7D-8.1

CONSULTING
ENGINEERING
ASSOCIATES, INC.

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National Oceanic and Atmospheric Administration

16580 WYOMING AVENUE

DETROIT, MICHIGAN 48221

PRELIMINARY ENGINEERING STUDY
FOR THE
PROPOSED WASHINGTON AVENUE MARINA
ON
PERE MARQUETTE LAKE

Prepared for
The City of Ludington

Submitted by:
Consulting Engineering Associates, Inc.
16580 Wyoming Avenue
Detroit, Michigan 48221

CONSULTING ENGINEERING ASSOCIATES, INC.
ENGINEERING CONSULTANTS
16580 WYOMING AVENUE TELEPHONE DI. 1-5797
DETROIT, MICHIGAN 48221

September 9, 1985

City of Ludington
201 S. William Street
Ludington, MI 49431

Attn: Mr. Gerald J. Richards, City Manager

Re: Proposed Washington Avenue Marina
on Pere Marquette Lake

Gentlemen:

In accordance with the agreement between the City of Ludington and this firm, the accompanying preliminary engineering report plans and estimates were prepared for the proposed construction of recreational boating facilities on a 9.3 acre site located on the east shore of Pere Marquette Lake just to the north of the city's Peter Copeyon Park.

We are transmitting herewith, ten (10) copies of our report for your review and consideration.

Very truly yours,
Consulting Engineering Associates, Inc.

by _____
John J. McClay, P.E.

JJMc/vlj

ATTACH.

CONTENTS

APPENDIXES

PURPOSE AND SCOPE

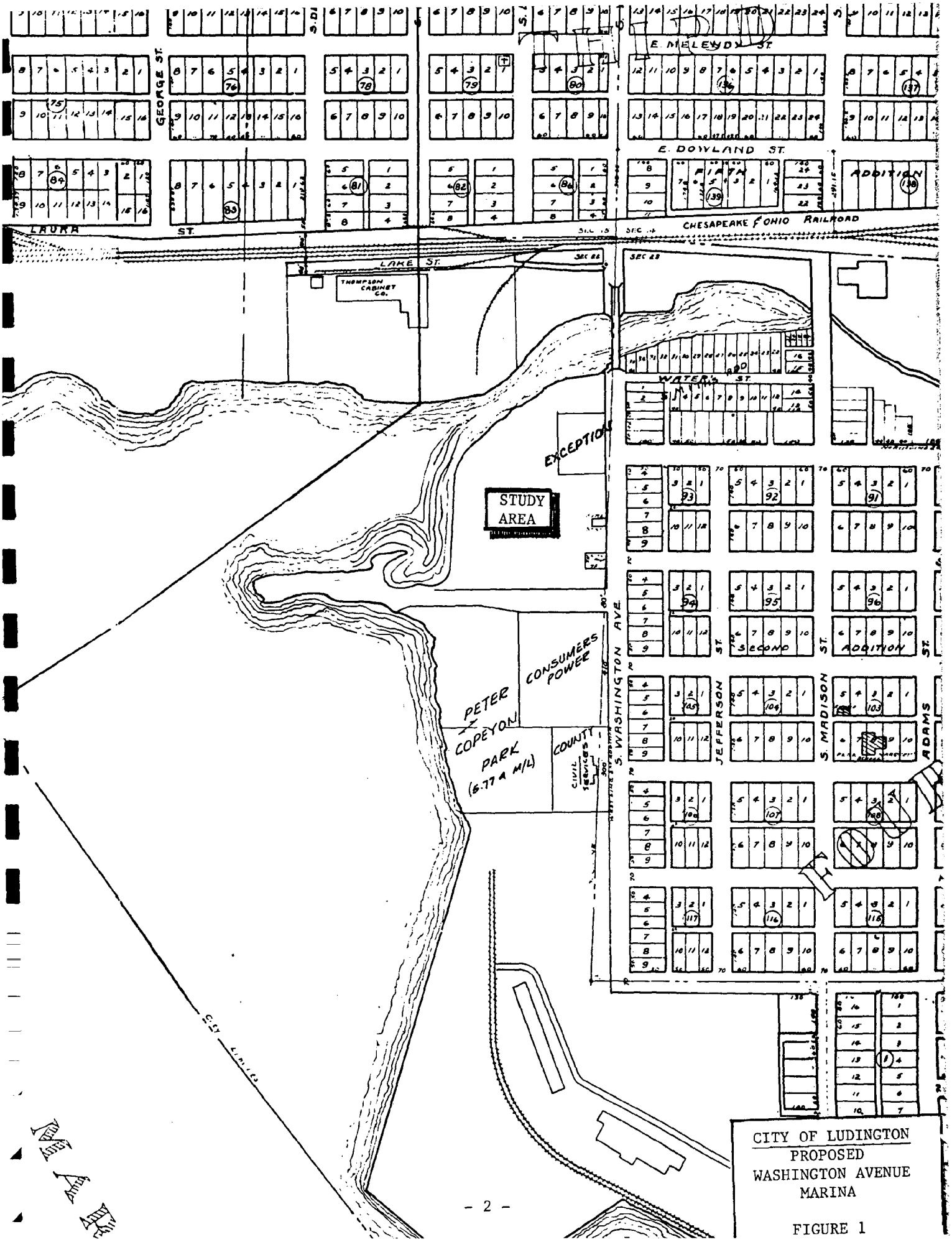
The purpose of this engineering study is to determine the feasibility and most desirable means of constructing a recreational boat harbor on a site adjacent to the City of Ludington's Peter Copeyon Park. The 9.3± acre site which is located on the east shore of Pere Marquette Lake, lying west of Washington Avenue and north of Second Street extended, is shown on Figure 1. The requirements for this engineering study were detailed in the city's original Request for Proposals (RFP), and, along with the usual planning and cost estimates, included extensive field surveys and soil investigations. In addition to these requirements, the city also requested that this study include consideration of a plan, developed by the Waterways Division.

SITE INVESTIGATIONS

Field investigations for this study included a property survey, a topographic survey, a hydrographic survey and subsurface investigations.

The required property survey was performed by the firm of Nordlund, Dunlap and Associates, Inc. A surveyor's certificate was also prepared by that firm and a copy filed with City of Ludington.

The required topographic survey which covered the entire site of the proposed project was performed by Consulting Engineering Associates, Inc. This topographic survey served to locate existing structures, ground elevations and other pertinent features. The required hydrographic survey was made along the frontage of the proposed site for a distance of approximately 650 feet to the west of the northeast property corner. Soundings were made at 10 foot intervals along lines 50 feet apart, extending offshore, between 50 and 60 feet into the lake, to depths in excess of 10 feet below International Great Lakes Datum (EL 576.8). A plan of existing site conditions as determined by this survey work is shown on Plate C1 (see Appendix C).



CITY OF LUDINGTON
PROPOSED
WASHINGTON AVENUE
MARINA

FIGURE 1

The required soil borings were made by the firm of Grand Rapids Testing Service. In conformance with the requirements of the RFP, soils exploration consisted of six borings taken to a depth 30 feet below existing ground. These borings locations are also shown on Plate C1; and the logs of the borings are to be found in Appendix A. The soils encountered by this subsurface investigation can be characterized as loose to medium-loose fine sands. The only difficulty anticipated with excavating such soils in the dry would be in areas adjacent to the lake, where heavy ground water flows through these soils could lead to a dangerous quicksand like condition.

