Owner/Sponsor: Napa County

Project Description: The project consists of a 100-foot wide channel with a project depth of -15.0 feet MLLW, extending from Mare Island Strait causeway to Asylum Slough. Upstream of Asylum Slough, the channel is 75 feet wide with a project depth of -10.0 feet MLLW, extending to to Third Street in Napa, with a cutoff at Horseshoe Bend. Additionally, a 300-foot wide turning basin with a project depth of -10.0 feet MLLW is maintained at Jacks Bend; plus additional widenings, realignments, dikes, and revetments as required in other difficult sections.

Project Location: In the Napa River, City of Napa; Napa and Solano Counties.

Max. Project Depth: -15.0 Feet MLLW | **Classification of Work:** Maintenance

Material Quantity: The total volume of material removed from the project in 1962, 1981, and 1988 was 1,652,500 cy, with an average annual volume of approximately 63,500 cy.

Sediment Grain Size Distribution: Not classified.

Contamination History : None.

Frequency of Dredging and Sedimentation: The project was dredged in 1962, 1981, and 1988; with an average dredging frequency of one event every 8.7 years. *Shoaling is generally uniform and confined to the reach between "Good Luck Point" and head of navigation; increased shoaling occurs at Jacks Bend.

Method(s) of Dredging: Corps of Engineers records indicate that hydraulic pipeline dredges were used on this project.

Historical Disposal Method: Between 1962 and 1988, all material removed from the project, (1,652,575 cy), was disposed of at 3 upland disposal sites located adjacent to the river. The three sites are: The Napa Sanitation site (5 acres, current capacity; 50,000 cy) located north of Imola Avenue, west of the Southern Pacific Railroad tracks, and east of the Napa River; the Kennedy Park site (37 acres, current capcity; 150,000 cy) located north of Asylum Slough and east of the Napa River; and the Edgerly Island site (26 acres, currently full) located on the northern tip of Edgerly Island.

Historical Dredging Season: Infrequent.

Potential for Reduction of Dredging: Channel reallignment to contours of upstream sedimentation and/or bank stabilization are possible, however not likely. In addition, realignment of a portion of the River is a definite possibility.

Site References: Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Napa River, Cuttings Wharf and Mare Island. NOAA Chart 18654.

Additional Notes: Material quantities taken from: *USACE, San Francisco District, O & M Project Management Branch, dredging records and Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project N

Name:	**Petaluma River, Across the Flats-Federally Authorized Project**
Project Owner/Sponsor:	City of Petaluma
Project Description:	This project is authorized as part of the Petaluma River project, and consists of a 200 foot wide channel with a proj of -8.0 feet MLLW. The project extends across the 'Flats' from deep water in San Pablo Bay to the Railroad Bridge mouth of the Petaluma River.
Project Location:	Through the Petaluma River to San Pablo Bay; Sonoma and Marin Counties.
Max. Project Depth:	-8.0 Feet MLLW
Classification of Work:	Maintenar
Material Quantity:	Between 1941and 1988, a total of 2,998,500 cy of material was removed, with an average annual volume of approximately 64,000 cy. **Records from other sources indicate that from 1962 to 1987 an approximate an volume was 55,000 cy.
Sediment Grain Size Distribution:	Classified as silt and silty loam.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1941 to 1988 show an average dredging frequency of one event every 7.8 years. Dredge recor uniform shoaling characteristics for the site. **From mile 0.0 to mile -2.0 sedimentation rates are between inches per year.
Method(s) of Dredging:	Normally a hydraulic pipeline or clamshell dredge is used to maintain the channel depth.
Historical Disposal Method:	All material removed from the channel, from 1941 to 1987 (2,998,500 cy), was disposed of at the San Pabl disposal site (SF-10).
Historical Dredging Season:	2nd or 3rd Qtr.
Potential for Reduction of Dredging:	Optimizing dredging practices appears to be the only feasible method of reducing dredging for this portion Petaluma River Project.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. D Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. Dredging and Disposal R SFBCDC & USACE, August 1993. Calif. Quad Map, Petaluma Point. NOAA Chart 18654.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging rec LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE; Sediment B for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D); and San Francisco Bay Dre Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 8.b

Name: **Petaluma River-Federally Authorized Project**

Project Owner/Sponsor: City of Petaluma

Project Description: The project consists of a 100-foot wide channel with a project depth of -8 feet MLLW, extending from the Railroad Bridge at the mouth of the Petaluma River, to Western Avenue in Petaluma. The project includes a 300 to 400-foot wide turning basin, a 50-foot wide channel to Washington Street, and a 40-foot wide channel extending 935 feet above the Washington Street Bridge (with project depths of -4.0 feet MLLW). (The 935 foot portion of the project above the Washington Street Bridge is not maintained and has been recommended for deletion from the project).

