ATTACHMENT 32

PORT OF SAN DIEGO
AND SAN DIEGO INTERNATIONAL AIRPORT (LINDBERGH FIELD)
3165 PACIFIC HIGHWAY • SAN DIEGO, CALIFORNIA
Telephone 291-3900 • Mailing Address: P. O. Box 488, San Diego 92112

February 15, 1975

Dear Sir or Madam:

Part of the San Diego Unified Port District's Capital Improvement Program and Master Plan calls, under the Public Recreation category, for the completion of the Chula Vista Small Boat Basin. This requires the removal of the remaining mud and related sediments from the existing basin and deepening of the approach channels.

The Port's Master Plan, adopted in 1972, also calls, under the Preservation and Research category, for an area designated as "habitat replacement".

District staff recommended that these projects be carried out jointly. To determine the viability of this approach, the Board of Port Commissioners directed a study of using dredge spoil from the small boat basin to establish an island-like manmade wildlife reserve and salt marsh. In the fall of 1974, it authorized the "South Bay Wildlife Reserve Feasibility Study" and charged the consultant to develop a comprehensive project plan having "maximum environmental benefit consistent with economic justification".

The attached report presents detailed scientific data relevant to the project area's biology and sediment characteristics. The study was designed jointly by District staff, coordinated by Environmental Management, and the consultant's project director, Dr. David D. Smith.

The concept of the project and some of the specific results discussed here, have been presented to Federal and State conservation agencies, as well as local environmental groups in public meetings in the spring of 1975. A project EIR is presently underway. Should you have comments or questions, please direct these to:

Tomas E. Firle, Coordinator
Environmental Management
Port of San Diego
P.O. Box 488
San Diego, CA. 92112

Sincerely,

Tomas E. Firle

TOMAS E. FIRLE
Coordinator, Environmental Management

Attachment
TEF/par

Baseline Investigation

UPD # EM 74/1.1
DSA/EQA/MBC #TV K-211-B

BIOLOGICAL RECONNAISSANCE

AND

SEDIMENT CHEMISTRY

CHULA VISTA SMALL BOAT BASIN

Study by

DAVID D. SMITH & ASSOCIATES
ENVIRONMENTAL QUALITY ANALYSTS, INC.
MARINE BIOLOGICAL CONSULTANTS, INC.
A Joint Venture

150 South Arroyo Parkway
Pasadena, California 91109

Project Director: Dr. David D. Smith
SDUPD Study Design: Tomas E. Firle

PORT OF SAN DIEGO UNIFIED PORT DISTRICT

February 15, 1975

CONTENTS

INTRODUCTION

The San Diego Unified Port District is currently considering a two element project in south San Diego Bay which would involve a) dredging the mud area within the Small Boat Basin in Chula Vista, and b) use of the dredged mud to develop a 90 to 100 acre island-like wildlife reserve and salt marsh in a more remote part of south San Diego Bay.

The Port District retained the Joint Venture consultants David D. Smith and Associates, Environmental Quality Analysts, Inc., and Marine Biological Consultants, Inc., to evaluate the environmental, engineering, and economic feasibility of using the dredged mud to form the island, the wildlife reserve and the salt marsh.

This two part report summarizes the results of a portion of the overall study, namely, a biological reconnaissance and sediment chemistry investigation of the area proposed for dredging in the Chula Vista Small Boat Basin.

PART I

BIOLOGICAL RECONNAISSANCE

SUMMARY

On 3 December 1974 a biological reconnaissance was conducted by diving biologists within and adjacent to the Chula Vista Small Boat Basin where future dredging is contemplated. The purpose of the reconnaissance was to determine the species composition and abundance of marine communities in the area which would be affected by the dredging.

Three randomly located core samples were collected along a 10 ft transect at each of five stations and quick frozen. Infaunal organisms in the uppermost 4.5 inches of each core were extracted by sieving through a 0.5 mm screen and were then preserved, identified, and counted.

A total of 31 species was observed by diving biologists, and 899 individuals representing 40 infaunal species were recovered from the sediment samples. Species composition, abundance and diversity of the marine community were typical for the type and location of the habitat, and were in general accord with previously reported observations in the area.

At least two species of the polychaetous worms present are associated with conditions of high organic loading, restricted water circulation and waste discharges.

No species considered to be rare or endangered were found in the area. Two species of Chione (clams) occasionally harvested by sportfishermen were present, but do not constitute a significant fishery in the area.

Although dredging operations will have a localized adverse short-term effect on the marine community in the project site, recolonization by recruitment of organisms from surrounding areas probably will be accomplished within a few months. Further, deposition of dredge spoil in the vicinity of the SDG&E dike to create a wildlife reserve and salt marsh would provide an increase in potential nursery area for marine and avian biota.

