NOBLE
CONSULTANTS, INC.

ITEM NO. 26

July 19, 2013

Mr. Kevin T. Byrne
Chairman, Harbor & Beaches Advisory Committee
City of Oceanside
300 North Coast Highway
Oceanside, CA 92054

Re: Oceanside Beach Preliminary Retention Study
For the City of Oceanside

Dear Kevin:

Noble Consultants, Inc. is pleased to submit this proposal to perform a preliminary engineering evaluation for proposing beach nourishment and its retention from approximately Tyson Street to Eaton Street within the City of Oceanside. In the early 1980's R.M. Noble & Associates performed the following three studies for the City of Oceanside:

- Letter Report, Review of Proposed Groin Field, Oceanside Beach dated January 24, 1983.
- Preliminary Engineering Report, Beach Protection Facilities, Oceanside, California dated August 1, 1983.
- Preliminary Engineering Study, Strand Seawall Feasibility, Between Tyson and Hayes Streets dated March 1, 1985.

The scope of work addressed in the above January 24, 1983 letter report consisted of reviewing a September 1980 Corps of Engineers report that recommended a groin field for Oceanside Beach; making recommendations for modifications to this groin field regarding its length, width, spacing, construction materials and methodology, and phasing construction over two or more years; and discussing permit requirements. A proposed groin field and sandfill project was presented in this letter report.

Whereas the scope of work addressed in the above August 1, 1983 report presented four alternative groin field layouts along Oceanside Beach, and their estimated construction costs for the groins and beach nourishment.

Scope of Services

Our proposed scope of services for this preliminary phase of work will consist of the following tasks:

NOVATO 359 BEL MARIN KEYS BLVD., SUITE 9, NOVATO, CA 94949-5637 (415) 884-0727 FAX (415) 884-0735
IRVINE 2201 DUPONT DR., SUITE 620, IRVINE, CA 92612-7509 (949) 752-1530 FAX (949) 752-8381
SAN DIEGO P.O. BOX 231531, ENCINITAS, CA 92023-1531 (760) 715-8537
http: www.nobleconsultants.com

1) Cursory review of previous studies, reports and data pertaining to Oceanside Beach including Corps of Engineers reports, the above referenced reports, SANDAG Phase I and Phase II beach nourishment projects, California Beach Restoration Study of January 2002, Regional Sediment Management Plan for San Diego County, etc.

2) Develop preliminary beach nourishment and beach retention plan in order to minimize the rate of loss of beach sediments, thereby lengthening re-nourishment requirements, and provide a preliminary estimate of the associated construction cost.

3) Provide estimated consultant fee to perform next phase of work which could consist of performing the following tasks:

    a. preliminary engineering and feasibility of a selected plan
    b. regulatory permitting requirements and obstacles to overcome
    c. public outreach program and strategy for regulatory permitting agencies
    d. potential public funding sources and effort to pursue these sources, and
    e. implementation plan to pursue approvals and funding

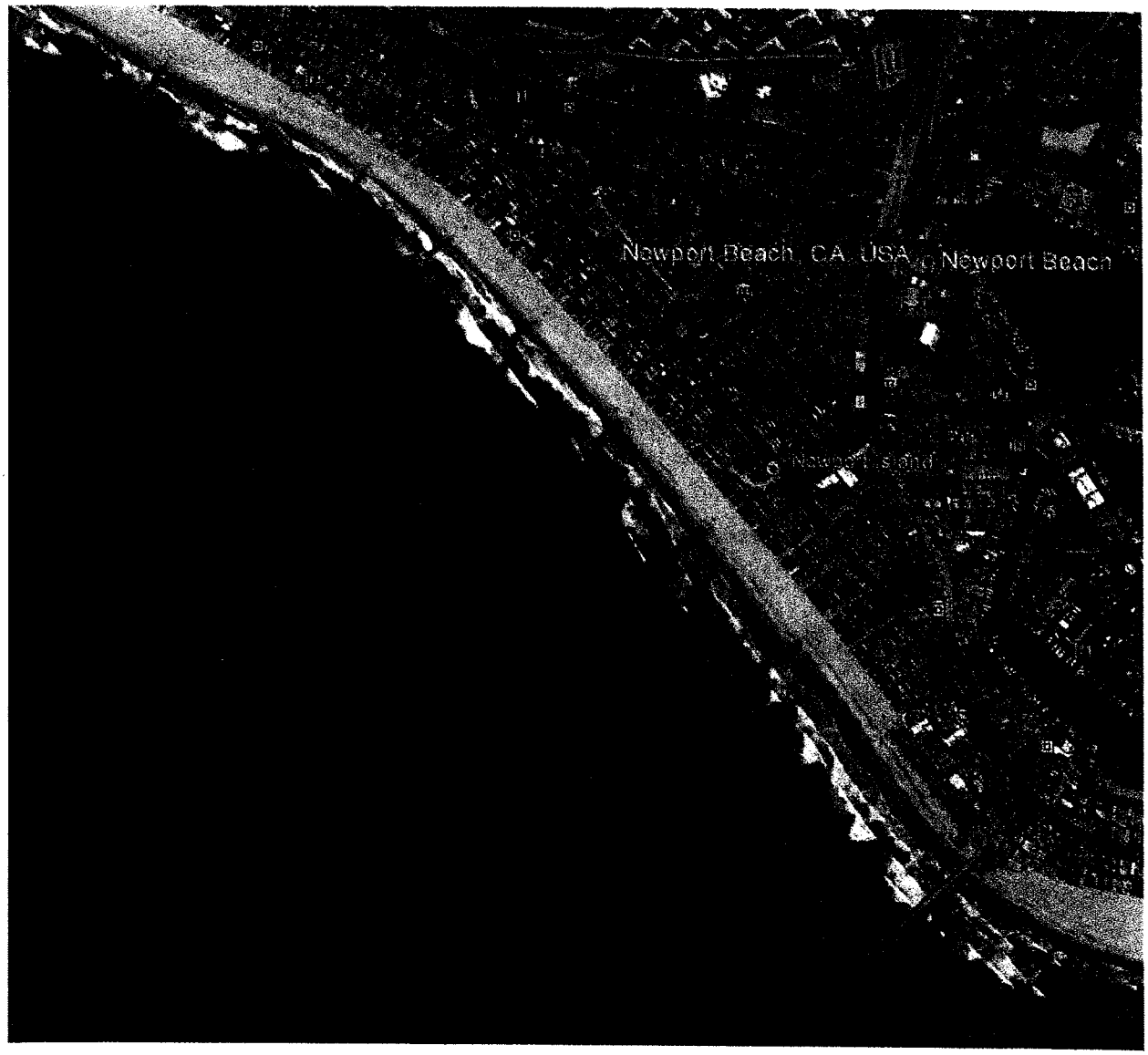
4) Summarize above tasks in a memorandum report and attend one meeting to present findings and recommendations.