Project Location: Petaluma River, from the mouth at San Pablo Bay to the City of Petaluma. Located in Sonoma and Marin Counties.

Max. Project Depth: -8.0 Feet MLLW | **Classification of Work:** Maintenance

Material Quantity: From 1937 to 1988, a total of 2,898,500 cy of material was removed, with an average annual volume of approximately 57,000 cy.

Sediment Grain Size Distribution: Classified as sand and silt.

Contamination History : None.

Frequency of Dredging and Sedimentation: Records from 1937 to 1988 show an average dredging frequency of one event every 2.7 years. **Sedimentation: Upstream-Petaluma, mile 13 and above, 10 to 15 inches per year, Haystack Landing, mile 13 to 10.5, 0 to 10 inches per year, the remainder of the project showing negligible sedimentation, or erosion.

Method(s) of Dredging: Normally a hydraulic pipeline dredge is used to maintain the channel depth.

Historical Disposal Method: The material from all recent maintenance dredging activities has been placed in an upland disposal site located slightly south of the City of Petaluma on the east side of the Petaluma River.

Historical Dredging Season: 2nd or 3rd Qtr.

Potential for Reduction of Dredging: **Optimization of channel dimensions and limits of dredging based on use and navigation factors may reduce dredging requirements. Possible inclusion of sediment traps in the upstream flood control project would help, however is unlikely due to institutional constraints.

Site References: Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Petaluma Point, Novato, Petaluma River and Petaluma. NOAA Chart 18654.

Additional Notes: Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging records. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE, Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No:

Name:	**Pinole Shoal-Federally Authorized Project**
Project Owner/Sponsor:	Currently none. Potentially Contra Costa County for future deepening.
Project Description:	The project consists of a 600-foot wide, 11-mile long channel, with a project depth of -36.0 feet MLLW. The project is located in upper San Pablo Bay through the Pinole Shoal, with a maneuvering area adjacent to Oleum Pier at the m Carquinez Straits. This channel is scheduled for deepening to -45.0 feet MLLW in 1997, as part of the John F. Baldw Channel, Phase III.
Project Location:	Channel through Pinole Shoal in San Pablo Bay; Contra Costa County.
Max. Project Depth:	-45.0 Feet MLLW
Classification of Work:	Maintenanc
Material Quantity:	Between 1957 and 1991, a total of 9,657,500 cy of material was removed, with an average annual volume of approximately 284,500 cy. **Records from other sources indicate that from 1982 to 1987 average annual volu 150,000 cy.
Sediment Grain Size Distribution:	Classified as sandy silt.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1957 to 1991 show an average dredging frequency of one event every 2.1 years. **Sedimentatio mile 4 to 4.5, 4 to 6 inches per year; mile 4.5 to 5.8, 2 to 4 inches per year; mile 5.8 to 7.3, 5 to 10 inches per and from mile 7.3 to 7.6, 0 to 6 inches per yr. Shoaling is highest at channel angle points.
Method(s) of Dredging:	Hopper dredge.
Historical Disposal Method:	All material (9,657,741 cy) dredged between 1955 and 1991, with the exception of 266,039 cy disposed of at sites in 1969, was disposed of at the San Pablo Bay site (SF-10).
Historical Dredging Season:	Variable. This project is often combined with the dredging of Mare Island Strait and the Suisun Bay Channel
Potential for Reduction of Dredging:	**Realignment of channel, dredging optimization, and disposal site changes may reduce dredging requirement
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTM Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. Calif. Quad Maps; Mare Isla Petaluma Point. NOAA Chart 18654.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging record Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and San Francisco Bay Dredging Records for 1985 to 1993, USACE. San Francisco District. Dredging records included in the for Dredged Material Disposal in the San Francisco Bay Region, Phase I document disagree with those included in oth records; thus records in the Phase I document dating back to 1936 are not included in the tabulations. **Reduce Dredg Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 10