The hydrographic survey work done for this study is deemed adequate for two of the four schemes developed in this study. However, should a plan be selected which proposes modification to the shoreline outside the limits of this hydrographic survey, additional field work will be required prior to any final design work.

EXISTING UTILITIES

Information regarding existing underground utilities was obtained from city records and from record maps maintained by local utility companies. Since available utility records are diagrammatic rather than showing as-built conditions, the locations of those underground services shown on Plate C1 should be considered as approximate only. Referring to Plate C1, it is to be noted that the only sanitary sewer convenient to the site is located in Washington Avenue. Due to the difference in ground elevations it would be necessary to pump sanitary flows up to this sewer. It is understood that a sanitary lift station is to be installed to serve planned improvements in Copeyon Park, and that this lift station would be adequate to handle sanitary flows for the proposed project. Once that installation is complete, all required city services would be convenient for connections serving the project.

Electrical service in the Ludington area is provided by Consumers Power Company. Existing primary distribution in the vicinity is deemed adequate to service anticipated electrical demand for this project.

ALTERNATIVE PLANS

Four alternative layouts for the proposed Washington Avenue marina are presented in this study. A general plan of each is shown in Appendix C (Plates C2 through C5) and are discussed in this section.

Schemes I, II & III were developed by Consulting Engineering Associates, Inc. (C.E.A.) following requirements set forth in the city's R.F.P. and applicable design standards of the Department of Natural Resources, Waterways Division. It was assumed in the development of these three schemes that mooring was to be split between seasonal and transient boaters, and therefore, the percentage of slips provided in each length group follows current Waterways recommendations for such a facility. The number of parking stalls provided in each of the schemes also follows those ratios currently in use. Since the R.F.P. did not impose any cost constraints, nor specify total number of slips to be provided, these layouts were developed letting site shape and existing topography control the size of the proposed mooring basin. Referring to Plate C1, it can be seen that the abrupt change in ground elevation, along with the excluded parcel, serve to restrict development to the east. To facilitate excavation in the dry, each layout maintains a narrow strip of earth to function as a dike between the lake and the proposed basin prior to digging out the entrance channel, thereby minimizing costs for both excavating and shore protection. As a result, the mooring capacities of these three schemes were limited to between 55 and 63 boats. After review of these schemes, the city and Waterways Division decided that the proposed mooring facilities should be enlarged to accommodate at least 100 craft, and,

primarily be used for mooring of seasonal craft. On the basis of that criteria, Waterway's engineering staff developed an alternative layout which is included in this study as Scheme IV, providing mooring for 115 boats. This plan is shown on Plate C5. To achieve an increase in capacity over those schemes developed by C.E.A., it was necessary to enlarge the basin to the west, excavating out into Pere Marquette Lake; sheet pile an area to accommodate the toilet and shower building; excavate into the existing hill at the east end of the parking lot to provide for parking and elimination of mooring slips for 60 foot boats. This increase in size of the mooring basin reduced land area available for parking and, therefore, this scheme is short on parking for some 40 cars.

Of the plans developed by C.E.A., Scheme II is thought to represent the best of the three. However, if funding is available and maximizing mooring is the primary concern, then Scheme IV is certainly the plan of choice. The only real problem to be addressed in that plan is the need for additional parking. Utilization of the land area to the east of the basin is not thought to be practical or convenient. In those terms, the most suitable area for additional parking would appear to lie to the south of the proposed parking area where an additional 50 cars could be accommodated. Although this would solve parking needs, it does block future widening of the existing access road which may be incompatible with the inevitable increase in the traffic.

APPENDIX A

LOGS OF SOIL BORINGS TAKEN FOR THE PROPOSED WASHINGTON AVENUE MARINA ON PERE MARQUETTE LAKE IN THE CITY OF LUDINGTON

Borings for this engineering study were taken by Grand Rapids Testing Service on July 29, 1985. The logs of these soil borings are presented in this Appendix and their locations are shown on Plate C1 of Appendix C.

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 1 (Page 1 of 2)
SURFACE ELEV. 582.2

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0	0.75	GRAVELLY TOPSOIL		2	3	5
1.5	2.0	LOOSE BROWN CLAYEY SAND	1	6	5	4
2.5		LOOSE ▽	2	3	3	10
3.0	4.0	BLACK fine to coarse SAND AND GRAVEL WITH SOME ORGANICS	3	6	3	3
4.5	5.5	BLACK ORGANIC MATERIAL (PEAT AND WOOD)	4	5	2	6
6.0		LOOSE TO MEDIUM LOOSE	5	6	4	5
7.5			6	7	4	5
9.0			7	8	9	5
10.5		BROWN				
14.5		fine				
16.0						
19.5		SAND	8	9	8	7
21.0						

Boring Continued on Page 2

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 1 (Page 2 of 2)
SURFACE ELEV. 582.2

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0			MEDIUM LOOSE TO MEDIUM DENSE			
24.5			BROWN			
				10	26	34	42
26.0			fine			
28.5			SAND			
				11	6	9	11
30.0	30.0					

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 2
SURFACE ELEV. 589.0

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0	0.2	WHITE GRAVEL				
	0.2	TOPSOIL	1a	1	1	2
1.5	1.5	BROWN SANDY TOPSOIL	1b			
		LOOSE BROWN fine	2	2	2	3
3.0						
4.5	4.3	SAND	3	3	2	2
		VERY STIFF BROWN	4	9	9	12
6.0	6.5	SANDY CLAY				
		MEDIUM DENSE CLAYEY	5	6	9	13
7.5	8.5	SILT	6	8	14	18
9.0		HARD	7	8	16	18
10.5		CLAY AND SILT				
13.0	13.0					
14.5		LOOSE TO MEDIUM DENSE				
16.0		BROWN fine	8	1	2	4
19.5		SAND	9	4	8	16
21.0						

Boring Continued on Page 2

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 2 (Page 2 of 2)
SURFACE ELEV. _____

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0			MEDIUM DENSE			
24.5			BROWN			
				10	6	8	11
26.0			fine			
28.5			SAND			
				11	7	10	12
30.0	30.0					

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates CLIENT'S PROJECT NO. _____
DATUM _____ DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 3 (Page 1 of 2)
SURFACE ELEV. 581.4

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0		WHITE SANDY GRAVEL (LIMESTONE)	1	10	28	22
1.5			2	10	23	22
2.0		▽				
3.0						
3.5						
4.0		LOOSE DARK BROWN fine SAND	3a	12	4	5
4.5		LOOSE TO VERY LOOSE BLACK ORGANIC MATERIAL WITH WOOD AND LENSES OF SAND	3b			
6.0			4	4	1	1
6.5						
		LOOSE TO MEDIUM LOOSE BROWN fine SAND	5	2	3	5
7.5			6	4	6	6
9.0						
9.5			7	3	4	6
10.5		MEDIUM LOOSE TO LOOSE LIGHT BROWN fine SAND				
14.5			8	3	3	3
16.0						
19.5			9	1	2	2
21.0						

Boring Continued on Page 2)

