Evans Lake 8-30

227

1985

Date:

WATER BODY FACT SHEET

REGION: 8

TYPE OF RESOURCE: lake
RESOURCE VALUE:

W A T E R B O D Y
NAME: Evans Lake 4 (Fairmont Park, Riverside)

DAM NAME IF DIFFERENT: Fairmount Park

USGS QUADRANGLE: ______ COUNTY Riverside

OWNER: City of Riverside OPERATOR IF DIFFERENT: Parks & Rec. - Fairmont Park

PUBLIC ACCESS/FEES: open / non-fee

SURFACE AREA (in acres): 42 VOLUME (in acre-feet): ______

MEAN DEPTH (in feet): 10' MAXIMUM DEPTH (in feet): ______

PRINCIPAL INFLOW(S):
3 raw wells; no storm drains (now); some pecolation; can get flood bypass water in winter

PRINCIPAL OUTFLOW(S):
2 channels (on SW side, W side) - natural channels flow back to SAR;

DISCHARGERS WITHIN 25 RIVERMILES:

Permit No.	Agency Name	Facility Name	Discharge Q
none tributary to lake			

4 BP + WQA

Water-body is man-made in 1920's; (dammed up a watercourse near SAR.)

BENEFICIAL USES: trout, catfish, crappie, shad (stocked)

RECl, REC2, WARM, COLD, WILD; exempted fr MUN by 89-42

posted vs swimming (also ranger)

DESCRIPTION OF AVAILABLE DATA:

1986 TSMP measured 1 largemouth bass fillet for Se ~~only~~, ~~other~~ organics ~~[illegible]~~; no exceedances or any over 85% EDL;

irregularly monitored by City; UCR Monit site 6 (Lake Evans trib to SAR at Mission)

DESCRIPTION OF WATER QUALITY:

generally good due to flow through from pumping GW.

UCR data at site 6 shows this to be high qual water.

av TKN = .5 ± .3, av NH_4N = 0.1 ± .1, av NO_3N = 0.6 ± .3, av NO_2-N < 0.1, av TDS = 515 ± 68

WATER QUALITY PROBLEM(S):

minor algae buildup (affects ~ 2 acres)

fish/duck kills 3-4 yrs ago due - had a major storm drain (drains 20 urban acres); now bypassed; also corrected by dredging lake, creating silt. basin behind dam.

DESCRIPTION OF PROBLEM:

build-up of nutrients; impacts of storm flows

BENEFICIAL USE(S) AFFECTED:

aesthetics;

PROBABLE SOURCE(S):

NPS storm flows carry in sediment + toxics

CURRENT ACTIONS:

Currently developing 2 fishing piers.

PROGRAM(S) DIRECTLY INVOLVED IN CURRENT ACTIONS:

ADDITIONAL ACTIONS:

PROGRAMS DIRECTLY AFFECTED BY STATE AND REGIONAL BOARD ADDITIONAL ACTIONS:

COSTS PER YEAR, CONTRACT ($):__________ PY:______ DURATION:______

City OKs consultant to solve Fairmount dispute

The Riverside City Council agreed Nov. 26 to hire a consultant to aid the city in a dispute with a contractor who has refused to complete work at Fairmount Park's three lakes.

Larry Tyler, president of Terra-Cal Construction, said Nov. 26 he stopped work at the lakes about 45 days ago after the company and the city could not agree on who was responsible for repairing defects in a storm drain.

The city hired the Baldwin Park-based construction company in August 1984 to upgrade lakes Evans, Fairmount, and Brown.

Among other things, the company was to construct an underground bypass channel around the two largest lakes, Evans and Fairmount, to carry polluted storm runoff into the Santa Ana River.

Dee Bachman, city parks director, told the council that shortly after Terra-Cal installed the storm drain and repaved the street around Lake Evans, an "abrupt settlement of the pavement occurred," which ruptured a water line in Dexter Drive and undermined a section of the road.

The damage was repaired by city workers after Terra-Cal refused to make the repairs, Bachman said. The city subsequently inspected the storm drain and came up with a list of defects.

However, Terra-Cal, while accepting responsibility for some repairs, said it was not responsible for the settlement of the pavement. The company said there was an inherent defect in the pipeline, which was designed by the city Public Works Department.

Council members voted 7-0 to spend $4,900 to hire the engineering firm of Woodward Clyde Associates after Bachman said the city needed experts to determine the cause of the settlement.

Bachman said he could not estimate when the work at the lakes, which is 90 percent completed, would be wrapped up. He said Terra-Cal is several months behind on the project.

"In fairness, the contractor encountered some engineering problems that no one anticipated and expended considerably more money than he anticipated. So we have attempted to work with him to get this to a conclusion," City Manager Douglas Weiford told the council.

Weiford said the main reason city staff members recommended hiring outside experts is because Terra-Cal has hired a consultant.

"The city's action is a counteraction because all of this may end up in a court of law," Weiford told the council.

LAKE EVANS REHABILITATION STUDY
CITY OF RIVERSIDE
LAKE BOTTOM SOILS ANALYSES

NOVEMBER 1982

FOR

FLORIAN/MARTINEZ ASSOCIATES
13132 NEWPORT AVE., SUITE 110
TUSTIN, CA 92680

BY

SCOTT SOULE & ASSOCIATES
856 N. ELM ST., SUITE K
ORANGE, CA 92667

LAKE EVANS REHABILITATION STUDY

LAKE BOTTOM SOILS ANALYSES

I. OBJECTIVES:

The study resulting in the report entitled, The Rehabilitation of Lake Evans: The Assessment and Conceptual Plan for an Urban Fishery, June 1982, indicated a possible problem with heavy metal concentrations in the soft, silty material covering the lake bottom. Samples of the sediments below the soft silt were not analyzed. It was recognized, however, that it would be impossible to complete the planning for disposal of the material to be excavated from the lake bottom until it was known, whether or not heavy metals were present, and if so, at what concentrations.

Accordingly, in September, 1982, the City of Riverside authorized a study to determine (1) whether heavy metals were present in the lake bottom below the silt and in the underlying sediments and if so, at what concentrations; (2) the restrictions and limitations, if any, the Santa Ana Regional Water Quality Control Board would impose on disposition of excavated material; (3) permeability of the river bottom sediments adjacent to the lake; and (4) establishing wells to monitor the groundwater level near the lake.

II. METHODOLOGY:

A. Collection of samples

Soil samples were taken from the lake bottom, from a few feet below lake bottom and from the flood plain sediments at the anticipated level of maximum lake excavation.

The first group utilizes ten samples taken by Leighton and Associates, Inc., in March, 1982, using a boat and a hollow core sampling tool to sample the soft silt and into the firmer sediments immediately under the soft silt. These ten individual borings were composited into three samples for analysis, A, B, and C.

The water depths and sample depths for the composited samples are shown in Table 1 and sampling locations for the ten borings are shown on Figure 1.

TABLE 1

DEPTH OF COMPOSITE SAMPLES:

BORINGS MADE 3-25-82

SAMPLE DESIGNATION	DEPTH OF LAKE WATER	LAKE BOTTOM SAMPLE LENGTH - APPROXIMATELY		
		SILT	SAND	TOTAL
"A" (composite of 1, 2, 3, 6, 7, 10)	5½' Avg.	11" Avg.	4" Avg.	15"
"B" (4,5)	7' & 7½'	20" Avg.	5" Avg.	25"
"C" (8,9)	4½' & 3'	14" Avg.	5" Avg.	19"

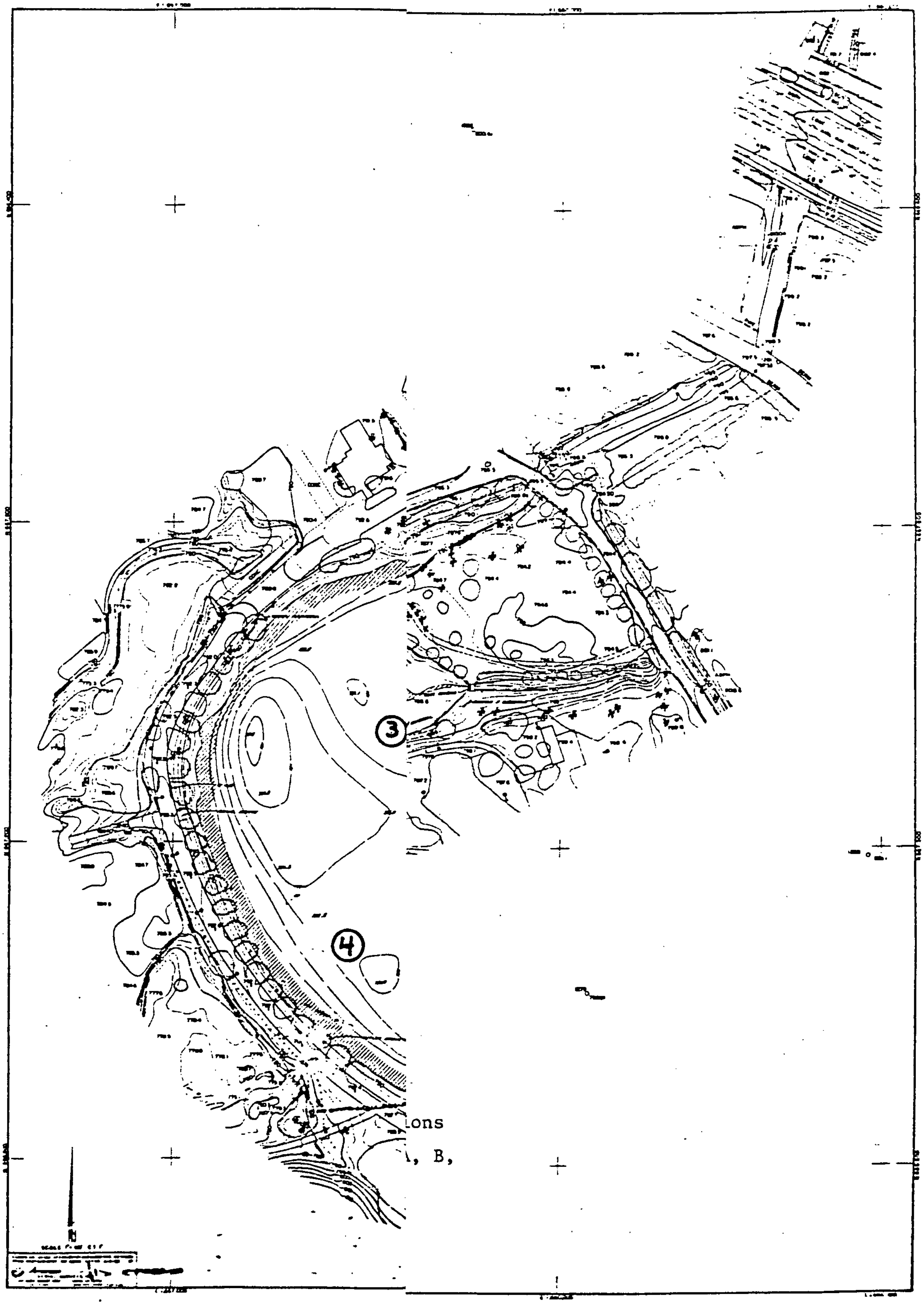
The second group is comprised of six sample borings taken by Leighton and Associates September, 1982, again using a boat and hand sample tool. These samples, designated WB-1 through WB-6, represent the lake bottom sediments from one foot to two and a half feet below the layer of soft silt. Sampling depth information is presented in Table 2 and sample locations are shown on Figure 2.