Overview

Beach nourishment has long been recognized as a viable means of beach restoration in California, and has been performed along California beaches during the past century with the additional benefits beyond that of widening eroding and narrow beach widths, to providing improved coastal access and recreation, enhancing public health and safety, restoring wildlife habitats, increasing protection for upland facilities from winter storm waves, and increasing the revenue stream from coastal tourists. However, it is essential to maintain the placed protective beach fills against long-term erosion by either a schedule for re-nourishment projects of beach suitable sands, the development of retention devices to slow down the loss rate of beach sands, or preferably a combination of beach nourishment and beach fill protective devices that lengthen the interval and reduces the volume of required beach fills.

One example is the Orange County Beach Erosion Control Project that was initiated by the Corps of Engineers in concert with the State of California and the County of Orange in 1964. The objective of this regional beach nourishment program was to mitigate erosion along the shoreline between Surfside-Sunset Beach and Newport Harbor. The Surfside-Sunset Beach segment has consisted of periodic beach nourishment every few years, averaging about 425,000 cubic yards per year, since the initial placement of 4 million cubic yards of fill in 1964. Whereas

the West Newport Beach segment consists of 8 groins constructed between 1968 and 1973 and the placement of about 1.7 million cubic yards of fill during the 3 separate stages of groin construction. Since this groin field construction, there was nearly 1.3 million cubic yards of beach quality sands placed in a nearshore sand bar in 1992 off the coast of Newport Beach, and there has been very minimal placement of sand size material on two occasions that was dumped offshore at 60th Street since then. However, West Newport Beach does benefit from sand placed at Surfside-Sunset Beach as it migrates downcoast to West Newport Beach. The West Newport Beach groin field, consisting of eight groins between 28th and 56th Streets, is shown below.



Both the 2001 and 2012 SANDAG Regional Beach Sand Projects (RBSP) consisted of the placement of offshore dredged sands on selected beaches within San Diego County. However, since neither project included a sand retention component the longevity of placed sands depends on the individual site conditions of each beach receiving sand, on the dredged sand characteristics placed on these beaches, and on the beach exposure to both the prevailing and storm wave and tidal conditions. Since it is both very costly and time consuming to receive RBSP approvals for implementation, a beach sand retention component would seem advisable.

The Challenge

Even though traditional coastal structures such as groins and breakwaters have been used effectively to stabilize beaches in the past, their use now is unlikely to be favored. Therefore the challenge is to find an effective sand retention methodology that is environmentally consistent with this section of coastline, or to be successful in the regulatory permitting process and with the stakeholders in the use of more traditional retention devices. One approach would be to seek ways to demonstrate and implement new and innovative sand retention technologies that are more compatible with the Oceanside shoreline setting and that provide multi-purpose benefits of beach preservation, biological enhancement, and increased recreational opportunities.

Otherwise, a more traditional sand retention approach, such as using a groin field coupled with beach nourishment, would be more challenging in receiving regulatory agency approvals and buy-ins by the various stakeholders to reduce exposure to opposition and potential litigation. In addition to the challenge regarding the technical approach to beach sand retention and receiving regulatory approvals, the challenge to secure sufficient project funding will be significant.

Relevant Experience

Noble Consultants, Inc. is a small business civil engineering firm that specializes in coastal engineering. Following are a few significant regional coastal sediment management studies, plans and design/implementation projects that we performed and oversaw:

- San Diego Regional Beach Sand Project, 2001. Design and Construction Management of 2.1 million cubic yards of placed beach sand nourishment.
- Venice Beach Nourishment Project, 2006. Assisted Los Angeles County to plan, permit, design and construct the Venice Beach Replenishment Project.
- BEACON Coastal Regional Sediment Management Plan, 2009. Prepared the regional sediment management plan and its accompanying strategic implementation plan for the Ventura and Santa Barbara Counties shoreline.
- Los Angeles County Coastal Regional Sediment Management Plan, 2012. Prepared the regional sediment management plan for the Los Angeles County coastline.

- Coastal Sand Management Plan, 1989. Prepared the Santa Barbara and Ventura Counties Coastline Sand Management Plan for BEACON.
- California Coastal Storm & Tidal Wave Study (CCSTWS) for Orange County, 2001. Prepared the CCSTWS for the entire Orange County shoreline for the Corps of Engineers.
- California Coastal Storm & Tidal Wave Study (CCSTWS) for Los Angeles, 2010. Prepared the CCSTWS for the entire Los Angeles County shoreline for the Corps of Engineers.
- Encinitas and Solana Beach Shoreline Study, 2003. Prepared the Without Project feasibility analysis for the Encinitas and Solana Beach shoreline to determine the viability of providing shore protection and environmental restoration.

Fee

We propose to perform the above Scope of Services on a time-and-expense basis in accordance with our attached Schedule of Charges. We estimate that our fee to perform this work will be $29,800 and we will not exceed this amount without first receiving your authorization.

Please call me if you would like to discuss the contents of this proposal.

Sincerely,

NOBLE CONSULTANTS, INC.

Ronald M. Noble, P.E., D.CE, D.PE, D.WRE
President

RMN/rmn
attach.

NOBLE
CONSULTANTS, INC.

SCHEDULE OF CHARGES

Labor (per hour)*

Senior Principal Engineer	$280	Construction Cost Estimator	$135
Principal Engineer	234	Senior Survey Engineer	135
Associate Engineer II	206	Staff Engineer III	132
Associate Engineer I	192	Staff Engineer II	128
Senior Structural Engineer II	178	Staff Engineer I	115
Senior Structural Engineer I	166	Surveyor II	110
Senior Engineer III	192	Surveyor I	98
Senior Engineer II	178	Senior Construction Inspector	106
Senior Engineer I	166	CADD Designer/Operator	106
Structural Engineer	156	Assistant Engineer	102
Project Engineer II	146	Construction Inspector	98
Project Engineer I	136	Technician	84
Construction Manager	142	Word Processing / Clerical	76

* Depositions, mediations, arbitrations, and court appearance labor is two times the rate shown and billed in 1/2-day increments.

*Reimbursable Expenses***

In-house

Survey Vessel	$300 per day	CADD Plots	$2.00 per page
RTK-DGPS Surveying	375 per day	Imagenex Profiling Sonar	375 per day
Locus DGPS Surveying	275 per day	Imagenex Side Scan Sonar	375 per day
DGPS Navigation System	375 per day	Sparker Sub-bottom Profiler	400 per day
Gyro	25 per day	Uniboom Sub-bottom Profiler	350 per day
Motion Compensator	200 per day	3.5 Tuned Transducer System	250 per day
Precision Depth Sounder	75 per day	Marine Magnetometer	200 per day
Tide Gage	75 per day	Underwater Video System	125 per day
Theodolite/Total Station	150 per day	Truck	100 per day
Radios	15 per day	Generator	50 per day
Photocopying	0.30 per page	Inspector Boat	100 per day
Color Photocopy (8-1/2x11)	1.00 per page	Automobile	1.00 per mile
Color Photocopy (11x17)	1.25 per page		

Out-of-Pocket

Travel, Subconsultants, Printing, Communication, etc.