"N"- STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DRILLING METHOD DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 3 (Page 2 of 2)
SURFACE ELEV. 581.4

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0			LOOSE TO MEDIUM DENSE			
24.5			LIGHT BROWN	10	15	16	24
26.0			fine			
28.5			SAND	11	5	7	10
30.0	30.0					

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 4 (Page 1 of 2)
SURFACE ELEV. 588.5

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0	0.5	TOPSOIL				
1.5	1.5	BROWN SANDY GRAVEL	1	3	5	6
	2.0	BLACK ORGANIC SAND				
3.0	3.5	MEDIUM LOOSE BROWN fine SAND	2	18	7	7
4.5	5.0	LOOSE ORGANIC MATERIAL WITH LENSES OF SAND	3	6	3	2
	5.5	VERY LOOSE BROWN fine SAND	4a	3	1	1
6.0	6.5	VERY LOOSE BLACK ORGANIC SAND WITH SOME GRAVEL	4b			
7.5		VERY STIFF BROWN CLAY	5	5	10	16
			6	5	9	10
9.3	9.3	▽	7	9	7	5
10.5		STIFF BROWN SILTY CLAY				
14.5	15.0		8	4	6	10
16.0		MEDIUM DENSE TO MEDIUM LOOSE BROWN fine SAND				
19.5			9	4	6	6
21.0						

Boring Continued on Page 2

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 4 (Page 2 of 2)
SURFACE ELEV. 588.5

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0			MEDIUM LOOSE TO MEDIUM DENSE			
24.5			BROWN	10	5	8	14
26.0			fine				
28.5			SAND	11	5	12	17
30.0	30.0						

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/29/85 DATE COMPLETED 7/29/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 5 (Page 1 of 2)
SURFACE ELEV. 582.3

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0						
	1.5	WHITE GRAVELLY SAND	1	3	6	7
1.5						
		BLACK ORGANIC MATERIAL	2	16	11	16
3.0						
3.5		▽	3	5	6	5
4.5		WITH				
		WOOD		5	26	5
6.0	5.9		4			
				6	4	2
7.5		WOOD				
				5	3	2
9.0						
				3	2	2
	10.1		5			
10.5		VERY LOOSE				
		GREY				
14.5						
			6	3	1	1
16.0						
		fine				
19.5		SAND				
			7	1 *		
21.0						

* 1 for 18"

Boring Continued on Page 2

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/30/85 DATE COMPLETED 7/30/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 5 (Page 2 of 2)
SURFACE ELEV. 582.3

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0						
		23.0	VERY LOOSE GREY fine SAND			
24.5			MEDIUM STIFF GREY CLAY WITH A TRACE OF SILT	8	3	4	3
26.0		27.0				
28.5			MEDIUM STIFF GREY SANDY CLAY	9	3	3	4
30.0		30.0				

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/30/85 DATE COMPLETED 7/30/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 6 (Page 1 of 2)
SURFACE ELEV. 582.0±

SAMPLE DEPTH	STRATIFICATION	DESCRIPTION		"N" 1	2	3
0.0		WHITE	1	2	6	14
1.5		medium to coarse				
	2.4	GRAVEL AND LIMESTONE		37	6	5
3.0	3.0	NOTE A	2			
	3.5			5	4	4
4.5		LOOSE	3			
		DARK BROWN	4	4	4	5
6.0		fine SAND				
	7.0	WITH WOOD		4	3	4
7.5	7.6	WOOD	5			
		LOOSE	6	3	3	3
9.0			7	3	2	3
10.5		BROWN				
		fine				
14.5		SAND				
	15.0					
16.0		VERY LOOSE BLACK SANDY SILTY ORGANIC MATERIAL	8	1 *	1	
	18.0					
19.5		LOOSE GREY fine SAND WITH A TRACE OF ORGANIC MAT'L.	9	1	2	4
21.0						

NOTE A:
MEDIUM LOOSE DARK BROWN fine SAND WITH SOME ORGANIC MATERIAL AND WOOD

* 1 for 12"

Boring Continued on Page 2

"N" - STANDARD PENETRATION RESISTANCE

PROJECT Small Craft Harbor Ludington, Michigan PROJECT NO. 60-0785
CLIENT Consulting Engineering Associates, Inc. CLIENT'S PROJECT NO.
DATUM DATE STARTED 7/30/85 DATE COMPLETED 7/30/85
DRILLER S. De Weese HELPER R. Burmeister
PLUGGING METHOD Natural Soil

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

BORING NO. 6 (Page 2 of 2)
SURFACE ELEV. 582.0±

	SAMPLE DEPTH	STRATIFICATION	DESCRIPTION	"N" 1	2	3
21.0						
			LOOSE GREY fine SAND			
		23.5	WITH TRACE OF ORGANIC MATERIAL			
24.5			LOOSE BROWN fine SAND	10	4	3	4
26.0						
		27.0	WITH A TRACE OF SILT			
28.5			MEDIUM LOOSE BROWN fine SAND	11	4	6	7
30.0		30.0				

