9D-1.2

MEMORIAL PARK REDEVELOPMENT STUDY

CITY OF DETROIT
RECREATION
DEPARTMENT

SEPTEMBER 1987

charles s. davis and associates, inc.
consulting engineers

Michigan Coastal Zone Management Program

COASTAL ZONE
INFORMATION CENTER

AUTHENTICATED
U.S. GOVERNMENT
INFORMATION
GPO

TABLE OF CONTENTS

I. Introduction and Existing Conditions

II. Divers Investigation

III. Soils Analysis

IV. Existing Hydraulic Data

V. Existing Utilities

VI. Short term goals

1. Marina Redevelopment
2. Park Redevelopment

VII. Long term goals

1. Marina Expansion
2. Park Redevelopment

Appendix A - Preliminary Soils Investigation

Appendix B - Cross Sections

Appendix C - Short Range Plan-Cost Itemization

Appendix D - Long Range Plan-Cost Itemization

ND266.M5 M48 1987

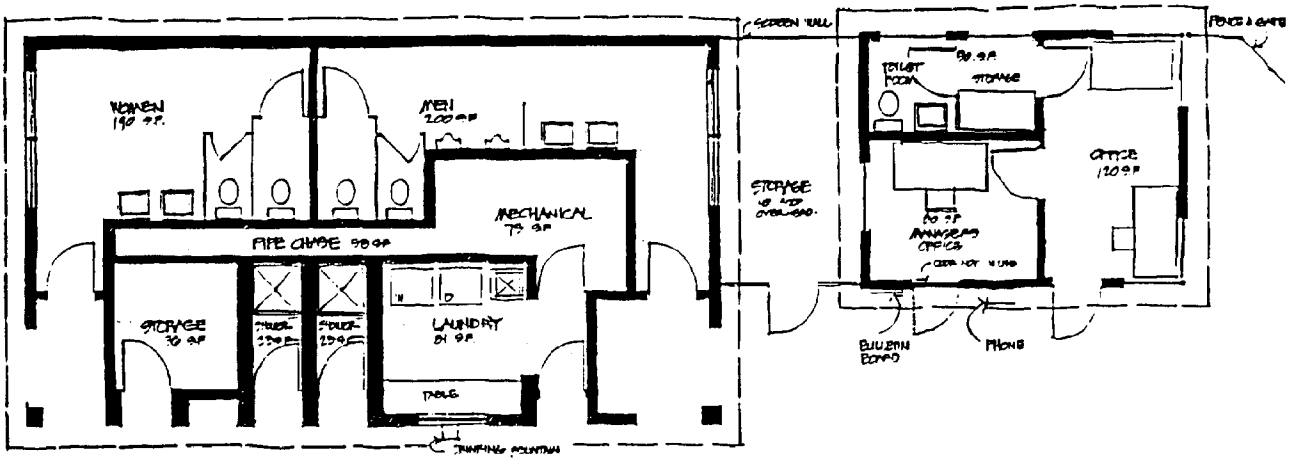
SECTION I - INTRODUCTION & EXISTING CONDITIONS

Memorial Park and the Memorial Park Marina are located on 36 acres of river front property, south of East Jefferson Avenue between Burns Drive and Marina Drive in the City of Detroit.

Existing Marina

The existing Marina facility covers 12 acres of the property and includes 96; 24 foot slips, 102; 36 foot slips and 34; 57 foot slips with 41 additional slips available for outboard motor boats. Parking for the boaters is currently provided adjacent to the individual docks at an approximate ratio of 1 car per slip.

The existing Marina is completely enclosed by chain link fence with a controlled access point at the north end of the Marina. The existing Marina Gatehouse building, located at the entrance serves as the gate house, for control of vehicular and visitor access, and also houses the restroom, shower, and laundry facilities (See figure 1 for footprint of existing building). Vending machines are also located at the building, this being the extent of food service currently available at the park.



EXISTING MARINA GATEHOUSE BUILDING

FIGURE # 1.

The existing Marina Basin is a horse shoe shape configuration approximately 300 feet wide and 1300 feet long. Boat slips are oriented in an east-west direction off each side of the basin. There is also a 10' wide center dock oriented north-south which extends 750 feet with 24' slips off of each side.

Scheduled for construction this summer is installation of a new steel sheet piling breakwater at the entrance to the marina from the Detroit River. Construction of the breakwater will lessen the wave action currently experienced by smaller boats housed in the marina due to the passing of large vessels in the river channel.

Existing Park

The remainder of the park property (approximately 24 acres) is currently utilized as recreational land. As can be seen on Exhibit I, the park has a gently rolling terrain which varies in elevation from 115'* at the north end of the park near East Jefferson Ave. to approximately 96.5'* at the edge of the Detroit River. Existing park facilities include meandering concrete walks, a basketball court, comfort station/restroom facilities (not currently in service), and a concrete promenade and fishing area adjacent to the existing seawall along the river's edge. Public parking is currently available for 160 cars with space for 80 cars in the Promenade Parking Lot and 80 additional cars in the existing parking lot located immediately north of the Marina Facility.

*Elevations refer to City of Detroit Datum

SECTION II - DIVERS INVESTIGATION

For the purpose of this study, the firm of Sea Side Diving Incorporated was contracted to perform an underwater inspection of the existing dock facilities within the Marina as well as the existing seawall both along the Detroit River and in the existing Marina basin. A copy of their inspection report is included as Exhibit I of this study.

In summary, the underwater docks and pilings are in good condition. The concrete wall also appears to be in sound condition with the exception of a few locations where spawling of the concrete has occurred. The method and costs for repair of these areas is covered in Section VI of this report.

SECTION III - SOILS ANALYSIS

The soil firm of SME (Soils and Materials Engineers, Inc.) was utilized to perform a preliminary soil investigation at the Memorial Park Site. A copy of their report is included as Appendix A of this study.

Three soil borings were taken at the Memorial Park site to determine the nature of the soils. There locations are shown on Exhibit II which is included as part of this report. One boring was taken in the existing Promenade area approximately 112 feet north of the Detroit River and the remaining two were taken immediately west of the existing Marina. In addition to a soils analysis of the existing material, a chemical analysis was also performed on the samples from two of the borings.

In general, the soil conditions encountered at the site consisted of mixed sand, clay, and rubble fill from the existing ground surface to depths of 13 to 18 feet. Under the fill layer, the soil consists of a silty clay material. Chemical analysis of the borings taken west of the existing Marina detected traces of gasoline, diesel fuel, and fuel oil as well as above normal levels of copper, zinc, cadmium and Dichloroethane. Because of the presence of these chemicals as well as the concrete rubble contained in the fill material, special problems may be encountered during various construction operations at the site.

Further discussion concerning these potential problems is covered in Section VII of this report.

It should be noted, however, that prior to final design of any of the alternatives suggested in this report, additional soil borings and more specialized testing will be required. This additional work is necessary to determine more specifically the existing soil parameters, particularly at the seawall locations where additional information is required to resolve final design factors.

SECTION IV - EXISTING HYDRAULIC DATA

Historical data provided by the City of Detroit sets the low water for the Detroit River at elevation 93.24 City of Detroit Datum (571.71 IGLD) and the high water at elevation 98.20 (576.67 IGLD). The water level at time of survey was approximately elevation 96.7 (575.17 IGLD). Due to the extremely high water levels of the Detroit River which have existed over the last two years, flooding has been experienced both in the Promenade area along the rivers edge and in the Marina area. The top of the existing seawall along the Detroit River is approximately elevation 96.5 and in the Marina area the top of the wall is approximately elevation 98.5. The current flooded condition at the Memorial Park site is the result of the low wall height, relative to the existing high water level, combined with the fact that a portion of the catch basin rim elevations are lower than the river water surface elevation for the existing storm sewer which outlets directly in the river.

*IGLD refers to International Great Lakes Datum

SECTION V - EXISTING UTILITIES

All available existing utility information is shown on Exhibit II included as a part of this report.

Water: A 6" watermain loop extends through the site which ties into the 6" watermain in Jefferson Avenue on the north end and to the existing 6" main in Burns Drive at the south end. From this line service is provided to the existing comfort station, the Marina Control Building and the boat slips. Fire protection throughout the site is also provided via the 6" water system.

Sewer: A 13' x 9' storm sewer runs from north to south on the west side of the existing park site, outletting into the Detroit River. This line serves as the eventual storm sewer outlet for the runoff from the existing parking lot located immediately north of the Marina as well as runoff from Burns Drive. The remaining storm sewers systems which drain the areas adjacent to the Marina basin as well as the promenade area outlet directly into the Marina Basin or the Detroit River respectively. This permits a very undesirable condition during periods of high water, because in some instances, the water level is higher than the existing ground elevation being drained, therefore, these areas remain constantly flooded.

Sanitary sewer service to the existing comfort station is provided by a 6" service which eventually connects to the 11' diameter sanitary sewer in Jefferson Avenue. The existing Marina Gatehouse building is served by an existing sanitary sewer located on the property immediately east of Memorial Park.

SECTION VI SHORT TERM REDEVELOPMENT PLAN

The proposed short term redevelopment plan for the Memorial Park site can be divided into 2 parts, one being the rehabilitation of the existing Marina facility and the second being the redevelopment of the park itself.

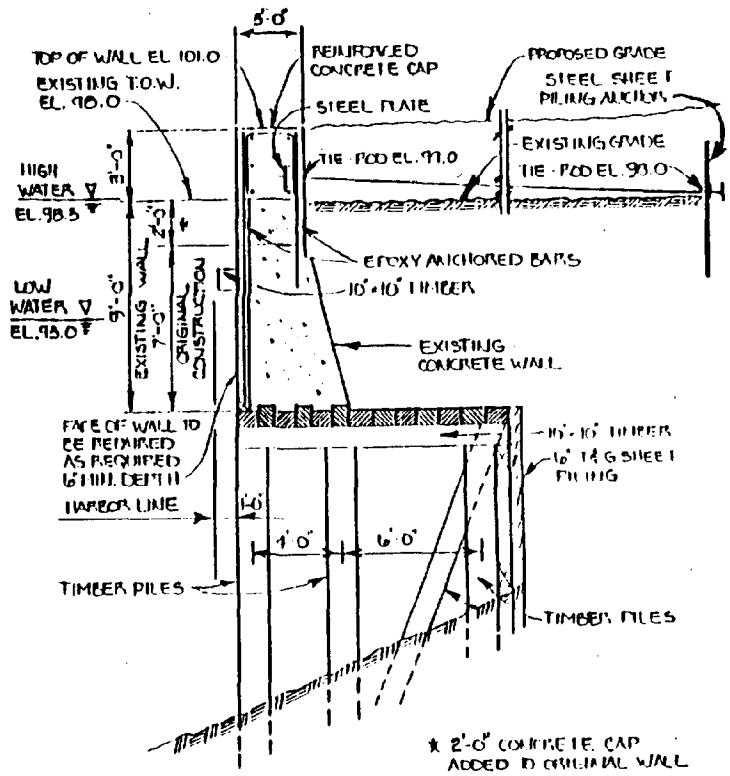
Marina Redevelopment - Short Term Goals

Discussion with City of Detroit Staff has been very effective in pinpointing and prioritizing current needs at the Marina facility. A list, in order of priority, of the major items of work proposed to be accomplished as part of the short term plan follows:

1. Raise and repair the existing Marina Seawall to elevation 101.0 (City of Detroit Datum) and in conjunction raise and repair the existing parking areas adjacent to the Marina Seawall.

   As discussed previously, the recent underwater investigation revealed certain areas along the existing seawall where spawling of the concrete is occurring.

   In addition, the relatively low elevation of the top of the seawall both in the Marina and along the river has contributed to the flooded condition recently experienced. A preliminary design to raise and repair the wall based on preliminary soils information has been accomplished and is detailed in Figure 2 below.



EXISTING WALL REPAIR DETAIL

FIGURE #2.

Together with the raising of the wall around the marina, the existing parking areas adjacent to wall must also be filled, regraded to improve drainage and repaved with asphalt.

2. Rehabilitation of all existing utilities. This work would include the reworking of the surface drainage around the Marina basin to eliminate direct runoff into the basin. This would be accomplished by construction of an underground storm drainage system.

The work in connection with raising the grade around the marina wall would involve installation of numerous new catch basins on both sides of the marina basin.

These catch basins are proposed to be connected by an underground storm drain. Flows on the east side of the basin would be directed to the north to a small lift station then pumped into the existing storm sewer system. On the west side of the basin, flows are proposed to be directed to the south and then west with eventual gravity connection to the existing storm sewer outfall. Runoff from the Promenade area is also proposed to be directed into the east-west line via underground storm drains as shown on Exhibit III.

In addition to the extensive storm drainage work proposed, all existing watermains and electric services within the Marina area are also proposed for replacement as a part of the short term rehabilitation. This work would include the lowering and replacement of the existing watermain as well as replacement of the existing electric services and installation of new utility terminals.

The existing pump out system has long presented problems for the Marina patrons as well as staff. Proposed short term rehabilitation includes the provisions for a new pump out facility as well as rehabilitation of the existing mechanical system.

3. Installation of a new Security System

The proposed security system preferred by City Staff utilizes a key card and control gate to restrict vehicular access to the Marina. Each key card is individually coded and the system has the capability of restricting the ingress to only one vehicle per card. In addition, the system works such that no other vehicle is able to enter through the gate using the same card until the initial vehicle exits.

4. Replace the existing center dock with a floating pier and T-docks.

The floating pier design proposed to replace the existing center dock would be of the type and configuration that could be reused if expansion of the Marina takes place as proposed in the Long Range Redevelopment plan shown in Exhibit IV.

5. Additional Parking

Installation of the new key card access system described above will enable the parking rules previously established by Marina Staff to be enforced, however, provisions for more parking for the Marina patrons is still a necessity.

To meet this demand, negotiations are proposed to continue with the Whittier Apartments across Burns Street from Memorial Park to lease a portion of their property for additional Marina parking.

The total estimated cost to accomplish the items described above as the short term goals for the Marina redevelopment is $2,310,000.00. An itemized breakdown of the cost estimate is included in Appendix C of this report.

Park Redevelopment - Short Term Goals

For the purpose of this report, the remaining recreational land at the park has been broken into 3 separate regions. For clarity, the Promenade is considered Region 1, the Park area north of the Marina is Region 2, and the Memorial Park Extension is Region 3. The short term goals for each area are addressed individually in the following text.

1. Region 1 - Promenade

   Short term redevelopment of Region 1, as shown on Exhibit III centers around the raising of the existing seawall along the Detroit River to an elevation of 101.0, City of Detroit Datum together with filling and regrading of the Promenade to match the new wall height.

   In addition, approximately 150 feet of new seawall is also proposed for construction near the existing fishing pier at the west end of the park. Preliminary design for both the raising of the wall and construction of the new seawall has been accomplished. The wall details are included as Figure 2 - Section VI and Figure 5 - Section VII. Construction of a new concrete boardwalk and miscellaneous concrete walkways, reconstruction of a portion of the existing public parking lot and resurfacing of the remainder of the lot as well as landscaping of the area are all proposed to be included as part of the short term redevelopment of the Memorial Park Promenade.