** In-house at scheduled rate plus 15%. Out-of-pocket at cost plus 15%.

Invoices

Bills are due and payable on presentation. Interest at 1.5% per month (but not exceeding the maximum rate allowable by law) is payable on any amounts not paid within 30 days.

PRELIMINARY ENGINEERING REPORT
BEACH PROTECTION FACILITIES
OCEANSIDE, CALIFORNIA
FOR THE CITY OF OCEANSIDE

AUGUST 1, 1983
Prepared By:

Ronald M. Noble
Coastal Engineering Consultant
R.M. NOBLE & ASSOCIATES
22541-A Pacific Coast Highway
Suite 58
Malibu, California 90265

PRELIMINARY ENGINEERING REPORT
FOR
BEACH PROTECTION FACILITIES

INTRODUCTION

This report presents four alternative groin field layouts along Oceanside Beach, and cost estimates for both their construction and their beach sand nourishment. The coastal processes for the Oceanside area, and the recommendation for these beach protection facilities are discussed in detail by Dr. Douglas L. Inman in his final oceanographic report for beach facilities.

While the Community Facility District deals with the beach protection facilities and the pier, this preliminary engineering report does not include the pier. The pier is included separately by others. Also, during a July Council meeting, the City Council of Oceanside made the decision that seawalls (shoreline revetments) should not be included within this beach protection facilities project. Even though seawalls may benefit property owners, they should be funded through a special assessment district such as the 1911 or 1913 Assessment District Acts.

SAND NOURISHMENT

As described in Dr. Inman's report, in order to reestablish and maintain stable beaches along Oceanside, it is essential that the eroded offshore and beach profiles be renourished with sand, and maintained in equilibrium through natural and artificial sand nourishment. Low profile, wave absorbant groins, adjustable in height and length are recommended along with sand nourishment. These groins would be used to stabilize the beach in the longshore direction until the beach and offshore profiles are reestablished to normal equilibrium beach profile conditions.

Artificial sand nourishment in one or a combination of forms is required to replace the original source sand provided by the San Luis Rey River and rivers to the north, and to bypass sand either trapped or diverted offshore by Oceanside Harbor. Means of artificial sand nourishment include harbor bypassing, offshore recovery and/or trucking of suitable sand obtained from rivers and local catch basins.

Cost estimates associated with artificial sand nourishment include such items as increased harbor bypassing facilities from those currently planned, offshore recovery of sand and trucking of sand. Increased harbor bypass facilities would consist of lengthening the discharge line to the south of the southerly most groin, adding required booster pumps for this discharge line lengthening, and potentially increasing the capacity of the

bypass facilities for the north fillet beach to the north of Oceanside Harbor.

Initially, sand nourishment on the order of one million or more cubic yards would be required to fill the groin field cells. Thereafter, approximately one-quarter of a million cubic yards would be required annually to maintain an equilibrium profile. However, during the first several years approximately one-half a million cubic yards could be required annually to reestablish the eroded offshore beach profile to an equilibrium condition.

Cost estimates for providing various forms of sand nourishment could range between $3.0 million to $8 plus million. The exact combination of sand nourishment methods that would eventually be used can not be identified at this time. Therefore, actual unit costs and total sand nourishment costs are not now accurately known. The total sand nourishment costs to initially fill the entire groin field to its impoundment capacity including the increased bypass facilities and offshore nourishment would be too expensive for this project. Therefore, it is possible that a reduced initial sand nourishment program would require a longer period for the stabilization of the Oceanside beach and offshore area.

Sand nourishment unit costs used in this report were the following:

Trucked sand	$3 to $5/cubic yard

Offshore recovered sand	$3 to $5/cubic yard
Bypassed sand	$1 to $2/cubic yard
Bypass facility expansion	$1 million to $2 plus million

GROIN FIELD LAYOUTS

Four groin field alternatives are presented in this report. Low profile, wave absorbant groins which are adjustable in height and length have been recommended which would extend offshore to the -10 feet Mean Sea Level (MSL) bottom contour. It has been proposed that they be adjustable in height to accommodate the changing sand level in order to control the amount of sand bypassed from groin to groin. The outer length of groin would be adjusted to allow their coverage with sand as the beach rebuilds.

The groin length required to extend offshore to a water depth of -10 feet MSL would average somewhere between 500 to 650 feet. At this time, it is estimated that groins should be spaced approximately 1,000 feet apart. The northern groins could possibly be spaced at a greater distance, but this would have to be determined during engineering design. The southerly two groins should act as transitional groins by being progressively smaller in length and closer in spacing to allow for the adequate bypass of sand to their south.

Groins are estimated to cost approximately $700 to $1,000 per lineal feet in length depending on their type of construction

and overall length. However, groins of 500 feet or longer are estimated to cost closer to $1,000 per lineal feet. The groin field layouts shown in Figures 1 and 2 are non-dimensional, schematic layouts. Their exact spacing, location and length would be determined during the engineering design phase.

Alternative 1 shown in Figure 1, represents the original groin field layout between the Oceanside Pier and Buena Vista Lagoon. It consists of 13 groins of which eleven are 600 feet long, one is 400 feet long and one is 200 feet long. All 13 groins are spaced at approximately 1,000 feet on center. Cost estimates for this alternative as well as the other discussed alternatives is shown in Table 1.

Alternative 2 shown in Figure 1, also shows a groin field layout between the Oceanside Pier and Buena Vista Lagoon. However, this alternative and Alternatives 3 and 4 were prepared after the overall project funds were reduced by more than two million dollars. This plan consists of 12 groins of which ten are 500 feet long, one is 300 feet long, and one is 200 feet long. Three groins are spaced at 1,500 feet, one at 1,300 feet, six at 1,000 feet, one at 800 feet and one at 600 feet.

Alternative 3 shown in Figure 2, shows a groin field layout from the Oceanside Pier to Cassidy Street. This plan consists of 10 groins of which eight are 600 feet long, one is 400 feet long and one is 200 feet long. Eight groins are spaced at 1,000 feet while one is at 800 feet and one is at 600 feet. Alternative 4

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shown in Figure 2, shows a groin field layout from the Oceanside Pier to Loma Alta Creek. This plan consists of 8 groins of which six are 650 feet long, one is 400 feet long and one is 250 feet long. Six groins are spaced at 1,000 feet and two are spaced at 800 feet.

CONCLUSION

At the City Council of Oceanside's request, the City Engineer was to coordinate the beach protection facilities work and determine whether a project for approximately $11 million could be accomplished. Based on this request and on resolving the public and private property concerns dealing with the project limits, several alternatives were analyzed. The best alternative in providing beach protection to the City of Oceanside beaches for the approximate $11 million project cost is Alternative 2 with a groin field layout from the Oceanside Pier to Buena Vista Lagoon for an estimated cost of $11.43 million.