INTRODUCTION

The San Diego Unified Port District (SDUPD) is currently considering a two element project in south San Diego Bay which would involve: a) dredging the mud area within the Small Boat Basin at "J" Street in Chula Vista, and b) use of the dredged mud to develop a 90 to 100 acre wildlife reserve and salt marsh in a more remote part of South Bay.

As shown in Figure 1, the area to be dredged measures about 2,100 ft north-south and about 1,200 ft east-west at its widest part. The area is partly enclosed by an L-shaped peninsula constructed in 1968, on which the launching ramp, parking area, and other facilities are located. In developing the Small Boat Basin, the area would be dredged to a depth of -11 ft mean lower low water (MLLW), and about one million cubic yards of sediment would be removed. The sediment would be moved to another part of South Bay (possibly in the vicinity of Station 5 in Figure 1) to form an island-like wildlife reserve and salt marsh.

The biological reconnaissance reported here is part of a broader eight month study being carried out by the Joint Venture on behalf of the SDUPD to determine the environmental, engineering, and economic feasibility of developing the proposed reserve and marsh. The specific objectives of this survey were to determine the species composition and abundance of marine communities present in the area and to establish the presence or absence of any commercially valuable and/or rare or endangered species that would be affected by dredging.

METHODS

On 3 December 1974, a team of Marine Biological Consultants, Inc. diving biologists collected infaunal sediment samples and recorded their underwater observations at each of the five sampling locations illustrated in Figure 1. The presence and relative abundance of large algae and animals was recorded by divers at each of the infaunal sampling stations. Water depth and estimated underwater visibility was also noted. Specimens of the diver observed organisms were returned to the laboratory for positive identification. In addition to these recorded