Name:	**Richmond Harbor-Federal and Non-Federal Project Areas**
Project Owner/Sponsor:	City of Richmond
Project Description:	The project includes: Southampton Shoal Channel which is 600 feet wide, 4,000 feet long, and has a project depth of -45.0 feet MLLW; the Outer Harbor Approach Channels which are 2,000 to 2,500 feet wide, 8,000 feet long , and have project depths of between -32.0 and -35.0 feet MLLW; the Inner Harbor Entrance Channel which is 500 to 1,150 feet wide, 20,000 feet long, and has a project depth of -35.0 feet MLLW; the Santa Fe Channel which is 200 feet wide, 2,000 feet long, and has a project depth of -30.0 feet MLLW; and the San Pablo Channel which is 50 feet wide, 2,000 feet long with a project depth of -20.0 feet MLLW. A proposed Port of Richmond project will deepen the Inner Harbor Channel to -41.0 feet MLLW and the existing -30.0-foot MLLW Santa Fe Channel to -38.0 feet MLLW, and provide a 1,200-foot wide turning basin.
Project Location:	San Francisco Bay, City of Richmond; Contra Costa County.
Max. Project Depth:	**-45.0 Feet MLLW** — **Classification of Work:** **Maintenance**
Material Quantity:	Between 1955 and 1993, a total of 29,334,000 cy of material was removed with an average annual volume of approximately 772,000 cy.
Sediment Grain Size Distribution:	The Inner Harbor is classified as clay to silty clay. The outer Harbor is classified as sandy loam and silty clay loam.
Contamination History :	The United Heckathorn Superfund site adjacent to the Richmond Harbor appears to be the source for DDT in the Richmond Harbor. Other contaminants of concern include metals and organics of various
Frequency of Dredging and Sedimentation:	Records from 1938 to 1993 show an average dredging frequency of one event per year, with some areas not maintained due to contamination.
Method(s) of Dredging:	Hopper dredging by Federal dredges and contract dredges.
Historical Disposal Method:	From 1955 through 1970, 8,669,000 cy was disposed of at various open water sites. In 1956, 1958, 1960, 1962, 1965, 1966, and from 1971 through 1993, 20,664,500 cy of material was disposed of at the Alcatraz site (SF-11).
Historical Dredging Season:	2nd Qtr.
Potential for Reduction of Dredging:	Currently, some areas of this project are not maintained due to contamination. If contamination issues are resolved, dredging volumes may increase.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. **(for in-situ contaminant concentrations see pages B-38/39 of this document). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Richmond and San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging records, Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D), and the San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. Dredging records included in the LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I document, disagree with those included in other records; thus records in the Phase I document dating back to 1940 are not included in the tabulations.

DREDGING PROJECT PROFILE

Project No:

Name:	**Point Molate Naval Fuel Depot-U.S. Navy Project**
Project Owner/Sponsor:	United States Navy
Project Description:	The project consists of two basins adjacent to the fuel docks. The basin west of the pier being approximately 2,000 fe and 550 feet wide, with a project depth of -35.0 feet MLLW; and the basin east of the pier being approximately 950 f 240 feet wide, with a project depth of -20.0 feet MLLW.
Project Location:	Just north of the Richmond-San Rafael Bridge; adjacent to the Point Molate Fuel Pier, City of Richmond; Co Costa County.
Max. Project Depth:	-35.0 Feet MLLW
Classification of Work:	Maintenanc
Material Quantity:	Between 1956 and 1992, a total of 2,690,000 cy of material was removed, with an average annual volume of approximately 74,719 cy.
Sediment Grain Size Distribution:	Not classified.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1956 to 1992 show an average dredging frequency of one event every 1.9 years.
Method(s) of Dredging:	Hopper dredging by USACE and contract dredges.
Historical Disposal Method:	From 1956 through 1971, all material (1,455,000 cy) was disposed of at open water disposal sites. From 197 1992, all material (1,235,000 cy) was disposed of at the Alcatraz site (SF-11).
Historical Dredging Season:	4th Qtr.
Potential for Reduction of Dredging:	Depending on the impact of local base closures, the need for this facility may decline resulting in a reduction required maintenance dredging of this project.
Site References:	Dredging of various Naval Installations in the San Francisco Bay Area, Naval Facilities Engineering Command, West Division, San Bruno, CA, (Bluelines). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Q Maps, Richmond and San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging record Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D), and Sa Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 12