TABLE 1

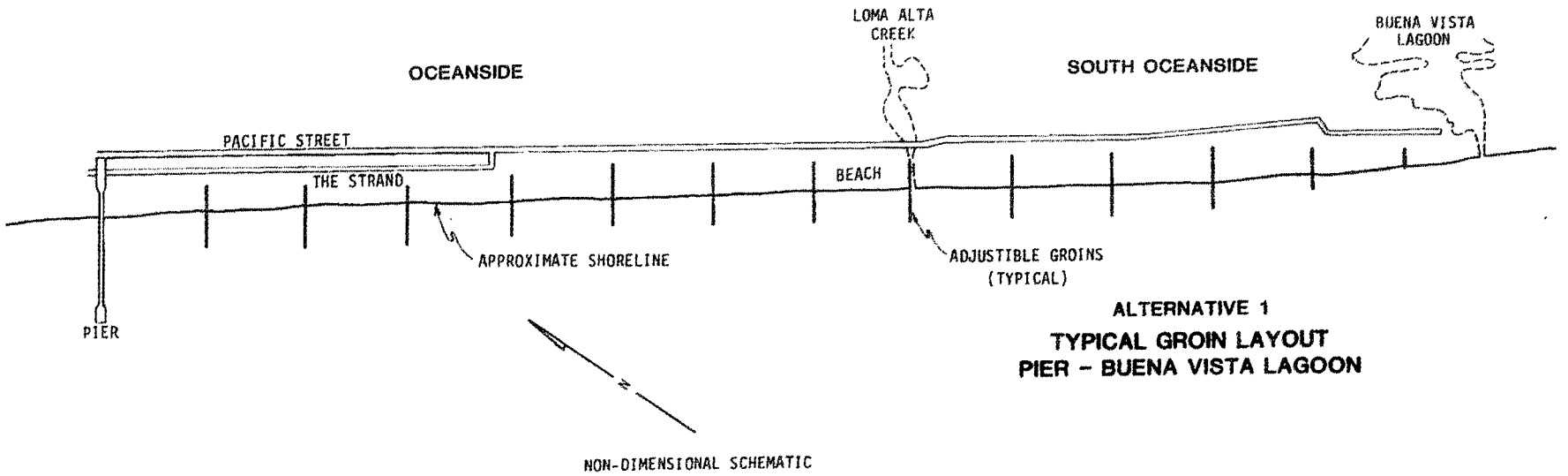
COST ESTIMATES

GROIN FIELD ALTERNATIVES

(in $ million)

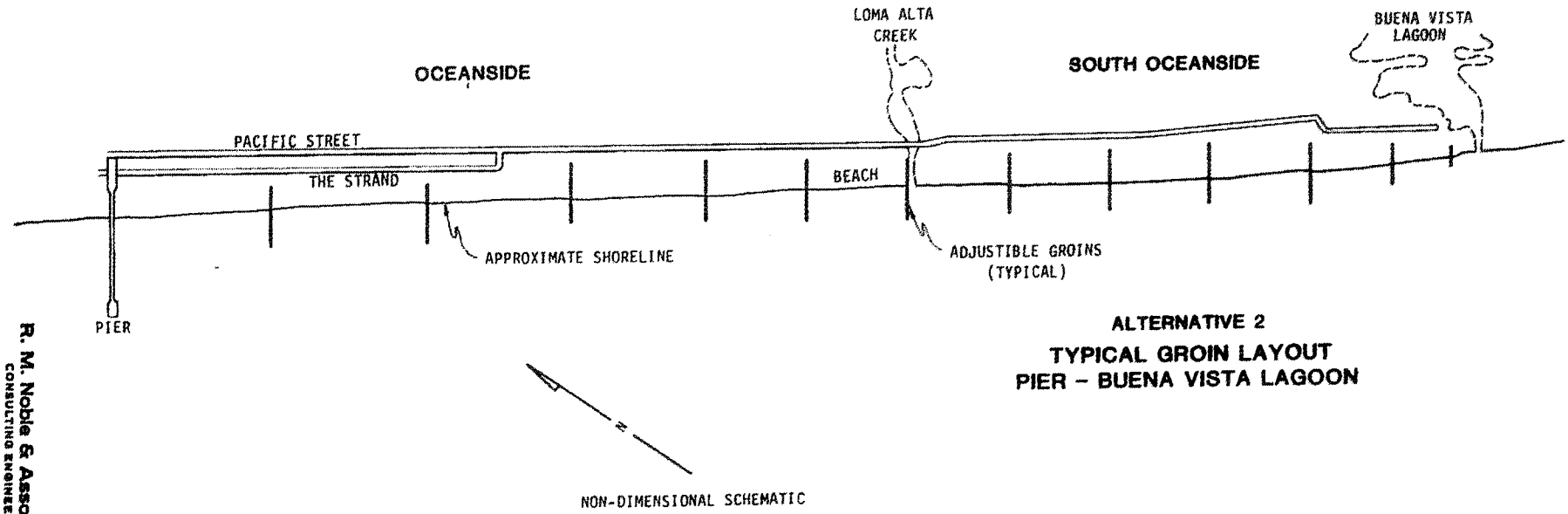
ALTERNATIVE	1	2	3	4
Groins	7.20	5.50	5.40	4.55
Sand Nourishment	3.5	3.5	3.4	4.0
Total Construction	10.70	9.00	8.80	8.55
Incidental*	2.89	2.43	2.38	2.31
TOTAL COSTS	13.59	11.43	11.18	10.86

* Includes financing and bonding, special counsel, assessment engineering, design, contract administration and inspection, testing, general administration and overhead, and miscellaneous taken as 27% total construction cost.