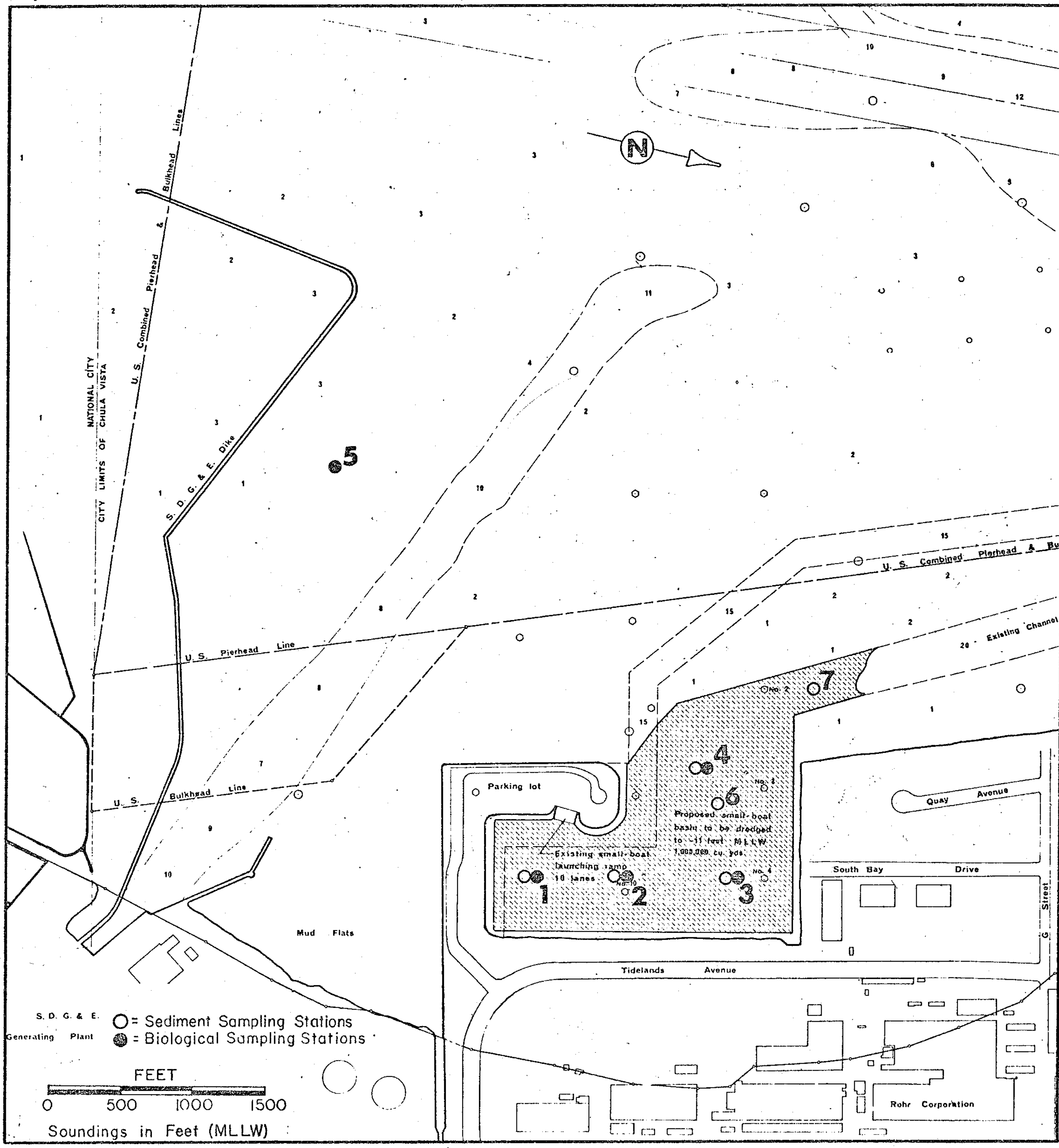

Figure 1. Map of Chula Vista Small Boat Basin and vicinity showing location of sediment and biological sampling stations.

diver observations, a representative underwater color photograph was made at each sampling location.

Three randomly located core samples were collected along a 10 ft transect at each of the five stations. Cores were collected with diver placed PVC coring tubes 12 in long and 2.13 in in diameter with a core surface area of 3.58 sq in. Core length was determined by sediment penetrability and averaged 10 to 11 in, with the exception of samples from Station 1, where a compact mixture of clay and sand limited core penetration to a depth of 4.5 in. In order to standardize sample volumes, only the top 4.5 in of all other cores were examined. Core samples were quick frozen and returned to the laboratory.

After thawing, the cores were extruded, and the total length and depth of the aerobic layer indicated by color was recorded.

All cored sediments were sieved through a 0.5 mm screen and the retained fraction fixed in 10 percent buffered Formalin. All invertebrate specimens were sorted and identified to the lowest possible taxon.

In addition, benthic sediment samples were analyzed for total carbon and inorganic carbon content. Organic carbon was determined by the difference between total carbon and inorganic carbon. These results were obtained by conventional analytical procedures (Kolpack and Bell 1968), using the LECO semi-automatic carbon analyzer and are expressed in percent dry weight. Carbon analyses were performed on a well-mixed portion of the top 3 in of the core samples.

RESULTS

GENERAL

The study area generally can be characterized as a shallow mud-sand bottom with little obvious relief. The proportion of sandy materials in the sediments (based on the sediment consistency) decreased from the inner stations (Stations 1 and 2) to the outer stations (3, 4 and 5). The proportion of the sandy materials in the sediments declines with increased distance from the shoreline sources.

Depth of the aerobic (oxygenated) layer in the cored sediments averaged 6.7 mm. Among Stations 1 through 4, the thickness of the aerobic layer increased from the inner to the outer part of the basin ($\bar{X}$ = 5, 6, 7.3 and 7.3 mm, respectively). Aerobic sediments at Station 5 were significantly thinner ($\bar{X}$ = 1.7 mm) than the other sampling locations. Strong sulphurous odors (H_2S) were noted among core samples from Stations 4 and 5, indicating anaerobic conditions in the sediment.

CARBON CONTENT

An analysis of the percent carbon in the sediments disclosed a trend of increasing total carbon concentrations (from 0.5 to 1.1 percent) from the inner to outer basin stations, as presented in Table 1. The organic carbon fraction which represented 90 to 100 percent of the total carbon concentration followed a similar trend. The inorganic carbon fraction in the form of $CaCO_3$ (shell debris and lithogenic minerals) had no apparent trend among the stations.

TABLE 1

Results of Sediment Carbon Analyses

Station	Total Organic Carbon TOC	Total Inorganic Carbon TIC	Total Carbon TC
1	0.492%	0.008% ± 0.011	0.500% ± 0.033
2	0.601%	0.063% ± 0.000	0.664% ± 0.044
3	0.679%	0.000% ± 0.000	0.679% ± 0.000
4	0.978%	0.088% ± 0.011	1.066% ± 0.011

Note: The samples were taken from the top 3 in of the core (aerobic layer). The 3 in layer was well mixed before the sample was taken.

BIOLOGICAL FINDINGS

A total of 31 species was observed by diving biologists, and 899 individuals representing 40 infaunal species were recovered from the sediment samples. Organisms not identified to species represent either juvenile forms for which taxonomic literature is lacking or adult specimens whose identification is pending confirmation.

Results of diver observations and analysis of core samples are summarized in Tables 2 and 3 respectively. A brief description of the communities at each of the five stations follows:

- Station 1. The shallowest of the stations (-3 ft), Station 1 is located on a sandy-mud bottom with small clumps of the filamentous green algae Chaetomorpha aerea scattered along the bottom among patches of the larger green algae, Ulva sp. The most conspicuous animal was the California horn snail, Cerithidea californica. The wanderings of these snails had left numerous tracks in the soft sediment. Clam siphons were commonly observed, and several species were collected including the littleneck clam, Protothaca staminea, and the California jackknife clam, Tagelus californianus. Large shorebird tracks, possibly egret or heron prints, were common on the mud bottom.