Name:	**Chevron (Richmond Long Wharf)-Non Federal Project**
Project Owner/Sponsor:	**Chevron Oil Company**
Project Description:	A pier approximately 2,500 feet long, located approximately 4,000 feet west of the City of Richmond. Located between Point Richmond and the Richmond-San Rafael Bridge, on the Southampton Shoal Channel in San Francisco Bay.
Project Location:	Richmond Long Wharf, City of Richmond; Contra Costa County.
Max. Project Depth:	**-45.0 Feet MLLW** — **Classification of Work:** **Maintenance**
Material Quantity:	*One dredging event is indicated in 1991, when 284,800 cy of material was removed. Dredging volumes included in the 'Other Small Projects' category. **Approximate average annual volume of 120,000 cy.
Sediment Grain Size Distribution:	Classified as silts and sandy silts.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Only one distinct dredging event is shown in the records in 1991. **The back slope was modified on this project in 1975 to reduce sedimentation, resulting in a reduction of required dredging by approximately 38%.
Method(s) of Dredging:	Hopper or clamshell.
Historical Disposal Method:	In 1991, disposal was at the Alcatraz site (SF-11). For all other events not individually recorded, open water disposal is assumed.
Historical Dredging Season:	2nd Qtr.
Potential for Reduction of Dredging:	**As noted above, structural modifications recommended and implemented through analysis of the project, have resulted in a significant reduction in dredging requirements.
Site References:	Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps: San Quentin and Richmond. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D) and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. *Only one event is shown in the records in 1991, under the itemized 'Other Small Projects' category. Prior to 1991, the 'Other Small Projects' category was not itemized. Therefore, prior to 1991 this project is most likely included in the 'Other Small Projects' records. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project N

Name:	**Petaluma River, Across the Flats-Federally Authorized Project**
Project Owner/Sponsor:	City of Petaluma
Project Description:	This project is authorized as part of the Petaluma River project, and consists of a 200 foot wide channel with a p of -8.0 feet MLLW. The project extends across the 'Flats' from deep water in San Pablo Bay to the Railroad Brid mouth of the Petaluma River.
Project Location:	Through the Petaluma River to San Pablo Bay; Sonoma and Marin Counties.
Max. Project Depth:	**-8.0 Feet MLLW**
Classification of Work:	Mainten
Material Quantity:	Between 1941and 1988, a total of 2,998,500 cy of material was removed, with an average annual volume approximately 64,000 cy. **Records from other sources indicate that from 1962 to 1987 an approximate volume was 55,000 cy.
Sediment Grain Size Distribution:	Classified as silt and silty loam.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1941 to 1988 show an average dredging frequency of one event every 7.8 years. Dredge re uniform shoaling characteristics for the site. **From mile 0.0 to mile -2.0 sedimentation rates are betwe inches per year.
Method(s) of Dredging:	Normally a hydraulic pipeline or clamshell dredge is used to maintain the channel depth.
Historical Disposal Method:	All material removed from the channel, from 1941 to 1987 (2,998,500 cy), was disposed of at the San P disposal site (SF-10).
Historical Dredging Season:	2nd or 3rd Qtr.
Potential for Reduction of Dredging:	Optimizing dredging practices appears to be the only feasible method of reducing dredging for this port Petaluma River Project.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 198 Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. Dredging and Disposa SFBCDC & USACE, August 1993. Calif. Quad Map, Petaluma Point. NOAA Chart 18654.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE; Sedimen for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D); and San Francisco Bay Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LT Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 8.b