TABLE 2

DEPTH OF LAKE BOTTOM SAMPLES:

BORINGS MADE 9-30-82

SAMPLE DESIGNATION	DEPTH OF LAKE WATER	DEPTH OF SILT	BORING DEPTH BELOW SILT LAYER	SAMPLE LENGTH
WB-1	5'	20"	2'	6"
WB-2	5'	14"	2'	6"
WB-3	8'	25"	1½'	6"
WB-4	5'	5"	2'	6"
WB-5	4'	38"	1'	6"
WB-6	5'	12"	2½'	6"



ons

, B,

The third group of samples were taken at four locations on the lake's edge using a drill truck and are designated B-3 through B-6. The depths at which samples were taken are shown in Table 3 and boring locations are shown on Figure 2.

TABLE 3

DEPTH OF LAKE EDGE BORING SAMPLES:

BORINGS MADE 9-28-82

SAMPLE DESIGNATION	DEPTH OF DRY LAKE EDGE BORING	SAMPLE LENGTH
B5	20'	6"
B-3	13'	6"
B-4	18'	6"
B-5	19'	6"
B-6	18'	6"

B. Analyses of samples

All of the samples were delivered to Crosby Laboratories where the first group were composited into three samples (A, B, & C) and all samples were given laboratory numbers. Crosby Laboratories ran the wet-dry and volatile solids analyses.

The fourteen numbered samples were analyzed for the five heavy metals (barium, cadmium, chronium, lead, and mercury) by Associated Laboratories using the "Appendix II - EP Toxicity Test Procedures" as given in the Federal Register, Volume 45, Number 98, May 19, 1980, Rules and Regulations.

The fourteen ashed samples were given to Pacific Spectrochemical Laboratory for semiquantitative spectrog-his analysis.

The analyses results from all three laboratories were retabulated by Crosby Laboratories to show all results for each sample (laboratory number) on one page. This information is included as Appendix 1.

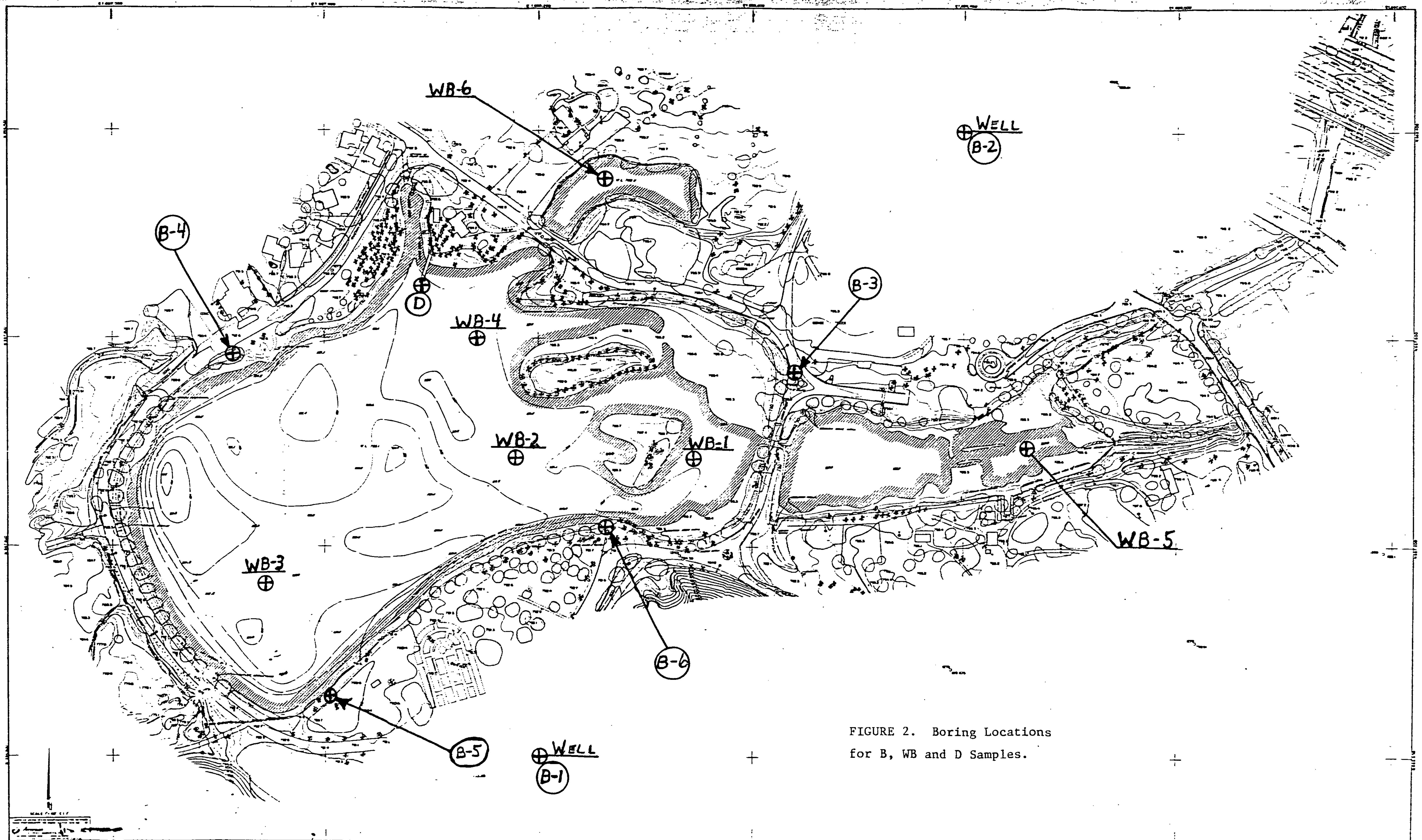


FIGURE 2. Boring Locations for B, WB and D Samples.

C. Permeability

Leighton and Associates reviewed the sediments encountered in drilling borings B-3 through B-6 and selected a representative sample for testing. The laboratory test results are included as Appendix II.

D. Groundwater monitoring wells

Two groundwater monitoring wells were drilled by Leighton and Associates. The wells are cased with PVC piping and capped. Well locations are shown on Figure 2.

III. FINDINGS:

A. Laboratory Analyses of Test Borings

1. EP Extracted samples

Some fourteen test borings were analyzed for barium, cadmium, chronium, lead and mercury by the EP extraction procedure using the Atomic Absorption Analyses method after EP extraction of the samples. No significant amounts of these metals were found in any of the samples. See Table 4. The concentration of metals present is so low that it would pass the standards set for California drinking water, Title 22. See Appendix I for the detailed results of the Chemical Analyses of Test Borings.

There should be no potential problems in the handling or disposal of any of the lake bottom material on the basis of heavy metals contamination.

TABLE 4

CHEMICAL ANALYSES SUMMARY OF TEST BORINGS

CHEM. LAB. NO.	S. SOULE SAMPLE NO.	MILLIGRAMS/LITER BY E.P. EXTRACTION				
		BARIUM	CADMIUM	CHROMIUM	LEAD	MERCURY
43194	A (1,2,3,6,7, 10)	0.53	1. ND< 0.01	ND< 0.01	ND< 0.01	ND< 0.005
43195	B(4,5)	0.80	"	"	"	"
43196	C(8,9)	0.91	"	"	0.03	"
43242	B5	0.04	"	"	ND< 0.01	"
43307	WB-1	0.21	"	"	"	"
43308	WB-2	0.33	"	"	"	"
43309	WB-3	0.16	"	"	"	0.0016
43310	WB-4	0.88	"	"	"	0.0012
43311	WB-5	0.27	"	"	"	0.0013
43312	WB-6	0.28	"	"	"	0.0022
43386	B-3	0.09	"	"	"	ND< 0.0005
43386	B-4	0.22	"	"	"	"
43388	B-5	0.04	"	"	"	0.0006
43389	B-6	0.12	"	"	"	ND< 0.0005
Min.		0.04	ND	ND	ND	ND
Max.		0.91	ND	ND	0.03	0.0022
[2] M.C.L.		1.0	0.01	0.05	0.05	0.002

Notes: 1. ND< X or ND = None Detected

2. M.C.L. = Maximum Contaminant Level per California Drinking Water Standard, Title 22.

2. Moisture and Volatile Solids

The moisture and volatile solids were run on the fourteen samples with the results shown in Appendix I, "Chemical Analyses of Test Borings." These showed a range of some 11.46% to 15.28% of moisture for the lake edge borings and 13.23% to 38.86% of moisture for the lake bottom samples. No problems are anticipated from this moisture content.

The volatile solids, which is essentially the same as organic material, showed a range of 2.79% to 4.76% of wet sample weight for the first set of lake bottom composite samples. The second set of lake bottom samples going below the silt (WB-1 through WB-6) showed a range of 0.24% to 1.46% of wet sample weight. The third group of samples from the lake edge borings showed 0.35%, 0.38%, 0.51%, and 7.10% of the wet samples. The 7.10% sample cut through a tree root so this would not necessarily be considered a representative sample for this use.

Another lake bottom sample was obtained on 10-31-82 (Sample "D") from the end of the sailing club pier to verify the above and it showed 1.51% of wet sample weight. This sample included all the silt at this point and about 4" of the compacted bottom material to attempt to get a worst case organic sample. This further verified the minimum amounts of organic materials in the bottom silt. See Appendix I, Lab report on Sample D.

Since the organic matter in the lake bottom and soil below the lake bottom is relatively small, no problems are anticipated in the handling or disposal of the lake bottom material from the standpoint of organic material.

3. Spectrographic Analyses of Ash Samples

The fourteen dried laboratory samples were ashed to remove the volatile or organic materials and these ash samples were then subjected to spectrographic analyses to determine if this would show any unusual chemical element concentrations. The results as shown in Appendix I, "Chemical Analyses of Test Borings" indicate no unusual concentration of any chemical elements found in the samples. This further verifies the E.P. Extraction findings.

B. Permeability of Soils

Permeability of soil borings B-3 through B-6 was assessed visually by the field geologist. A representative sample tested for permeability in the laboratory permitted water movement of approximately 30 feet per 24 hours. The visual or estimated permeability and the laboratory test agreed quite closely. See Appendix II for the Leighton and Associates laboratory report.

C. Monitoring Wells

The groundwater levels in the two test wells were 13 feet and 11 feet respectively for B-1 and B-2, see Figure 2.

IV. <u>DISCUSSION AND CONCLUSIONS</u>:

Movement and disposal of materials containing possible contaminants or other substances posing hazards to health and/or the environment are subject to regulation. Plans for the disposal of materials to be excavated in the rehabilitation of Lake Evans must have the approval of the California Regional Water Quality Control Board - Santa Ana Region (RWQCB).

The Santa Ana RWQCB personnel were aware of the concerns expressed in the June 1982 study and indicated that additional tests would be required before final plans could be made regarding disposition of the excavated material.

The RWQCB personnel were contacted three times during the present study. First, during the field phase when lake and lake edge borings were in progress, to inform them of progress and acquaint them of the general study plans. After the chemical analyses were completed, a meeting was held October 29, 1982 at the RWQCB Riverside office to present them with the Appendix I, Chemical Analyses of Test Borings and to discuss these findings and their implications. The third contact was on November 5, 1982, when complete copies of the laboratory reports from Associated Laboratories and Pacific Spectrochemical Laboratories were supplied to complete the RWQCB files on this study.