ALTERNATIVE 1

TYPICAL GROIN LAYOUT
PIER – BUENA VISTA LAGOON

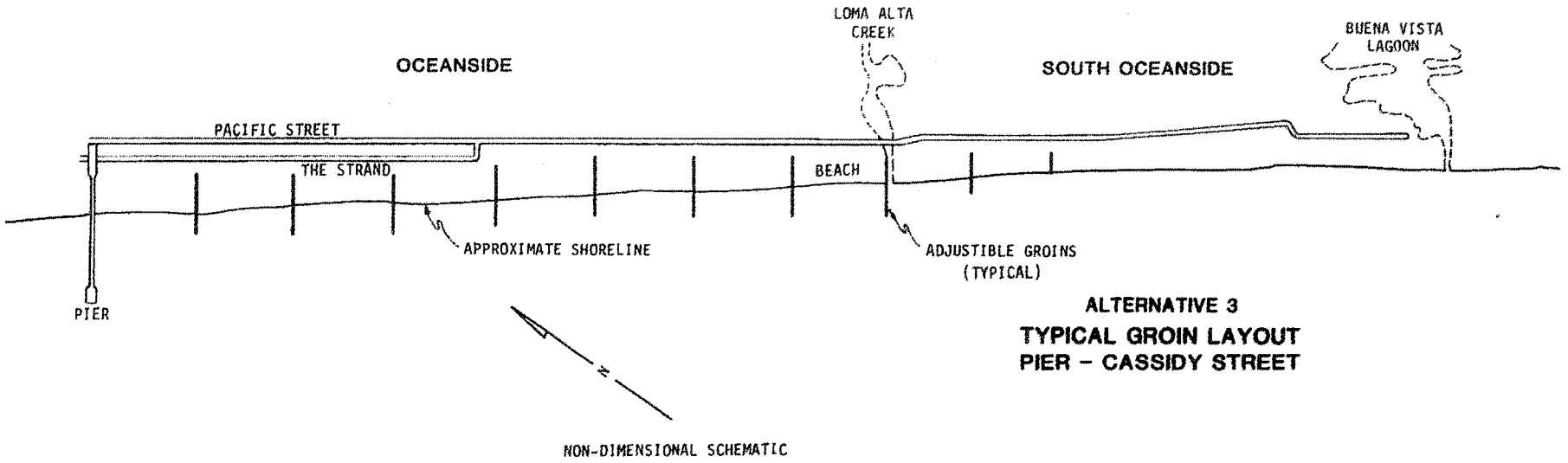


ALTERNATIVE 2

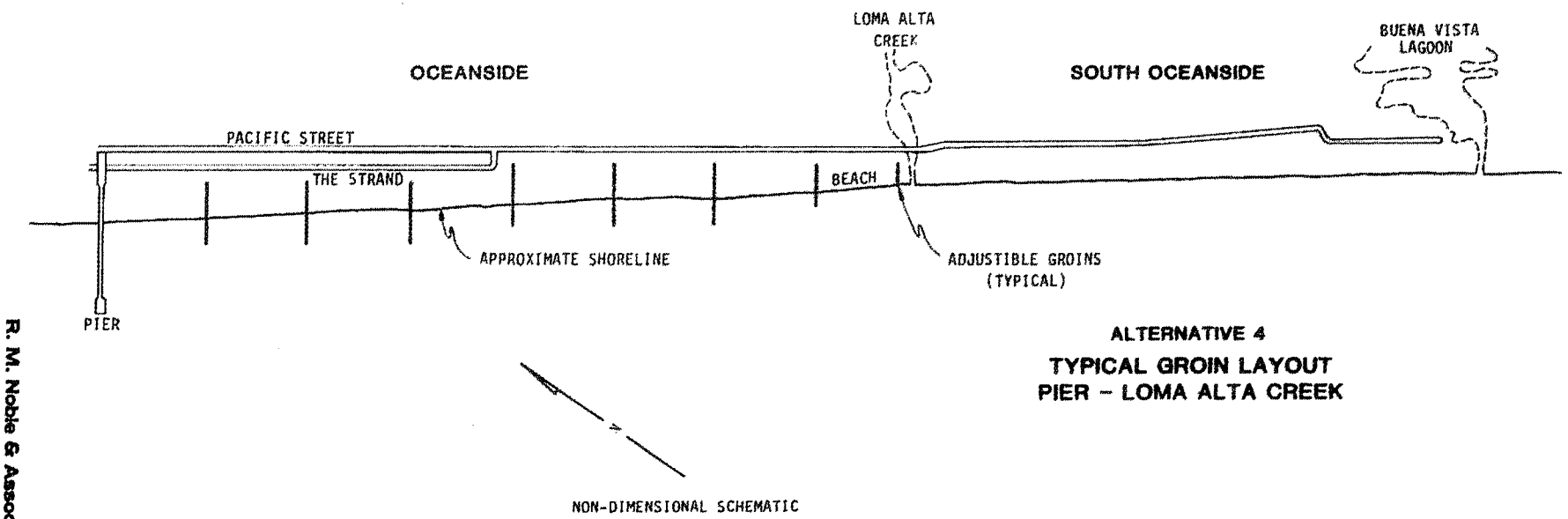
TYPICAL GROIN LAYOUT
PIER – BUENA VISTA LAGOON

R. M. Noble & Associates
CONSULTING ENGINEERS

FIGURE 1



ALTERNATIVE 3
TYPICAL GROIN LAYOUT
PIER – CASSIDY STREET



ALTERNATIVE 4
TYPICAL GROIN LAYOUT
PIER – LOMA ALTA CREEK

R. M. Noble & Associates
CONSULTING ENGINEERS

FIGURE 2

Letter Report
Review of
Proposed Groin Field
Oceanside Beach
For the City of Oceanside

R.M. NOBLE & ASSOCIATES Job No. 17-01
Malibu, California
January 24, 1983

January 24, 1983

City of Oceanside
Civic Center
321 North Nevada
Oceanside, California 92054

Attention: Ms. Suzanne E. Foucault
Acting City Manager

Gentlemen:

Letter Report
Review of
Proposed Groin Field
Oceanside Beach
For the City of Oceanside

INTRODUCTION

This letter report presents our findings and recommendations in accordance with your letter of January 4, 1983, pertaining to the construction of a groin field to provide the necessary beach erosion control for Oceanside beach. The beach area of concern lies between Tyson Street and Buena Vista Lagoon within the City of Oceanside.

SCOPE

The scope of this study is described in your letter of January 4, 1983, which is summarized as follows:

1. Review the U.S. Army Corps of Engineers report entitled "Survey Report for Beach Erosion Control" dated September 1980.

2. Make a recommendation as to whether the groin field presented in this report can be modified and retain its effectiveness.

3. Modifications of the groin field to be considered include but are not limited to length, width, spacing, construction materials and methodology, and phasing of construction over two or more years. Discuss permits required for any recommended modifications.

4. Determine whether a groin field can be effectively constructed more economically and more quickly than that which is presented in the Corps of Engineers report with consideration given to the Sand Bypass System currently under design.

5. Provide a letter report with findings and recommendations to the City no later than January 26, 1983. In addition, make an oral presentation of the report and respond to any questions at the January 26 meeting of the City Council, and be prepared to attend a second City Council meeting, for similar purposes, if deemed necessary.

REVIEWED INVESTIGATIONS

The following investigations were reviewed during this study:

1. "Coastal Processes Study of the Oceanside, California, Littoral Cell", Miscellaneous Paper H-78-8, by Lyndell Z. Hales, Hydraulic Laboratory, U.S. Army Engineer Waterways Experiment Station, August 1978.

2. "Oceanside Harbor and Beach, California, Design of Structures for Harbor Improvement and Beach Erosion Control, Hydraulic Model Investigation", Technical Report HL-80-10, by Charles R. Curren & Claude E. Chatham, Jr., Hydraulics Laboratory, U.S. Army Engineers Waterways Experiment Station, June 1980.