Total cost for this work is estimated to be $730,400.00 An itemized breakdown of the costs are included in Appendix C of this report.

2. Region 2 - Area north of the existing Marina

Short term redevelopment of Region 2, the park area just north of the Marina is proposed to include rehabilitation of the existing restroom/comfort station facility, removal the existing basketball court, installation of a children's play area and picnic shelter, construction of additional public parking for 20 cars along Marina Drive, and the resurfacing of the existing public parking lot. Regrading of the area as well as new landscaping are also included as part of the short term redevelopment plan. Total estimated cost for the proposed work for Region 2 is $346,500.00. A cost breakdown follows in Appendix C of this report.

3. Region 3 - Memorial Park Extension

Short term redevelopment of Region 3, the Memorial Park Expansion area is proposed to include raising of the existing seawall to elevation 101.0, construction of a new concrete boardwalk, installation of a picnic shelter and a children's play area as well as filling, regrading and additional landscaping for the area.

Currently a chain link fence exists between the Marina and the Memorial Park Extension. Installation of a gate along this east fence line with controlled access is proposed to allow access to the area by the Marina patrons.

The estimated cost for redevelopment of Region 3 is $493,900.00. An itemized breakdown of the cost is included in Appendix C.

Summary of Costs - Short Term Goals

Marina Redevelopment	2,310,000.00
Region 1 - Promenade Area	730,400.00
Region 2 - Area North of Marina	346,500.00
Region 3 - Memorial Park Extension	493,900.00
Total Cost Short Term Goals	3,880,800.00

Note: All estimated costs are based on 1988 prices.

SECTION VII - THE LONG TERM REDEVELOPMENT PLAN

The proposed long term redevelopment plan for Memorial Park as shown in Exhibit IV centers around the expansion of the existing Marina Facility. The proposed expansion would increase the size of Marina basin from 8 acres to 15 acres. As was the case with the short term goals, the long term redevelopment plan can also be separated into two parts, redevelopment of the Marina and the rehabilitation of the Park itself.

Marina Expansion - Long Term Goals

The proposed Marina layout, as well as the boat slip and pier design, follow the requirements and guidelines established by the State of Michigan Department of Natural Resources (DNR) Waterways Division. The recommended layout has been reviewed and conceptually approved by the Waterways Division. As shown in Exhibit IV, expansion of the Marina would encompass the existing Marina basin as well as approximately 12 acres of the park property adjacent immediately west of the existing Marina.

The new slip layout is proposed as a T-Dock configuration with finger piers off the main piers and the boat slips oriented in the north-south direction. The expanded Marina will provide capacity for 193; 30' boats (55%) and 158; 45' boats (45%).

In addition, the marina will be able to accommodate 2 or 3 60' boats on an interim basis as it is the desire of both the City of Detroit & the DNR Waterway Division that 60' boats be phased out at the Memorial Park Marina.

The boat docks are proposed to be 3' wide with a center to center distance of 35' for 30' boats and 40' for 45' boats. The length of the docks as shown on the concept drawing is proposed to be equal to the length of the boat to be docked in the slip. As an alternative to this, the docks may have a length of 3/4 of the boat length if a mooring pile is provided at the end of the docks. Although a cost savings may be realized by using mooring piles, disagreements may arise between boaters in adjacent slips when required to share the mooring piling. Therefore, cost estimates included in this report are based on dock lengths equal to the length of the boat. Fairway width between the boat docks shall be 1 1/2 x the boat lengths and a minimum of 60' adjacent to the seawall. The width of the main pier shall be 10' to accommodate pier dock boxes which are to be provided at each slip. Per recommendation from the Waterways Division, a floating dock design is proposed to be utilized for the 30' boats with a fixed pile foundation pier design for the docks housing the 45' boats.

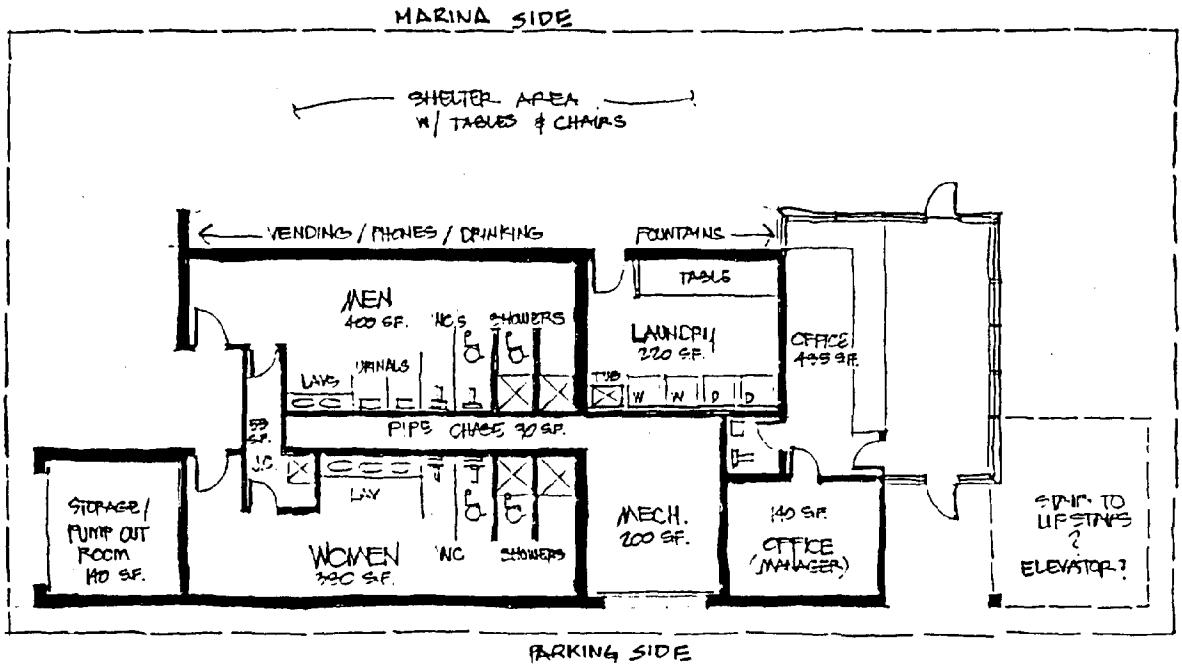
The new entrance channel from the Detroit River to the Marina is proposed to be narrowed dramatically from its current width of approximately 300' to 140'. In addition, the entrance is proposed to be skewed slightly to the north-east and the entrance seawalls lined with rip-rap. Implementation of these measures in combination will mitigate the wave action which normally would be felt in the marina during the passing of larger vessels in the river channel.

As can be seen on the proposed redevelopment concept plan, Exhibit IV, onsite parking for the boat owners will be provided in a parking lot adjacent to the Marina Basin. The proposed lot has a capacity of 300 cars, this being a ratio of .8 car per slip in addition to the 20 spaces provided for employee parking. As described in Section VI of this report, the potential for additional parking exists across Burns Drive from the park at a lot owned by the Whittier Apartments. Long term redevelopment shall include the leasing of this area to provide additional parking for Marina patrons at a total ratio of 1.5 car per slip.

The key card security system previously described in Section VI as part of the short term redevelopment plan is again proposed to be utilized to control the ingress of vehicles to the Marina. The new parking arrangement and revised location of the Marina access point make it unfeasible to utilize the existing marina building as the Gatehouse facility, therefore, a new building is proposed for construction.

An alternative use for the existing building is discussed later in this section.

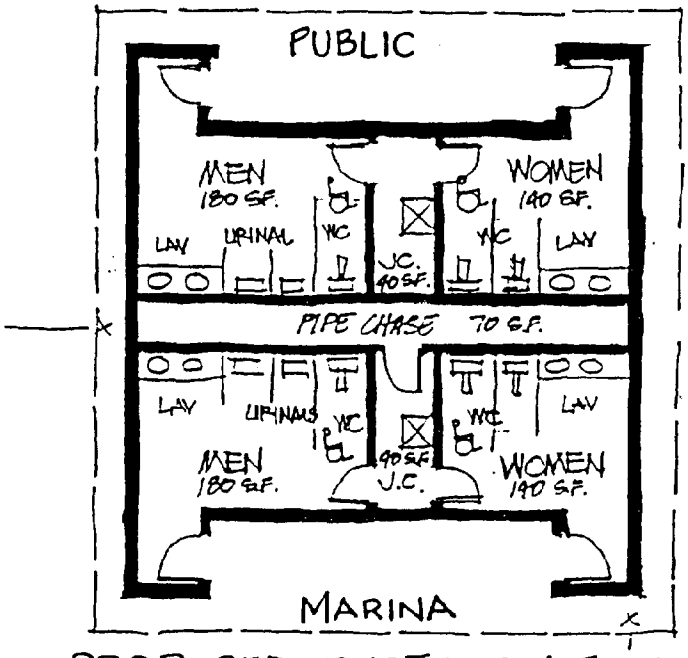
In addition to the Gatehouse building, two other new buildings are proposed for construction in conjunction with the Marina Expansion. The larger of the two structures, the new Marina Control Building shown in Figure 3 below, would be located immediately east of the Marina parking lot at approximately the midpoint of the new Marina basin. This facility would house restroom and shower facilities, and the Marina laundry facility as well as the electric transformers. The Harbor Master's office would also be located in this facility and thus the building would function as the base for Marina Security.



PROPOSED MARINA CONTROL BUILDING

FIGURE # 3

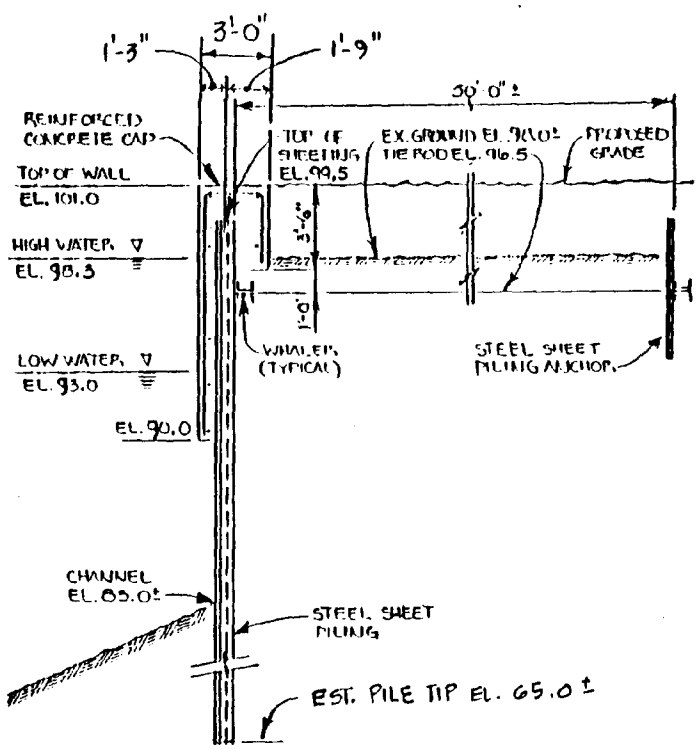
The smaller structure, planned for location near the south-east corner of the Marina parking lot, is slated to house only restroom facilities. The building design as shown in Figure 4 below, is such that the structure would be a shared facility with access for the public on the one side and access for the Marina patrons on the other. In this way service is provided for the public who are utilizing the Promenade area and, at the same time, the boat owners are provided the convenience of an additional restroom facility for their use.



PROPOSED RESTROOM FACILITY

FIGURE # 4

Expansion of the Marina Basin and redesign of the Channel entrance necessitates construction of a substantial length of new seawall at the Memorial Park Site. As discussed previously in Section IV of this report, a preliminary soils investigation has been performed. Information from the soils report together with the proposed utilization of the areas adjacent to the new walls, as shown in Exhibit IV, have been useful in developing a preliminary design for the proposed seawall. Due to existing soil conditions, a cantileaver type retaining wall will not be cost effective, rather, an anchored sheet pile wall design, shall be implemented. A preliminary wall section is shown in Figure 5 below. Preliminary design requires steel sheet piling lengths of 30 to 40 feet with tie backs spaced approximately 12 feet apart.



PROPOSED WALL DETAIL

FIGURE #5

It must be stressed that tie back spacings and sheet piling lengths outlined in this report are preliminary in nature and are to be utilized only for feasibility and estimating purposes. Once again, it should be noted that prior to final design, additional soil borings and more specialized testing will be required, particularly along the Marina basin wall, to determine more specific soil parameters necessary to resolve final design factors.

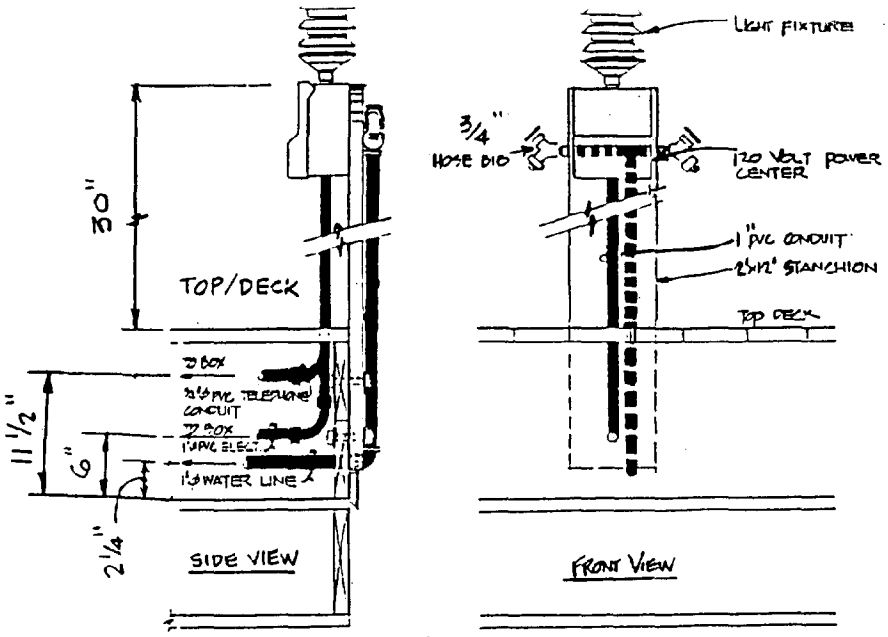
Extensive dredging of the park land west of the existing basin will also be required to construct the expanded Marina basin. Quantities calculated for cost estimating purposes are based on the DNR requirements of depths of 8' below low water elevation in the slip areas and 10' below low water datum in the fairway areas. Cross sections taken through the existing and proposed Marina are included in Appendix B. These sections include the proposed dredging limits superimposed on the existing topography and are able to show with more clarity the actual extent of the excavation necessary.

The preliminary soils report suggests that much of the material to be excavated will consist of rubble fill and some degree of difficulty is likely to be encountered during excavation operations.