Species diversity of the infaunal samples (2.64) was the median value among the sampling locations. The average density of organisms was the highest among the stations. Among the 18 infaunal (sediment dwelling) species recorded, the five most abundant species were four species of annelid worms (Capitella capitata, Polydora sp., Streblospio benedicti and an oligochaete) and a clam (Tagelus sp.).

- Station 2. Though similar in appearance to Station 1, Station 2 contained a greater number of diver observed organisms. The green algae, Enteromorpha sp. and Ulva sp., were more abundant than at Station 1. The smooth chione, Chione fluctifraga, was the most conspicuous animal along with numerous juvenile (>1 cm) sea hares, Aplysia sp.

The number of infaunal species was equal to Station 1, but the density of individuals was significantly lower, which produced a greater species diversity value. The most abundant infaunal organism was the tanaid crustacean, Leptochelia sp. As found at Station 1, the annelid worms comprised the major taxonomic group and were represented by nearly the same species. The species diversity (2.63) was the same as at Station 1.

- Station 3. Although slightly deeper (-3.5 ft) than Stations 1 and 2, the general appearance and sediment composition was physically indistinguishable from the previous locations. The increased density of Ulva sp. may account for the appearance of the minute herbivorous snail Lacuna sp. in dense concentrations on the algal blades.

Table 2. Relative Abundance and Distribution of Diver Observed Organisms in the Chula Vista Small Boat Basin

Scientific and Common Names	Station 1	2	3	4	5
PLANTAE					
CHLOROPHYTA					
Chaetomorpha aerea (green alga)	A				
Enteromorpha sp. (green alga)	P	C			
Ulva sp. (green alga)	C	A	A	A	A
RHODOPHYTA					
Centroceras clavulatum (red alga)		P			
Gracilaria sp. (red alga)				P	
Griffithsia pacifica (red alga)				P	
ANIMALIA					
PORIFERA					
Haliclona sp. (sponge)					P
Tetilla ?mutabilis (wandering sponge)					P
CNIDARIA					
Cerianthidea, unid. (anemone)				P	
Corymorpha palma (hydroid)				P	
Diadumene cf. leucolena (anemone)				P	A
ARTHROPODA					
Balanus amphitrite (acorn barnacle)		P			
Serolis carinata (isopod)				C	
MOLLUSCA					
Aplysia sp. (sea hare)		C			
Cerithidea californica (California horn snail)	C	P			
Chione fluctifraga (smooth chione)		C	P		
C. undatella (chione)			P		P
clam siphons	P	P			
Crucibulum spinosum (snail)					C
Lacuna sp. (clam)			A		
Musculus senhousei (clam)					C
Nassarius tegula (snail)		P			
Protothaca staminea (littleneck clam)	P	P			
Solen rosaceus (clam)		P	P		
Tagelus californianus (California jackknife clam)	P				
ECHINODERMATA					
Axiognathus pugetana (brittle star)				C	
CHORDATA					
UROCHORDATA					
Styela plicata (sea squirt)				P	
VERTEBRATA					
Clevelandia ios (goby)		P	P		
Hypsopsetta guttulata (diamond turbot)				P	
Platyrhinoidis triseriata (thornback ray)				P	
Urolophus halleri (round stingray)				P	

A = Abundant (> 50 or 75% to 100% cover)
C = Common (10 to 50)
P = Present (1 to 10)

Table 3. Abundance, Distribution and Diversity of Infaunal Species found in Core Samples collected from the Chula Vista Small Boat Basin.