3. "San Diego County, Vicinity of Oceanside, California, Survey Report for Beach Erosion Control", by U.S. Army Corps of Engineers, Los Angeles District, September 1980.

4. "Geotechnical Report, Oceanside Beach Nourishment, Oceanside, California", by U.S. Army Corps of Engineers, Los Angeles District, March 1981.

5. "Report on a Program for Installing, Monitoring and Evaluating the Effectiveness of a Sand Bypass System as a Means of Maintenance of the Harbor Channels, Oceanside Harbor, Oceanside, California", by U.S. Army Corps of Engineers, Los Angeles District, March 1982.

6. "Draft Report, Experimental Sand Bypass System at Oceanside Harbor, California, Phase 1: Data Collection and Analysis", by Moffatt & Nichol, Engineers, November 1982.

In addition to the above reports, other information relative to coastal processes at Oceanside were reviewed, such as offshore bottom profiles prepared by the U.S. Army Corps of Engineers, Los Angeles District and by the University of California, Scripps Institution of Oceanography.

COASTAL PROCESSES

Oceanside is located close to the center of a littoral cell which extends from Dana Point to La Jolla. Net littoral drift

appears to be from north to south, although there are frequent reversals due to the varying wave climate. The Oceanside Harbor complex consisting of Oceanside Harbor and the Del Mar Boat Basin acts as a sand "sink" which traps sand moving in either direction. South of the harbor complex the shoreline from the San Luis Rey River to the Buena Vista Lagoon in Oceanside has suffered severe erosion over the years. During periods of severe erosion this beach has been stripped of it's sand, with mostly cobbles remaining. The existing Oceanside beach sands are mainly classified as fine sands.

The littoral transport study performed by Hales of the Waterways Experiment Station (WES) calculates that there is a potential net annual littoral transport of 102,000 cubic yards to the south in the Oceanside area. Several studies performed just prior to this study stated that the net annual transport was to the north. Earlier studies have reported net southerly transports. Many of these studies are based on the use of wave statistics, which have been developed by several sources. The potential longshore transport rate has then been calculated from these waves. The results of these studies have been questionable due to critized wave data, the method wave data was applied in calculating transport rates, the separate tabulation of sea and swell data, etc.

The WES value of 102,000 annual cubic yards of littoral transport to the south for Oceanside is based on an annual northerly drift of 421,000 cubic yards due to southern swell which, almost negates an annual 454,000 cubic yards of southerly drift due to sea. This large component of northerly drift resulting from southern hemisphere swell seems questionable. It is our feeling that the average net annual transport is to the south, and that it exceeds 100,000 cubic yards.

During storm wave activity from either westerly or southerly directions, higher waves with higher wave steepness result in large amounts of sand being removed from Oceanside beach and deposited offshore as well as being transported alongshore. When this occurs during high tide conditions the beach is eroded further shoreward. For the beach to be restored naturally, the offshore material must be returned along with an adequate supply of littoral transport. Apparently, a large amount of the offshore material is not being returned to the Oceanside beach, and the sand that does return, through the forces of waves with lower heights and steepness, is much slower in returning. An unknown amount of this sand is lost directly offshore, or eventually lost to the south in either the Carlsbad or La Jolla submarine canyons. In addition, the entrance channel to the Oceanside Harbor complex is infilled with sand.

It is suspected that the offshore Oceanside area, itself, has been depleted of sand over the years. This could be partially contributed to the fact that less and less sand over the years has reached the shoreline from inland sources, thus reducing the supply of transport material.

Considering the above discussion, it is questionable whether the planned sand bypass system can by itself maintain Oceanside beach and provide the necessary protection to shoreline property. Even if the bypass system could pump sand at several times the normal littoral transport rate in order to restore the eroded beach after heavy storm action, the beach would still be vulnerable to severe erosion during periods of storm wave action. Also, if a bypass system was capable of supplying sand to the beach at a high enough rate to eventually restore the beach, a long period of time could be required for this restoration to take place. During periods of northerly drift this beach sand would be more susceptible to re-entering the harbor entrance than if it were retained by some shore erosion control means. It is our opinion that structural shore protection, such as a groin field, is essential in conjunction with a sand bypass system in order to maintain an adequate beach width during times of storm wave action.

GROIN FIELD CONSIDERATIONS

From a review of the WES hydraulic model investigation for an Oceanside beach groin field, the following was shown to give satisfactory model results:

- a closer groin spacing to the south than the groin spacing to the north
- a southerly groin spacing of 1,000 feet
- a northerly groin spacing in the vicinity of Wisconsin Avenue and northerly of 1,400 feet or more
- transition groins of shorter length and spacing at the extreme south end to decrease shoreline erosion south of the groin field
- a groin spacing of 1,250 feet versus 1,000 feet could be adequate when considering a continuous supply of sediment transport to the groin field
- a groin length of 800 feet which is finally dimensioned as 724 feet

The model investigation also showed the following to give unsatisfactory or nonbeneficial model results:

- increasing the groin spacing from 1,000 feet to 1,250 feet increased longshore currents and ripcurrents in each cell, increased shoreline erosion in the middle of cells, and increased sediment movement from one cell to another and eventually out of the groin field
- increasing the groin length from 800 feet to 1,000 feet was nonbeneficial

- constructing a T-head at the end of the groins was not beneficial

- reducing the groin length from 800 feet to 700 feet results in the shoreline receding by approximately 100 feet

Hydraulic model investigations of a groin field's impact on the littoral processes taking place at a site are at best only qualitative in their results and should only be used as a guide but not quantitatively. It still remains a difficult process to select the proper groin lengths, spacings and profiles for a site's wave and sediment characteristics, offshore bottom conditions and rates of longshore transport.

In the planning of a groin field, the following factors should be considered:

- An adequate supply of sediment transport is required.

- It is important to initially fill a groin field to its impoundment capacity to stabilize the downdrift beach. If the beach is not renourished as the groin field is constructed, downdrift shoreline erosion will continually occur until the groin field fills and material resumes its unrestricted movement downcoast. This erosion will remain unless sediment transport is supplied at several times the normal rate to replenish the lost material.

- The impoundment capacity of groins depends on the stability of the slope and alignment of the accretion fillet, which depends on the characteristics of littoral material and wave attack.

- Groins can cause erosion to the immediate downdrift shoreline since transport currents do not move sediments immediately shoreward after passing the last groin. Also, if groins do not remain filled they can reduce the sediment transport rate to the downdrift shoreline.

- Groins are more effective for a uniform angled wave approach, but if properly configured they can be effective for reversals in angled wave approach. They are not effective for direct-in wave approach.

- A groin's length must be sufficient to create the desired beach shape and still allow sand to pass around its outer end, while groin spacing is a function of groin length and the desired final shoreline shape.

- Groins will more easily retain the coarser materials which stand on steeper beach slopes through the process of sorting.

- Groin construction should be initiated from the downdrift end. Constructing slowly from the downcoast end up, helps to verify groin spacing and length.