Name:	**Petaluma River-Federally Authorized Project**
Project Owner/Sponsor:	City of Petaluma
Project Description:	The project consists of a 100-foot wide channel with a project depth of -8 feet MLLW, extending from the Railroad Bridge at the mouth of the Petaluma River, to Western Avenue in Petaluma. The project includes a 300 to 400-foot wide turning basin, a 50-foot wide channel to Washington Street, and a 40-foot wide channel extending 935 feet above the Washington Street Bridge (with project depths of -4.0 feet MLLW). (The 935 foot portion of the project above the Washington Street Bridge is not maintained and has been recommended for deletion from the project).
Project Location:	Petaluma River, from the mouth at San Pablo Bay to the City of Petaluma. Located in Sonoma and Marin Counties.
Max. Project Depth:	-8.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	From 1937 to 1988, a total of 2,898,500 cy of material was removed, with an average annual volume of approximately 57,000 cy.
Sediment Grain Size Distribution:	Classified as sand and silt.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1937 to 1988 show an average dredging frequency of one event every 2.7 years. **Sedimentation: Upstream-Petaluma, mile 13 and above, 10 to 15 inches per year; Haystack Landing, mile 13 to 10.5, 0 to 10 inches per year, the remainder of the project showing negligible sedimentation, or erosion.
Method(s) of Dredging:	Normally a hydraulic pipeline dredge is used to maintain the channel depth.
Historical Disposal Method:	The material from all recent maintenance dredging activities has been placed in an upland disposal site located slightly south of the City of Petaluma on the east side of the Petaluma River.
Historical Dredging Season:	2nd or 3rd Qtr.
Potential for Reduction of Dredging:	**Optimization of channel dimensions and limits of dredging based on use and navigation factors may reduce dredging requirements. Possible inclusion of sediment traps in the upstream flood control project would help, however is unlikely due to institutional constraints.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Petaluma Point, Novato, Petaluma River and Petaluma. NOAA Chart 18654.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging records. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE, Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project N

Name:	**Pinole Shoal-Federally Authorized Project**
Project Owner/Sponsor:	Currently none. Potentially Contra Costa County for future deepening.
Project Description:	The project consists of a 600-foot wide, 11-mile long channel, with a project depth of -36.0 feet MLLW. The proje is located in upper San Pablo Bay through the Pinole Shoal, with a maneuvering area adjacent to Oleum Pier at th Carquinez Straits. This channel is scheduled for deepening to -45.0 feet MLLW in 1997, as part of the John F. Ba Channel, Phase III.
Project Location:	Channel through Pinole Shoal in San Pablo Bay; Contra Costa County.
Max. Project Depth:	-45.0 Feet MLLW
Classification of Work:	Maintena
Material Quantity:	Between 1957 and 1991, a total of 9,657,500 cy of material was removed, with an average annual volume approximately 284,500 cy. **Records from other sources indicate that from 1982 to 1987 average annual 150,000 cy.
Sediment Grain Size Distribution:	Classified as sandy silt.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1957 to 1991 show an average dredging frequency of one event every 2.1 years. **Sediment mile 4 to 4.5, 4 to 6 inches per year; mile 4.5 to 5.8, 2 to 4 inches per year; mile 5.8 to 7.3, 5 to 10 inches and from mile 7.3 to 7.6, 0 to 6 inches per yr. Shoaling is highest at channel angle points.
Method(s) of Dredging:	Hopper dredge.
Historical Disposal Method:	All material (9,657,741 cy) dredged between 1955 and 1991, with the exception of 266,039 cy disposed sites in 1969, was disposed of at the San Pablo Bay site (SF-10).
Historical Dredging Season:	Variable. This project is often combined with the dredging of Mare Island Strait and the Suisun Bay Cha
Potential for Reduction of Dredging:	**Realignment of channel, dredging optimization, and disposal site changes may reduce dredging require
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. Calif. Quad Maps; Mare Petaluma Point. NOAA Chart 18654.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging re Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc., Feb. 1992, (Appendix D), and Francisco Bay Dredging Records for 1985 to 1993, USACE. San Francisco District. Dredging records included in for Dredged Material Disposal in the San Francisco Bay Region, Phase I document disagree with those included in records; thus records in the Phase I document dating back to 1936 are not included in the tabulations. **Reduce D Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, Francisco District.