Species	Station 1 A	Station 1 B	Station 1 C	Station 1 $\bar{X}$	Station 1 SD	Station 2 A	Station 2 B	Station 2 C	Station 2 $\bar{X}$	Station 2 SD	Station 3 A	Station 3 B	Station 3 C	Station 3 $\bar{X}$	Station 3 SD	Station 4 A	Station 4 B	Station 4 C	Station 4 $\bar{X}$	Station 4 SD	Station 5 A	Station 5 B	Station 5 C	Station 5 $\bar{X}$	Station 5 SD	Total
CNIDARIA																										
Anthozoa, unid.		1		1.0							1			1.0												2
Plumularia sp.		1		1.0																						1
PLATYHELMINTHES																										
Platyhelminthes, unid.																					1					1
NEMERTEA																										
Nemertea, unid.			P			P		P													P					P
NEMATODA																										
Nematoda, unid.			P			P		P								P					P					P
ANNELIDA																										
POLYCHAETA																										
Armandia bioculata							3		1.0	± 1.7	10	5	7	7.3	± 2.5								1	1.0		26
Capitella capitata	22	5	10	12.3	± 8.7	5	9		4.7	± 4.5	1			1.0		14	9	6	9.7	± 4.1		1		1.0		82
Eteone sp.						1			1.0				1	1.0												2
Exogone sp.	5		10	5.0	± 5.0		5	10	5.0	± 5.0							1	1	1.0							32
Flabelligeridae, unid.																						1		1.0		1
Haploscoloplos elongatus												1		1.0							2		3	1.7	± 1.5	6
Lumbrineris sp.																					1			1.0		1
Capitellidae, unid.							9	6	5.0	± 4.5	17	8	15	13.3	± 4.7	5	4	9	6.0	± 2.6	3	2	3	2.7	± 0.6	81
Megalomma pigmentata																		1	1.0							1
Neanthes arenaceodentata		1		1.0			5	1	2.0	± 2.6	12	1	2	5.0	± 6.1	3	4	3	3.3	± 0.6	1	1	1	1.0	± 0	35
Polydora sp.	23	5	16	14.7	± 9.1		5		1.7	± 2.9	1	1		1.0		1	1	1	1.0	± 0						54
Streblospio benedicti	15	5	16	12.0	± 6.1	3			1.0	± 1.7			3	1.0	± 1.7											42
OLIGOCHAETA																										
Oligochaeta, unid.	50	21	23	31.3	±16.2	6	7	4	5.7	± 1.5	31	1	18	16.7	±15.0	30	30	26	28.7	± 2.3			1	1.0		248
ARTHROPODA																										
Acuminodeutopus heteruropus											1	1	4	2.0	± 1.7											6
Ampithoe sp.													1	1.0												1
Aoridae, unid.													1	1.0												1
Corophium uenoi			2	1.0		1	1	4	2.0	± 1.7						2			1.0							10
Cylindroleberis mariae											35	6	17	19.3	±14.6			2	1.0				2	1.0		62
Elasmopus sp.													1	1.0												1
Euphilomedes carcharodonta												1	2	1.0	± 1.0											3
Eusiridae, unid.																		5	1.7	± 2.9						5
Gammaridea, unid.						1			1.0				3	1.0	± 1.7											4
Harpacticoida, unid.	1	1		1.0																						2
Leptochelia sp.	2	4		2.0	± 2.0	10	29	28	22.3	±10.7	9	2	8	22.3	±10.7	2	1	2	1.7	± 0.6	4	3		2.3	± 2.1	104
Podoceras sp.		1		1.0																						1
Rudilemboides stenopropodus													1	1.0												1
Rutiderma cf. judayi											4		1	1.7	± 2.1											5
MOLLUSCA																										
Acteocina harpa								1	1.0																	1
Chione fluctifraga						1			1.0							1			1.0							2
Chione sp.	1			1.0																						1
Musculus senhousei											2			1.0							1			1.0		3
Solen rosaceus											1			1.0												1
Tagelus sp.	18	10	12	13.3	± 4.2	1	3	10	4.7	± 4.7						3	1	1	1.7	± 1.2						59
Tellina meropsis	1			1.0		1			1.0		1		1	1.0							1	1	4	2.0	± 1.7	10
Veneridae, unid.		1		1.0													1		1.0							2
Total Individuals	138	56	89	95.0	±41.1	30	76	64	58.0	±23.7	126	27	86	79.7	±49.8	61	52	57	57.0	± 5.0	13	9	15	13.0	± 3.8	
Station Total Individuals		283					170					239					170					37				899
Number of Species		18					18					23					15					14				
Shannon Wiener Diversity (H')	2.53	2.80	2.61	2.64	± 0.14	2.73	2.80	2.36	2.63	± 0.23	2.87	2.78	3.31	2.98	± 0.28	8.23	2.01	2.55	2.26	± 0.27	2.84	2.42	2.60	2.62	± 0.21	
Brillouin Diversity (H)	2.37	2.43	2.24	2.40	± 0.03	2.23	2.52	2.12	2.29	± 0.20	2.64	2.23	2.93	2.60	± 0.40	1.96	1.73	2.22	1.97	± 0.24	1.87	1.65	1.96	1.82	± 0.15	
Evenness (E)	0.75	0.77	0.93	0.82	± 0.09	0.81	0.83	0.78	0.81	± 0.03	0.75	0.83	0.81	0.80	± 0.04	0.69	0.62	0.73	0.68	± 0.05	0.91	0.96	0.93	0.93	± 0.03	

P - Present, no estimate of numbers

Although fewer species of diver observed organisms were recorded here than at any of the other stations, the number of infaunal species (23) was the greatest among the sampling locations. In addition, the density of infaunal organisms was second only to Station 1. The increased number of species was due to the occurrence of several species of amphipods. The five most abundant organisms were three species of annelid worms (Armandia bioculata, Capitellidae, unid., Oligochaeta, unid.) and two crustacean species (ostracod, Cylindroleberis mariae, and tanaid, Leptochelia sp.). The species diversity (2.98) was the highest among the sampling stations.