In addition, due to the abnormally high concentrations of certain organic compounds detected during chemical analysis of the soil samples, additional cost is likely to be incurred because of the special method in which the material must be handled and disposed of in order to meet applicable government regulations.

Proposed to be included as part of the Marina redevelopment is the provision for utilities at each boat slip. One "utility terminal" will be provided for every two boat slips. The terminals are located between two of the finger piers or docks and provide electrical and water service for the 2 slips. A typical detail of a utility terminal is shown in Figure six below.

Electrical service shall be 30 amps for each 30' slip and 50 amps for each 45' or 60' slip. Two 3/4" hose bibs with check valves will be provided on each utility terminal. Additional utilities such as cable T.V. and telephone will be accommodated by the placement of "blank" conduit inside the main piers during the initial Marina redevelopment enabling future installation should their service be desired.



UTILITY TERMINALS
FIGURE # 6.

In addition to the utility terminals, a public address system which can be heard throughout all portions of the Marina is proposed to be provided.

The proposed long term redevelopment concept plan, Exhibit IV denotes the existing utilities and access points for the installation of the new utilities to serve the Marina.

Electric service for the Marina facilities as well as the 3 new buildings are proposed to be provided by extension to the south and west of the existing electric lines which currently serve the comfort station and Marina Gatehouse. Telephone service will be provided from the existing telephone lines in Burns Drive.

As shown on Exhibit IV, a sanitary sewer is proposed to be extended from the existing pump station near the north-west corner of the site to the south to serve both the new Marina Control building as well as the proposed restroom facility near the Promenade.

Sanitary service for use by the boaters will be provided by means of a pumpout facility which will be located at the end of the main pier adjacent to the Marina Control Building. A pump and force main will be utilized to transfer the waste flows from this location to a sanitary manhole.

Storm drainage for the new parking lots and other improvements will be provided by extension of the underground storm system proposed in the short term goals previously covered in this report.

In addition to new utilities to be installed as part of the Marina redevelopment, the Marina Expansion necessitates the relocation of some existing utilities. In particular, the existing 6" watermain located immediately west of the existing Marina will require relocation to facilitate dredging operations. The proposed new watermain alignment is such that water service from the line can easily be provided for the new Marina facilities as well as the proposed buildings.

Cost analysis of the work described above has been accomplished and is estimated at $11,100,000.00. An itemized breakdown of cost can be found in Appendix D of this report.

Park Redevelopment - Long Term Goals

Expansion of the Marina as proposed above leaves a remainder of 17 acres of actual land for recreational use. Long term redevelopment planning for the remaining recreational land has been broken into 3 separate regions for the purpose of clarity, with Region 1 being considered the Promenade, Region 2 the Memorial Park expansion, and Region 3 the remaining park between the expanded Marina and Jefferson Avenue.

It should be noted that this report assumes that the short term redevelopment plan has been implemented prior to the long term redevelopment. Therefore, cost estimates for the long term redevelopment goals do not include costs for work previously proposed as short term redevelopment goals.

1. <u>Region 1 - Promenade</u>

For purpose of this study, the Promenade is defined as the 4.5 acres of property adjacent to the Detroit River west of the new channel entrance as well as the 2 acres along Burns Drive which acts as a buffer strip between the roadway and the proposed Marina Parking lot.

Redevelopment of the Promenade area includes construction of a public parking lot with capacity for 34 cars, a turn around for Burns Avenue, new concrete walks, installation of a children's play area and extensive new landscaping.

The long range plan also includes construction of the restroom facility described previously in this section and shown previously in Figure 4. As discussed, final design of the building shall be such that the facility houses restroom facilities for Marina patrons on one side and the general public on the other.

The total cost for the above described work is estimated to be $374,000.00. An itemized breakdown is included in Appendix D of this report.

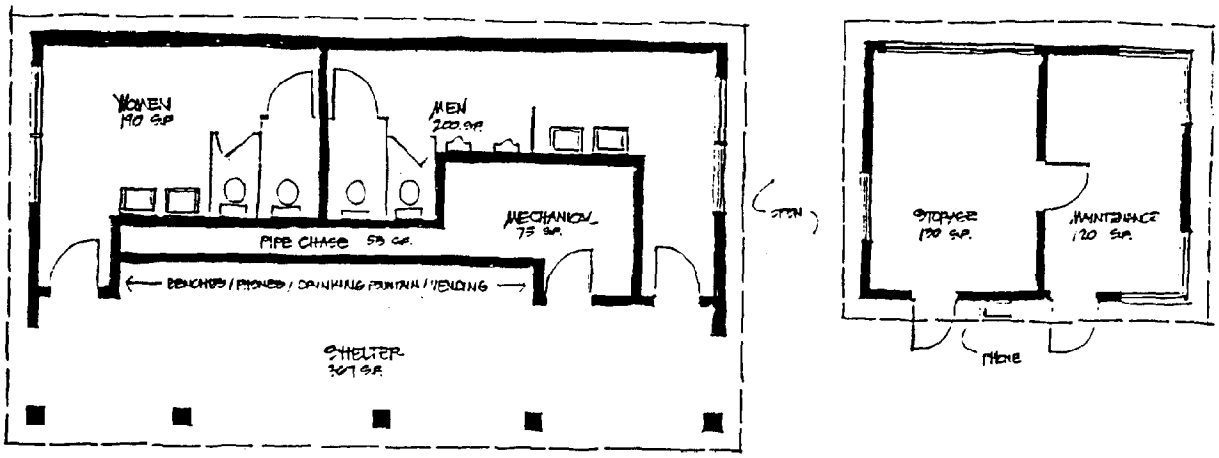
2. Region 2 - Memorial Park Expansion

The Memorial Park Expansion area includes the 4.3 acres of park land east of the Marina and immediately north of the river. In the long range planning, public access would be allowed along the east wall of the Marina basin both by pedestrian as well as cars, therefore, redevelopment of this area includes construction of additional public parking and a turn around area for vehicles near the river's edge. A fishing pier and additional landscaping of the region are also included as part of the long range plan.

The estimated cost for this work is $242,000.00. A cost breakdown is included in Appendix D.

3. Region 3 - Area North of the expanded Marina

Long range planning for Region 3, the area north of the proposed expanded Marina proposes construction of new concrete walks and extensive new landscaping.
In addition, the long range redevelopment calls for removal of the existing comfort station and the rennovation of the former Marina Gatehouse building for use as public restrooms (see Figure 7 below). A public restroom facility at this location would best serve the needs of the public utilizing either the play area and picnic shelters north of the Marina or the expanded fishing and picnic areas near the river's edge east of the Marina.



RENOVATED GATEHOUSE BUILDING
FIGURE # 7.

Cost to accomplish the above describe work is estimated at $396,000.00. An itemized breakdown is included in Appendix D.

Summary of Costs - Long Term Goals

Marina Redevelopment	11,100,000.00
Region 1 -Promenade Area	374,000.00
Region 2 - Area North of Marina	242,000.00
Region 3 - Memorial Park Extension	396,000.00
Total Cost Short Term Goals	12,112,000.00

Note: Total cost does not reflect work included in short range redevelopment plan.

All estimated costs are based on 1988 prices.

APPENDIX A

PRELIMINARY SOILS INVESTIGATION

34400 GLENDALE AVENUE
LIVONIA, MICHIGAN 48150
(313) 525-0310

KENNETH W. AHANER, P.E.
RICHARD D. ANDERSON, P.E.
THEODORE D. DZURMAN, P.E.
GARNETT H. EVANS, P.E.
FRANK A. HENDERSON, P.E.
EDWARD S. LINDOW, P.E.

JERRY B. SIVENS, P.E.
GARY M. HUSSAR, P.E.
LARRY P. JEDELE, P.E.
STARR D. KUHN, P.E.
GERARD P. MADEJ, P.E.
ROBERT C. RABELER, P.E.
FRANCIS P. WIDHIS, P.E.
TIMOTHY R. BEDENIS, P.E.
CHERYL KERRES DIETRICH
PAUL C. LARSEN, P.E.
TIMOTHY J. MITCHELL, P.E.
JOHN C. ZAHZECKI, C.W.I.

CONSULTANT
ULRICH W. STOLL, P.E.

ANN ARBOR
BATTLE CREEK
BAY CITY
INDIANAPOLIS
LANSING

August 10, 1987

Ms. Helen M. Himes, P.E.
Charles S. Davis Associates, Inc.
220 Bagley, Suite 700
Detroit, Michigan 48226

RE: Geotechnical Investigation
Memorial Park Marina
Detroit, Michigan
SME Project No. E/10579

Dear Ms. Himes:

We have completed our geotechnical investigation for the proposed Memorial Park Marina expansion, to be constructed in Detroit, Michigan. This letter presents the results of our field investigation and our comments concerning design and construction of sheet pile retaining walls. An environmental evaluation was also requested. The results of the soils chemical analysis are not yet available at the time of writing, and will be sent to you later as an addendum to this letter.

Project Information

The site is located at Memorial Park, south of Jefferson Avenue and between Burns Street and Marina Drive, in Detroit, Michigan. Based on the site plan, provided by Charles S. Davis and Associates (the Engineer), the site generally slopes down from north to south, with ground surface elevations varying from about 117 feet DCD to about 97 DCD along the Detroit River. The water level of the Detroit River is currently at about 98 DCD.

We understand the proposed development is to consist of extending the existing marina basin to the west, into the area which is currently being used as recreational land. Based on the conceptual plan provided to us by the Engineer, piers with boat slips will extend westward from the retaining wall at the east side of the basin. The slips will be reached by channels running along the north, west, and south ends of the basin, and between the boat slip piers. Parking for passenger vehicles could be within about 20 feet of the west wall of the marina basin.

Steel sheeting is to be used for construction of retaining walls. The top of the sheeting is to be about elevation 101 feet, DCD. Proposed channel depths below low water level (LWL) are as follows: boat slips, 5 feet; channels, 7 feet; main channel, 10 feet. LWL is about elevation 93.25 DCD, and High Water Level (HWL) is about elevation 98.2 DCD.

Field Operations

The number and depth of the borings were selected by the Engineer, with input from SME. The boring locations were selected by the Engineer. Three soil borings were performed at the site for this investigation, extending to depths of 40 to 45 feet below the existing ground surface. The borings were drilled by SME at points close to the planned locations. Boring locations were controlled by drilling equipment access. Ground surface elevations were interpolated from contour elevations on the site plan prepared by the Engineer.

The soil borings were drilled using a truck-mounted rotary type drilling rig. The bore holes were advanced to the sampling depths using continuous flight hollow stem augers. The borings included soil sampling in general accordance with ASTM Standard D-1586 (split-barrel sampling procedures). Results of the boring data showing materials encountered, penetration resistances obtained in the soil and other pertinent field observations made during the drilling operations are included on the logs at the end of this letter.

Groundwater measurements were also obtained in the bore holes during and after completion of drilling at each location. Since the bore holes were backfilled soon after drilling, long term water level information is not available from these borings.

An explosive gas indicator was placed in each borehole to detect the presence of explosive gas escaping from the boreholes.

Laboratory Testing

The soil samples were sealed in glass jars in the field and brought to the laboratory for further examination and testing. Also, samples of the fill materials have been subjected to a soils chemical analysis. The results of the chemical analysis tests are not available at the time of this writing, and will be sent when they are available.

The soil samples were classified in the laboratory by a geotechnical engineer in general accordance with the Unified Soil

Classification System. The general testing program consisted of performing moisture content, and hand penetrometer and/or Torvane shear tests upon portions of the cohesive samples obtained. In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to penetration of a small calibrated spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tsf. In the Torvane shear test, the shear strength of a cohesive soil sample is estimated by measuring the torque applied to a small spring loaded vane which is inserted into the soil sample. The shear strength of a cohesive sample is equal to one-half the unconfined compression strength. The Torvane is generally used to test the strength of softer clays.

Subsurface Conditions

A. Soil Conditions

The soil conditions encountered at the boring locations can be summarized as follows. Mixed sand, clay, and rubble fill or possible fill extended to depths of 13 to 16 feet below the existing ground surface. At Boring 1, clayey sand was observed underlying the fill materials to a depth of 18 feet, which was underlain by silty clay to the explored depth of the boring. At Boring 2, the fill was underlain by clayey silt to 24 feet, followed by sand to 27 feet, and finally underlain by silty clay to the explored depth of the boring. At Boring 3, underlying the fill to the explored depth of the boring was silty clay.

The fill material was very loose to medium dense, with Standard Penetration Test resistances (N-values) of 4 to 17 blows per foot. The moisture content of the fill generally varied from about 12 to 27 percent.

The natural sand soils in Borings 1 and 2 were very loose to loose, with N-values of 4 and 9 blows per foot. The clayey silt was soft, with a shear strength of about 200 psf, and a moisture content of about 48 percent.

The silty clay layer encountered at a depth of about 15 feet in Boring 3 was very stiff, with unconfined compression strengths of 3-1/2 and 2-1/2 tsf, and moisture contents of about 16 and 17 percent. The underlying silty clay soils in Boring 3 and silty clay soils in the other borings, were soft to medium, with shear strengths of about 300 to 800 psf, and moisture contents of about 12 to 37 percent.

Please refer to the boring logs for the specific details of the soil conditions at the respective boring locations. Stratification lines on the boring logs indicate a general transition between soil types. They are not intended to show an area of exact geological change.

B. Groundwater Conditions

Groundwater was encountered at depths of 3.5 to 9 feet below the existing ground surface (elevations 96 to 101, DCD) during the drilling operations. Water was encountered at depths of 3 to 28 feet (elevations 82 to 96, DCD) immediately after completion of the drilling operations.

Based on the available information, we believe the water level at this site to be about elevation 98 feet, DCD, which is about the current level of the Detroit River. Due to the proximity of this site to the Detroit River, we believe the groundwater levels are primarily influenced by the water level of the river. The long term hydrostatic groundwater level should be expected to fluctuate on a seasonal and long term basis with variations in precipitation, evaporation and surface run-off.

C. Explosive Gas

Based on the results of our explosive gas indicator, explosive gas mixtures were not encountered in any of the three soil borings.

D. Chemical Testing Results

At the time of this writing, the results from the chemical testing of selected samples of the existing fill materials was not complete. We shall submit the analysis of the test results in a subsequent letter, after they become available.

Analysis and Recommendations

Based upon the soil boring information and our understanding of the proposed project, as mentioned herein, we present the following preliminary geotechnical recommendations related to design and construction of marina retaining walls. The analyses and recommendations in this letter are preliminary in nature, and should not be used for specific design purposes. After the design criteria are more complete, additional soil borings should be performed in areas where the retaining walls will be constructed. If the conceptual design is incorrect or changed subsequent to our reporting, or if conditions during construction

are found to be significantly different from those encountered in our borings, we should be contacted so we may re-evaluate our recommendations to the extent dictated.