"N" - STANDARD PENETRATION RESISTANCE

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DRILLER S. De Weese HELPER R. Burmeister
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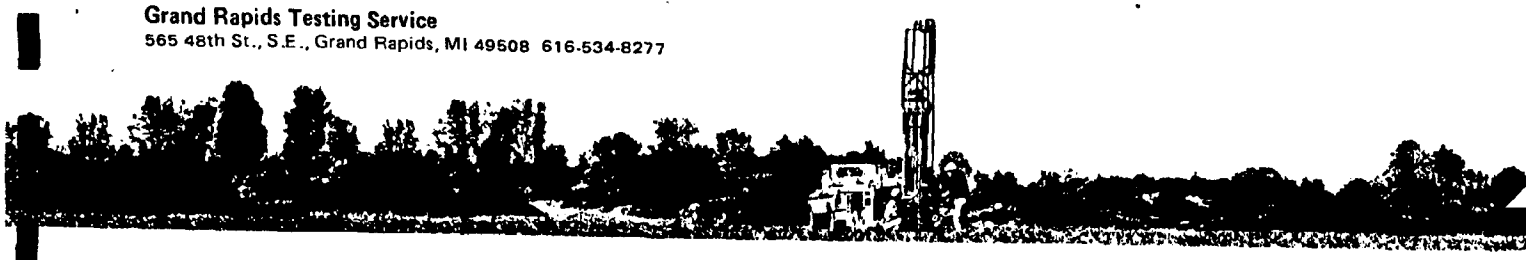
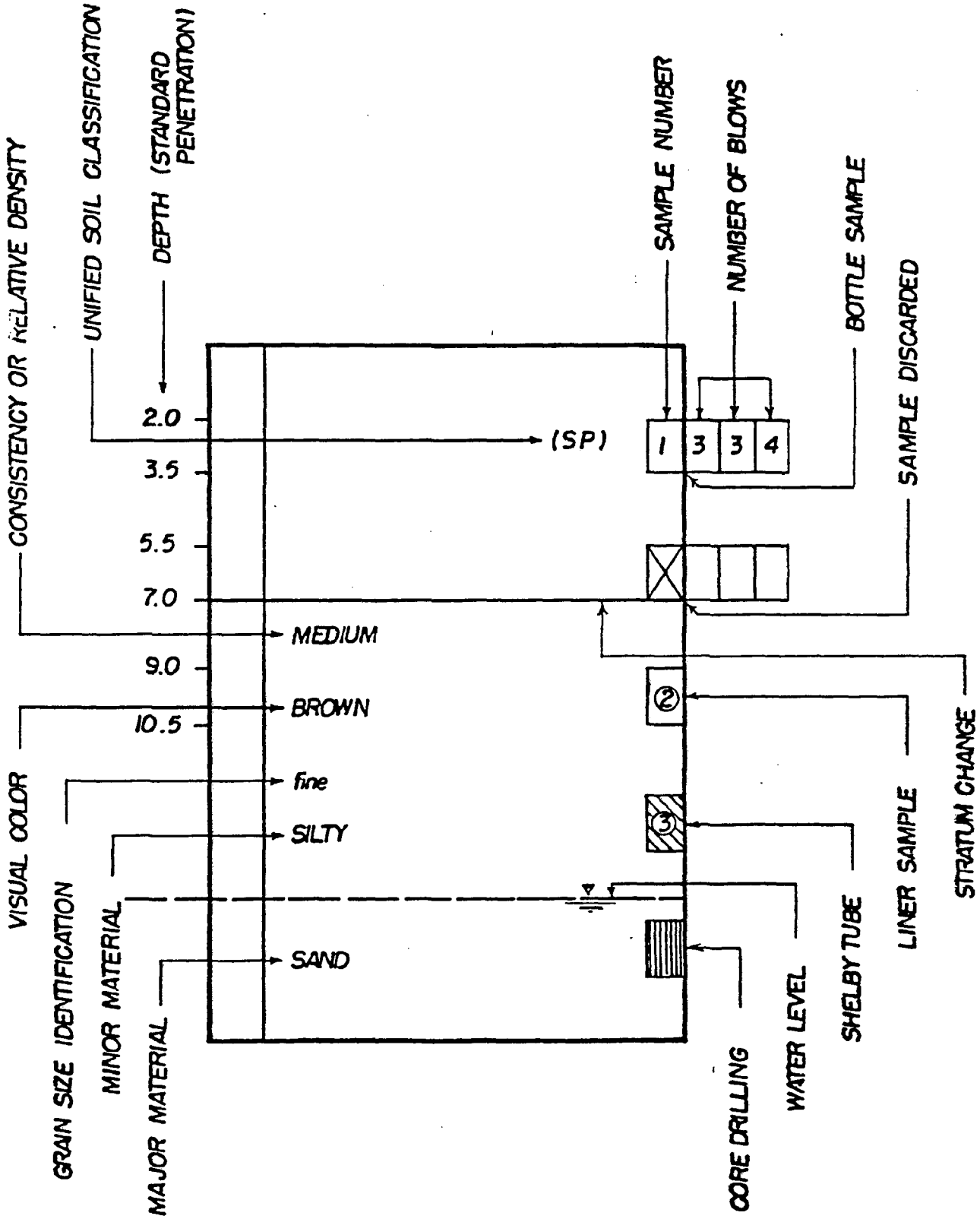
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277





BORING LOG LEGEND

Grand Rapids Testing Service
565 48th St., S.E., Grand Rapids, MI 49508 616-534-8277

RELATIVE DENSITY AND CONSISTENCY TABLE

Sand and Silt, Relative Density		Consistency of Clay	
No. of blows req'd to drive a sampler 1 ft. using a 140# hammer falling 30" 2" O.D. Samplers	RELATIVE DENSITY	No. of blows req'd to drive a sampler 1 ft. using a 140# hammer falling 30" 2" O.D. Samplers	CONSISTENCY
<4	Very Loose	<2	Very Soft
4-10	Loose	2-4	Soft
10-30	Medium	4-8	Medium
30-50	Dense	8-15	Stiff
>50	Very Dense	15-30	Very Stiff
		>30	Hard

APPENDIX B

PRELIMINARY COST ESTIMATES
FOR THE PROPOSED
WASHINGTON AVENUE MARINA
ON
PERE MARQUETTE LAKE
IN THE
CITY OF LUDINGTON

Preliminary Cost Estimates

The following cost estimates were prepared for the four alternative schemes shown in Appendix C for the proposed Washington Avenue Marina Site. Each of the following estimates includes the costs for all the principal items of work which are identifiable during this preliminary study, except for any costs associated with acquistion of the site.

The unit prices and job costs used in the following estimates represent 1985 price levels and are intended to represent the in-place value for each of the items of work listed. The construction cost determined for each scheme is not intended to represent the lowest price that might be expected if the project were bid in 1985, but rather a price somewhere between the low and average of all bids. These estimated construction costs are intended for comparative purposes only and would require adjustment for a future construction date.

PRELIMINARY COST ESTIMATE
FOR
PROPOSED RECREATIONAL BOAT
HARBOR ON PERE MARQUETTE LAKE

SCHEME I

	ITEMS OF WORK	UNIT	QUANTITIES	UNIT PRICES	AMOUNTS[1]
1.	Demolition & Clearing		Job		$ 32,000
2.	Excavation	C.Y.	113,290	4.00	453,200
3.	Revet Mattress	S.Y.	7,300	25.00	182,500
4.	Riprap	C.Y.	720	21.00	15,100
5.	Floating Docks	S.F.	11,220	23.00	258,100
6.	Dock Anchorage System		Job		15,400
7.	Dock Office		Job		2,000
8.	Toilet & Shower Bldg.	S.F.	1,000	75.00	75,000
9.	Paved Roads & Parking	S.Y.	1,830	8.50	15,600
10.	Concrete Walk	S.Y.	435	16.00	7,000
11.	Sodding	S.Y.	2,960	2.50	7,400
12.	Topsoil & Seeding	S.Y.	3,900	.65	2,500
13.	Landscaping		Job		2,500
14.	Electrical Service		Job		100,000
15.	Water Service		Job		27,500
16.	Sanitary Pumpout System		Job		5,000
17.	Sanitary Sewer		Job		11,000
	Construction Cost				$1,211,800
	Contingencies				121,700
	Engineering				77,500
	TOTAL PROJECT COST[2]				$1,411,000

(1) rounded to nearest 100 dollars
(2) does not include land acquisition

PRELIMINARY COST ESTIMATE
FOR
PROPOSED RECREATIONAL BOAT
HARBOR ON PERE MARQUETTE LAKE

SCHEME II

	ITEMS OF WORK	UNIT	QUANTITIES	UNIT PRICES	AMOUNTS[1]
1.	Demolition & Clearing		Job		$ 32,000
2.	Excavation	C.Y.	103,570	4.00	414,300
3.	Revet Mattress	S.Y.	3,735	25.00	93,400
4.	Gabion Retaining Structure	L.F.	580	250.00	145,000
5.	Riprap	C.Y.	80	30.00	2,400
6.	Floating Docks	S.F.	12,103	23.00	278,400
7.	Dock Anchorage System		Job		17,600
8.	Dock Office		Job		2,000
9.	Toilet & Shower Bldg.	S.F.	1,000	75.00	75,000
10.	Paved Roads & Parking	S.Y.	7,825	8.50	66,500
11.	Concrete Walk	S.Y.	695	16.00	11,100
12.	Sodding	S.Y.	2,540	2.50	6,400
13.	Topsoil & Seeding	S.Y.	6,470	.65	4,200
14.	Landscaping		Job		2,500
15.	Electrical Service		Job		122,000
16.	Water Service		Job		25,200
17.	Sanitary Sewer		Job		7,000
18.	Sanitary Pumpout		Job		6,500
	Construction Cost				$1,311,500
	Contingencies				130,900
	Engineering				82,600
	TOTAL PROJECT COST[2]				$1,525,000