On the basis of the study findings and our preliminary discussions with RWQCB personnel, it can be concluded that there are no potential problems with disposal of material to be excavated from the lake insofar as contaminants or hazardous materials are concerned. The material to be excavated appears suitable for use as general fill.

The soils permeability testing and groundwater monitoring were somewhat secondary aspects of the study but they add valuable and instructive information. At the moderate permeability rating of 30 feet per 24 hours and with groundwater levels near the lake at or just below lake bottom level, it appears quite reasonable that a 8-10 feet head pressure would result in a considerable volume of water moving from the lake to the adjacent groundwater aquifer.

APPENDIX I

8-51
Evans Lake

1982

CROSBY LABORATORIES

RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639-3821

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

LAB NO. 43194
SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: A (1, 2, 3, 6, 7,10)*

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.53	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	25.9403	GRAMS
MOISTURE (WT. LOSS @ 104° C)	33.41	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	66.59	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	2.79	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	63.80	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	4.2
ALUMINUM	AL	9.9
CALCIUM	CA	6.2
SODIUM	NA	5.0
MAGNESIUM	MG	1.3
POTASSIUM	K	3.2
TITANIUM	TI	0.7
MANGANESE	MN	0.037
LEAD	PB	0.028
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0050
VANADIUM	V	0.0073
COPPER	CU	0.0097
NICKEL	NI	0.0023
ZIRCONIUM	ZR	0.025
COBALT	CO	0.0025
STRONTIUM	SR	0.021
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 6 SEPARATE SAMPLES.

EDWIN S. CROSBY, PHD.
DIRECTOR

APPENDIX I - 1

Approved by: State of California, Department of Health Services, Laboratory Section

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ORANGE, CALIFORNIA 92667

LAB NO. 43195
SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B (4, 5) *

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.80	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES		
SAMPLE ALIQUOT, WET WEIGHT	19.8905	GRAMS
MOISTURE (WT. LOSS @ 104° C)	38.86	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	61.14	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	4.76	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	56.38	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	4.9
ALUMINUM	AL	10.0
CALCIUM	CA	7.8
SODIUM	NA	4.4
MAGNESIUM	MG	1.6
POTASSIUM	K	2.3
TITANIUM	TI	0.99
MANGANESE	MN	0.044
LEAD	PB	0.031
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0059
VANADIUM	V	0.0086
COPPER	CU	0.016
NICKEL	NI	0.0030
ZIRCONIUM	ZR	0.034
COBALT	CO	0.0036
STRONTIUM	SR	0.012
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.023
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 2 SEPARATE SAMPLES.

EDWIN S. CROSBY, PHD.
DIRECTOR

APPENDIX I - 2

CROSBY LABORATORIES

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LAB NO. 43196
SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: C (8, 9) *

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.91	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	0.03	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES		
SAMPLE ALIQUOT, WET WEIGHT	15.3054	GRAMS
MOISTURE (WT. LOSS @ 104° C)	33.36	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	66.64	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	3.30	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	63.34	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	3.7
ALUMINUM	AL	12.0
CALCIUM	CA	5.6
SODIUM	NA	5.3
MAGNESIUM	MG	1.5
POTASSIUM	K	3.5
TITANIUM	TI	0.62
MANGANESE	MN	0.037
LEAD	PB	0.0098
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0065
VANADIUM	V	0.0068
COPPER	CU	0.011
NICKEL	NI	0.0021
ZIRCONIUM	ZR	0.028
COBALT	CO	0.0029
STRONTIUM	SR	0.046
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.024
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 2 SEPARATE SAMPLES.

EDWIN S. CROSBY, PHD.
DIRECTOR

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LAB NO. 43242

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SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 30, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B5

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.04	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES		
SAMPLE ALIQUOT, WET WEIGHT	16.2635	GRAMS
MOISTURE (WT. LOSS @ 104° C)	17.85	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	82.15	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.50	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	81.65	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	25.0
IRON	FE	2.0
ALUMINUM	AL	10.0
CALCIUM	CA	2.7
SODIUM	NA	7.2
MAGNESIUM	MG	0.75
POTASSIUM	K	3.5
TITANIUM	TI	0.38
MANGANESE	MN	0.037
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0048
VANADIUM	V	0.0058
COPPER	CU	0.0052
NICKEL	NI	0.0012
ZIRCONIUM	ZR	0.018
COBALT	CO	TR<0.001
STRONTIUM	SR	0.044
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.0092
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

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LAB NO. 43307

SCOTT SOULE & ASSOCIATES
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ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-1

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.21	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	14.3565	GRAMS
MOISTURE (WT. LOSS @ 104° C)	13.23	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	86.77	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.08	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	85.69	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	22.0
IRON	FE	3.2
ALUMINUM	AL	11.0
CALCIUM	CA	5.2
SODIUM	NA	5.9
MAGNESIUM	MG	0.9
POTASSIUM	K	3.8
TITANIUM	TI	0.8
MANGANESE	MN	0.029
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0057
VANADIUM	V	0.0069
COPPER	CU	0.0029
NICKEL	NI	0.00073
ZIRCONIUM	ZR	0.014
COBALT	CO	TR<0.001
STRONTIUM	SR	0.050
YTTERBIUM	YB	0.0049
CHROMIUM	CR	0.0081
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

APPENDIX I - 5

CROSBY LABORATORIES
RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639-3821

LAB NO. 43308

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-2

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.33	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	13.8289	GRAMS
MOISTURE (WT. LOSS @ 104° C)	19.58	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	80.42	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.01	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	79.41	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	25.0
IRON	FE	2.5
ALUMINUM	AL	11.0
CALCIUM	CA	3.1
SODIUM	NA	6.4
MAGNESIUM	MG	0.75
POTASSIUM	K	2.4
TITANIUM	TI	0.45
MANGANESE	MN	0.047
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0033
VANADIUM	V	0.0065
COPPER	CU	0.0022
NICKEL	NI	0.0013
ZIRCONIUM	ZR	0.019
COBALT	CO	TR<0.001
STRONTIUM	SR	0.059
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.010
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

APPENDIX I - 6

Approved by: State of California, Department of Health Services, Laboratory Section

CROSBY LABORATORIES

RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

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SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

LAB NO. 43309
SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-3

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.16	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0016	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	14.4301	GRAMS
MOISTURE (WT. LOSS @ 104° C)	17.10	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	82.90	% OF WET SAMPLE
VOLATILE SOLIDS (LOSS @ 550° C)	1.11	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	81.79	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	27.0
IRON	FE	4.6
ALUMINUM	AL	8.6
CALCIUM	CA	3.2
SODIUM	NA	4.9
MAGNESIUM	MG	1.1
POTASSIUM	K	2.3
TITANIUM	TI	0.62
MANGANESE	MN	0.059
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0059
VANADIUM	V	0.0090
COPPER	CU	0.00081
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.021
COBALT	CO	TR<0.001
STRONTIUM	SR	0.033
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.015
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

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LAB NO. 43310

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-4

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.88	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0012	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.0140	GRAMS
MOISTURE (WT. LOSS @ 104° C)	25.76	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	74.24	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.46	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	72.78	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	5.3
ALUMINUM	AL	9.2
CALCIUM	CA	8.5
SODIUM	NA	5.2
MAGNESIUM	MG	1.1
POTASSIUM	K	3.4
TITANIUM	TI	0.77
MANGANESE	MN	0.050
LEAD	PB	TR<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0066
VANADIUM	V	0.0076
COPPER	CU	0.0051
NICKEL	NI	0.0016
ZIRCONIUM	ZR	0.040
COBALT	CO	TR<0.001
STRONTIUM	SR	0.033
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.014
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby
EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639-3821

LAB NO. 43311

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-5

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.27	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0013	MG/L

SOLIDS - WET SAMPLES		
SAMPLE ALIQUOT, WET WEIGHT	16.8671	GRAMS
MOISTURE (WT. LOSS @ 104° C)	15.65	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	84.35	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.97	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	83.38	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	27.0
IRON	FE	2.3
ALUMINUM	AL	7.8
CALCIUM	CA	3.7
SODIUM	NA	6.1
MAGNESIUM	MG	1.1
POTASSIUM	K	4.0
TITANIUM	TI	0.58
MANGANESE	MN	0.036
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0054
VANADIUM	V	0.0080
COPPER	CU	0.0018
NICKEL	NI	0.0018
ZIRCONIUM	ZR	0.032
COBALT	CO	0.0023
STRONTIUM	SR	0.027
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

[signature]

EDWIN S. CROSBY, PHD.
DIRECTOR

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RESEARCH AND CONSULTING

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LAB NO. 43312

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-6

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.28	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0022	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	15.9993	GRAMS
MOISTURE (WT. LOSS @ 104° C)	20.23	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	79.77	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.24	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	79.53	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	3.0
ALUMINUM	AL	10.0
CALCIUM	CA	4.1
SODIUM	NA	6.1
MAGNESIUM	MG	1.2
POTASSIUM	K	4.3
TITANIUM	TI	0.69
MANGANESE	MN	0.037
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0062
VANADIUM	V	0.0098
COPPER	CU	0.0023
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.027
COBALT	CO	0.0019
STRONTIUM	SR	0.023
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

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LAB NO. 43386

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCOTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-3

CHEMICAL ANALYSES

		Concentration	Units
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.09	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	17.0575	GRAMS
MOISTURE (WT. LOSS @ 104° C)	12.57	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	87.43	% OF WET SAMPLE
VOLATILE SOLIDS (LOSS @ 550° C)	0.51	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	86.92	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	4.2
ALUMINUM	AL	8.9
CALCIUM	CA	3.3
SODIUM	NA	7.5
MAGNESIUM	MG	0.76
POTASSIUM	K	4.0
TITANIUM	TI	0.71
MANGANESE	MN	0.079
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0052
VANADIUM	V	0.012
COPPER	CU	0.012
NICKEL	NI	0.0015
ZIRCONIUM	ZR	0.047
COBALT	CO	ND<0.001
STRONTIUM	SR	0.047
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.024
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES
RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

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LAB NO. 43387

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-4

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.22	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	17.8757	GRAMS
MOISTURE (WT. LOSS @ 104° C)	15.28	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	84.72	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	7.10	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	77.62	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	3.7
ALUMINUM	AL	10.0
CALCIUM	CA	7.9
SODIUM	NA	4.5
MAGNESIUM	MG	1.7
POTASSIUM	K	2.7
TITANIUM	TI	0.95
MANGANESE	MN	0.044
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0053
VANADIUM	V	0.0086
COPPER	CU	0.0075
NICKEL	NI	0.0018
ZIRCONIUM	ZR	0.035
COBALT	CO	0.0024
STRONTIUM	SR	0.023
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.014
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

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LAB NO. 43388

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-5

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.04	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0006	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.2328	GRAMS
MOISTURE (WT. LOSS @ 104° C)	16.67	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	83.33	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.38	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	82.95	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	3.6
ALUMINUM	AL	8.6
CALCIUM	CA	3.1
SODIUM	NA	7.2
MAGNESIUM	MG	1.0
POTASSIUM	K	5.3
TITANIUM	TI	0.7
MANGANESE	MN	0.044
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0034
VANADIUM	V	0.011
COPPER	CU	0.027
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.056
COBALT	CO	0.0025
STRONTIUM	SR	0.032
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.025
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES
RESEARCH AND CONSULTING