A. Marina Design

Based on the project construction as described herein, and the conceptual plan provided to us by the Engineer, we understand piers for boat slips will extend perpendicular to the marina retaining walls. Thus, the walls will be mainly in channel areas, where 7 to 10 feet of channel depth is required below LWL.

Given the available project information and the soil boring conditions, we believe several types of construction could be used for retaining wall. These types basically fall into two categories; cantilevered and anchored bulkheads.

1. Cantilevered Walls

Due to the marina configuration and the soil conditions, a typical free standing cantilevered steel sheetpile retaining wall does not appear cost effective, and may not be technically feasible. With water depths of 10 feet for LWL conditions in the main channel, support of the retaining wall may be difficult because of the weak underlying soils.

We believe cantilevered walls could be successfully utilized if a stabilizing berm is used in front of the wall. The berm, consisting of (nominally) 6 inch size crushed stone or rip-rap, would provide the resistance necessary for support. Preliminarily, we anticipate a stone berm depth of about 8 feet in thickness, projecting about 25 to 35 feet away from the wall would be necessary in combination with cantilevered sheet piles of about 40 to 50 feet in length.

Adequate stability must be provided during all phases of construction. Since the stone berm would be necessary to provide sufficient stability to the wall, it will be necessary to install the berm before the sheeting is fully loaded (phased loading) or provide temporary tiebacks until the stone berm is in place. For phased loading of the wall, the construction sequence could be as follows: excavate behind the proposed wall; install the sheeting; dredge and place the stone berm in front of the wall; and then backfill behind the wall. For the temporary tiebacks, the construction sequence could be: install the sheeting, temporary tiebacks and anchors; dredge in front of wall and place stone berm, remove tieback and anchors.

Any excavations behind the wall, before or after the wall is installed, should be refilled with an approved granular material.

2. Anchored Sheetpile Wall

For an anchored sheetpile wall design, the sheeting is held near the top with tie bars or cables connected to anchors, located some distance behind the wall. The anchors typically consist of concrete deadmen or another sheetpile wall, installed below grade. Based on the conceptual plan, we do not anticipate serious problems with locating anchors on this site.

The thickness and nature of the fill in the marina area may require relatively large or deep deadman or sheetpile anchors. If an anchored alternative is selected, we recommend test pits be performed along the anchor line to determine the depth and consistency of the fill materials. Based on the properties of the soil, an anchor design may then be performed.

We preliminarily anticipate sheet pile lengths of 30 to 40 feet could be used with a properly designed anchor system.

B. Construction Considerations

We anticipate some problems with excavation during the construction at this site. A relatively large amount of material will have to be excavated and removed. We anticipate this material will primarily consist of rubble fill. The materials excavated should be handled and disposed of in a proper manner in accordance with governing regulations.

The excavation contractor should be prepared with suitable equipment to excavate and remove large pieces of concrete, wood, wood piles, etc., during mass excavation.

Obstructions could be encountered during the installation of sheetpiles. The riverfront of Detroit has a long history of development and industrial activity. Although a records search was not performed for this project, we believe it may be possible old timber pile foundations could be encountered during driving of the sheetpiling. Efforts should be made to locate and remove old timber piles or other large obstructions which may interfere with sheetpile installation during the mass excavation. Also, the contractor who installs the sheetpiling should be aware of the possibility of large obstructions, and should be prepared to remove them once encountered.

All excavations will require adequate slopes or shoring for slope stability. All excavations should be sloped as necessary to comply with MI-OSHA requirements. If dictated by the ground conditions, an adequately constructed and braced shoring system should be provided for employees working in an excavation that may expose employees to the danger of moving ground. If material is stockpiled or heavy equipment is operated near an excavation, stronger shoring must be used to resist the extra pressure due to superimposed loads.

C. Additional Investigation

Sheeting lengths and other recommendations contained in this letter are considered preliminary in nature. They are intended for feasibility and estimating purposes only, and should not be construed as specific design recommendations.

Factors affecting sheetpile design include (but are not limited to) soil strength parameters and surcharge loads behind walls, such as landscaped berms and parking areas. For soft clay soils encountered in the soil borings, relatively small changes in strength parameters can have a significant affect on sheetpile lengths and design considerations. After the project plans are more complete, we recommend additional soil borings be performed along the marina basin walls to resolve the design factors. Also, we recommend more specialized soil sampling and testing procedures should be used. This would include Shelby tube sampling to obtain larger, relatively undisturbed samples of the cohesive soils below the fill; and triaxial shear tests in the laboratory, to more accurately determine strength parameters. SME would be pleased to provide these services.

D. Construction Quality Control

SME should be given the opportunity to review the project plans and specifications to verify the project is as anticipated when our preliminary design recommendations were provided and our recommendations were properly incorporated. In addition, SME should be used during construction to monitor all site preparation activities and retaining wall installation activities.

General Comments

This letter report has been prepared in accordance with generally accepted geotechnical engineering practices to aid in the evaluation of this property and to assist in the design of this project. This report, with its recommendations and conclusions, should be considered preliminary in nature. In the event of

changes in the design criteria, the conclusions and recommendations contained in this letter shall not be considered valid unless the changes are reviewed, and the conclusions of this report are modified or approved in writing by our office.

The analysis and recommendations submitted in this letter are based upon the data obtained from the three soil borings performed at the approximate locations indicated on the appended location plan. This report does not reflect variations which may occur between the borings. The nature and extent of the variations may not become evident until the time of construction. If significant variations then become evident, it may be necessary for us to re-evaluate the recommendations of this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of soil and foundation engineering. Specifically, field logs are prepared during the drilling and sampling operations that describe field occurrences, sampling locations, and other information. However, the samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the final logs. The engineer preparing the report reviews the field logs, laboratory classifications and test data and then prepares the final boring logs. Our recommendations are based on the contents of the final logs and the information contained therein.

We appreciate the opportunity to serve you during this phase of the project. If there are any questions concerning this letter, please contact us.

Very truly yours,

SOIL AND MATERIALS ENGINEERS, INC.

Theodore A. Janish
Geotechnical Engineer

Garrett H. Evans, P.E.
Principal Engineer

Enclosures

2 pc: enclosed

IMPORTANT INFORMATION
ABOUT YOUR
GEOTECHNICAL ENGINEERING REPORT

More construction problems are caused by site subsurface conditions than any other factor. As troublesome as subsurface problems can be, their frequency and extent have been lessened considerably in recent years, thanks to the Association of Soil and Foundation Engineers (ASFE).

When ASFE was founded in 1969, subsurface problems were frequently being resolved through lawsuits. In fact, the situation had grown to such alarming proportions that consulting geotechnical engineers had the worst professional liability record of all design professionals. *By 1980, ASFE-member consulting soil and foundation engineers had the best professional liability record.* This dramatic turn-about can be attributed directly to client acceptance of problem-solving programs and materials developed by ASFE for its members' application. *This acceptance was gained because clients perceived the ASFE approach to be in their own best interests.* Disputes benefit only those who earn their living from others' disagreements.

The following suggestions and observations are offered to help you reduce the geotechnical-related delays, cost-overruns and other costly headaches that can occur during a construction project.

A GEOTECHNICAL ENGINEERING REPORT IS BASED ON A UNIQUE SET OF PROJECT-SPECIFIC FACTORS

A geotechnical engineering report is based on a subsurface exploration plan designed to incorporate a unique set of project-specific factors. These typically include: the general nature of the structure involved, its size and configuration; the location of the structure on the site and its orientation; physical concomitants such as access roads, parking lots, and underground utilities; and the level of additional risk which the client assumed by virtue of limitations imposed upon the exploratory program. To help avoid costly problems, consult the geotechnical engineer to determine how any factors which change subsequent to the date of his report may affect his recommendations.

Unless your consulting geotechnical engineer indicates otherwise, *your geotechnical engineering report should not be used:*

- When the nature of the proposed structure is changed, for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one;
- when the size or configuration of the proposed structure is altered;
- when the location or orientation of the proposed structure is modified;
- when there is a change of ownership, or
- for application to an adjacent site.

A geotechnical engineer cannot accept responsibility for problems which may develop if he is not consulted after factors considered in his report's development have changed.

MOST GEOTECHNICAL "FINDINGS" ARE PROFESSIONAL ESTIMATES

Site exploration identifies actual subsurface conditions only at those points where samples are taken, when they are taken. Data derived through sampling and subsequent laboratory testing are extrapolated by the geotechnical engineer who then renders an opinion about overall subsurface conditions, their likely reaction to proposed construction activity, and appropriate foundation design. Even under optimal circumstances actual conditions may differ from those opined to exist, because no geotechnical engineer, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. For example, the actual interface between materials may be far more gradual or abrupt than the report indicates, and actual conditions in areas not sampled may differ from predictions. *Nothing can be done to prevent the unanticipated, but steps can be taken to help minimize their impact.* For this reason, *most experienced owners retain their geotechnical consultant through the construction stage,* to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

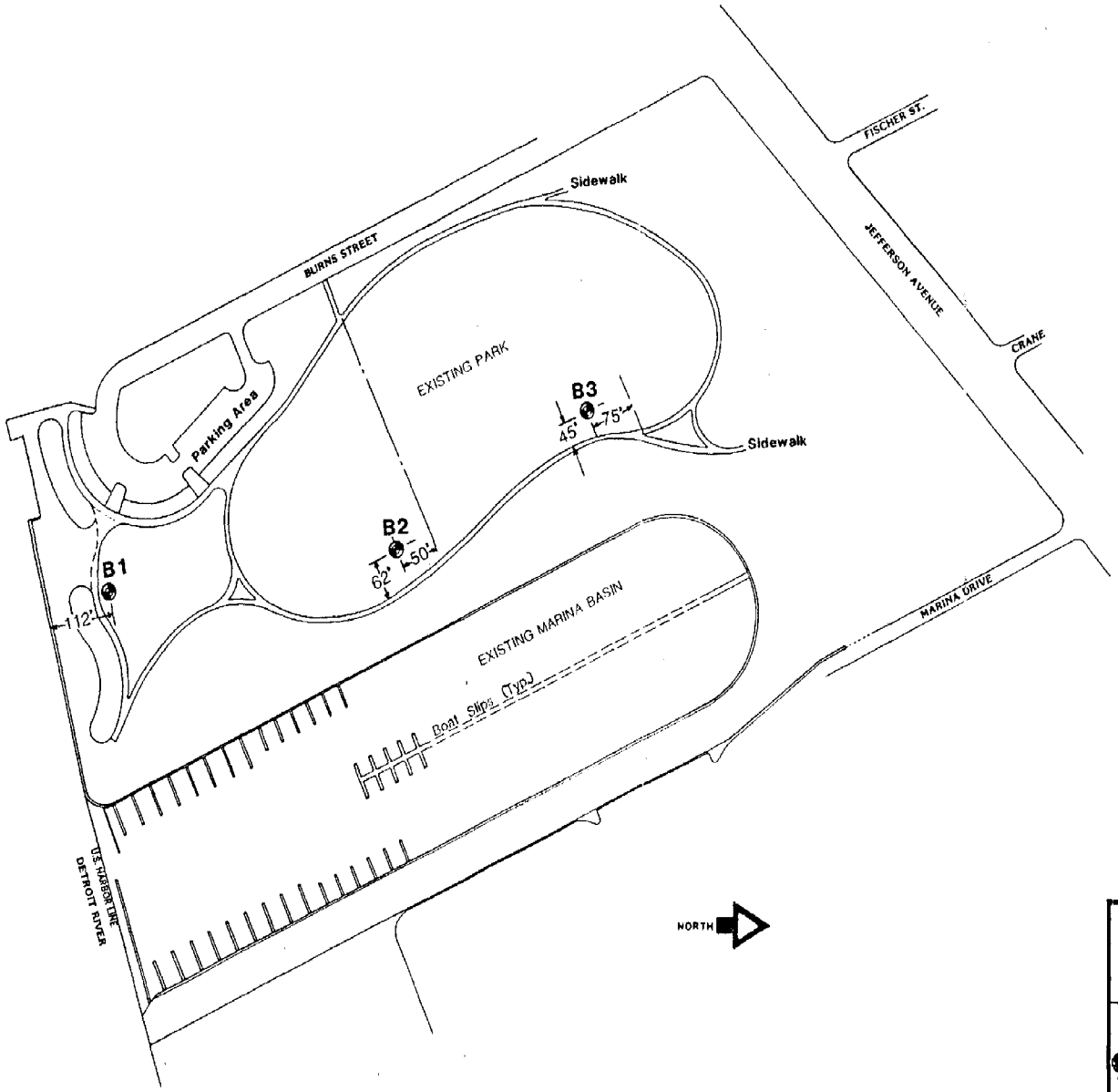
SUBSURFACE CONDITIONS CAN CHANGE

Subsurface conditions may be modified by constantly-changing natural forces. Because a geotechnical engineering report is based on conditions which existed at the time of subsurface exploration, *construction decisions should not be based on a geotechnical engineering report whose adequacy may have been affected by time.* Speak with the geotechnical consultant to learn if additional tests are advisable before construction starts.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

A GEOTECHNICAL ENGINEERING REPORT IS SUBJECT TO MISINTERPRETATION

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical engineering report. To help avoid these problems, the geotechnical engineer should be retained to work with other appropriate design professionals to explain relevant geotechnical findings and to review the adequacy



SOIL BORING LOCATION DIAGRAM
MEMORIAL MARINA
DETROIT, MICHIGAN

soil and materials engineers, inc	ANN ARBOR BATTLE CREEK BAY CITY LANSING LIVONIA	Date 8/6/87 Drawn By CB Scale 1":200' Job E 10579

soil and materials engineers, inc

general notes

Drilling & Sampling Symbols

SS – Split-Spoon - 1⅜" I.D., 2" O.D. except where noted
ST – Shelby Tube - 2" O.D. except where noted
PS – Piston Sample - 3" diameter
AS – Power Auger Sample
WS – Wash Sample
HA – Hand Auger Sample
BS – Miscellaneous Bag or Bottle Sample
NR – No Recovery
RC – Rock Core with diamond bit, NX size, except where noted
RB – Rock Bit

Standard "N" Penetration – Blows per foot of a 140 pound hammer falling 30 inches on a 2 inch O.D. split spoon, except where noted.

Water Level Measurement Symbols

WL – Water Level
WCI – Wet Cave In
DCI – Dry Cave In
WS – While Sampling
WD – While Drilling
BCR – Before Casing Removal
ACR – After Casing Removal
AB – After Boring

Particle Sizes

Boulders – Greater than 12" (305 mm)
Cobbles – 3" (76.2mm) to 12" (305mm)
Gravel - Coarse – ¾" (19.05 mm) to 3" (76.2 mm)
Gravel - Fine – No. 4 (3/16") (4.75mm) to ¾" (19.05mm)
Sand Coarse – No. 10 (2.00mm) to No. 4 (4.75mm)
Sand Medium – No. 40 (0.425mm) to No. 10 (2.00mm)
Sand Fine – No. 200 (0.074mm) to No. 40 (0.425mm)
Silt – 0.005mm to 0.074 mm
Clay – Less than 0.005 mm

Water levels indicated on the boring logs are the levels measured in the boring at the times indicated. The accurate determination of ground water levels may not be possible with short term observations especially in impervious soils. The levels shown may fluctuate throughout the year with variations in precipitation, evaporation, and runoff.