(1) rounded to nearest 100 dollars
(2) does not include land acquisition

PRELIMINARY COST ESTIMATE
FOR
PROPOSED RECREATIONAL BOAT
HARBOR ON PERE MARQUETTE LAKE

SCHEME III

	ITEMS OF WORK	UNIT	QUANTITIES	UNIT PRICES	AMOUNTS[1]
1.	Demolition & Clearing		Job		$ 32,000
2.	Excavation	C.Y.	101,432	4.00	405,700
3.	Revet Mattress	S.Y.	5,400	25.00	135,100
4.	Gabion Retaining Structure	L.F.	235	250.00	58,800
5.	Riprap	C.Y.	1,140	20.00	22,800
6.	Floating Docks	S.F.	11,720	23.00	269,600
7.	Dock Anchorage System		Job		17,000
8.	Dock Office		Job		2,000
9.	Toilet & Shower Bldg.	S.F.	1,000	75.00	75,000
10.	Paved Roads & Parking	S.Y.	7,245	8.50	61,600
11.	Concrete Walk	S.Y.	485	16.00	7,800
12.	Sodding	S.Y.	3,230	2.50	8,100
13.	Topsoil & Seeding	S.Y.	4,000	.65	2,600
14.	Landscaping		Job		2,500
15.	Electrical Service		Job		112,000
16.	Water Service		Job		27,200
17.	Sanitary Sewer		Job		32,400
18.	Sanitary Pumpout System		Job		4,000
19.	Sanitary Lift Station		Job		24,200
	Construction Cost				$1,300,300
	Contingencies				130,600
	Engineering[3]				82,100
	TOTAL PROJECT COST[2]				$1,513,000

(1) rounded to nearest 100 dollars
(2) does not include land acquistion
(3) does not include additional field work that may not be required

PRELIMINARY COST ESTIMATE
FOR
PROPOSED RECREATIONAL BOAT
HARBOR ON PERE MARQUETTE LAKE

SCHEME IV

	ITEMS OF WORK	UNIT	QUANTITIES	UNIT PRICES	AMOUNTS[1]
1.	Demolition & Clearing		Job		$ 32,000
2.	Excavation	C.Y.	111,055	4.00	444,200
3.	Revet Mattress	S.Y.	3,700	25.00	92,500
4.	Stone Breakwater	C.Y.	3,705	30.00	111,200
5.	Steel Sheet Piling	L.F.	135	450.00	60,800
6.	Gabion Retaining Structure	C.Y.	1,560	60.00	93,600
7.	Floating Docks	S.F.	27,500	23.00	632,500
8.	Dock Anchorage System		Job		32,200
9.	Dock Office		Job		2,000
10.	Toilet & Shower Building	S.F.	1,500	75.00	112,500
11.	Paved Roads & Paving	S.Y.	3,690	8.50	31,400
12.	Sodding	S.Y.	1,540	2.50	3,900
13.	Concrete Walk	S.Y.	430	16.00	6,900
14.	Topsoil & Seeding	S.Y.	1,500	.65	1,000
15.	Landscaping		Job		2,500
16.	Electrical Service		Job		160,000
17.	Water Service		Job		33,300
18.	Sanitary Sewer		Job		5,000
19.	Sanitary Pumpout		Job		7,700
	Construction Cost				$1,865,200
	Contingencies				183,400
	Engineering[3]				111,400
	TOTAL PROJECT COST[2]				$2,160,000

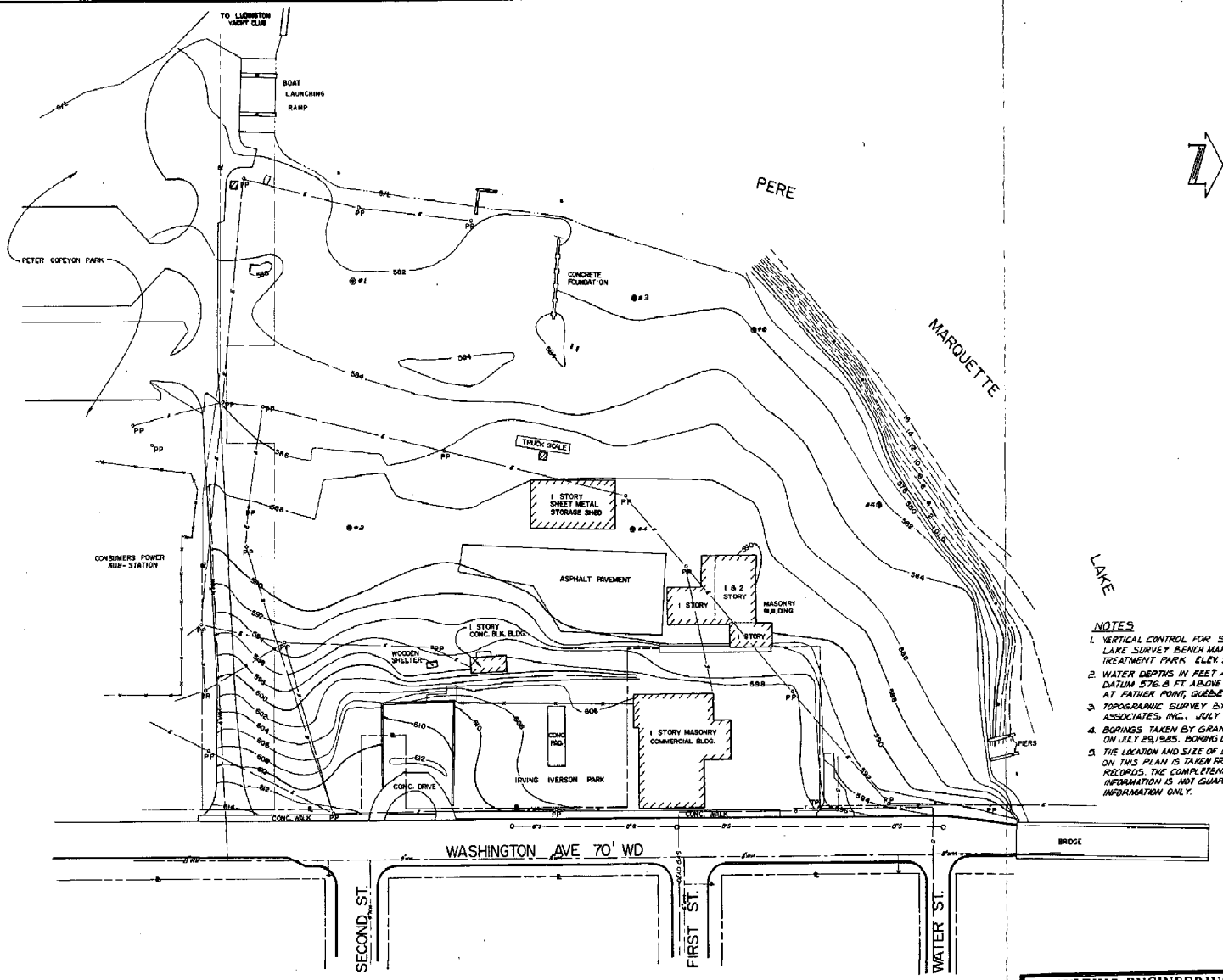
(1) rounded to nearest 100 dollars
(2) does not include land acquistion
(3) does not include additional field work that may be required