RECOMMENDATIONS

The purpose of a groin field at Oceanside beach is to maintain a recreational beach and to provide adequate shoreline protection to residential, commercial, and public property. It is also important that a groin field does not contribute to unacceptable shoreline erosion south of the groin field. For an Oceanside groin field to function properly it is essential that an adequate supply of sand is supplied from the north through the planned Oceanside Harbor sand bypass system, and that the groin field be artificially filled to its impoundment capacity when the groins are constructed. The WES coastal processes report by Hales indicates that during the occurrence of southern hemisphere swell there is a large volume of sand transported to the north, with a fair portion of this material reaching the Oceanside Harbor entrance. Even though this northerly component seems high it could be adequate in providing sand to a groin field during southern swell activity. This assumes that sand is available to the south of the groin field for transport. The planned Oceanside Harbor sand bypass system should be designed with discharge points at various locations along a groin field including a discharge location at the groin field's southerly end in case it is required due to shoreline erosion.

Ideally, a groin field should begin at the downcoast point of shoreline erosion within the littoral cell and stretch to the upcoast point of erosion, assuming that erosion is occurring throughout this stretch. In the Oceanside case this would involve crossing into the City of Carlsbad and beyond. It is difficult to predict at which southerly point to initiate groin construction, and have it remain as economical as possible and effective. However, it is recommended that groin construction be initiated at the Corps of Engineer's baseline station 198+00 with a 400 foot long transitional groin.

The length of groins must be long enough to trap sufficient sand for retaining the desired beach, but not extend excessively past the breaker zone which could force sediment moving around the structure too far offshore to return to the next downdrift cell. Typically, a longer groin is required to retain finer sand particles than that for the coarser particles. In the case of Oceanside where beach sands are mainly fine sands this is important in consideration of groin length. Since the hydraulic model investigation did not consider the model relation of the tracer material settling velocity to the prototype sand settling velocity, it is unknown what impact this would have on model results of different groin lengths and spacings.

It is recommended that the groin length be a minimum of 650 feet in crest length for groins located at baseline station 160+00 and north, and a minimum of 550 feet south of station

160+00 to the transitional groin at station 198+00. For a typical 650 feet groin, the crest would begin 100 feet seaward of the Corps of Engineer's baseline and extend to 750 feet seaward of this baseline, as shown in Figure 1. However, instead of a constant crest elevation of +10 feet MLLW as shown by the Corps of Engineers, the following is recommended:

- crest elevation of +10 feet MLLW from 100 feet to 450 feet seaward of baseline
- crest elevation sloping on 1:20 (vertical:horizontal) slope from +10 feet at 450 feet to +3 feet at 590 feet seaward of baseline
- crest elevation of +3 feet MLLW from 590 feet to 750 feet seaward of baseline

The shorter groins would be similar to the above recommendations, however the shoreward +10 feet crest elevation would extend approximately 350 feet seaward of the baseline. The shorter groins are based on the proposed 100 feet wide nourished beach south of Loma Alta Creek (versus a 200 feet beach north of Loma Alta Creek) and the -12 feet MLLW water depth being closer to the shore's baseline than to the north. However, individual groin lengths would require confirmation during final design of a groin field.

It is recommended that the groins be rubble mound groins constructed of stone. Side slopes should be 1.5:1 and the seaward end should be 2:1. Groin cross sections and stone sizes would be similar to those shown in the Corps of Engineers, Survey Report, but these should be detailed during final design.

These groins have been plotted on Oceanside beach offshore profiles prepared by the Corps of Engineers for the years 1950, 1962, 1963, 1972, 1973, 1981 and 1982, and by the Scripps Institution of Oceanography during the year 1982. The groin's seaward end typically reaches the starting area of the offshore sand bar when it has formed. The groin's offshore crest section has ben lowered in elevation in order to reduce the required amount of stone. The +10 feet crest elevation has been extended approximately 150 feet seaward of the seaward crest for the proposed beach nourishment. The reduced groin crest section should still remain effective in retaining beach sands during angled wave approach. It should also help in reducing ripcurrents along the groins.

A rubble mound groin has been recommended for its higher absorption and less reflection of wave energy, and for its potential in modification, if necessary. The required bottom depth of groin construction to prevent undermining due to bottom scour should be determined during the final design of groins. However, from plotting the groins on past surveyed bottom profiles, the outer 400 feet will need to be several feet deeper than that shown in the Corps of Engineers, Survey Report.

A groin spacing of 1,333 feet is recommended between baseline stations 100+00 to 140+00, and 1,000 feet between stations 140+00 to 190+00 with the transitional groin at station 198+00, as shown in Figure 1. During reversals in angled wave approach the accretion fillets will shift to the new updrift side of the groins while the downdrift side recedes. Some sand will constantly be lost, and therefore sediment transport is required to refill the groin system. During periods of direct-in wave approach the groin field will not be effective. If the groins are constructed in stages, then modifications may be made in groin length, spacing and profile, if necessary. Therefore, it might be desirable to construct the groin field over a period of two or more years. It is estimated that these groins would cost somewhere between $350,000 to $450,000 per groin.

PERMITS

The main permit requirements are briefly described for the construction of a groin field by the City of Oceanside at Oceanside beach. An Environmental Impact Report (EIR) would be prepared conforming to the California Environmental Quality Act (CEQA) requirements for certification by the City of Oceanside. The City of Oceanside has estimated that this could be accomplished in a minimum of 8 months which includes scoping, retaining a consultant, notice of preparation, preparation, and review and comments by the required agencies.

A California Coastal Commission permit would be required. The minimum time period from filing to initial hearing, assuming there are no delays, is 49 days. The time period beyond this depends on whether the Commission approves the permit and, if it does, if there are any special conditions to satisfy. If there are no concerns, a Coastal permit should take 2 to 3 months. However, a groin field at Oceanside beach would probably be a controversial project to the Coastal Commission, and to other parties which could appeal an approval. Therefore, the time period required to receive approval is unknown, assuming approval is received.

The State Lands Commission does not require a permit since the area of groin construction has been granted to the City of Oceanside by the State under its Grant of Tide and Submerged Lands. However, they would participate through CEQA requirements. The State Regional Water Quality Board also would not require a permit, but would request review of the EIR. Other agencies such as the U.S. Department of Fish and Wildlife Service would only be involved in the CEQA review process of the EIR. The U.S. Army Corps of Engineers would require Section 10 and Section 404 permits. This process could take 60 to 90 days assuming they did not perform their own Environmental Impact Statement.

If the entire permit process went smoothly, it could be accomplished in one year from initiation of an EIR to approval of

all permits. However, with the controversial nature of a groin field project at Oceanside beach, it could take much longer.