Classification

Cohesionless Soils

Very Loose	:	0 to 4 Blows
Loose	:	5 to 9 Blows
Medium Dense	:	10 to 29 Blows
Dense	:	30 to 49 Blows
Very Dense	:	50 to 80 Blows
Extremely Dense	:	Over 80 Blows

Cohesive Soils

CONSISTENCY		UNCONFINED COMPRESSIVE STRENGTH
Very Soft	:	Less than 0.25 tons/ft²
Soft	:	0.25 to 0.49 tons/ft²
Medium	:	0.50 to 0.99 tons/ft²
Stiff	:	1.00 to 1.99 tons/ft²
Very Stiff	:	2.00 to 3.99 tons/ft²
Hard	:	Greater than 4.00 tons/ft²

Soil Constituents

"Trace"		Less than 10%
"Trace to Some"	:	10% to 20%
"Some"	:	20% to 35%
"And"	:	35% to 60%

Soil Description

If clay content is sufficient so that clay dominates soil properties then clay becomes the primary noun with the other major soil constituent as modifier, ie. silty clay. Other minor soil constituents may be added according to estimates of soil constituents present, ie. silty clay, trace to some sand, trace gravel.

OWNER
City of Detroit

ARCHITECT / ENGINE .
Charles S. Davis & Associates, Inc.

LOCATION
Detroit, Michigan

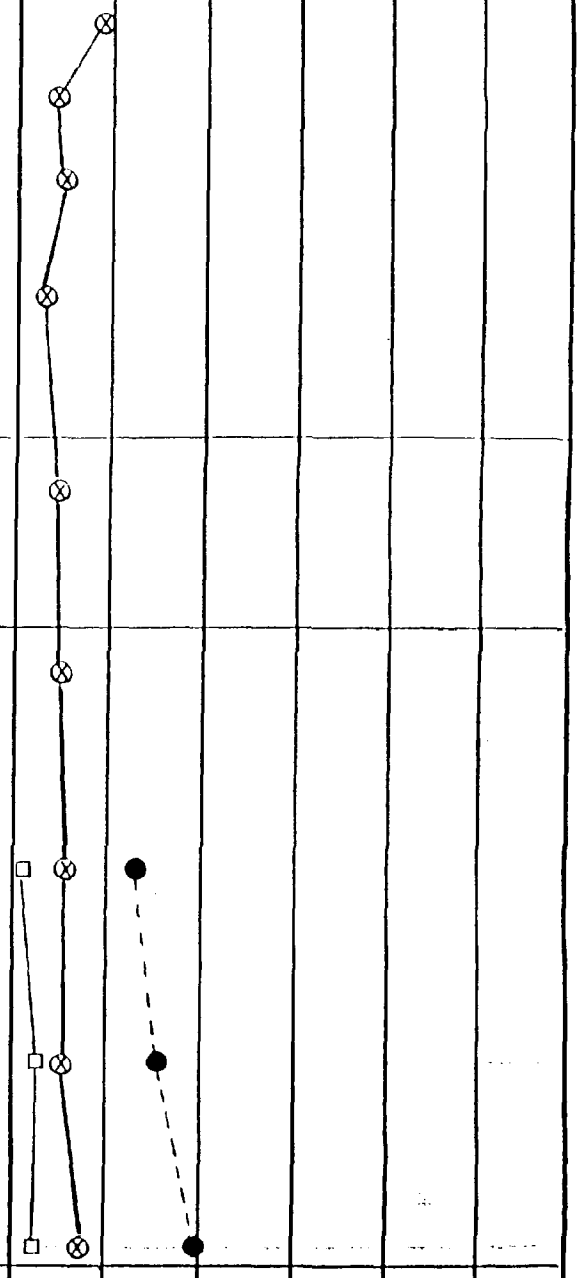
PROJECT NAME
Memorial Park Marina

LEGEND
- STANDARD PENETRATION, "N" (BLOWS/FT)
- NATURAL WATER CONTENT, %
- TORVANE SHEAR STRENGTH (tsf)
- UNCONFINED COMPRESSIVE STRENGTH (tsf)
- CALIBRATED HAND PENETROMETER STRENGTH (tsf)

SCALE: 1 2 3 4 5 tsf; 10 20 30 40 50 %, N

SURFACE ELEVATION 99±DCD

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
1	SS	■		Mixed Sand, Clay, and Rubble Fill- Pieces of Concrete and Brick - Dark Brown - Moist to Wet - Loose to Very Loose - (SP-CL-Fill)	
2	SS	■			
			5		
3	SS	■			
4	SS	■	10		
5	SS	■	15	Clayey Fine Sand - Trace to Some Silt - With Shell Fragments, Root Fibers and Occasional Clay Seams- Grey - Wet - Very Loose - (SC)	
6	SS	■	20		
7	SS	■	25	Silty Clay - Trace Sand and Gravel With Occasional Silt and Sand Seams - Grey - Soft - (CL)	
8	SS	■	30		
9	SS	■	35		



- CONTINUED ON NEXT PAGE -

OWNER	ARCHITECT / ENGINEER
City of Detroit	Charles S. Davis & Associates, Inc.
LOCATION	**PROJECT NAME**
Detroit, Michigan	Memorial Park Marina

LEGEND
- STANDARD PENETRATION, "N" (BLOWS/FT.)
- NATURAL WATER CONTENT, %
- TORVANE SHEAR STRENGTH (tsf)
- UNCONFINED COMPRESSIVE STRENGTH (tsf)
- CALIBRATED HAND PENETROMETER STRENGTH (tsf)

SCALE: 1 2 3 4 5 tsf; 10 20 30 40 50 %,N

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
				SURFACE ELEVATION 99±DCD	
				- CONTINUED FROM FIRST PAGE -	
			35		
10	SS	■	40	Silty Clay - Trace Sand and Gravel - With Occasional Silt and Sand Seams - Grey - Soft - (CL)	
11	SS	■	45		
				- END OF BORING -	

NOTE: The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

MINERAL WELL PERMIT NO.

WATER LEVEL OBSERVATIONS

3.5' WHILE SAMPLING OR WHILE DRILLING
3' IMMEDIATELY AFTER COMPLETION
____ ____ AFTER COMPLETION

BORING STARTED	7-23-87
BORING COMPLETED	7-23-87
RIG: #72	DRAWN BY: CB
FOREMAN: JH	APPROVED: WD/TJ
JOB: E10579	SHEET: 2 of 2

NOTE: Boring backfilled with natural soils unless otherwise noted.

soil and materials engineers, inc

OWNER
City of Detroit

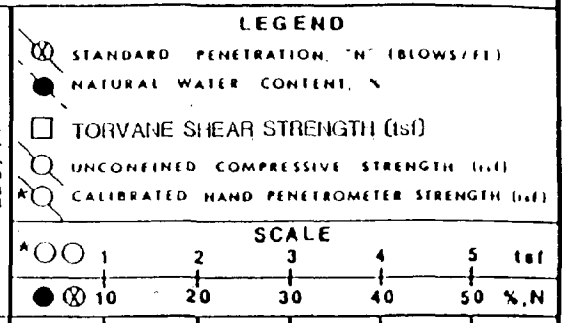
ARCHITECT / ENGINE
Charles S. Davis & Associates, Inc.

LOCATION
Detroit, Michigan

PROJECT NAME
Memorial Park Marina

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
				SURFACE ELEVATION 107±DCD	
1	SS	■		Mixed Sand, Clay, and Rubble Fill- With Pieces of Brick and Concrete- Dark Brown - Medium Dense - (SP-CL-Fill)	
2	SS	■			
			5		
3	SS	■			
4	SS	■	10	Organic Clayey Silt - With Pieces of Wood - Trace Sand and Gravel - Black to Wet - Loose - (OL - Possible Fill)	
5	SS	■	15		
6	SS	■	20	Clayey Silt - With Root Fibers - Trace Sand - Discolored Gray - Soft - (ML - OL)	
7	SS	■	25	Clayey Fine to Medium Sand - Trace Gravel - Grey - Wet - Loose - (SC)	
8	SS	■	30	Silty Clay - Trace Sand and Gravel- With Occasional Sand and Silt Seams - Grey - Soft - (CL)	
9	SS	■	35		

- CONTINUED ON NEXT PAGE -



OWNER	ARCHITECT / ENGINEER
City of Detroit	Charles S. Davis & Associates, Inc.
LOCATION	**PROJECT NAME**
Detroit, Michigan	Memorial Park Marina

LEGEND
- ⊗ STANDARD PENETRATION, "N" (BLOWS/FT.)
- ● NATURAL WATER CONTENT, %
- □ TORVANE SHEAR STRENGTH (tsf)
- ○ UNCONFINED COMPRESSIVE STRENGTH (tsf)
- *○ CALIBRATED HAND PENETROMETER STRENGTH (tsf)

SCALE: *○○ 1 2 3 4 5 tsf; ● ⊗ 10 20 30 40 50 %, N

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
				SURFACE ELEVATION 107±DCD	
				- CONTINUED FROM FIRST PAGE -	
			35	Silty Clay - Trace Sand and Gravel - With Occasional Sand and Silt Seams - Grey - Soft - (CL)	
10	SS	■			
			40	- END OF BORING -	

NOTE: The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

MINERAL WELL PERMIT NO.

WATER LEVEL OBSERVATIONS

8' WHILE SAMPLING OR WHILE DRILLING
18' IMMEDIATELY AFTER COMPLETION
____ ____ AFTER COMPLETION

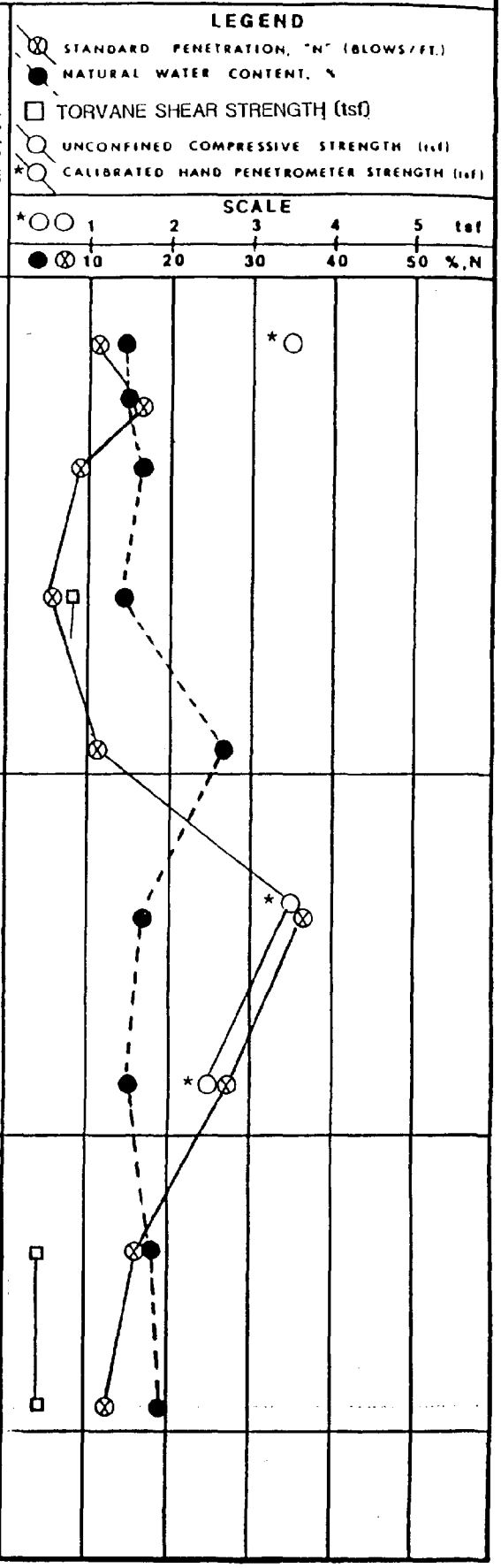
BORING STARTED	7-22-87
BORING COMPLETED	7-22-87
RIG: #72	DRAWN BY: CB
FOREMAN: JH	APPROVED: RH/TJ
JOB: E10579	SHEET: 2 of 2

NOTE: Boring backfilled with nat

soil and materials engineers, inc

OWNER	ARCHITECT / ENGINI
City of Detroit	Charles S. Davis & Associates, Inc.
LOCATION	**PROJECT NAME**
Detroit, Michigan	Memorial Park Marina

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
				SURFACE ELEVATION 110±DCD	
1	SS	■		Mixed Clay, Sand, and Rubble Fill- With Pieces of Slag and Concrete - Black - Medium Dense to Loose - (CL-SP-Fill)	
2	SS	■			
3	SS	■	5		
4	SS	■	10		
5	SS	■	15		
6	SS	■	20	Silty Clay - Occasional Grey Silt Seams - Trace Sand and Gravel - Mottled Brown and Grey - Very Stiff - (CL)	
7	SS	■	25		
8	SS	■	30	Silty Clay - Trace Sand and Gravel - Brown to Grey - Medium to Soft - (CL)	
9	SS	■	35		



- CONTINUED ON NEXT PAGE -

OWNER	ARCHITECT / ENGINEER
City of Detroit	Charles S. Davis & Associates, Inc.
LOCATION	**PROJECT NAME**
Detroit, Michigan	Memorial Park Marina

LEGEND
- STANDARD PENETRATION, "N" (BLOWS/FT.)
- NATURAL WATER CONTENT, %
- ATTERBERG LIMITS P.L.% L.L.%
- UNCONFINED COMPRESSIVE STRENGTH (tsf)
- CALIBRATED HAND PENETROMETER STRENGTH (tsf)

SCALE: * 1 2 3 4 5 tsf; 10 20 30 40 50 %,N

SAMPLE NUMBER	SAMPLE TYPE	SAMPLE DISTANCE	DEPTH IN FEET	DESCRIPTION OF MATERIAL	UNIT DRY WT. LBS/FT³
				SURFACE ELEVATION 110±DCD	
				- CONTINUED FROM FIRST PAGE -	
			35	Silty Clay - Trace Sand and Gravel - Brown to Grey - Medium to Soft - (CL)	
10	SS		40		
				END OF BORING	

NOTE: The indicated stratification lines are approximate. In situ, the transition between materials may be gradual.

MINERAL WELL PERMIT NO.