DREDGING PROJECT PROFILE

Project No: 10

Name:	**Richmond Harbor-Federal and Non-Federal Project Areas**
Project Owner/Sponsor:	City of Richmond
Project Description:	The project includes: Southampton Shoal Channel which is 600 feet wide, 4,000 feet long, and has a project depth of -45.0 feet MLLW; the Outer Harbor Approach Channels which are 2,000 to 2,500 feet wide, 8,000 feet long , and have project depths of between -32.0 and -35.0 feet MLLW; the Inner Harbor Entrance Channel which is 500 to 1,150 feet wide, 20,000 feet long, and has a project depth of -35.0 feet MLLW; the Santa Fe Channel which is 200 feet wide, 2,000 feet long, and has a project depth of -30.0 feet MLLW; and the San Pablo Channel which is 50 feet wide, 2,000 feet long with a project depth of -20.0 feet MLLW. A proposed Port of Richmond project will deepen the Inner Harbor Channel to -41.0 feet MLLW and the existing -30.0-foot MLLW Santa Fe Channel to -38.0 feet MLLW, and provide a 1,200-foot wide turning basin.
Project Location:	San Francisco Bay, City of Richmond; Contra Costa County.
Max. Project Depth:	-45.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	Between 1955 and 1993, a total of 29,334,000 cy of material was removed with an average annual volume of approximately 772,000 cy.
Sediment Grain Size Distribution:	The Inner Harbor is classified as clay to silty clay. The outer Harbor is classified as sandy loam and silty clay loam.
Contamination History :	The United Heckathorn Superfund site adjacent to the Richmond Harbor appears to be the source for DDT in the Richmond Harbor. Other contaminants of concern include metals and organics of various
Frequency of Dredging and Sedimentation:	Records from 1938 to 1993 show an average dredging frequency of one event per year, with some areas not maintained due to contamination.
Method(s) of Dredging:	Hopper dredging by Federal dredges and contract dredges.
Historical Disposal Method:	From 1955 through 1970, 8,669,000 cy was disposed of at various open water sites. In 1956, 1958, 1960, 1962, 1965, 1966, and from 1971 through 1993, 20,664,500 cy of material was disposed of at the Alcatraz site (SF-11).
Historical Dredging Season:	2nd Qtr.
Potential for Reduction of Dredging:	Currently, some areas of this project are not maintained due to contamination. If contamination issues are resolved, dredging volumes may increase.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec 1990 USACE. **(for in-situ contaminant concentrations see pages B-38/39 of this document). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps, Richmond and San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging records, Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D), and the San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. Dredging records included in the LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I document, disagree with those included in other records; thus records in the Phase I document dating back to 1940 are not included in the tabulations.

DREDGING PROJECT PROFILE

Project N

Name:	**Point Molate Naval Fuel Depot-U.S. Navy Project**
Project Owner/Sponsor:	United States Navy
Project Description:	The project consists of two basins adjacent to the fuel docks. The basin west of the pier being approximately 2,00 and 550 feet wide, with a project depth of -35.0 feet MLLW; and the basin east of the pier being approximately 6 240 feet wide, with a project depth of -20.0 feet MLLW.
Project Location:	Just north of the Richmond-San Rafael Bridge; adjacent to the Point Molate Fuel Pier, City of Richmond; C Costa County.
Max. Project Depth:	-35.0 Feet MLLW
Classification of Work:	Mainten
Material Quantity:	Between 1956 and 1992, a total of 2,690,000 cy of material was removed, with an average annual volum approximately 74,719 cy.
Sediment Grain Size Distribution:	Not classified.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1956 to 1992 show an average dredging frequency of one event every 1.9 years.
Method(s) of Dredging:	Hopper dredging by USACE and contract dredges.
Historical Disposal Method:	From 1956 through 1971, all material (1,455,000 cy) was disposed of at open water disposal sites. From 1992, all material (1,235,000 cy) was disposed of at the Alcatraz site (SF-11).
Historical Dredging Season:	4th Qtr.
Potential for Reduction of Dredging:	Depending on the impact of local base closures, the need for this facility may decline resulting in a reduc required maintenance dredging of this project.
Site References:	Dredging of various Naval Installations in the San Francisco Bay Area, Naval Facilities Engineering Command, W Division, San Bruno, CA, (Bluelines). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Ca Maps, Richmond and San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging re Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D), and Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 12

Name:	**Chevron (Richmond Long Wharf)-Non Federal Project**
Project Owner/Sponsor:	**Chevron Oil Company**
Project Description:	A pier approximately 2,500 feet long, located approximately 4,000 feet west of the City of Richmond. Located between Point Richmond and the Richmond-San Rafael Bridge, on the Southampton Shoal Channel in San Francisco Bay.
Project Location:	Richmond Long Wharf, City of Richmond; Contra Costa County.
Max. Project Depth:	-45.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	*One dredging event is indicated in 1991, when 284,800 cy of material was removed. Dredging volumes included in the 'Other Small Projects' category. **Approximate average annual volume of 120,000 cy.
Sediment Grain Size Distribution:	Classified as silts and sandy silts.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Only one distinct dredging event is shown in the records in 1991. **The back slope was modified on this project in 1975 to reduce sedimentation, resulting in a reduction of required dredging by approximately 38%.
Method(s) of Dredging:	Hopper or clamshell.
Historical Disposal Method:	In 1991, disposal was at the Alcatraz site (SF-11). For all other events not individually recorded, open water disposal is assumed.
Historical Dredging Season:	2nd Qtr.
Potential for Reduction of Dredging:	**As noted above, structural modifications recommended and implemented through analysis of the project, have resulted in a significant reduction in dredging requirements.
Site References:	Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Maps: San Quentin and Richmond. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D) and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. *Only one event is shown in the records in 1991, under the itemized 'Other Small Projects' category. Prior to 1991, the 'Other Small Projects' category was not itemized. Therefore, prior to 1991 this project is most likely included in the 'Other Small Projects' records. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project N