APPENDIX C

PRELIMINARY PLANS
FOR THE PROPOSED
WASHINGTON AVENUE MARINA
ON
PERE MARQUETTE LAKE
IN THE
CITY OF LUDINGTON

Plate	Title
C1	Plan of Site and Underground Utilities
C2	General Plan - Scheme I
C3	General Plan - Scheme II
C4	General Plan - Scheme III
C5	General Plan - Scheme IV

LUI | UT
LUI | UT



SITE PLAN

100 50 0 100 200

NOTES

1. VERTICAL CONTROL FOR SURVEY REFERS TO U.S. LAKE SURVEY BENCH MARK AT LUDINGTON SEWAGE TREATMENT PARK. ELEV 582.210 (I.G.L.D. 1955)
2. WATER DEPTHS IN FEET ARE REFERRED TO LOW WATER DATUM 576.8 FT. ABOVE MEAN LOW WATER LEVEL AT FATHER POINT, QUEBEC. (I.G.L.D. 1955)
3. TOPOGRAPHIC SURVEY BY CONSULTING ENGINEERING ASSOCIATES, INC., JULY 1985.
4. BORINGS TAKEN BY GRAND RAPIDS TESTING SERVICE ON JULY 29, 1985. BORING LOCATIONS ON PLAN SHOWN THUS ●
5. THE LOCATION AND SIZE OF UNDERGROUND UTILITIES SHOWN ON THIS PLAN IS TAKEN FROM THE BEST AVAILABLE RECORDS. THE COMPLETENESS OR ACCURACY OF SUCH INFORMATION IS NOT GUARANTEED BUT IS SHOWN FOR INFORMATION ONLY.

LEGEND

- 8"S — SANITARY SEWER
- 6"WM — WATER MAIN & HYDRANT
- G — GAS MAIN
- E — OVERHEAD ELECTRIC LINE
- T — OVERHEAD TELEPHONE LINE
- MANHOLE
- PP ELECTRIC POLE
- TP TELEPHONE POLE
- BORING LOCATION
- PILING

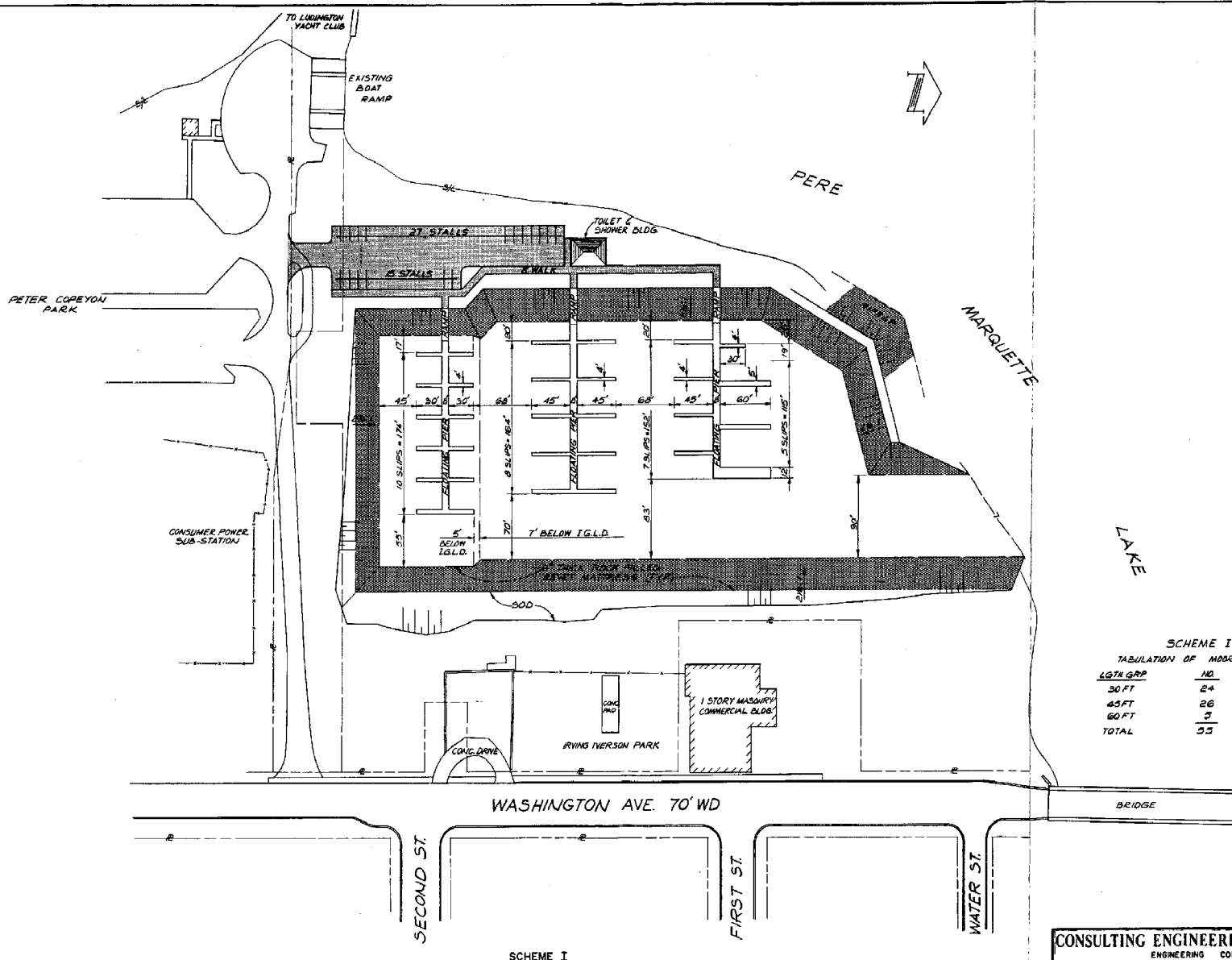
CONSULTING ENGINEERING ASSOCIATES, INC
ENGINEERING CONSULTANTS
16580 WYOMING AVE. DETROIT MICH. 48221 313/ 341-5797

CITY OF LUDINGTON
PROPOSED RECREATIONAL BOAT HARBOR
PLAN OF SITE

DESIGN BY	CHKD.	FILE NO.	SCALE	SHEET
JJMP			AS SHOWN	1 of 5
DRAWN BY	APPD.	DRG. NO.	DATE	
ND & MSK			JULY 85	

PLATE C1

LU2 |S|
LU2 |S|



SCHEME I

TABULATION OF MOORING FACILITIES

LGTH GRP	NO.	%
30 FT	24	43.6
45 FT	26	47.3
60 FT	5	9.1
TOTAL	55	100.0

SCHEME I

GENERAL PLAN

100 50 0 100 200

CONSULTING ENGINEERING ASSOCIATES, INC
ENGINEERING CONSULTANTS
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CITY OF LUDINGTON