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LAB NO. 43389

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-6

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.12	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.1651	GRAMS
MOISTURE (WT. LOSS @ 104° C)	11.46	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	88.54	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.35	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	88.19	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	26.0
IRON	FE	3.0
ALUMINUM	AL	10.0
CALCIUM	CA	1.4
SODIUM	NA	6.0
MAGNESIUM	MG	0.54
POTASSIUM	K	4.5
TITANIUM	TI	0.37
MANGANESE	MN	0.032
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0072
VANADIUM	V	0.0070
COPPER	CU	0.019
NICKEL	NI	0.0013
ZIRCONIUM	ZR	0.035
COBALT	CO	ND<0.001
STRONTIUM	SR	0.044
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.0091
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES
RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental
625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639.3821

LAB NO. 43589
SUBMITTED NOVEMBER 1, 1982
REPORTED NOVEMBER 3, 1982

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE IDENTIFICATION:

BOTTOM MUCK, SAMPLE D

RESULTS:

PARAMETER	WEIGHT GRAMS	% OF DRY WEIGHT	% OF WET WEIGHT
WET SAMPLE	22.3015	--	100.00
MOISTURE (LOSS @ 104° C)	7.7493	--	34.75
DRY SAMPLE, 104° C	14.5522	100.00	65.25
VOLATILE SOLIDS (LOSS @ 550° C)	0.3381	2.32	1.51
ASH, 550° C	14.2141	97.68	63.74

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

APPENDIX II

LEIGHTON and ASSOCIATES
INCORPORATED

SOIL ENGINEERING TESTING GEOLOGY ENVIRONMENTAL SCIENCES

October 12, 1982

Project No. 6820132-03

TO: Scott Soule and Associates
856 North Elm Avenue, Suite K
Orange, California 92667

ATTENTION: Mr. Scott Soule

SUBJECT: Laboratory Grain Size and Permeability Test, Soil Sample, Lake Evans, Fairmount Park, City of Riverside

As requested by you, we have completed grain size and permeability tests on one soil sample from the subject site. The relatively undisturbed soil sample (from Boring B-5 at 19 feet) was classified as Sand (SP) light to medium brown, fine to medium grained. The D_{10} size of the sample was determined to be 0.15 millimeter (see Plate 1).

The permeability (K) which expresses the ease with which water passes through a soil, was determined on the soil sample. The test results, using a constant head permeameter, showed a permeability of 3.24×10^{-2} cms/sec. This result indicates medium permeability (Plate 3). The test result appears to be consistent with the value estimated, utilizing Hazen's formula: $K=C\ (D_{10}^2)$.

Should you have any questions, please do not hesitate to call us.

Respectfully submitted,

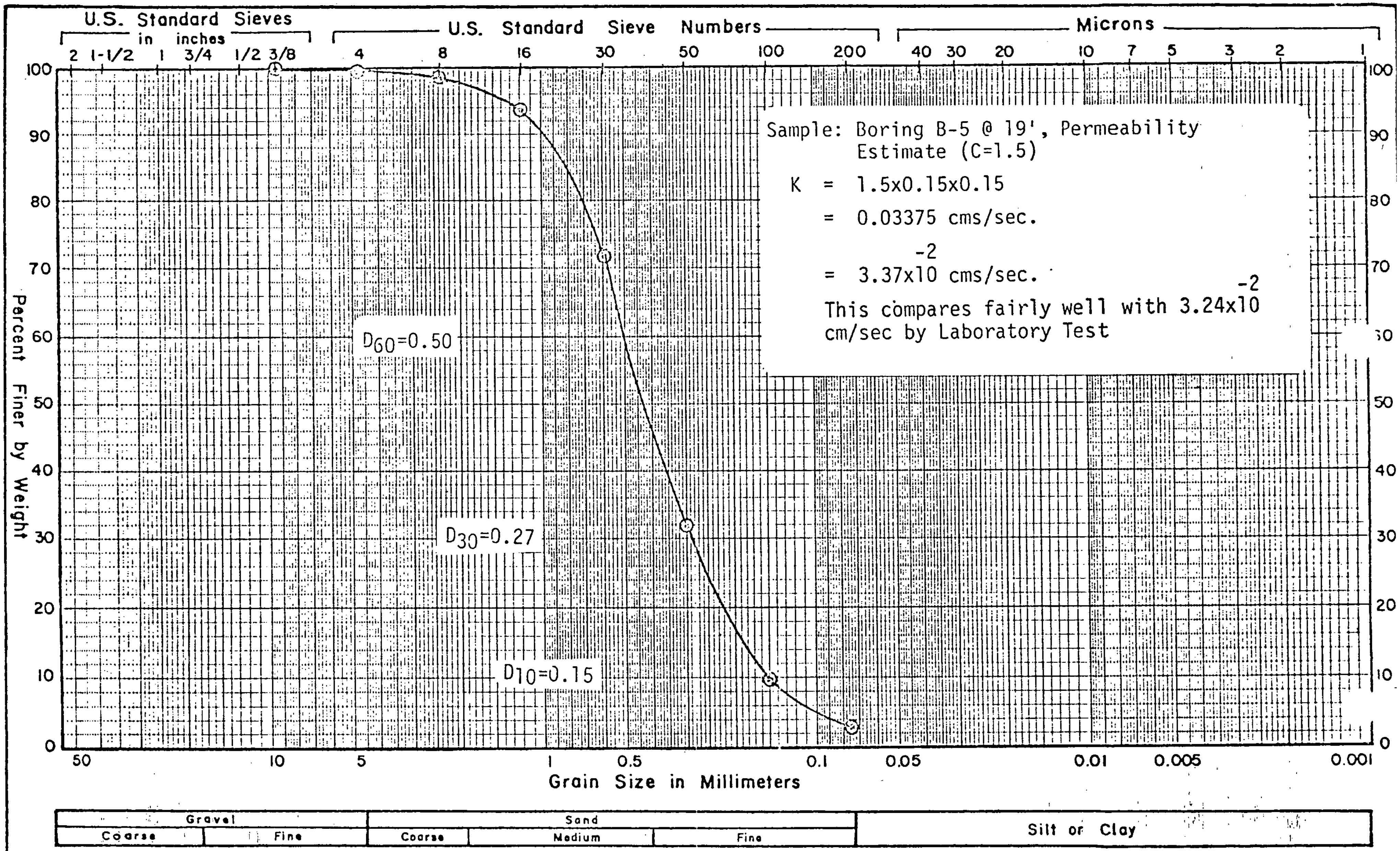
S. A. Siddiqui
RCE 19915

SAS/nln

Distribution: (2) Addressee
Attachments: Gradation Test Results - Plate 1
Permeability Test Data - Plate 2
Relative Values of Permeability - Plate 3

7265 JURUPA AVE., SUITE C, RIVERSIDE, CALIFORNIA 92504 (714) 785-0156

Project No.: 6820132-03



Symbol	Hole No.	Sample No.	Depth or Elev.	Field Moisture (%)	LL (%)	PI (%)	Activity PI/-2u	Cu D_{60}/D_{10}	Cc $(D_{30})^2 / (D_{10} \times D_{60})$	Percent Passing No. 200	Percent Passing 2u	U.S.C.S.
⊙	B-5	1	19'	-	-	-	-	3.3	0.97	3	-	SP

GRADATION TEST RESULTS

APPENDIX II - 2

Leighton & Associates

Plate No.: 1

310A (1/78)

PERMEABILITY TEST DATA SHEET

PROJECT NAME Lake [illegible]	PROJECT NO. 682-0132-03	
BORING NO. B-5	SAMPLE NO. 1	DEPTH 19'
SOIL DESCRIPTION: Sand (SP) light to medium brown, fine to medium grained		TECHNICIAN RK

SAMPLE		DIAMETER		LENGTH	
UNDISTURBED	☐	2.4"	☑	1.0"	☐
REMOLDED	☐	3.0"	☐	3.00"	☐
☐ A.S.T.M. 1557 ___		4.0"	☐	4.59"	☐
☐ U.B.C. 29-2		OTHER	☐ ___	OTHER	☑ 0.625 in

✓ Constant Head

REMOLD DATA: HAMMER WEIGHT ___ DROP HEIGHT ___ BLOWS PER LAYER ___ NO. LAYERS ___

DATE	TIME	ELAPSED TIME t, sec	WATER VOLUME V, cm³	DISCHARGE RATE Q, cm³/sec	PRESSURE p, lbs/in²	PERMEABILITY K, cm/sec
		137.5	250	1.8182	0.2708	3.35×10^{-2}
		141.5	250	1.7668	"	3.25×10^{-2}
		142.0	250	1.7606	"	3.24×10^{-2}

$$K = \frac{Q\ell}{27.7\,p\,A}$$

$A = 4.524\ in^2$

Q = Discharge, cm³/sec

ℓ = Length of sample, inches

p = Pressure, psi

A = Sample Area, cm²

$(Q = V(cm^3)/t(sec))$

FOR DIA. = 4.0"
ℓ = 1.0"

$$K = \frac{Q}{2260\,p}$$

FOR DIA. = 4.0"
ℓ = 4.59"

$$K = \frac{Q}{492\,p}$$

MOISTURE/DENS.	BEFORE	AFTER
WT OF RING + SOIL		
WT OF RING		
WT OF SOIL		
RING FACTOR		
WET DENSITY, PCF		
WT OF TARE + SOIL	—	
DRY WT TARE + SOIL	—	
NET LOSS - MOIST.	—	
WT OF TARE	—	
WT OF DRY SOIL	—	
MOIST. CONTENT		
DRY DENSITY, PCF		—

Table 2:1 RELATIVE VALUES OF PERMEABILITY
(After Terzaghi and Peck)[2:3]

Relative Permeability	*Values of k (cm/sec)*	*Typical Soil*	ft/day.
Very permeable	Over 1×10^{-1}	Coarse gravel	over 300 ft/day
Medium permeability	1×10^{-1}–1×10^{-3}	Sand, fine sand	300 – 3
Low permeability	1×10^{-3}–1×10^{-5}	Silty sand, dirty sand	3 – .03
Very low permeability	1×10^{-5}–1×10^{-7}	Silt	.03 – .0003
Impervious	Less than 1×10^{-7}	Clay	less than .0003 ft

(To convert to feet per minute, multiply above values by 2; to convert to feet per day, multiply above by 3×10^3)

Variation of *k* in a Soil Mass In most soils the value of *k* depends on the direction in which the water is traveling. The *k* in the direction parallel to the bedding planes or planes of stratification is usually from 2 to 30 times that in the direction perpendicular to the bedding or stratification, because of the layers of soils with relatively low permeabilities. In soil deposits with erratic lenses of either coarse, pervious materials or fine, impervious materials, the permeability varies greatly from point to point and is extremely difficult to determine.