Name:	**San Rafael Creek, Across the Flats-Federally Authorized Project**
Project Owner/Sponsor:	City of San Rafael
Project Description:	The project consists of a 100-foot wide channel across the 'Flats' in San Francisco Bay, from deep water to the mou Rafael Creek. Project depth is -8.0 feet MLLW.
Project Location:	San Francisco Bay, San Rafael Bay, City of San Rafael; Marin County.
Max. Project Depth:	-8.0 Feet MLLW **Classification of Work:** Maintena
Material Quantity:	Between 1942 and 1991, a total of 1,503,000 cy of material was removed from the San Rafael Creek Flats average annual volume of approximately 30,500 cy.
Sediment Grain Size Distribution:	Classified as bay mud.
Contamination History :	Due to failure of bio-assay tests of material at this site by the Corps of Engineers, dredged material remove site is unsuitable for unconfined aquatic disposal.
Frequency of Dredging and Sedimentation:	The 'Across the Flats' channel is scheduled for dredging once every seven years. Records from 1942 to 199 average dredging frequency of one event every 4.5 years. ** The average annual sedimentation is estimate feet/yr by the USACE. Analysis between 1978 and 1986 indicated slightly higher rates farther out into San
Method(s) of Dredging:	Clamshell for open water disposal, hydraulic pipeline for upland disposal.
Historical Disposal Method:	From 1931 through 1954, 1,579,931 cy was disposed of at the Alcatraz site (SF-11). In 1962, 1980 and 19 of 350,500 cy was disposed of at an upland site. In 1978, 1986 and 1992 a total of 702,000 cy was dispose Alcatraz site (SF-11).
Historical Dredging Season:	1st or 4th Qtr.
Potential for Reduction of Dredging:	**Dredging optimization and side slope flattening have potential for reducing dredging requirements.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. D Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Map, San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging rec LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I, and San Francisco Bay Dredging 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Ta Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 13.b

Name:	**San Rafael Creek-Federally Authorized Project**
Project Owner/Sponsor:	City of San Rafael
Project Description:	The project consists of a 60-foot wide channel extending from the mouth of San Rafael Creek to Irwin Street in San Rafael, including a 100-foot wide, 200-foot long turning basin. The entire project depth is -6.0 feet MLLW.
Project Location:	San Rafael Creek, City of San Rafael; Marin County.
Max. Project Depth:	-6.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	Between 1931 and 1991, a total of 1,471,000 cy of material was removed from the San Rafael Creek Channel, with an average annual volume of approximately 24,000 cy.
Sediment Grain Size Distribution:	Classified as silt.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	The San Rafael Creek Channel is scheduled for dredging every 4 years. Records from 1931 to 1991 show an average dredging frequency of one event every 4.6 years. **Shoaling rates are estimated at 6 to 12 inches/yr. upstream of Marin Yacht Club, and 4 to 6 inches/yr. downstream to the mouth.
Method(s) of Dredging:	Hydraulic pipeline and clamshell dredges.
Historical Disposal Method:	Primarily upland with some material recently going to the Alcatraz site (SF-11).
Historical Dredging Season:	1st or 4th Qtr.
Potential for Reduction of Dredging:	**No practical or feasible alternatives for reduction of dredging have been identified.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to Sept. 1988. Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Map, San Quentin. NOAA Chart 18649.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management branch, dredging records, LTMS, for Dredged Material Disposal in the San Francisco Bay Region, Phase I and San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. **Reduce Dredging Requirement Final Report, LTMS, Phase II, Task 3, Work Element C, by Moffat & Nichol Engineers for USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No