- Station 4. The community at this station was dominated by a dense stand of Ulva sp. which covered the bottom. Beneath the algal growth were numerous brittlestars, Axiognathus pugetana (reported as Amphiodia pugetana in Chambers and Merino, 1970; and Ford and Chambers, 1973), and isopod, *Serolis carinata*. Increased depth (6.5 ft) and, therefore, lack of tidal exposure may account for the presence of three species of fish (round stingray, thornback ray, and diamond turbot) and the abundance of *Ulva* sp. and brittlestars.

The number of infaunal species (15) was the second lowest in the study area and was due to the absence of several crustacean species found among the previous stations. The density of organisms, though somewhat lower than at the previous stations, was not significantly different. The reduced number of species produced a decline in the species diversity (2.26) and the lowest diversity among the stations.

• Station 5. The presence of dense concentrations of the anemone *Diadumene* cf. *leucolena* produced a bottom which appeared strikingly different than the previous areas examined. Concentrations of this salmon colored anemone were estimated as high as 1,000 individuals per sq m. Less abundant, but as equally conspicuous, was the wandering sponge, *Tetilla mutabilis*. This brick red sponge was commonly found in colonies 6 to 12 inches in diameter, loosely attached to the soft mud bottom. No fish were observed though the water depth (6.0 ft) was nearly the same as at Station 4.

The average density of infaunal organisms and number of species was the lowest among the five sampling locations. The paucity of species, and reduced densities, resulted in the second lowest species diversity value in the study area. The reduction in number of species was due principally to the absence of several species of crustaceans. The most abundant infaunal organism was the tanaid crustacean, *Leptochelia* sp. The majority of infaunal species were annelid worms.

DISCUSSION

Species composition, abundance and diversity of the marine community were typical for the type and location of the habitat, and were in general accord with previously reported observations in the study area.

The underwater observations of Turner and Mitchell (1967) along a transect offshore of the present study area recorded a species assemblage similar to that found in the present study. The absence of the bryozoan Zoobotryon californianus, which Turner and Mitchell found in great abundance, may be attributed to the marked seasonality of the organism.

Infaunal species composition as well as species diversity did not differ markedly from those reported by Chambers and Merino (1970) or Ford and Chambers (1973). Though neither report made reference to the ostracods, Cylindroleberis mariae or Euphilomedes carcharodonta, Ford and Chambers (1973) recorded many samples of unidentified species of ostracods which undoubtedly contained the above species. The dense concentration of Diadumene cf. leucolena in the area of Station 5 has not been described in the literature, but Ford and Chambers (1973) reported that Diadumene sp. was commonly abundant in their studies.

The assemblage of collected species, with some variation, is frequently encountered in shallow bays subject to high turbidity and fluctuating temperatures and salinities. Oligochaetous worms are typically associated with heavy sediment and organic loads in areas subject to freshwater influence (Brinkhurst and Simmons 1968). At least two of the collected species of polychaetous worms, Capitella capitata and Polydora sp., are found in association with similar conditions of high organic loading and restricted water circulation, including domestic waste discharges (Reish 1960). The ostracod, Cylindroleberis mariae, and snail, Cerithidea californica, are commonly found on mud bottoms of shallow estuaries. Other collected species typical of southern California bays and estuaries include the harvestable clams, Chione fluctifraga, C. undatella and Tagelus californianus.

None of the above species of marine organisms is considered rare or endangered, nor are the local populations found in the study area believed to constitute any significant portion of the species' total populations. In addition, none of the observed organisms are commercially important. Although both species of Chione (clams) are occasionally harvested by sportfishermen, they do not constitute a significant commercial or sport fishery.

The proposed dredging activities will remove non-mobile organisms and permanently alter the present habitat. In addition, there may be some temporary, localized distress of benthic biota from increasing turbidity. It is anticipated these effects would be short term and recolonization of the area by recruitment of organisms from surrounding areas would be accomplished in only a few months.

Any adverse impacts of dredging the Small Boat Basin will be adequately compensated by the creation of a larger area of new wetlands and tide flats from the dredge spoils. Characteristically, these habitats are significantly more productive than the shallow subtidal and, with the ultimate establishment of typical South Bay marsh vegetation, may provide a significant increase in potential nursery area for marine and avian biota.