From: Introductory Soil Mechanics and Foundations, Sowers and Sowers, Second Edition

Project No. 6820132-03 Plate No. 3

GKH

1st Draft 4/26/82

I. INTRODUCTION

I. INTRODUCTION

Lake Evans is an urban reservoir of some 41 acres located in Fairmount Park, the largest and one of the oldest publicly-owned recreational facilities in the City of Riverside, California. As depicted in maps of the region and locale presented as Figure 1, Lake Evans lies approximately 1.0 mile northwest of downtown Riverside and 0.25 miles southeast of the Santa Ana River. Owned by the City of Riverside, the lake is operated and maintained as an element within Fairmount Park by the City Department of Parks and Recreation. As such, Lake Evans is a multi-purpose facility. It is first an aesthetic and recreational resource of considerable and long-standing import in the local community. Second, by virtue of its location more than its designed intent, Lake Evans is a flood control facility subject to a large tributary area. And finally, the lake has historically housed a fishery that has provided recreation as well as a supplemental food supply for local anglers for many years. Today, however, Lake Evans is well past its prime. Yet, while its aesthetic characteristics and flood control function are somewhat impaired, it is the lake's potential as a fishery which is now, perhaps, most diminished.

It is the City's objective to redress this situation, and re-establish a healthy and productive fishery within Lake Evans for the benefit of the Riverside community. While fishery restoration is clearly the primary focus of this objective, it is recognized that secondary by-products of significant indirect benefit such as improved visual character and flood control capability should also accrue from any rehabilitation program due to the close relationahips between these secondary factors and sound fishery design.

Via a demonstration grant issued by the State Department of Parks and Recreation under the Urban Fishery Program (Chapter 3.5, Division 5, California Public Resources Code), the City of Riverside has been funded to pursue this objective. The City has retained Florian/Martinez Associates and a multi-disciplinary team of professional consultants to conduct a comprehensive assessment of Lake Evans' current condition, evaluate a range of rehabilitation strategies, and recommend a program which when implemented will re-establish and sustain a largely self-perpetuating fishery within the lake. This document presents a detailed summary of the background behind the project, the findings of the lake assessment, the functional and economic implications of alternative restoration elements, and the resulting conceptual rehabilitation program for the Lake Evans fishery recommended by the consulting team.

II. BACKGROUND

A. LAKE HISTORY [1]

The development and decline of Lake Evans occurred in several distinct phases which closely followed recreational use of the Fairmount Park area and, indeed, growth of the Riverside community itself since the town was founded in 1870. When the town founders first arrived and for years thereafter, clear artesian flows with subterranean supply by the Santa Ana River were not uncommon in the surrounding bottomland and floodplain. One such artesian spring in the Fairmount Park area became known as Spring Brook, originating roughly 1.5 miles to the northeast, flowing through the existing golf course which bears its name and into the Brown Lake inlet of the present lake opposite the Izaak Walton League clubhouse, through the lake bottom and on into the Santa Ana River at the base of Mount Roubidoux. Spring Brook and the adjoining banks became a favorite recreational destination for Riverside's early settlers, providing trout fishing, swimming, and a popular picnic area, as well as a source of good drinking water. A small bathhouse was constructed in the early 1890s along a section of the brook where the water had naturally ponded to depths adequate for swimming, apparently in or near what is now the small pond known as Brown Lake. However, the majority of the land now covered by Lake Evans was considered little more than wasteland by many residents at that time.

By the mid-1890s, the City of Riverside had acquired North Hill together with Spring Brook bottomland, an area of some 20 to 30 acres in order to establish a quarry as a source of paving material. Around this time, Spring Brook was diverted for unknown reasons from its natural channel to run through the major present inlet at the east end of the existing lake. Primarily through the vision of one man, Charles M. Dexter, the City was persuaded to recognize the potential of the recently acquired bottomland as a public play and picnic area and in 1897 declared the area a public park. Dexter and other citizens were authorized, without compensation, to begin making improvements, clearing brush, planting trees, etc.

In the first few years following 1900, the new park had become the focus of the community's recreational endeavors. Leading landowners had donated additional adjoining acreage with which to expand the park as well as sufficient supplementary water

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[1] Most of the factual information presented in this section is taken from several articles and two books concerning the history of the Fairmount Park area authored by Tom Patterson of the Press-Enterprise Company.

rights in Spring Brook with which to create a small lake. This lake, known as Fairmount Lake or Fairmount Park Lake, was the antecedent to Lake Evans and included the smaller water comprising the eastern section of the existing double lake configuration. Subsequently, improvements to the original lake were introduced consisting of a series of islands and causeways with connecting bridges in an oriental theme. While these features are reported to have been greatly admired, their basic design may have reflected an initial recognition of siltation impacts upon the lake which have become more and more pronounced in recent years.

Shortly after World War I, the park was more than doubled in size with a gift of over 60 acres from members of the prominent Evans family. From this new grant, the larger, second lake was developed and connected with the original lake via a bridge opening in the original dam. The lake was lined with numerous Montezuma Cypress trees around its perimeter and concessionaires operated battery-powered boats for fishing and pleasure cruising. In honor of the donor, the new lake was named Lake Evans in a grand opening on July 4, 1924.

Since the completion of the lake's development almost 60 years ago, the primary thrust of lake operations became maintenance; and in the face of very formidable phenomena that the lake's designers probably could not have foreseen, maintenance has been losing a race with deterioration for several decades. Probably the greatest assault on Lake Evans has been effected by the rapid growth and urbanization of the greater Riverside area, particularly within the tributary drainage area. This urban growth significantly altered the drainage characteristics of the watershed, dramatically increasing the annual yield of eroded silts and sediments being deposited within the lake. In 1969, an enormous amount of siltation occurred altering both shoreline and bottom topography. Much of the original Lake Fairmount as well as portions of the new Lake Evans became unsuitable to boating, and the old boathouse itself became stranded. Even two major dredging operations in the upper lake in recent years have not restored it to its former configuration.

In addition to siltation, the lake has been recipient to automotive residues and emissions, as well as other contaminants which are flushed from the streets and borne through the flood control system via stormwater runoff, with adverse effects upon the quality, appearance, and even odor of lake water. Moreover, wave action within the lake and overuse of the shoreline and adjoining park grounds has caused the erosion of the lake banks with further impact upon lake topography. Periodic attempts to stem the rate of shoreline erosion with a variety of retaining wall sections which are themselves deteriorating and the placement of concrete demolition along the lake banks has contributed to the distressed appearance of the lake.

Although the original design of Lake Evans probably placed higher priorities on the lake's aesthetic and passive recreational characteristics, fishing from boats as well as the shoreline became a popular and important element within the lake's functional profile. Unfortunately, the phenomena cited above have seriously degraded the lake's present and future potential as a fishery both by contributing to an unhealthy lake habitat and by restricting access to the lake's surviving fish populations. While this process of degradation has been in operation for some six decades, the lake's decline is now in an advanced and accelerating state. Rehabilitation will require a comprehensive and continuing commitment.

B. THE STATE URBAN FISHING PROGRAM AND LAKE EVANS

The Program. Recognizing the roles that additional recreational opportunities and supplemental food sources afforded by improved fisheries located in major metropolitan areas might play in partially alleviating certain socio-economic deficiencies, the California State Legislature passed Senate Bill No. 708 in 1982, enacting the Urban Fishing Program (Chapter 3.5, Division 5, California Public Resources Code). The program is established to provide local assistance grants to qualified urban fishing projects, and is to be jointly administered by the State Department of Parks and Recreation (DPR) and the State Department of Fish and Game (DFG). DPR has assumed principal responsibility for the review and approval of grant applications for the rehabilitation of urban lakes, while DFG has been assigned a technical and advisory capacity relative to the rehabilitative potential of the subject lakes.

To be eligible for grant funding under the program, each project must satisfy each of the following criteria:

- The subject lake must be situated in an urbanized section of a standard metropolitan statistical area,
- The lake must be close to and accessible by residents of an area comprised of economically disadvantaged persons,
- The lake must be served by public transportation and must be readily accessible to a large proportion of the residents of the entire metropolitan area,
- There must be significant and demonstrable public support and community interest in rehabilitation of the lake for sport fishing purposes,
- The rehabilitated lake must have a surface area of not less than five acres,
- The lake must be located in a public park or recreation area operated and currently staffed by the grant applicant,
- The lake must be held in fee by the applicant or be leased by the applicant for a period of not less than 25 years,
- And the applicant must prepare and submit with the application a rehabilitation plan demonstrating the lake's potential to support and sustain a fish

population through natural reproduction, citing methods and costs of rehabilitation and subsequent maintenance, and projecting the benefits to be derived therefrom.

DPR may award a grant under the program to any city, county, or district that provides park, recreation, or open-space facilities and will continue to operate and maintain the respective lake. The expenditure of grant funds is limited to the rehabilition and enhancement of lakes; funds may not be expended on improvements and/or operations outside of the lake itself which are not directly related to the establishment or enhancement of a fishery within the lake. Each grant recipient is to execute an agreement with DPR for a minimum term of 25 years specifying the terms under which each respective lake will be rehabilitated, operated, and maintained. No fee for fishing may be charged at any lake wholly or partially rehabilitated under the program. In an effort to expedite the implementation of the program and to develop expertise regarding the types of lakes most suitable to rehabilitation under the program, DPR is authorized during the 1981-82 fiscal year to make demonstation grants to qualified applicants concerning lakes representing a wide range of sizes, physical characteristics, and degree of degradation.

The Lake Evans Application and Grant. Recognizing the extent to which Lake Evans had deteriorated on the one hand, and that the lake and City circumstances were readily compliant with each of the Urban Fishing Program's general provisions and specific criteria on the other, the City Department of Parks and Recreation promptly filed an application with DPR in August 1981. The City's application requested funding of $1,400,000 under the grant for purposes of enhancing and preserving the fishery within Lake Evans. The City of Riverside was awarded a $1,400,000 grant by DPR for the proposed rehabilitation of Lake Evans, one of five urban lakes selected in a pilot program to the Urban Fishing Program for fiscal year 1981-82. A project agreement regarding the rehabilitation of Lake Evans between the City and DPR was executed in September 1981 with completion mandated by June 30, 1986.

C. LAKE REHABILITATION PROGRAM METHODOLOGY

The Lake Evans Fishery Rehabilitation Program is being undertaken in two distinct phases. The first phase consists of an assessment and conceptual planning process while the second phase will be comprised of the final design process, bid preparation, and construction. Under the first phase, the consulting team is to conduct a comprehensive analysis of the existing lake environment, identifying and evaluating each factor which bears upon the enhancement of the lake fishery including such diverse issues as lake configuration and topography, water quality, the lake's flood control role, the historic stocking record, and the extent to which the fishing priority must compete with other activities in or around the lake. From this assessment and analytical procedure, a pattern of environmental needs, planning constraints, design opportunities, legal obligations, community preferences, tradeoffs, and other relationships will emerge forming the basis of the ultimate rehabilitation plan.

Following the assessment procedure, the consulting team is to commence a conceptual brainstorming process in which a variety of solutions to the lake's now known problems are identified and examined relative to their effectiveness, technical feasibility, development and operating costs, impact on other systems, and the degree to which they comply with public objectives and the program. Some lake deficiencies may be resolved by obvious, inexpensive, and generally acceptable measures, while others can be addressed by a range of alternative concepts each with varying effectiveness, cost, public support, etc.

Throughout the assessment and conceptual planning phase, the consulting team will be working closely with the technical and managerial staff of the City Department of Parks and Recreation and with the Lake Evans Subcommittee of the City Parks and Recreation Commission in order to insure continuous input relative to community preferences, assessment of tradeoffs, etc. Thus, the consulting team will rely extensively on Department staff and the Subcommittee for sounding purposes with regard to preliminary rehabilitation concepts.