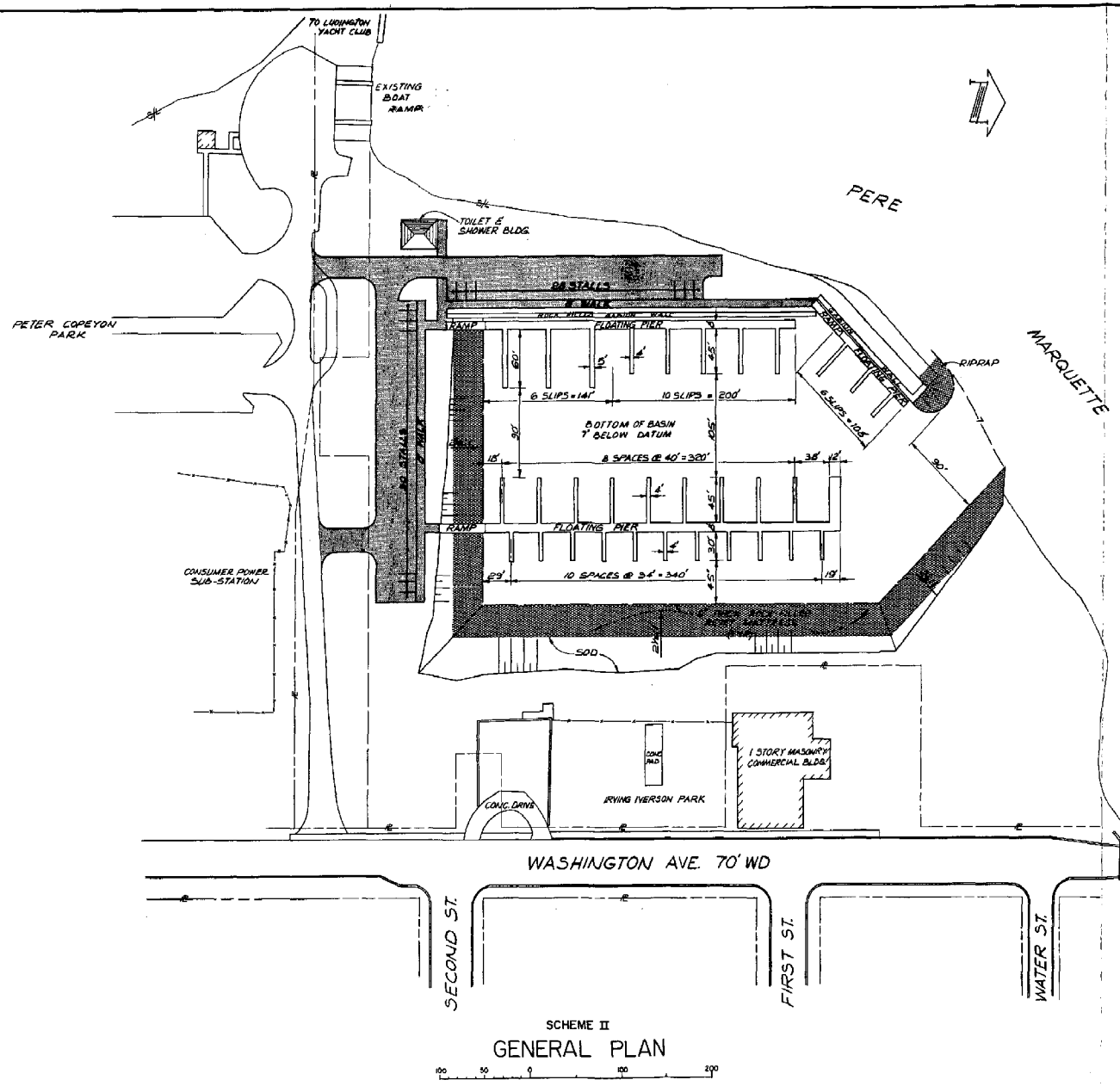
PROPOSED RECREATIONAL BOAT HARBOR

SCHEME I

DESIGN BY	CHKD.	FILE NO.	SCALE	SHEET
J.J.M.C.			AS SHOWN	2 of 5
DRAWN BY M.S.K.	APPD.	DWG NO.	DATE JULY 85	

PLATE C2

LU2 | S2
LU2 | S2



SCHEME II

GENERAL PLAN

100 50 0 100 200

SCHEME II

TABULATION OF MOORING FACILITIES

LGTH. GRP	NO.	%
30 FT	26	41.3
45 FT	31	49.2
60 FT	6	9.5
TOTAL	63	100.0

CONSULTING ENGINEERING ASSOCIATES, INC
ENGINEERING CONSULTANTS
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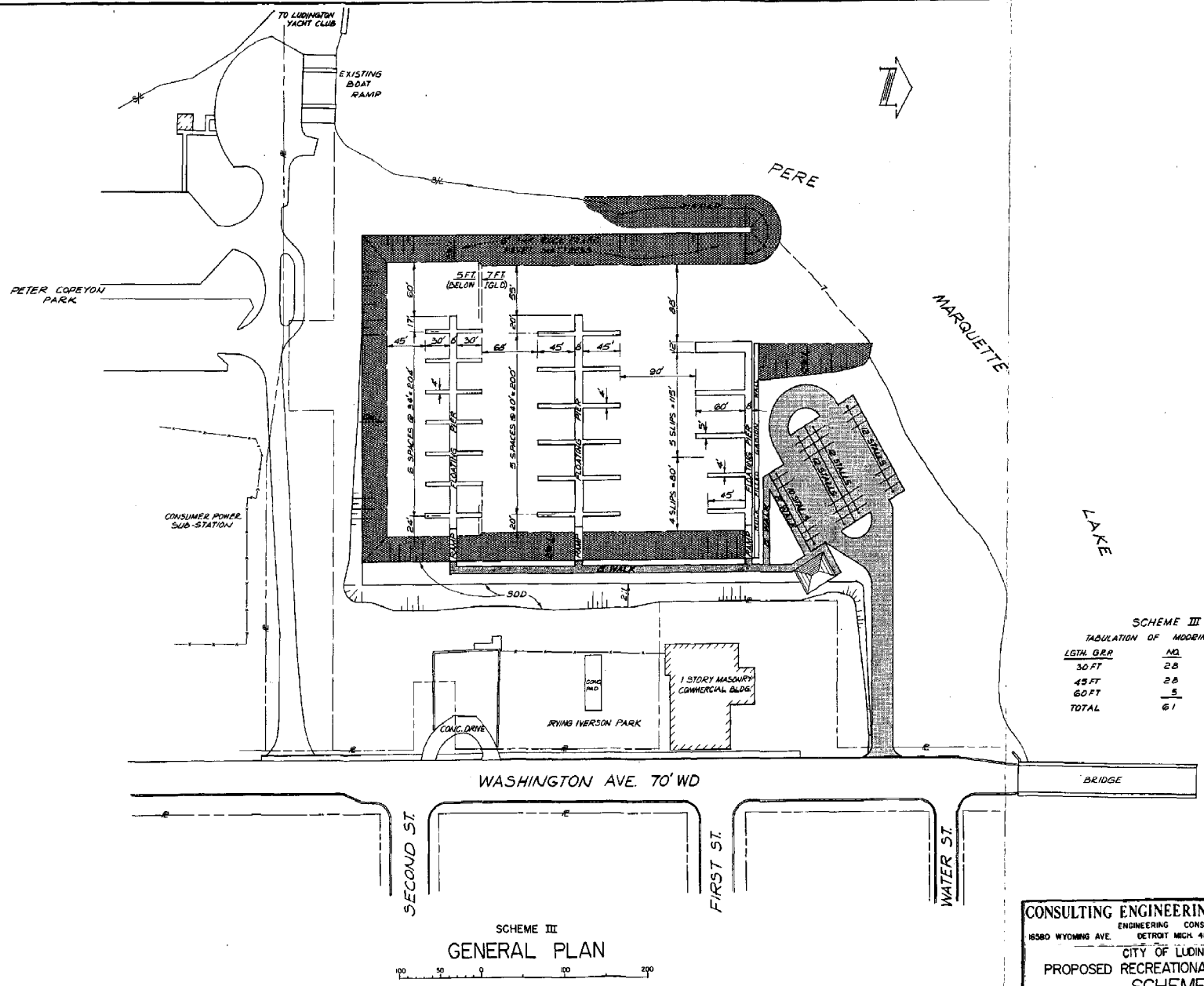
CITY OF LUDINGTON
PROPOSED RECREATIONAL BOAT HARBOR
SCHEME II