WATER LEVEL OBSERVATIONS

9' WHILE SAMPLING OR WHILE DRILLING
28' IMMEDIATELY AFTER COMPLETION
____ ____ AFTER COMPLETION

BORING STARTED	7-22-87
BORING COMPLETED	7-22-87
RIG: #72	DRAWN BY: CB
FOREMAN: JH	APPROVED: RH/TJ
JOB: E10579	SHEET: 2 of 2

NOTE: Boring backfilled with nat-

soil and materials engineers, inc

AMERICAN SOCIETY FOR TESTING AND MATERIALS
16 Race St., Philadelphia, Pa. 19103
Reprinted from Copyrighted 1981 Book of ASTM Standards, Part 19

Standard Method for
PENETRATION TEST AND SPLIT-BARREL SAMPLING OF SOILS[1]

ASTM Designation: D 1586-67 (Reapproved 1974)

This Standard of the American Society for Testing and Materials is issued under the fixed designation D 1586; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval.

This method has been approved for use by agencies of the Department of Defense and for listing in the DoD Index of Specifications and Standards.

1. Scope

1.1 This method describes a procedure for using a split-barrel sampler to obtain representative samples of soil for identification purposes and other laboratory tests, and to obtain a measure of the resistance of the soil to penetration of the sampler.

2. Apparatus

2.1 *Drilling Equipment*—Any drilling equipment shall be acceptable that provides a reasonably clean hold before insertion of the sampler to ensure that the penetration test is performed on undisturbed soil, and that will permit the driving of the sampler to obtain the sample and penetration record in accordance with the procedure described in Section 3. To avoid "whips" under the blows of the hammer, it is recommended that the drill rod have a stiffness equal to or greater than the A-rod. An "A" rod is a hollow drill rod or "steel" having an outside diameter of 1 5/8 in. (41.2 mm) and an inside diameter of 1 1/8 in. (28.5 mm), through which the rotary motion of drilling is transferred from the drilling motor to the cutting bit. A stiffer drill rod is suggested for holes deeper than 50 ft (15 m). The hole shall be limited in diameter to between 2 1/4 and 6 in. (57.2 and 152 mm).[2]

2.2 *Split-Barrel Sampler*—The sampler shall be constructed with the dimensions indicated in Fig. 1. The drive shoe shall be of hardened steel and shall be replaced or repaired when it becomes dented or distorted. The coupling head shall have four 1/2-in. (12.7-mm) (minimum diameter) vent ports and shall contain a ball check valve. If sizes other than the 2-in. (50.8-mm) sampler are permitted, the size shall be conspicuously noted on all penetration records.

2.3 *Drive Weight Assembly*—The assembly shall consist of a 140-lb (63.5-kg) weight, a driving head, and a guide permitting a free fall of 30 in. (0.76 m). Special precautions shall be taken to ensure that the energy of the falling weight is not reduced by friction between the drive weight and the guides.

2.4 *Accessory Equipment*—Labels, data sheets, sample jars, paraffin, and other necessary supplies should accompany the sampling equipment.

3. Procedure

3.1 Clear out the hole to sampling elevation using equipment that will ensure that the material to be sampled is not disturbed by the operation. In saturated sands and silts withdraw the drill bit slowly to prevent loosening of the soil around the hole. Maintain the water level in the hole at or above ground water level.

3.2 In no case shall a bottom-discharge bit be permitted. (Side-discharge bits are permissible.) The process of jetting through an open-tube sampler and then sampling when the desired depth is reached shall not be permitted. Where casing is used, it may not be driven below sampling elevation. Record any loss of circulation or excess pressure in drilling fluid during advancing of holes.

3.3 With the sampler resting on the bottom of the hole, drive the sampler with blows from the 140-lb (63.5-kg) hammer falling 30 in. (0.76 m) until either 18 in. (0.45 m) have been penetrated or 100 blows have been applied.

3.4 Repeat this operation at intervals not longer than 5 ft (1.5 m) in homogeneous strata and at every change of strata.

3.5 Record the number of blows required to effect each 6 in. (0.15 m) of penetration or fractions thereof. The first 6 in. (0.15 m) is considered to be a seating drive. The number of blows required for the second and third 6 in. (0.15 m) of penetration added is termed the penetration resistance, N. If the sampler is driven less than 18 in. (0.45 m), the penetration resistance is that for the last 1 ft (0.30 m) of penetration (if less than 1 ft (0.30 m) is penetrated, the logs shall state the number of blows and the fraction of 1 ft (0.30 m) penetrated).

3.6 Bring the sampler to the surface and open. Describe carefully typical samples of soils recovered as to composition, structure, consistency, color, and condition; then put into jars without ramming. Seal them with wax or hermetically seal to prevent evaporation of the soil moisture. Affix labels to the jar or make notations on the covers (or both) bearing job designation, boring number, sample number, depth penetration record, and length of recovery. Protect samples against extreme temperature changes.

4. Report

4.1 Data obtained in borings shall be recorded in the field and shall include the following:

4.1.1 Name and location of job,

4.1.2 Date of boring—start, finish,

4.1.3 Boring number and coordinate, if available,

4.1.4 Surface elevation, if available,

4.1.5 Sample number and depth,

4.1.6 Method of advancing sampler, penetration and recovery lengths,

4.1.7 Type and size of sampler,

4.1.8 Description of soil,

4.1.9 Thickness of layer,

4.1.10 Depth to water surface; to loss of water; to artesian head; time at which reading was made,

4.1.11 Type and make of machine,

4.1.12 Size of casing, depth of cased hole,

4.1.13 Number of blows per 6 in. (0.15 m),

4.1.14 Names of crewmen, and

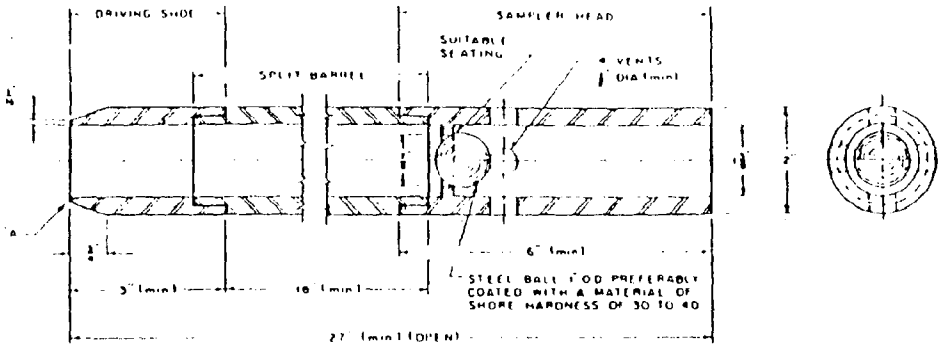
4.1.15 Weather, remarks.

---

[1] This method is under the jurisdiction of ASTM Committee D-18 on Soil and Rock.

Current edition approved Oct. 20, 1967. Originally issued 1958. Replaces D 1586 - 64 T.

[2] Hvorslev, M. J., *Surface Exploration and Sampling of Soils for Civil Engineering Purposes*, The Engineering Foundation, 345 East 47th St., New York, N. Y. 10017



NOTE 1—Split barrel may be 1½ in. inside diameter provided it contains a liner of 16 gage wall thickness.
NOTE 2—Core retainers in the driving shoe to prevent loss of sample are permitted.
NOTE 3—The corners at *A* may be slightly rounded.

Metric Equivalents

in	mm	in	mm
1/16 (16 gage)	1.5	2	50.8
½	12.7	3	76.2
¾	19.0	6	152.4
⅞	22.2	18	457.2
1⅜	34.9	27	685.8
1½	38.1		

FIG. 1 Standard Split Barrel Sampler Assembly.

The American Society for Testing and Materials takes no position respecting the validity of any patent rights asserted in connection with any item mentioned in this standard. Users of this standard are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

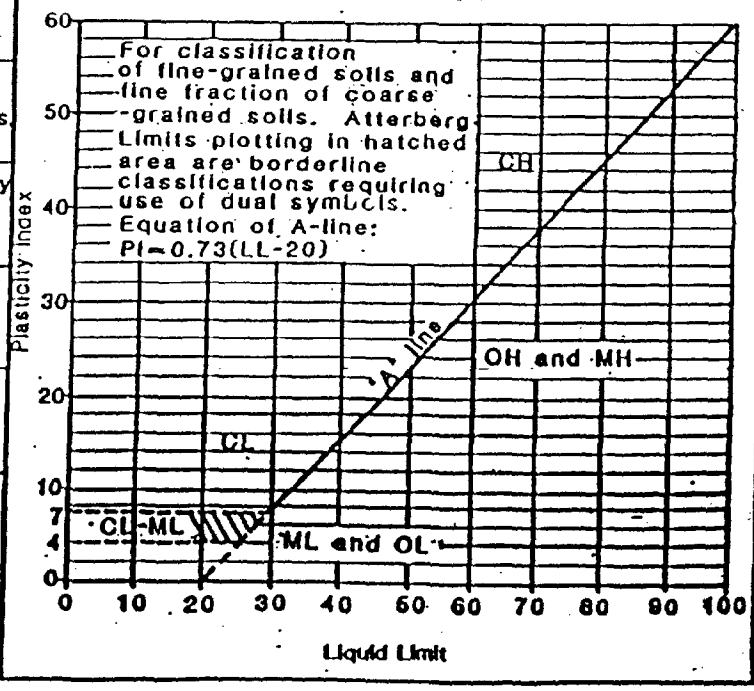
This standard is subject to revision at any time by the responsible technical committee and must be reviewed every five years and if not revised, either reapproved or withdrawn. Your comments are invited either for revision of this standard or for additional standards and should be addressed to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee, which you may attend. If you feel that your comments have not received a fair hearing you should make your views known to the ASTM Committee on Standards, 1916 Race St., Philadelphia, Pa. 19103, which will schedule a further hearing regarding your comments. Failing satisfaction there, you may appeal to the ASTM Board of Directors.

soil and materials gineers, inc

unified soil classification system

Major divisions			Group symbols	Typical names	Laboratory classification criteria		
Coarse-grained soils (More than half of material is larger than No. 200 sieve size)	Gravels (More than half of coarse fraction larger than No. 4 sieve size)	Clean gravels (Little or no fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% . . . . . GW,GP,SW,SP; More than 12% . . . . . GM,GC,SM,SC; 5 to 12% . . . . . Borderline cases requiring dual symbols	$Cu=\frac{D_{60}}{D_{10}}$ greater than 4; $Cc=\frac{(D_{30})^2}{D_{10}\times D_{60}}$ between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM d / u	Silty gravels, gravel-sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
	Sands (More than half of coarse fraction is smaller than No. 4 sieve size)	Clean sands (Little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines		$Cu=\frac{D_{60}}{D_{10}}$ greater than 6; $Cc=\frac{(D_{30})^2}{D_{10}\times D_{60}}$ between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM d / u	Silty sands, sand-silt mixtures		Atterberg limits below "A" line or P.I. less than 4	Limits plotting in hatched zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures		Atterberg limits above "A" line with P.I. greater than 7	
Fine-grained soils (More than half of material is smaller than No. 200 sieve)	Silts and clays (Liquid limit less than 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silty clays of low plasticity			
	Silts and clays (Liquid limit greater than 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
	Highly organic soils		Pt	Peat and other highly organic soils			

PLASTICITY CHART



111 WEST KINGSLEY
ANN ARBOR, MICHIGAN 48103
(313) 994 5055

KENNETH W. KRAMER, P.E.
RICHARD D. ANDERSON, P.E.
THEODORE D. DZIURMAN, P.E.
GARRETT H. EVANS, P.E.
FRANK A. HENDERSON, P.G.
EDWARD S. LINDOW, P.E.

JERRY B. GIVENS, P.E.
GARY M. HUSSAR, P.E.
LARRY P. JEDELE, P.E.
STARR D. KOHN, P.E.
GERARD P. MADEJ, P.E.
ROBERT C. HABLITZ, P.E.
FRANCIS E. WIGGIG, P.E.
TIMOTHY H. BEDENIS, P.E.
CHERYL KEARES DIETRICH
PAUL D. JAHSEN, P.E.
TIMOTHY J. MITCHELL, P.E.
JOHN C. ZANZECKI, CSM

CONSULTANT
ULRICH W. STOLL, P.E.

BATTLE CREEK
BAY CITY
INDIANAPOLIS
LANSING
LIVONIA

August 19, 1987

Ms. Helen Himes, P.E.
Charles S. Davis Associates, Inc.
220 Bagley, Suite 700
Detroit, Michigan 48226

RE: Environmental Evaluation
Memorial Park Marina
Detroit, Michigan
SME Project No. E-10579

Dear Ms. Himes:

We have received the results of the chemical tests performed on soil samples collected from the above referenced site. These results are enclosed. This letter should serve as an addendum to the geotechnical investigation report.

Selected soil samples extracted during Borings 2 and 3 were combined into two composite groups for analysis. Samples extracted during Boring 1 were not submitted for analysis. Composite Group I was composed of samples extracted from the 1.0- to 2.5-foot and 3.0- to 4.5-foot depth intervals during Borings 2 and 3. Composite Group II was composed of samples extracted from the 5.0- to 6.5-foot depth intervals during Borings 2 and 3 and the 8.5- to 10.0-foot depth interval during Boring 3.

Twenty-two organic compounds were detected in Composite Group I and 18 organic compounds were detected in Composite Group II. In addition, total phenolics were detected in both composite groups. Many of the organic compounds detected are gasoline and diesel fuel/ diesel exhaust/ fuel oil related. Several chlorinated organic compounds were also detected. The levels of many of organic compounds that were detected can be considered low, however, a number of levels are elevated. For instance, 295 mg/kg of 1,2-Dichloroethane was detected in Composite Group I.

Several inorganic elements were detected at elevated levels in the two composite groups when compared to common concentration ranges reported for soils. In particular, the levels of cadmium, copper and zinc appear to be elevated in both composite groups.

In addition, the level of lead detected in Composite Group I appears to be elevated.

We appreciate the opportunity to serve you during this phase of the project. If you have any questions regarding this letter, please contact us.

Sincerely,

SOIL AND MATERIALS ENGINEERS, INC.

Cheryl Kehres-Dietrich

Cheryl Kehres-Dietrich
Senior Hydrogeologist

Jerry B. Givens (CAKD)

Jerry B. Givens, P.E.
Project Manager

Enclosure

CAL

Canton Analytical Laboratory, Inc.
ENVIRONMENTAL ANALYSIS

August 12, 1987

Ms. Cheryl Kehres-Dietrich
SOIL AND MATERIALS ENGINEERS, INC.
111 W. Kingsley
Ann Arbor, MI 48103

RE: Lab #7070780 Composite Group I: B-2(S-1,S-2) & B-3(S-1, S-2) & 1 additional sample; samples rec'd 7/23/87

Dear Ms. Kehres-Dietrich:

The sample(s) we received from you has/have been analyzed as requested. The results are compiled in the enclosed report.

It is a pleasure to be of assistance to you. Please contact us if you have questions concerning any aspect of this work.

Very truly yours,

CANTON ANALYTICAL LABORATORY, INC.