Based upon the foregoing research, analysis, conceptual planning efforts, and public input, the consulting team will formulate and recommend a conceptual rehabilitation program for Lake Evans to the City of Riverside. This document represents a summary of that process and the program recommendations. Upon presenting the program to the City and after public hearings have been properly held and testimony received and considered, the recommended program must be formally approved in concept by the City Parks and Recreation Commission and by the City Council. With such approval, the program's second phase will commence, at which time the recommended rehabilitition program will be refined, designed in final, and submitted to DPR and DFG for approval per the grant agreement. Given DPR's final administrative approval, implementation of the program can proceed with construction.

III. REHABILITATION PLAN DEVELOPMENT

A. LAKE ASSESSMENT: INVENTORY AND ANALYSIS

Rehabilitation of Lake Evans for purposes of establishing a successful urban fishery can only be accomplished with a comprehensive understanding of the lake itself and the surrounding systems which directly influence it. For this reason, the rehabilitation program was initiated with such a comprehensive assessment of the lake's current status, its role within the surrounding park and urban context, the lake's deficiencies and advantages, and the resulting constraints imposed upon any opportunities offered the rehabilitation effort. The findings and methods utilized to obtain them, as well as the respective conclusions drawn by the consulting team, are presented here following for each of the basic factors and systems affecting the lake and a fishery within.

Lake Setting. Lake Evans is an essential element within Fairmount Park, the largest and second-oldest park facility in the City of Riverside. The park's 153 acres surrounding the lake are quite level, varying from an elevation of roughly 790 feet above sea level near the levee impounding the lake to almost 800 feet adjoining Market Street on the park's perimeter. Virtually all of the park has been reclaimed from the Santa Ana River floodplain. A majority of the park is improved with informal playing fields, grassy areas, and shady groves of mature trees, as well as more specialized recreational facilities such as a lawn bowling green, an extensive rose garden, a small pagoda, etc. The park enjoys excellent local and regional access via the arterial street system interconnected with Market Street and the Pomona Freeway (Route 60) with on- and off-ramps at Market Street adjoining the north side of the park. The vehicular system within the park consists of several interconnected loops which are aligned quite close to the lake edge in several areas; vehicular travel is restricted to one-way circulation in much of the park. Vehicular parking areas are for the most part concentrated on the eastern side of the park, east and northeast of the lake. By and large, these facilities have little influence on the lake fishery and, therefore, have not been thoroughly inventoried as part of the rehabilitation program.

Lake Configuration and Mechanics. Lake Evans actually consists of three separate but interconnected reservoirs of varying size with a combined surface area of approximately 40.8 acres as depicted in Figure 2. The smallest of these covers only 1.5 acres and is known as Brown Lake or Brown Pond, located on the north side of the major reservoir and separated by Dexter Drive. This pond may have been the original natural Spring Brook backwater at which the City's early settlers gathered for Fourth of July celebrations and family outings following incorporation in 1870. A second and somewhat larger reservoir is the original Fairmount Lake connected at the eastern side of the larger reservoir via a narrow channel opened through the old levee. This part of the lake has a normal surface area of 5.6 acres. Easily the major part of Lake Evans is the large, open water completed in 1924 with a surface area of some 33.7 acres or almost 85% of Lake Evans total surface area. In addition to the three distinct bodies of water comprising the lake, the lake's configuration is further influenced by two narrow inlets penetrating the northern shoreline, one reaching toward Brown Lake and another just to the west, and two islands in the eastern part of the large reservoir, 0.5 and 0.1 acre in size, respectively.

Mechanically, a large earthen levee seven to 12 feet high and 50 to 60 feet wide extending across the lake's western end for some 1,500 feet impounds the lake water. This levee was structurally repaired in 1979 and upon completion certified by the State Department of Water Resources, Division of Dam Safety. The lake is supplied by storm-water runoff whenever rainfall is sufficient but primarily during the winter rain season, and by supplementary well water pumped during the warm summer months. An overwhelming proportion of runoff entering the lake does so from two drainage facilties known as University Wash and the Box Springs Stormdrain , both of which terminate at the eastern end of the older reservoir as depicted in Figure 2. Lesser inlets from catch basins on park streets along the north side of the lake are also identified in Figure 2. The primary well water inlet is a standpipe struck in the narrow inlet west of Brown Pond.

A 300-foot spillway with an elevation of 789.8 feet is located at the north end of the lake levee and provides the lake's major outlet capacity during highwater. The spillway is supplemented with a weirbox outlet structure located near the southern end of the levee over Spring Brook's historic natural channel (see Figure 2). The weirbox has an outlet elevation of approximately 786 feet, allowing the lake to be drawn down to that level. Given these facilities, two lake water circulation patterns emerge as diagramed in Figure 2: one due to stormwater runoff and influencing the entire lake as it circulates through both larger reservoirs and through and around the islands and ultimately over the spillway, and the other influencing primarily the large, open water in the western end of the largest reservoir. Given the spillway elevation and large volumes of well water introduced during the warmer months, the City has consistently maintained the lake level at an elevation of 789 to 790 feet the year around.

Shoreline and Topography. The lake surface is adjoined by a composite total of roughly 8,500 feet of shoreline, including the two reservoirs, Brown Lake, and the two islands. This entire shoreline is presently in varying stages of decomposition and disrepair due to erosion as well as overuse. Erosion caused by sheetflow runoff into the lake and by wind waves has been assisted by excessive pedestrian activity which breaks down the earthen banks and promotes transport of the finer materials into the lake. The result has been to reduce the shoreline slopes themselves, making them more suitable to added pedestrian movement and undermining some varieties of lakeside vegetation. Of greater significance for the lake fishery, shoreline erosion has accelerated siltation, resulting in reduced depth, poorer water circulation, higher temperatures, and, in general, a poorer fish habitat around the lake's periphery which is the area most accessible to fishermen. In an interesting coincidence, one positive result of this recurring shoreline erosion around the lake has been the exposure of portions of many Montezuma Cypress Trees' root systems along the shoreline, producing a weathered and natural shoreline character that has become one of the lake's favored visual features.

In recognition of the lakeside erosion problem, numerous efforts to stabilize the shoreline are evident to the casual observer. Sections of concrete and grouted rock retaining walls to retard erosion and lakeside concrete walkways and even chainlink fencing to regulate pedestrian traffic are distributed around the lake's edges in an almost randem, discontinuous fashion. In many instances, these improvements are themselves in disrepair. Also, in what are apparently more recent and more desperate attempts to control erosion, concrete demolition has been piled against the shoreline in an unsightly and only marginally effective manner. See illustrative photographs presented in Figure 3.

Lake Evans' bottom topography has been compiled by a combination of stereophotogrammetric methods based on aerial photographs taken when the lake had been partially drained and actual depth measurements by field crews in the undrained areas and is depicted in Figure 4. With an average annual lake surface elevation of 789 feet, it is apparent that the lake is in general quite shallow. Depths in excess of five feet are found only in the western half of the main reservoir and depths of eight and nine feet are limited to two very small areas near the levee. The depth of the eastern reservoir is nowhere greater than four feet and depths around the islands and in Brown Lake are equally shallow.

The lake's existing bottom topography is a function of the original excavation altered by subsequent siltation due to shoreline erosion and deposition of sediments borne by stormwater runoff. In order to identify the depth as well as the distribution of these lake deposits, a series of lake bottom borings was taken and analyzed. The resulting topography of these deposits is also depicted in Figure 4, where it can be seen that siltation depths vary from as little as 4.5 inches to as much as 44 inches. In general, the sediment contours indicate that sediment depths are uniformly one to two feet deep throughout the lake, with isolated areas of three feet or more in the eastern end of the original lake and in the vicinity of the weirbox. Preliminary engineering calculations indicate that the total volume of this lake sediment is on the order of 100,000 cubic yards, or roughly 30% of the existing lake's total water volume. While these lake deposits have an obvious impact on the size of a potential fishery in the lake, they also have an adverse effect upon the habitat that sustains the fishery, as will be discussed in subsequent sections.

<u>Drainage and Flood Control</u>. The original designs of Fairmount Lake and then Lake Evans had intentionally factored the lake into the local drainage system as a means of water supply. However, over the last several decades, this very limited original intent has also caused the lake to become a component of considerable significance in the flood control system serving a large area, a role which was not foreseen by the lake's designers. The lake is recipient to four separate watersheds which vary considerably in size, as illustrated in Figure 5. Far and away the largest of these is a tributary area of some 16 square miles served by the University Wash system, entering the east end of the older reservoir. Using the synthetic hydrograph method, a procedure well-suited to projecting runoff from large watershed areas, recent hydrological calculations have determined the maximum peak runoff during a 100-year frequency storm to be 2,900 cubic feet per second (cfs). The 100-year storm is assumed to produce 2.70 inches of rain over the entire tributary area for a period of six hours. This peak value is appreciably below earlier projections for the University Wash system and correctly accounts for several flood control improvements which improve upstream detention and restriction characteristics. While this value is lower than earlier projection, 2,900 cfs entering the lake would nonetheless theoretically turn the lake's existing water volume over in less than one hour. The comparable runoff value during the 10-year frequency storm is 666 cfs.

In contrast to the University Wash system, the remaining three watersheds and their respective runoff volumes are comparatively minor. These have been analysed using the modified rational method which is better suited to smaller tributary areas. The largest of these is the Box Spring Stormdrain system serving a tributary watershed of roughly 500 largely urbanized acres southeast of the lake. The limiting factor in the transfer of stormwater to the lake from this watershed is not the magnitude of the storm, but rather the capacity of the 42" diameter stormdrain itself, which is approximately 157 cfs. Thus, during the 10-year storm, this stormdrain can accommodate a tributary of approximately 340 acres, delivering 157 cfs to the lake's east end. Discussions with Riverside County Flood Control District personnel indicate that the District does not presently intend to upgrade this stormdrain, but does plan to divert flows from the upper 160 acres of the watershed into another drainage system with necessary construction anticipated in the next two to five years.

The last two watersheds are even smaller. The older residential district to the south of the lake drains into Fairmount Park and Lake Evans at various points along the southern shoreline. This watershed is some 90 acres in size and generates approximately 80 cfs during the 10-year storm. The tributary area north of the lake encompasses some 80 acres, including the adjoining park land, the Fairmount Park Golf Course, and the Pomona Freeway right-of-way concentrates flow at several points along the northern shoreline. Because of the ponding characteristics of flows first on the golf course and then in Brown Lake before entering the lake, 10-year storm flows are reduced from this watershed to approximately 25 cfs. Although the combined flow from all four tributary watersheds during the 10-year storm is significantly less than that from the University Wash system alone during a 100-year storm, the combined 10-year flow still theoretically turns the Lake's existing water volume over in less than three hours.

The lake's existing flood control responsibilities have very significant implications for any future lake design and for any fishery within the lake. The Flood Control District has prepared an inflow hydrograph and outflow rating analysis for Lake Evans based upon 100-year storm conditions. This study indicates that the maximum surface level of the larger lower reservoir would be 792.9 feet, or 3.1 feet above the spillway elevation, while the maximum level of the upper reservoir would be 795.0 feet, or 2.1 feet above the lower lake. This differential between lakes is predicted since the 100-year flow of 2,900 cfs entering the upper reservoir cannot be conveyed through the bridged 18-foot opening in the old dike into the larger lake body at the same rate of flow. The result would be considerable flooding in the park to an elevation of 795 feet in the vicinity of the upper lake and to elevation 792.9 in the area south of the larger, lower lake and possibly over the south end of the levee. Moreover, the floodplain retention basin between the lake levee and the Santa Ana River levee may also pond during the 100-year storm to a level approaching the lake's spillway elevation.