Although creation of the proposed wetlands will involve burial and smothering of the present bottom organisms (for example, the populations of Diadumene and Tetilla at Station 5) in the area of spoil deposition, the general vicinity of Station 5 appears to be one of the more appropriate locations within the study area for creation of a marsh and tidal flat. Biological findings by Turner and Mitchell (1967), Chambers and Merino (1970), and Ford and Chambers (1973) support this recommendation because of the area's low number of infaunal species and individuals, and low species diversity. In addition, the predominant organisms in the area of Station 5 are two invertebrate forms, the anemones and sponges, which are not known to make a significant contribution to marine food chains.

PROJECT STAFF

The field investigation was carried out by Dr. David L. Mayer, Senior Marine Biologist, and Mr. John Carter, with the assistance of Mr. Ron Gallman of the SDUPD. The identifications of the specimens and data analysis was under Dr. Mayer's supervision and he wrote the report. The project was under the overall direction of Mr. Charles T. Mitchell, President of Marine Biological Consultants, Inc.

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PART II

SEDIMENT CHEMISTRY

SUMMARY

Six sediment cores were taken from various locations within the proposed dredging area at the Chula Vista Small Boat Basin. The top and bottom part (3 in) of four of the cores were analyzed for 14 chemical characteristics, including the seven trace metals and oil and grease specified in the various interim dredge spoil disposal criteria issued by Region IX (San Francisco) of the Environmental Protection Agency.

The results of the chemical analyses yield average values which are all substantially lower than the EPA Criteria values. Thus, the sediments to the depth sampled are chemically acceptable for dredging and disposal according to EPA's Criteria for "Marine (shallow) and Estuarine Water."

INTRODUCTION

In order to evaluate the suitability of the sediment in the Small Boat Basin for alternative types of dredge spoil disposal in connection with the proposed creation of an island-like wildlife reserve and salt marsh, representative samples were analyzed for 14 chemical characteristics in Environmental Quality Analysts, Inc. Costa Mesa laboratories. The specific objectives of the chemical work reported here were to determine the sediment concentration levels of nine trace metals, cyanide, oil and grease, and oxygen demand.

Six sample stations (1 through 4, 6 and 7) were selected in the Small Boat Basin at "J" Street in Chula Vista, as shown on Figure 1. Four stations (1, 2, 3 and 6) were situated in the basin proper, one in the entrance (4), and one in the proposed approach channel (7). Sample Stations 1 through 4 correspond to the biological reconnaissance stations discussed in Part I of the report. Station locations were chosen so as to be representative of the area to be dredged.

Top and bottom sections of the cores were analyzed to allow comparison of chemical characteristics of the more recent sediments (near the sediment-water interface) with the older, deeper sediments. The chemical characteristics tested include those specified in the various interim Dredge Spoil Disposal Criteria issued by Region IX (San Francisco) of the Environmental Protection Agency.

METHODS

Two cores were taken at each of the six stations by the "cookie-punch" method in which a diver manually drives a 3 in diameter thin-wall lucite plastic core tube about 24 to 30 in into the sediment. Upon retrieval, the core tubes were sealed, refrigerated, and returned to the laboratory in Costa Mesa.

The longer core of each pair for Station 1, 2, 3 and 4 was selected for analysis; cores selected for Stations 1 to 4 were 19, 18, 19 and 20 in long, respectively. The top and bottom 3 in of each of these cores were removed and homogenized, thus providing 8 discrete samples for chemical analysis. The remaining cores were frozen for storage.

Currently accepted methodologies (with particular reference to the Environmental Protection Agency's "Chemistry Laboratory Manual, Bottom Sediments," (1969) and other governmental and manufacturer publications) were used to determine the following chemical parameters:

- Trace Metals
  - Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Silver, Zinc
- Cyanide
- Oil and Grease
- Chemical Oxygen Demand
- Biochemical Oxygen Demand (5-day at 20^{o}C) - Station 4 only
- Immediate Oxygen Demand (15-minute) - Station 4 only

The trace metals were determined as "total metals" by atomic absorption spectrophotometry, except for arsenic which was determined using colorimetric techniques. The concentrations measured are summarized in Table 4; they are expressed in mg/kg and are reported on a dry-weight basis.

DREDGE SPOIL DISPOSAL CRITERIA

In 1972, Region IX (San Francisco) of the Environmental Protection Agency issued interim guidelines for determining the acceptability of dredged spoil for

Table 4. Results of Chemical Analyses of Sediment Cores from Chula Vista Small Boat Basin. Results expressed in mg/kg on dry-weight basis.