Roy Marvel

Roy Marvel
QA/QC Coordinator

RM/pj

AUG 14 1987
SME Ann Arbor

P.O. Box 1129 · 153 Elder Street · Ypsilanti, Michigan 48197 · (313) 483 7430

SOIL & MAT .ALS ENGINEERS

SAMPLES RECEIVED 07/23/87

LAB# 7070780 COMPOSITE GROUP I: B-2(S-1,S-2) & B-3(S-1,S-2)
LAB# 7070781 COMPOSITE GROUP II: B-2(S-3) & B-3(S-3,S-4)

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
PURGEABLES-30 VOLATILES, GC		
Chloroform	20	< 0.5
Bromodichloromethane	< 0.7	< 1.0
Dibromochloromethane	< 0.7	< 1.0
Bromoform	< 0.8	< 1.2
Bromomethane	< 0.7	< 1.0
Chloroethane	< 0.2	< 0.2
Methylene Chloride	< 0.3	< 0.5
Trichlorofluoromethane	< 0.7	< 1.0
1,1-Dichloroethene	< 0.2	< 0.2
Chloromethane	< 0.4	< 0.6
1,1-Dichloroethane	< 0.2	< 0.2
trans-1,2-Dichloroethene	< 0.2	< 0.2
1,2-Dichloroethane	295	< 0.2
1,1,1-Trichloroethane	< 0.2	< 0.2

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Carbon Tetrachloride	12	< 1.0
1,2-Dichloropropane	< 0.2	< 0.2
trans-1,3-Dichloropropene	< 0.2	< 0.2
Trichloroethene	< 0.2	< 0.2
cis-1,3-Dichloropropene	< 0.2	< 0.2
1,1,2-Trichloroethane	< 0.2	< 0.2
2-Chloroethyl Vinyl Ether	< 0.4	< 0.6
1,1,2,2-Tetrachloroethane	< 0.2	< 0.2
Tetrachloroethene	< 0.2	< 0.2
Vinyl Chloride	< 0.4	< 0.6
Benzene	31	< 0.02
Toluene	50	50
Chlorobenzene	< 0.02	3.5
Ethylbenzene	14	20
Acrolein	< 5.0	< 6.2
Acrylonitrile	< 5.0	< 6.2
BASE/NEUTRALS-46 CPDS, GC/MS		
Acenaphthene	0.12	0.44

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Acenaphthylene	< 0.010	< 0.02
Anthracene	0.49	1.3
Benzidine	< 0.3	< 0.5
Benzo(a)anthracene	1.2	2.6
Benzo(a)pyrene	0.85	2.3
Benzo(b)fluoranthene	0.44	1.1
Benzo(ghi)perylene	0.31	1.1
Benzo(k)fluoranthene	1.7	4.0
bis(2-Chloroethoxy) Methane	< 0.02	< 0.04
bis(2-Chloroethyl) Ether	< 0.03	< 0.05
bis(2-Chloroisopropyl) Ether	< 0.10	< 0.2
bis(2-Ethylhexyl) Phthalate	0.098	< 0.04
4-Bromophenyl Phenyl Ether	< 0.05	< 0.08
Butyl Benzyl Phthalate	< 0.05	< 0.08
2-Chloronaphthalene	< 0.02	< 0.03
4-Chlorophenyl Phenyl Ether	< 0.03	< 0.05
Chrysene	0.88	2.0
Dibenzo(a,h)anthracene	0.18	0.54

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
1,2-Dichlorobenzene	< 0.03	< 0.04
1,3-Dichlorobenzene	< 0.03	< 0.04
1,4-Dichlorobenzene	< 0.03	< 0.04
3,3'-Dichlorobenzidine	< 0.02	< 0.04
Diethyl Phthalate	< 0.07	< 0.1
Dimethyl Phthalate	< 0.02	< 0.03
Di-n-butyl Phthalate	< 0.01	< 0.02
2,4-Dinitrotoluene	< 0.10	< 0.2
2,6-Dinitrotoluene	< 0.10	< 0.2
Di-n-octyl Phthalate	< 0.02	< 0.03
1,2-Diphenylhydrazine	< 0.01	< 0.02
Fluoranthene	2.4	5.4
Fluorene	0.13	0.49
Hexachlorobenzene	< 0.03	< 0.06
Hexachlorobutadiene	< 0.06	< 0.10
Hexachlorocyclopentadiene	< 0.2	< 0.3
Hexachloroethane	< 0.08	< 0.1
Indeno(1,2,3-cd)pyrene	0.67	1.3

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Isophorone	< 0.02	< 0.03
Naphthalene	0.039	0.12
Nitrobenzene	< 0.03	< 0.05
N-Nitrosodimethylamine	< 0.05	< 0.08
N-Nitrosodi-N-propylamine	< 0.3	< 0.5
N-Nitrosodiphenylamine	< 0.04	< 0.06
Phenanthrene	1.6	4.4
Pyrene	1.7	4.8
1,2,4-Trichlorobenzene	< 0.04	< 0.07
ACID EXTRACTS-11 CPDS, GC/MS		
2-Chlorophenol	< 0.04	< 0.06
2,4-Dichlorophenol	< 0.05	< 0.07
2,4-Dimethylphenol	< 0.04	< 0.06
2-Methyl-4,6-dinitrophenol	< 0.08	< 0.1
2,4-Dinitrophenol	< 0.2	< 0.3
2-Nitrophenol	< 0.1	< 0.2
4-Nitrophenol	< 0.07	< 0.1
4-Chloro-3-methylphenol	< 0.05	< 0.08

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Pentachlorophenol	< 0.1	< 0.2
Phenol	< 0.02	< 0.04
2,4,6-Trichlorophenol	< 0.07	< 0.1
608 PCB'S/PESTICIDES		
PCB-1016	< 5.0	< 5.0
PCB-1221	< 5.0	< 5.0
PCB-1232	< 5.0	< 5.0
PCB-1242	< 5.0	< 5.0
PCB-1248	< 5.0	< 5.0
PCB-1254	< 5.0	< 5.0
PCB-1260	< 5.0	< 5.0
PCB-1262	< 5.0	< 5.0
PCB, Total	< 5.0	< 5.0
alpha-BHC	< 0.002	< 0.001
beta-BHC	< 0.002	< 0.002
gamma-BHC (Lindane)	< 0.004	< 0.003
Heptachlor	< 0.006	< 0.004
delta-BHC	< 0.002	< 0.002

CAL

SAMPLES RECEIVED 07/23/87

LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Aldrin	< 0.002	< 0.002
Heptachlor Epoxide	< 0.05	< 0.04
alpha-Endosulfan	< 0.01	< 0.005
4,4'-DDE	< 0.002	< 0.002
Dieldrin	< 0.002	< 0.001
Endrin	< 0.004	< 0.003
4,4'-DDD	< 0.01	< 0.01
beta-Endosulfan	< 0.04	< 0.03
4,4'-DDT	< 0.01	< 0.01
Endrin Aldehyde	< 0.02	< 0.01
Endosulfan Sulfate	< 0.05	< 0.04
Chlordane	< 0.01	< 0.01
Toxaphene	< 0.02	< 0.02
METALS-13 CPDS		
Antimony, Total	< 0.50	< 0.50
Arsenic, Total	0.35	0.20
Beryllium, Total	< 0.50	< 0.50
Cadmium, Total	3.0	4.5

CAL

SOIL & MAT IALS ENGINEERS

SAMPLES RECEIVED 07/23/87

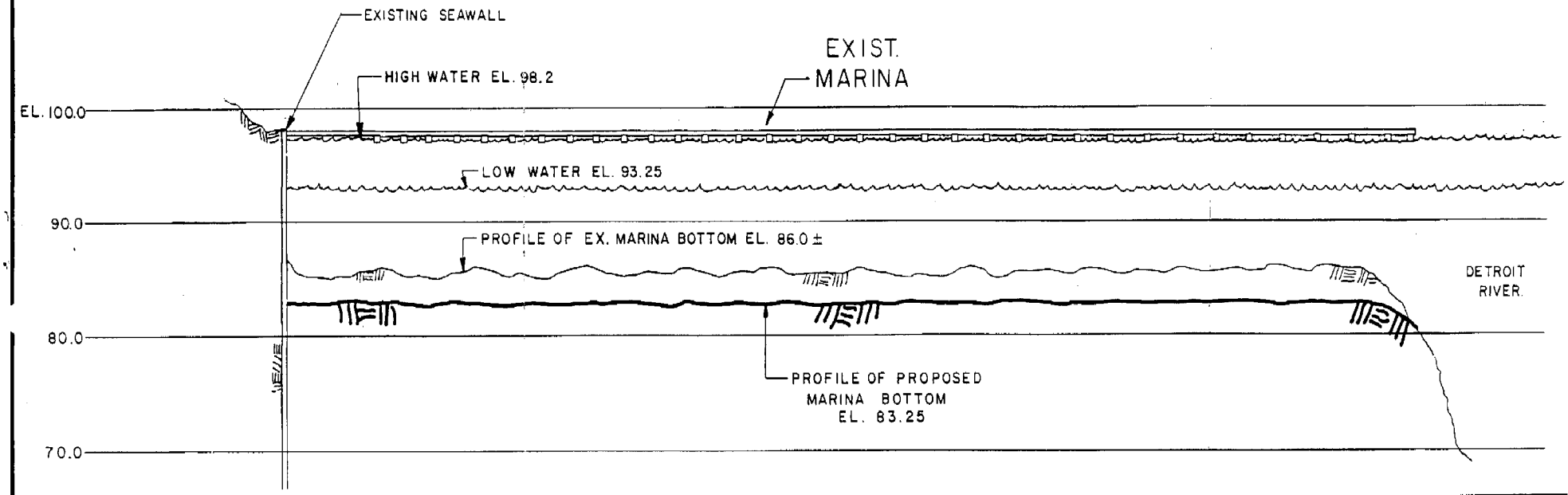
LAB#	7070780	7070781
UNITS	mg/kg	mg/kg
Chromium, Total	14	9.5
Copper, Total	130	650
Lead, Total	220	170
Mercury, Total	< 0.03	< 0.03
Nickel, Total	19	17
Selenium, Total	< 0.10	< 0.10
Silver, Total	< 0.50	< 0.50
Thallium, Total	< 0.10	< 0.10
Zinc, Total	350	1200
MISCELLANEOUS-3 CPDS		
Cyanide, Total	< 0.03	0.07
Asbestos, Fibers in Water/l	*N.D.	N.D.
Phenolics, Total	51	49
pH Units	8.6	8.8

*Non-detectable

CAL

APPENDIX B

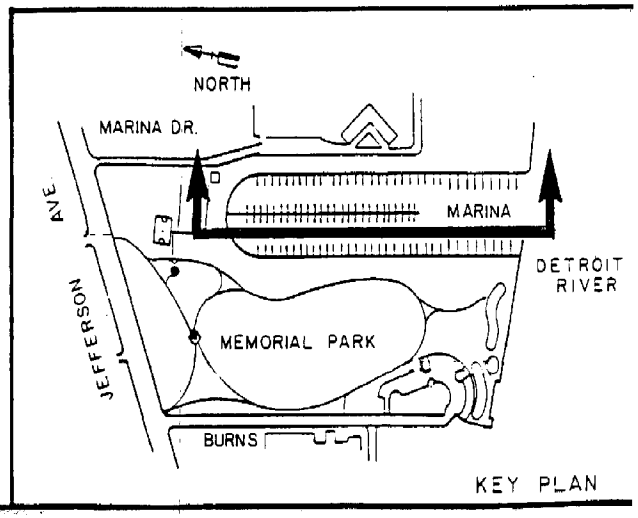
CROSS SECTIONS



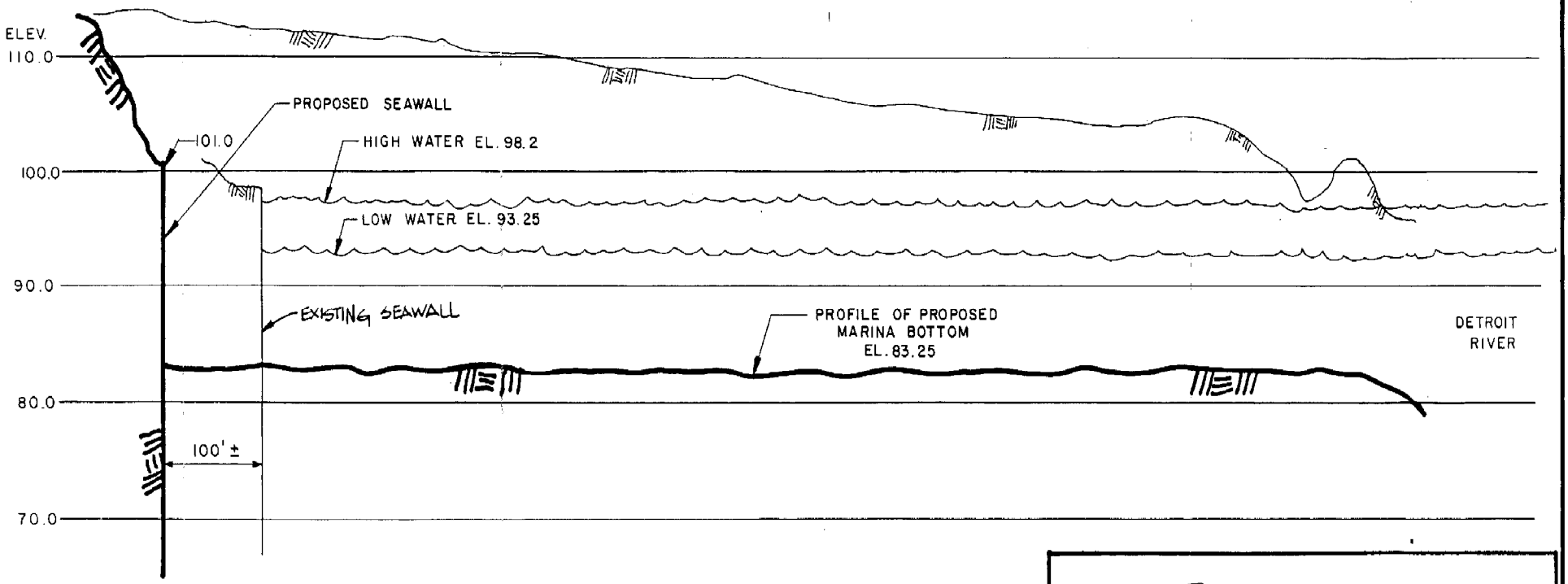
SHORT RANGE PLAN

MARINA SECTION LOOKING EAST

VERT. 1" = 10'-0" HORIZ. 1" = 100'-0"