Clearly, the impact of the stormwater velocities and sedimentation within the lake induced by such hydrological events cannot be favorable to a fishery within the lake. Even during the smaller 10-year storm, some destruction of spawning and foraging habitat should be anticipated in addition to the direct depletion of fishery populations through downstream transport. In order to fully understand the lake's flood control characteristics for purposes of lake and fishery design, extensive hydrological study routing various intensity storms through the three-tiered reservoir system comprised of the lake and the retention basin below should preceed the preparation of any final working drawings for ultimate improvement of Lake Evans.

Sedimentation Rates. The amount of sediment being transported from the tributary watershed areas into the lake has changed dramatically with the channel improvements in the University Wash system of the last decade. Since this drainage system is the main source of stormwater runoff, it is also the major source of sediments. Upstream flow restrictions, entry modifications, and earthen berms serve to limit the volume of eroded sediment reaching the channel bottom. Studies conducted for the Southern California Association of Governments have determined that erosion and downstream sedimentation increases with population growth and urban development. However, since the area's tributary to Lake Evans is already quite urbanized, significant changes in the recent rate of sedimentation in the lake are not anticipated.

This rate of sedimentation can be estimated in several ways, both theoretical and empirical, revealing a reliable range for planning purposes. In a publication entitled "Report of the Water Management Subcommittee on Factors Affecting Sediment Yield in the Pacific Southwest Area," prepared by the Pacific Southwest Inter-Agency Committee and recommended by the Flood Control District, ten factors are cited for consideration in determining sediment yield: geology, soils, climate, runoff, topography, ground cover, land use, upland erosion, channel erosion, and sediment transfer. Based on these factors, engineering calculations indicate that sediment yield in the University Wash system is approximately 0.2 acre-feet per square mile of tributary area. Given the lake's total watershed area of 17 square miles, the total volume of sediment carried into the lake is projected to be approximately 3.4 acre feet per year. With an estimated trap or retention efficiency of 75% to 80%, the theoretical sediment yield in Lake Evans would be approximately 2.6 acre feet per year.

The City Public Works Department has successfully dredged the upper lake on two recent occasions, following the 1978-79 winter and again in early 1980. In the first operation, hydrolic dredging was employed to remove approximately 20,000 cubic yards of silt restoring the upper lake to a depth of five feet. While this operation does not provide a relative annual sediment yield since the date of previous desilting, if any, is not known, it does provide a benchmark for the second dredging operation. The second operation removed roughly 5,200 cubic yards or ~~3.2~~ 1.07 acre-feet of sediment from the upper lake, only one year later. In each operation, the dredging cost to the City was $7.00 per cubic yard.

In still an additional approach, the amount of sediment presently lying upon the upper lake bottom can be estimated from the lake bottom contours surveyed as part of the rehabilitation program in March 1982. This method yields an estimate of approximately 7.0 acre feet accumulated in the upper lake since the last dredging operation in 1980, indicating an annual sedimentation rate of roughly 3.5 acre feet per year. Both of the latter two empirical results should be considered conservative since all sediments would not be expected to fall out of suspension in the upper lake as indicated by the one- and two-foot sediment depths found throughout the main lake. Nevertheless, these methods suggest an average annual sedimentation rate in Lake Evans conservatively ranging from 2.5 to 3.5 acre feet per year.

<u>Water Quality</u>. In view of the urbanized nature of much of the tributary watershed, the resulting potential for significant quantities of pollutants such as automotive emissions and residues, landscaping nutrients and pesticides, and even industrial wastes to be washed down the drainage and flood control systems into the lake was recognized. Accordingly, a chemical sampling analysis of lake water and lake sediments was undertaken at several points within the lake body and compared with samples taken from the University Wash flood control channel, the Box Spring Stormdrain, and the major well supplying supplementary water to the lake during warmer months. These locations are all identified in Figure 6. These samples were taken in late January 1982, several days after a moderately heavy rain and a good flow was still discharging into the lake. The lake was full and water was running one to two inches deep over the levee spillway. The chemical analyses were conducted by state approved laboratories in accordance with testing procedures established by the U.S. Environmental Protection Agency.

A review of the water sample chemical analyses reveals no major problems in establishing a self-sustaining fishery in Lake Evans. In general, water quality in the lake and well was found to be good. No pesticide concentrations were identified. These findings are supported by the results of earlier sample analyses of water from three local wells taken for the City several months previously in October 1981. While the samples of flood control channel and stormdrain water taken as part of the rehabilitation program did not reveal much variation between the composition of incoming flows and lake water, there is concern that this finding only reflects the heavy flushing of the flood control system as well as the lake affected by the storm only a few days before. This concern is supported by testing evidence of inflowing water from these two drainage facilities taken just before and then during a storm in December 1980 for the City. This evidence revealed that phosphate levels had increased 13 to 16 times in the drainage inflows during the storm, and that biochemical oxygen demand levels (BOD) had increased 19 to 45 times during the same interval. Although this purging of pollutants through the flood control system is probably not a major concern in conjunction with larger winter storms which tend to flush the lake as well, during smaller storms and during the dry months when the drainage system is recipient to nuisance flows only, an adverse chemical buildup in the lake body may occur in the absence of mechanical assistance.

This condition if further suggested by the chemical analyses of the underlying lake sediments or bottom sludge which revealed a considerable buildup of several toxic metals, in some instances many times allowable levels. These results are summarized in the following text table for each of the three sampling locations relative to the maximum contaminant concentrations established by the Environmental Protection Agency.

Contaminant	Maximum Concentration	Lake Evans Sediment Concentrations		
		Location A	Location B	Location C
Arsenic	5.0 mg/l	NONE DETECTED		
Barium	100.0 mg/l	265.0 mg/l	66.5 mg/l	237.0 mg/l
Cadmium	1.0 mg/l	7.0 mg/l	1.5 mg/l	5.5 mg/l
Chromium	5.0 mg/l	53.0 mg/l	19.0 mg/l	45.5 mg/l
Lead	5.0 mg/l	113.0 mg/l	34.0 mg/l	135.0 mg/l
Mercury	0.2 mg/l	0.55 mg/l	0.15 mg/l	0.44 mg/l
Selenium	5.0 mg/l	NONE DETECTED		

From the nature of the sediment samples, it is clear that the soft upper layer of bottom sludge has retained and concentrated metal that has precipitated out of the water. The upper strata of the harder underlying bottom material contains a much lower concentration level, while still contaminated. Should removal of the lake sediments become desirable as part of the rehabilitation effort, it may be necessary to place those materials with excessive contaminant concentrations in a Class I sanitary landfill licensed to accept hazardous wastes. In addition, while Boron is not considered a hazardous waste, it also exhibited considerable buildup in the lake sediments and might eventually reach a concentration injurious to acquatic and ornamental plants.

In addition to the chemical testing procedure, a dissolved oxygen and temperature (DO-T) sampling program was undertaken in February 1982 to examine these components of the lake environment. DO-T measurements were taken at 15 locations within the lake identified in Figure 6 using an Aquasonic AE 500 portable instrument with cable probe, calibrated before use. Measurements were made three times during the test day, and later supplemented with dawn and evening readings. The resulting DO and T readings have each been plotted against four sections of lake topography presented in Figures 7 and 8.

The readings portray a relatively homogeneous water with no DO or T stratification or layering. This is attributed partly to the season and partly to the lake's limited depth, given a fairly substantial inflow and good wind mixing. The readings indicate a slight warming from the deeper west end of the lake to the shallow eastern end and a slight reduction of dissolved oxygen, both of which conditions would be expected in a lake of this size and depth. Although the DO readings were more than adequate for fish propagation, they were somewhat lower than anticipated by the consulting team investigators. It was suspected that DO levels were being depleted by high BOD levels contributed by incoming drainage flows and a high waterfowl population. However, the chemical analyses reported a rather low and favorable BOD level. Additional BOD analyses in February confirmed a low BOD level, indicating that a good flow through the lake as well as percolation losses tend to purge the lake, maintaining acceptable water quality therein. During the sampling procedure, an obnoxious odor emanating from the shallow water at the east end of the upper lake and from the Box Springs Stormdrain was noted, further suggesting that this stormdrain is a source of pollutants.

Supplemental Water Supply. During the dry months, the lake is subject to significant evaporation and percolation losses. Evaporation losses are estimated to be roughly 325 acre feet per year. And although an extensive ground water analysis around the perimeter of the lake reveals that the local water table is only six to 13 feet below ground surface during winter months with only a three- to five-foot seasonal differential, percolation through the unlined lake bottom is certain to occur. Moreover, the lack of storm flows through the lake can cause considerable BOD buildup with damaging impact upon the lake fishery. Consequently, in order to replace direct evaporation and percolation losses and to maintain an adequate dissolved oxygen level through improved circulation and aeration afforded by incoming flows, the City has pumped significant quantities of water into the lake from three nearby wells. From 1971 through 1979, well logs for these three wells indicate that an average of over 2,300 acre feet of water was being supplied to the lake each year.[1] Compared with the rather limited evaporation loss estimation, this supplemental water supply quantity is appreciable from the standpoints of both direct pumping cost and indirect costs of ground water recharge programs in which the City of Riverside almost certainly participates. This usage does, however, have the indirect benefit of establishing a City need for the water for purposes of future ground water basin adjudication.

Waterfowl Population. Lake Evans is the temporary and/or permanent home of a comparatively large waterfowl population, a population that is considered far too large to economically sustain a clean and attractive lake that achieves a desired fish production potential. This population consists of a resident duck population numbering in the several hundreds, and is supplemented seasonally by migrating fowl and by coots and seagulls making more frequent visits from other parts of the region. This population is sustained in part by frequent feeding of the ducks by visitors to the park and lake. While waterfowl provide the lake with visual interest and diversity, an excessively large population adversely affects the lake environment by adding nutrients to the lake water with a potentially significant cumulative impact on water quality. Loadings of nitrogen and phosphorus that are apt to trigger algae and acquatic plant problems have been set at approximately 20 pounds of nitrogen and 1.5 pounds of phosphorus per surface acre per year in shallow lakes such as Lake Evans. The phosphorus threshhold is about the same as has been measured from a single domestic duck over a one-year period.

Thus, a general planning standard for waterfowl populations in comparable warm water lakes is a maximum of one duck per each one to two acres of lake surface. This standard suggests that the lake's resident population should not exceed 20 to 40 ducks, still high when additional waste loading from migrating and other visiting waterfowl is considered.

1 "Interim Report for Fairmount Park Masterplan, City of Riverside," prepared by Willdan Associates and Recreation Systems, Inc." March 1980.

Lake Evans Fishery. Very little factual information is available relative to the Lake Evans fishery. In February 1970, a biologist from the Chino Fisheries Base of the State Department of Fish and Game (DFG) compiled the following stocking record for the lake from 1938:

Variety	Fishes Stocked
• Largemouth Bass	40,899
• Green Sunfish	7,000
• Bluegill	305,400
• Black Crappie	4,500
• Unspecified Crappie Species	26,470
• Channel Catfish	3,365
• White Catfish	25
• Unspecified Catfish Species	65,172
• Golden Shiner	3,332
• Carp	200

Some 97% of these fishes were stocked from 1938 to 1950, while from 1960 to 1970 only the 25 White Catfish were stocked (total weight - 21 pounds).