Name:	**Treasure Island Naval Station-U.S. Navy Project**
Project Owner/Sponsor:	United States Navy
Project Description:	The project consists of an approximately 3-mile long, 1,000 to 1,500-foot wide channel, with a project depth of -35 MLLW, located adjacent to the north and eastern shores of Treasure Island. This channel continues around the east Yerba Buena Island, extending approximately 3,000 feet beyond the southern tip of Yerba Buena Island. In additio contiguous berthing zones on the north and eastern sides of Treasure Island are dredged to a depth of -45.0 feet ML
Project Location:	East side of Treasure and Yerba Buena Islands, in San Francisco Bay.
Max. Project Depth:	-45.0 Feet MLLW
Classification of Work:	Maintenan
Material Quantity:	The total volume of material removed for two projects (1970 and 1985) was 763,500 cy, with an average a volume between 1970 and 1985 of approximately 51,000 cy.
Sediment Grain Size Distribution:	Not classified.
Contamination History :	None.
Frequency of Dredging and Sedimentation:	Records from 1970 to 1993 show an average dredging frequency of one event every 11.5 years.
Method(s) of Dredging:	Clamshell or hopper dredge for open water disposal. Hydraulic pipeline or clamshell dredge for upland pla
Historical Disposal Method:	In 1970, a total of 272,000 cy was disposed of at open water sites. In 1985, 35,000 cy was disposed of on T Island, and 457,000 cy was disposed of at the Alcatraz site (SF-11).
Historical Dredging Season:	3rd Qtr.
Potential for Reduction of Dredging:	No specific studies appear to have investigated dredging reduction at the site. Base closure could have a sig impact on the dredging requirements at this site depending on future site uses.
Site References:	Dredging of Various Naval Installations in the San Francisco Bay Area, Naval Facilities Engineering Command, We Division, San Bruno, CA, (Bluelines). Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Ca Map Oakland West. NOAA Charts 18649 and 18650.
Additional Notes:	Material quantities taken from: USACE, San Francisco District, O & M Project Management Branch, dredging rec Sediment Budget Study for San Francisco Bay, Ogden Beeman and Associates, Inc. Feb. 1992, (Appendix D) and t Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District.

DREDGING PROJECT PROFILE

Project No: 15

Name:	**Port of San Francisco-Non-Federal Project**
Project Owner/Sponsor:	Port of San Francisco
Project Description:	The Port of San Francisco project includes most of the areas on the San Francisco waterfront, from Fisherman's Wharf, east and south along the Embarcadero, to India Basin, and the San Francisco International Airport.
Project Location:	San Francisco Bay, City and County of San Francisco.
Max. Project Depth:	-40.0 Feet MLLW
Classification of Work:	Maintenance
Material Quantity:	Two dredging events are indicated in 1991 and 1992, when respective volumes of 60,500 and 51,000 cy of material were removed. Dredging volumes are included in the 'Other Small Projects' category. *Approximate average annual volume of 50,000 cy. The Port indicated that they expect to dredge at least 130,000 cy per year in the future.
Sediment Grain Size Distribution:	Various materials. Predominantly classified as clean sand, to silts and clays.
Contamination History :	Some historically contaminated material, material has been placed in Port Sonoma-Marin for transfer to Redwood Sanitary Landfill. This material was slightly contaminated and the quantities placed upland where negotiated.
Frequency of Dredging and Sedimentation:	**Only two distinct dredging events are shown in the records for 1991 and 1992. The Port indicated that they normally have two dredging episodes annually, one in late spring or early summer, and one in late fall.
Method(s) of Dredging:	Clamshell dredges are normally used.
Historical Disposal Method:	Alcatraz site (SF-11).
Historical Dredging Season:	Prior to 1987, the Port operated its own clamshell dredge on a year-round basis.
Potential for Reduction of Dredging:	Changing uses for various maritime facilities on Port property may reduce the future dredging needs for this Port.
Site References:	Project & Index Maps, USACE, San Francisco District, River and Harbors Projects; Revised to September 1988. LTMS Management Strategy for Dredged Material Disposal in the San Francisco Bay Region, Phase I, Dec. 1990, USACE. *Dredging and Disposal Road Map, SFBCDC & USACE, August 1993. Calif. Quad Map, San Francisco North. NOAA Chart 18649.
Additional Notes:	Material quantities taken from; San Francisco Bay Dredging Records for 1985 to 1993, USACE, San Francisco District. **Prior to 1991, the 'Other Small Projects' category was not itemized. Therefore, prior to 1991 this project is most likely included in the 'Other Small Projects' records.