DESIGN BY	CHKD.	FILE NO.	SCALE	SHEET
JJMC			AS SHOWN	3 of 5
DRAWN BY MSK	APPD.	DWG NO.	DATE JULY 85	

PLATE C3

LU2 | S3
LU2 | S3



SCHEME III

GENERAL PLAN

100 50 0 100 200

SCHEME III

TABULATION OF MOORING FACILITIES

LGTH. G.R.P.	NO.	%
30 FT	28	45.9
45 FT	28	45.9
60 FT	5	8.2
TOTAL	61	100.0

CONSULTING ENGINEERING ASSOCIATES, INC.
ENGINEERING CONSULTANTS
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CITY OF LUDINGTON

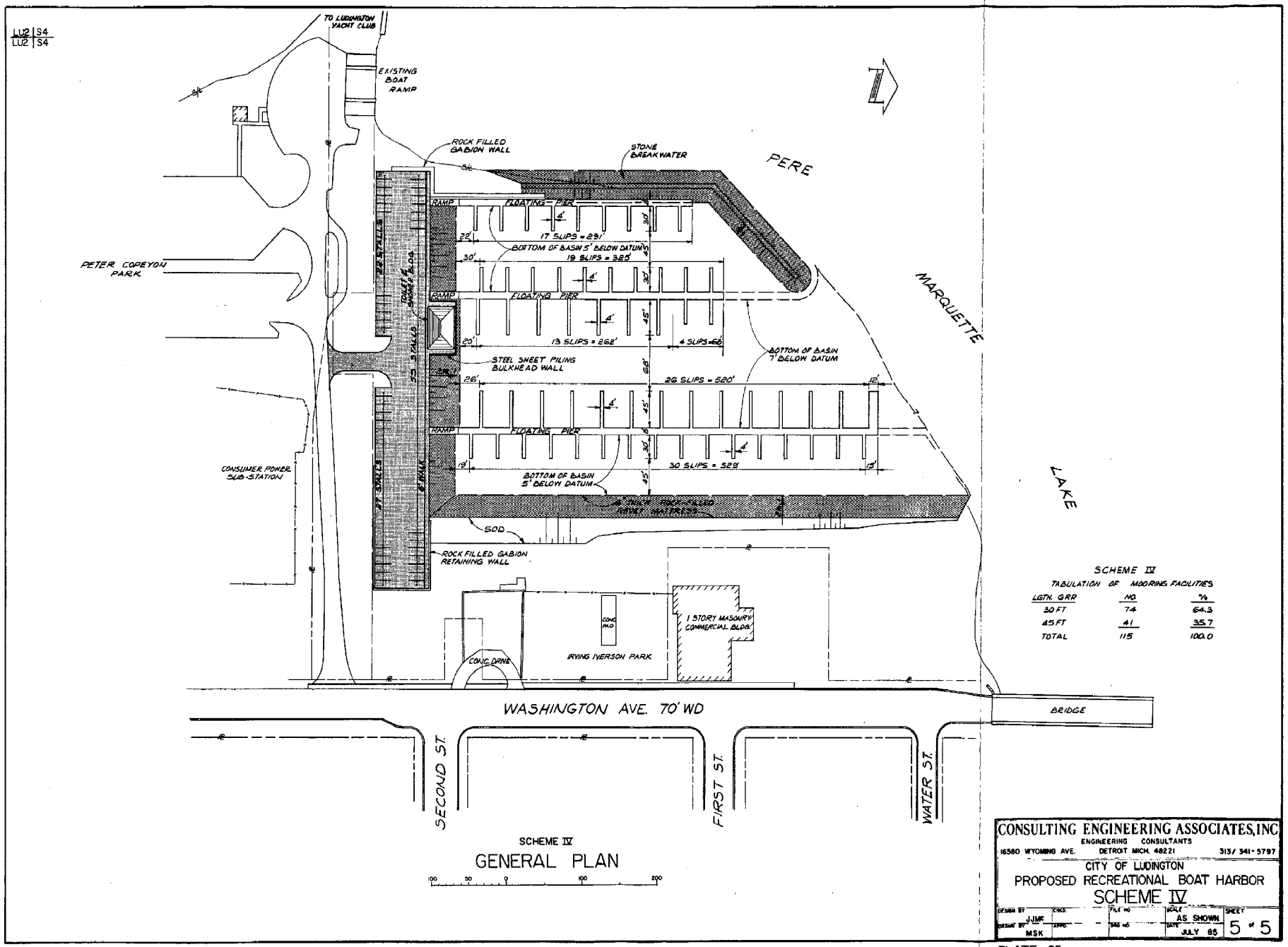
PROPOSED RECREATIONAL BOAT HARBOR

SCHEME III

DESIGN BY	CHKD	FILE NO	SCALE	SHEET
JJMC			AS SHOWN	4 of 5
DRAWN BY MSK	APPD	DRG NO	DATE JULY 85	

PLATE C4

LU2 | S4
LU2 | S4



SCHEME IV

TABULATION OF MOORING FACILITIES

LGTH. GRP	NO.	%
30 FT	74	64.3
45 FT	41	35.7
TOTAL	115	100.0

SCHEME IV

GENERAL PLAN

100 50 0 100 200

CONSULTING ENGINEERING ASSOCIATES, INC
ENGINEERING CONSULTANTS
16580 WYOMING AVE. DETROIT MICH. 48221 313/ 341-5797

CITY OF LUDINGTON
PROPOSED RECREATIONAL BOAT HARBOR
SCHEME IV

DESIGN BY	CHKD.	FILE NO.	SCALE	SHEET
DRAWN BY JJMC	APPD.	SAG NO.	AS SHOWN	5 of 5
MSK			DATE JULY 85	

PLATE C5