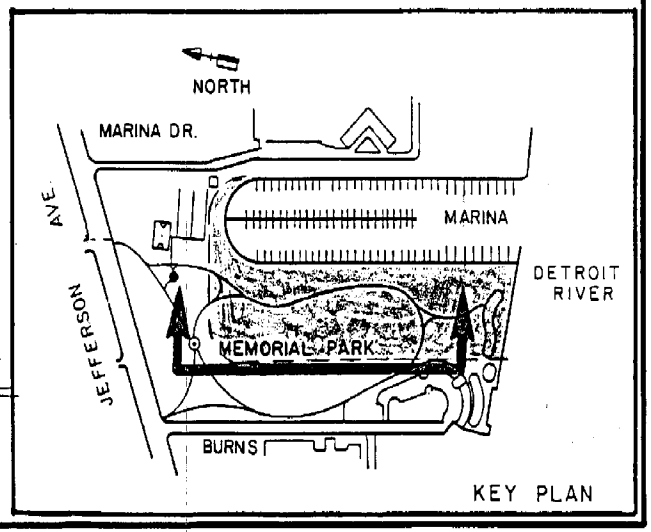
KEY PLAN

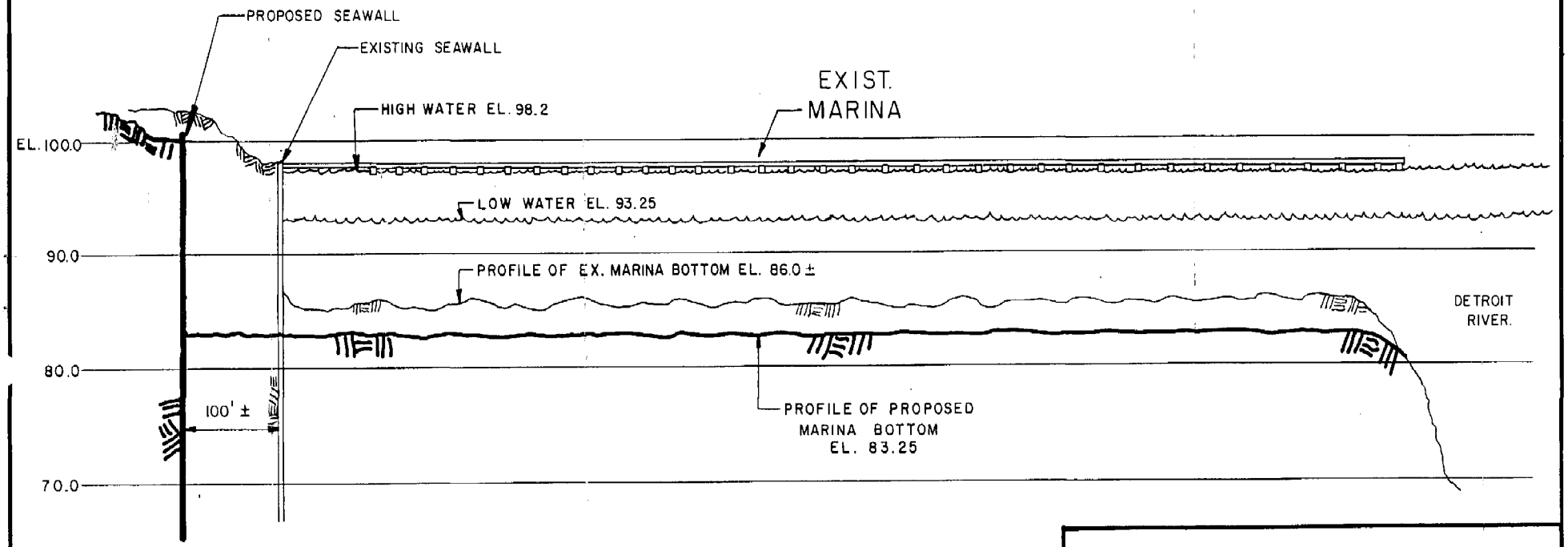


LONG RANGE PLAN

MARINA SECTION LOOKING EAST

VERT. 1" = 10'-0" HORIZ. 1" = 100'-0"

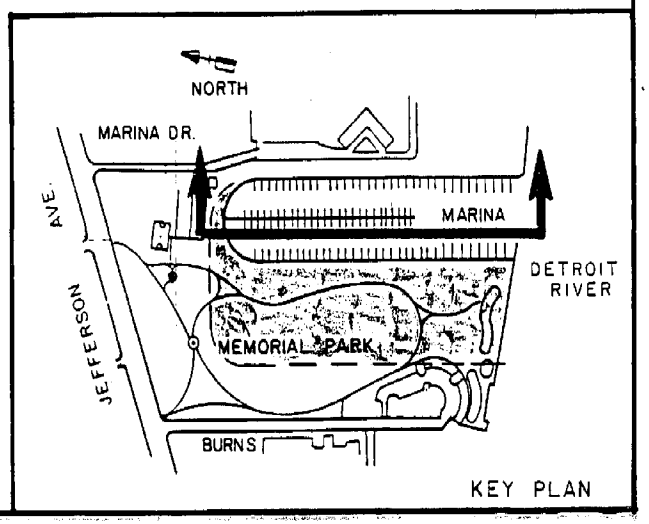




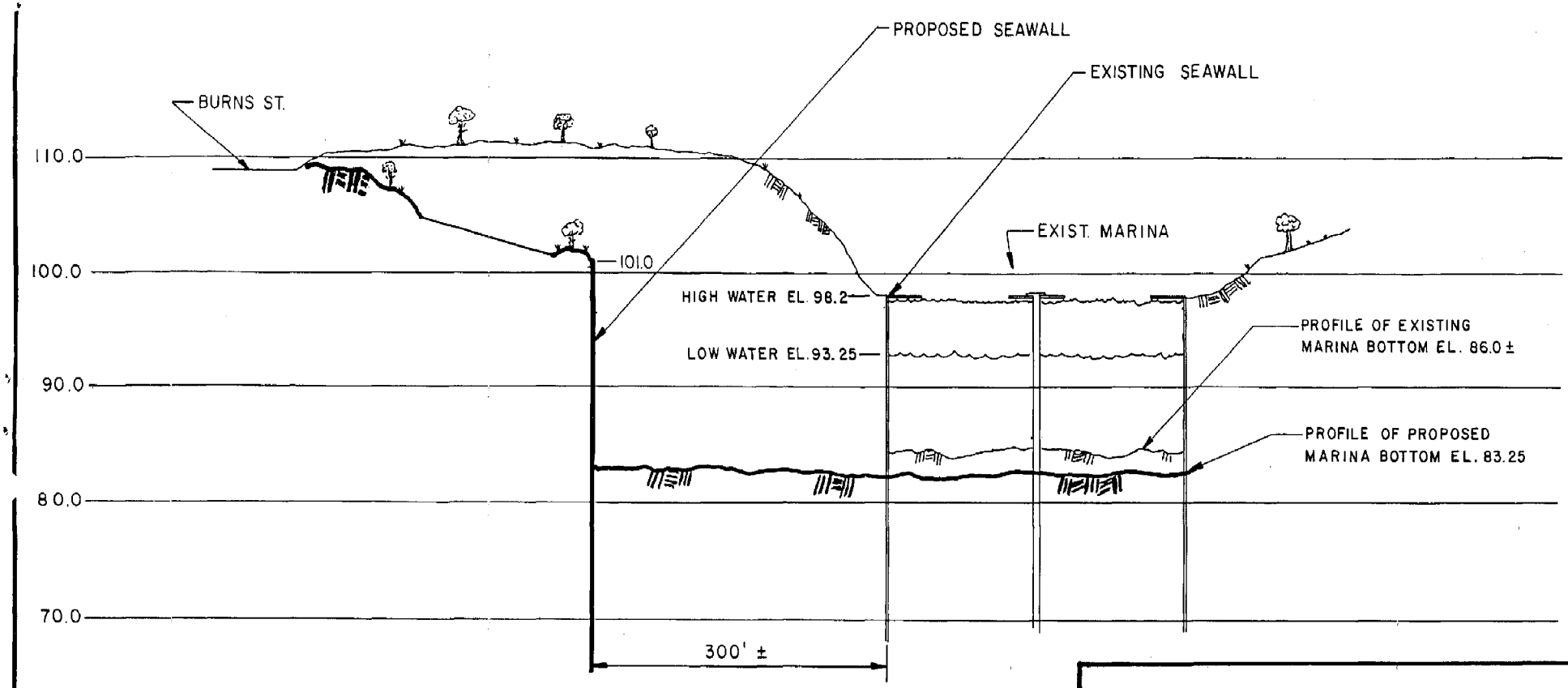
LONG RANGE PLAN

MARINA SECTION LOOKING EAST

VERT. 1" = 10'-0" HORIZ. 1" = 100'-0"



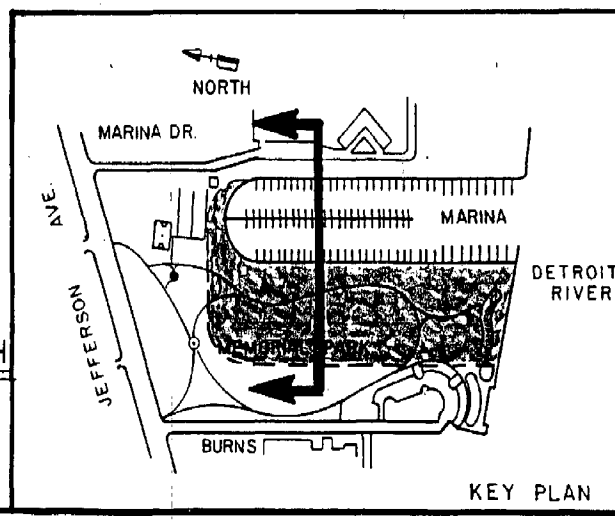
KEY PLAN



LONG RANGE PLAN

MARINA SECTION LOOKING NORTH

VERT. 1" = 10'-0" HORIZ. 1" = 100'-0"



KEY PLAN

APPENDIX C

SHORT RANGE PLAN - COST ITEMIZATION

MEMORIAL PARK REDEVELOPMENT
SHORT RANGE PLAN-COST ITEMIZATION
MARINA REDEVELOPMENT

ITEM		AMOUNT
Raise and Repair Seawall		$ 700,000.00
Raise Area Adjacent to Seawall		$ 75,000.00
Pavement Construction		$ 150,000.00
Underground Storm Sewer System		$ 145,000.00
Rehabilitation of Existing Utilities		$ 460,000.00
Pump Out Facility and Mechanical System Rehabilitation		$ 60,000.00
Center Dock Replacement		$ 500,000.00
Key Card Security System		$ 10,000.00
	Subtotal	$2,100,000.00
	10% Contingencies	210,000.00
	Total Cost	$2,310,000.00

MEMORIAL PARK REDEVELOPMENT
SHORT RANGE PLAN-COST ITEMIZATION
REGION I-PROMENADE REDEVELOPMENT

ITEM		AMOUNT
Raise and Repair Seawall		$125,000.00
Construct New Seawall		$150,000.00
Raise Area Adjacent to Seawall		$ 90,000.00
Underground Storm Sewer System		$ 37,500.00
Concrete Walk Construction		$ 50,000.00
Picnic Shelter		$ 60,000.00
Landscaping		$150,000.00
	Subtotal	$662,500.00
	10% Contingencies	66,250.00
	Total Cost	$728,750.00

MEMORIAL PARK REDEVELOPMENT
SHORT RANGE PLAN-COST ITEMIZATION
REGION 2-AREA NORTH of the MARINA

ITEM		AMOUNT
Parking Lot Construction		$ 25,000.00
Parking Lot Rehabilitation		$ 20,000.00
Concrete Walk Construction		$ 10,000.00
Storm Sewer System		$ 15,000.00
Existing Comfort Station Renovation		$100,000.00
Children's Play Area		$ 25,000.00
Picnic Shelter		$ 60,000.00
Landscaping		$ 60,000.00
	Subtotal	$315,000.00
	10% Contingencies	31,500.00
	Total Cost	$346,500.00

MEMORIAL PARK REDEVELOPMENT
SHORT RANGE PLAN-COST ITEMIZATION
REGION 3-MEMORIAL PARK EXTENSION

ITEM		AMOUNT
Install Seawall		$260,000.00
Fill Area Adjacent to Seawall		$ 40,000.00
Children's Play Area		$ 25,000.00
Picnic Shelter		$ 60,000.00
Landscaping		$ 50,000.00
	Subtotal	$435,000.00
	10% Contingencies	43,500.00
	Total Cost	$478,500.00

APPENDIX D

LONG RANGE PLAN - COST ITEMIZATION

MEMORIAL PARK REDEVELOPMENT
LONG RANGE PLAN - COST ITEMIZATION
MARINA REDEVELOPMENT AND EXPANSION

ITEM		AMOUNT
New Seawall		$ 3,200,000.00
Excavation		$ 2,700,000.00
Marina Docks and Channel Entrance		$ 1,600,000.00
Marina Utilities		$ 650,000.00
Off Site Utilities		$ 200,000.00
Parking Lot		$ 400,000.00
Concrete Walkways		$ 240,000.00
Marina Gatehouse		$ 50,000.00
Marina Control Building		$ 800,000.00
Restroom Facility		$ 200,000.00
Landscaping		$ 50,000.00
	Subtotal	$10,090,000.00
	10% Contingencies	1,010,000.00
	Total Cost	11,100,000.00

Note: Total cost does not reflect costs for work included in the short range development plan.

MEMORIAL PARK REDEVELOPMENT
LONG RANGE PLAN - COST ITEMIZATION
REGION 1 - PROMENADE REDEVELOPMENT

ITEM		AMOUNT
Parking Lot and Roadway Construction		$ 75,000.00
Children's Play Area		$ 25,000.00
Picnic Shelter		$ 60,000.00
Concrete Walkways		$ 50,000.00
Landscaping		$130,000.00
	Subtotal	$340,000.00
	10% Contingencies	34,000.00
	Total Cost	$374,000.00

Note: Total cost does not reflect costs for work included in the short range redevelopment plan.

MEMORIAL PARK REDEVELOPMENT
LONG RANGE PLAN - COST ITEMIZATION
REGION 2 - MEMORIAL PARK EXTENSION

ITEM		AMOUNT
Roadway and Parking Lot Construction		$ 75,000.00
Expanded Children's Play Area		$ 15,000.00
Fishing Promenade		$ 30,000.00
Grading and Landscaping		$ 75,000.00
	Subtotal	$195,000.00
	10% Contingencies	19,500.00
	Total Cost	$214,500.00

Note: Total cost does not reflect costs for work included in the short range redevelopment plan.

MEMORIAL PARK REDEVELOPMENT
LONG RANGE PLAN - COST ITEMIZATION
REGION 3 - AREA NORTH OF THE MARINA

ITEM		AMOUNT
Removal of Existing Comfort Station		$ 50,000.00
Removal of Existing Parking Lot		$ 5,000.00
Renovation of Existing Gatehouse		$100,000.00
Parking Lot Construction		$ 15,000.00
Relocation of Existing Armillary		$ 5,000.00
Concrete Walkways		$ 40,000.00
Grading and Landscaping		$100,000.00
	Subtotal	$315,000.00
	10% Contingencies	31,500.00
	Total Cost	$346,500.00

Note: Total cost does not reflect work included in the short range redevelopment plan.

NOAA COASTAL SERVICES CTR LIBRARY
3 6668 14112002 4