Station	1	1	2	2	3	3	4	4		
Core Section	Top 3 in	Bottom 3 in	Top 3 in	Bottom 3 in	Top 3 in	Bottom 3 in	Top 3 in	Bottom 3 in		
Sample Number	945	946	947	948	949	950	951	952	Average Value	EPA[a] Region IX Criteria
Trace Metals										
Arsenic	0.47	0.28	1.6	0.51	0.86	0.40	4.1	1.7	1.2	[5]
Cadmium	1.0	1.8	0.47	1.20	1.9	4.8	2.0	1.4	1.8	3
Total Chromium	56	77	49	49	98	70	75	38	64	[100]
Copper	22	34	18	26	28	51	40	26	31	[50]
Nickel	14	20	12	16	17	24	24	13	18	n.s.[b]
Lead	23	34	12	16	25	40	26	22	25	180
Mercury	0.035	0.039	0.090	0.032	0.050	0.38	0.11	0.17	0.11	1.5
Silver	2.6	1.7	2.8	0.88	7.6	3.2	53	1.1	2.5[c]	n.s.
Zinc	91	110	73	80	100	150	110	81	99	300
Cyanide	0.0024	0.0021	0.0024	0.0035	0.013	0.0001	0.013	0.0042	0.0051	n.s.
Oil and Grease	640	660	660	540	580	1400	370	780	700	4000
Oxygen Demand										
Chemical Oxygen Demand	4000	13000	13000	20000	17000	27000	40000	30000	20000	n.s. n.s.
Biochemical Oxygen Demand (5-day at 20C)							1300	730		n.s.
Immediate Oxygen Demand (15-minute)							150	180		

[a]Source: EPA, Region IX, Disposal Criteria Value (see Table 5, this report)
[b]n.s. = not specified
[c]Average value does not include result from top 3 in of Station 4
[ ] = specified in earlier EPA Criteria but subsequently dropped

open water disposal. These guidelines included proposed numeric criteria for maximum acceptable concentrations of various chemical constituents, principally the trace metals: arsenic, cadmium, chromium, copper, lead, mercury, and zinc. These values are listed in column 2 of Table 5.

Table 5. Maximum Levels for Trace Metals in Dredged Spoils; EPA, Region IX Criteria

Parameter	1972 Criteria mg/kg[a]	1973 Criteria mg/kg	1974 Criteria mg/kg
Arsenic	5	n.s.	n.s.
Cadmium	2	2	3
Total Chromium	100	n.s.	n.s.
Copper	50	n.s.	n.s.
Lead	50	50	180
Mercury	0.5	1.0	1.5
Tin	n.s.	n.s.	n.s.
Zinc	75	130	300
Oil and grease	n.s.	1500	4000

[a]dry-weight basis
[b]n.s. = not specified

A revised set of Dredge Spoil Disposal Criteria were issued in October 1973. As evident from comparison of columns 2 and 3 of Table 5, the 1973 criteria did not retain the suggested limiting values for three trace metals (arsenic, chromium, and copper) included in the 1972 Criteria. In addition, the 1973 Criteria increased the acceptable levels for two other metals: mercury and zinc.

A year later, Revision I of these Dredge Spoil Disposal Criteria was issued. This revision distinguished between fresh water, and marine (shallow) and estuarine water disposal sites, and for the marine estuarine category increased the acceptable value for the four metals listed (cadmium, lead, mercury, and zinc), as shown in the last column of Table 5.

Although the October 1974 Revision I Criteria for cadmium, lead, mercury, and zinc, and for oil and grease are the only values which would be applied by EPA in evaluating the acceptability of spoil for aquatic disposal, the earlier values for arsenic, chromium, and copper are included in the Criteria column of Table 4 for information and comparison purposes.

RESULTS

From examination of the results of the chemical analyses summarized in Table 4, it is evident that the average values are all substantially lower than the EPA Criteria values. Further, only for cadmium and copper are there even single values which exceed the criteria level; one cadmium sample with a value of 4.8 is moderately higher than the 3.0 criteria value, and one copper sample with a value of 51 is just above the 50 criteria value.

In the case of silver, for which EPA has no established criteria, one sample with a value of 53 was about seven times higher than the next highest silver value. Because all other samples showed much lower silver values, this relatively high concentration is judged to be localized in character.

Comparison of concentration values among the 4 locations and between the upper and lower sections of each core disclosed no clear-cut trends except that for all but two of the trace metal values, core 2 had the lowest concentrations.

Based on the range of concentration values and the averages reported in Table 4, and the EPA Criteria in Table 5, the sediments to the depth sampled are chemically acceptable for dredging and disposal according to EPA's Criteria for "Marine (shallow) and Estuarine Water."

PROJECT STAFF

The sediment samples were collected by Mr. Randy Jones and Mr. Bob Blue with the assistance of Mr. Ron Gallman of the SDUPD. The field work was supervised by Mr. James Lawson.

The laboratory analytical work was under the supervision of Mr. Rohel Amundson, Laboratory Supervisor. Mr. Amundson and Dr. David Smith wrote the report. The project was under the overall direction of Mr. Malcolm L. Whitt, General Manager of Environmental Quality Analysts, Inc.