If the Corps of Engineers constructed the groin field, then they would obtain the necessary permits. They would write a consistency statement for a California Coastal permit. This could be appealed by the Coastal Commission. However, if the Corps of Engineers were to construct the groin field, they would need Congressional approval of their Survey Report before preparing a General Design Memorandum and detailed plans and specifications. This could require 3 to 4 years.

* * *

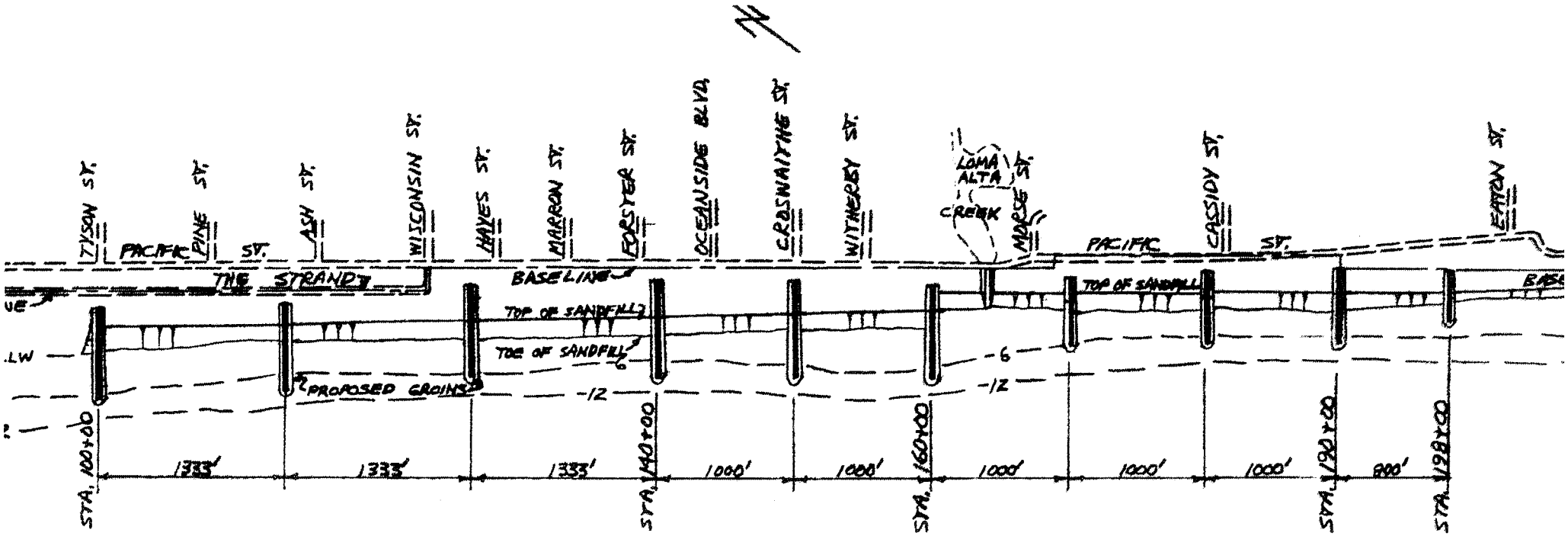
It has been a pleasure working with the City of Oceanside on this report. Should you have any questions concerning this report, please call us.

Very truly yours,

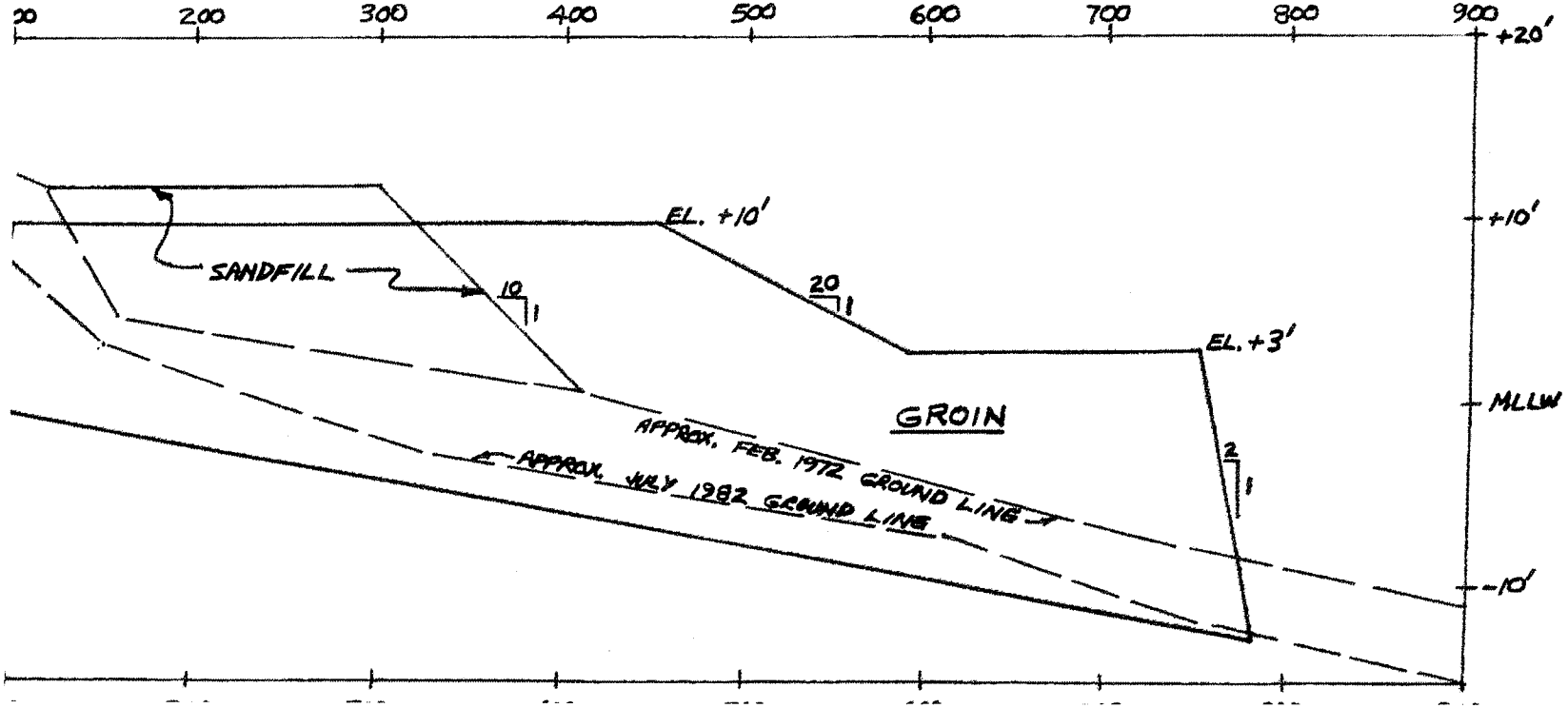
R.M. NOBLE & ASSOCIATES

Ronald M. Noble

RMN/cld



PROPOSED GROINS AND SANDFILL



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