Two creel censuses by Chino Fisheries Base personnel were also conducted in April and August 1970, yielding angling success rates of 0.233 and 0.261 fish caught per angler hour in April and August, respectively, and 0.568 and 0.363 total fish caught per angler interviewed. A total of 418 angling hours were recorded during the ten-hour April survey, compared with 210 angling hours in August. Virtually all fish caught consisted of small sunfish, primarily Bluegill four to five inches long. All angling occurred from shore.

In 1972, DFG began stocking Lake Evans with an annual allotment of Rainbow Trout catchables. Stocking commenced each fall as soon as the lake's water temperature dropped adequately with a stocking of 500 to 600 pounds, and followed approximately every other week with 300 additional pounds. The catchables were normally over one-fourth pound in size. Some 10,000 to 12,000 pounds, or an estimated 25,000 to 36,000 catchables, have been planted each year in this program. The trout program was interrupted whenever the lake was found to be unsuitable, due for example to excess turpidity following a sotrm, and was terminated each spring when lake temperatures rose to 70° F or more. This program has been extremely popular with local anglers, with as many as 50 to 100 anglers at one time a common site and appreciably more after each stocking. In urban waters where angling pressure is intensive, it is not unusual for each pound of trout to generate three or more angler visits. On this basis, a 10,000-pound annual allotment for Lake Evans might generate 30,000 angling visits per year.

In addition to the catchable trout the DFG has also stocked Lake Evans each spring with Channel Catfish. In the early years of the program the Channel Catfish were large fingerling size but now they run from 6 to ten inches. Unlike catchable trout which are stocked for immediate harvest and most of which are caught within a week or two, Channel Catfish enter the catch over a period of several years. The numbers of fish caught in relation to the numbers stocked is much lower than for catchable trout, but the percent of weight harvested as compared to pounds stocked generally ranges from 300% to 800% due to growth following stocking.

A good warmwater fishing lake in Southern California with heavy angling pressure should yield around 150 pounds of fish per surface acre of water. The yield for Lake Evans is not known and there is insufficient information upon which to base a reliable estimate. It is known, however, that the lake offers a number of conditions that are not conducive to good fish production. These conditions include: 1) the layer of soft, bottom sediment over much of the lake bottom; 2) the absence of suitable spawning strata for most warmwater fishes; 3) the absence of protection and cover for forage species and for young of game species; 4) the lack of protection, cover, and terratorial areas for adult fish; 5) the lack of suitable strata and conditions for the development of fish food organism; 6) the lack of depth in the lake; and 8) the presence of excessive numbers of waterfowl, some of which are serious fish predators.

In view of the above and based on the available fishery and limnological information, a rough estimate of the annual harvest of fish produced in Lake Evans might be 15 to 25 pounds per surface acre. At 40 acres this would be some 600 to 1,000 pounds, or some 2,400 to 4,000 fish averaging one quarter pound each. Even at two ounces per fish, there would be less than 10,000 fish available or less than 28 fish per day. This is neither good fishing nor good fish production. Nonetheless, the lake is quite suitable for the development of a self-sustaining warmwater fishery given remedial improvements.

Shoreline Trees. Around the entire perimeter of the lake and each of the islands, an estimated several hundred mature trees are growing upon the lake banks, along the shoreline, and in some instances in the water itself. Two species, the Montezuma Cypress and the Mexican Fan Palm, predominate, though smaller numbers of Elm, Pine, and Senegal Date Palm are also common. The Montezuma Cypress trees, of which there are perhaps 150 to 200 specimens distributed almost uniformly around the lake approximately 50 feet apart, were introduced when the larger, lower lake was constructued in the mid-1920s and have become characteristic of the lake setting with their broad canopies and eroded root systems. The tall Mexican Fan Palms, of which there may also be 200 individual trees, reach heights of 30 to 50 feet and are concentrated for the most part in groves along the northern shoreline of the larger reservoir, adjoining the two small inlets, and on the two islands. See illustrative photographs presented in Figure 9.

While these trees give the lake and park grounds a wooded and shaded character that is highly valued in the Riverside area, the close proximity to the lake also contributes appreciably to nutrient loading in the lake body through leaf dropping and tree debris. Through almost six decades of shoreline erosion, these shoreline trees are throught to be much closer to the lake than they were originally. As much as 25% of the combined canopy area of all the shoreline Montezuma Cypress now overhangs the water itself.

Use and Visual Character of the Lake. Lake Evans has historically been utilized for four primary recreational purposes: fishing, sailing, pleasure boating in paddle and/or row boats, and as a visual amenity. No swimming is currently allowed in the lake. As previously noted, fishing by 100 or more anglers is not uncommon at one time even though the lake and the fishery within it have become seriously deteriorated. An overwhelming majority of all fishing at present is conducted from the shoreline since there is no public boating concession presently operating on the lake. The City Department of Parks and Recreation does issue permits allowing the use of private boats on the lake, but little boat fishing actually occurs. The favorite shoreline fishing locations seem to be located along the north, south, and west shorelines as depicted in Figure 10.

The Riverside ? Sailing Club operates a sailing school on weekends and holidays the year-around from ? , from three small wooden docks on the small inlet incising the northern shoreline behind the Izaak Walton League Building (see Figure 10). With a fleet of ? , the Club holds races regularly while individual sailers are seen even more frequently. Pleasure boating in a variety of manually-powered craft has long been associated with Lake Evans. However, when the major storms and resulting flood during the winter of 1968-69 left the old boathouse on the south side of the upper lake (see Figure 10) stranded on dry ground, the boating concession was closed down and has not been reopened despite the apparent attraction of doing so.

Clearly, the aspect of Lake Evans that is utilized most frequently by the largest segment of the community is its role as a passive visual amenity. As is the case of almost any water feature in a semi-arrid environment, the lake enjoys special appreciation in this regard. With its several separate lake surfaces, inlets, islands, long shoreline, open expanses of water, and various related and nearby facilities, the lake offers a wide variety of visual characteristics and moods of great import in the community. With favorable weather, the lake is visited by throngs of people who come to rest, read, think, and play around it. Along the lake's shoreline, however, this favorable visual character is marred in many places by the presence of unsightly concerete demolition intended to retard erosion, by an odd assortment of old and broken retention walls, walkways, and fences, by unmanaged brush growth in and over the water, and by collections of large and small debris in the shallows. These adverse visual features reduce the enjoyment normally derived from the fishing experience and are in some instances even hazardous while restricting access. In developing a rehabilitation program focused on the enhancement of the lake fishery, it will be important to bear the lake's other recreational responsibilities in mind.

B. MARKET SUPPORT FOR ANCILLARY FISHING CONCESSIONS

Although the Urban Fishing Program under which the Lake Evans Rehabilitation grant has been awarded specifically prohibits the City from charging any fees for the right to fish in the lake after completion of the program, commercially operated ancillary fishing concessions do not appear to be prohibited. In order to determine the extent to which such facilities could be economically self-supporting, a market and feasibility analysis was conducted by the consulting team.

Utilizing penetration rate data generated at other Southern California lake facilities, it is estimated that 90% to 95% of the fishing population using Lake Evans will reside within 10 miles of the lake. The total population of the market area formed by this ten-mile radius was estimated to be slightly over 470,000 people in 1981, with growth to almost 563,000 people projected by 1990. Although household sizes have fallen steadily over the last decade, this trend is expected to reverse during the 1980s with some growth in household size expected by 1990. Median household income levels in the market area for 1981 has reached $18,070 per year. While significant household income growth of over 100% has occurred since 1970, an actual decline in purchasing power of over 7% had been experienced during the period due to inflation.

Based on a nationwide survey of participation in sport fishing conducted by the A.C. Nielson Company, it is estimated that approximately 32% of the market population participates in freshwater sport fishing at least once per year, and that the overall average frequency for participants is about 13.1 times per year. Applying these figures to the market area population and assuming penetration rates for Lake Evans of 2.0% to 2.4% based on the adjusted survey results at other comparable facilities, a range of from roughly 39,970 to 47,970 fishing visits to the lake could be expected currently, and from 46,860 to 56,240 visits by 1990.

The experience at comparable lakes indicates that only 14.1% of freshwater fishing participants actually fish from row boats, with an average occupancy of roughly 2.5 persons per boat. Thus, the annual boat rental potential at Lake Evans appears to range from 2,390 to almost 2,870 boats currently, growing to between 2,640 and 3,170 boats in 1990. The experience of other Southern California lakes also indicates that some 75% of all boat rental occurs during the warmer months, from May through September. On this basis, daily boat rentals will range from as few as two on winter weekdays to about 25 for summer week-end days. Assuming half of the annual boat rentals are at full-day rates of $10.00 per day and the balance at a half-day rate of $6.00, total potential boat rental revenue would be roughly $18,000 to $21,600 presently. Given a 5% per annum fee inflator, boat rental revenue would increase to between $31,200 and $37,550 by 1990.

In addition to boat rentals, ancillary fishing concessions dispensing tackle and food products could support the fishing activity. The experience at other comparable lakes indicates that per capita tackle and food expenditures are $.34 and $.18. Applying this data to Lake Evans fishing participants and assuming an annual 5% fee escalator, potential tackle purchases would produce $13,590 to $16,310 in revenue presently, growing to between $24,840 and $29,810 by 1990. Similarly, snackbar purchases would yield $7,200 to $8,630 in revenue presently, and $13,120 to $15,750 by 1990. Collectively, then, an ancillary fishing concession offering boat rentals, fishing tackle, and food products could be expected to generate $38,790 to $46,540 in annual revenue currently, and with projected population growth, $69,160 to $83,110 by 1990.

Against this potential revenue generation, anticipated development and operating costs must be assessed. The capital cost of developing a concession facility consisting of a boat dock, equipment shed, a combination tackle shop/snack shop/office facility, and 25 fully outfitted 12-foot aluminium boats is conservatively estimated at $28,835. Annual operating costs, assuming a 1.5-person payroll, tackle and snack product mark-up rates of 100%, and very minor yearly maintenance costs for facilties and equipment, are estimated to range between roughly $46,650 and $48,720 were the facility in operation today, based on the 2.0% to 2.4% market penetration rate range for Lake Evans. With a 5% per annum cost inflator, these operating cost levels increase to between $72,540 and $76,340 by 1990.

By comparing these projected revenue and cost figures summarized in the text table below, it is apparent that a commercially operated concession supported only by fishing participants at Lake Evans is marginal.

	Annual Revenue		Operating Costs		Net Income	
Year	2.0%	2.4%	2.0%	2.4%	2.0%	2.4%
1982	$38,790	$46,540	$46,650	$48,720	($7,850)	($2,180)
1990	$69,160	$83,110	$72,540	$76,340	($3,380)	$6,770

Operating losses would be expected in all instances except under the higher penetration rate (2.4%) in 1990. Moreover, this analysis has assumed that initial capital expenditure would be made by the City or some other public entity not subject to interest expenses of return on investment expectations. Thus, it can be readily concluded that a concession would not be self-sufficient unless regularly patronized by other users of the lake and park for such activities as pleasure boating.

D. SUMMARY OF LAKE EVANS REHABILITATION CONSIDERATIONS

From the lake assessment phase, in which a comprehensive inventory and analysis of the existing lake environment was conducted, in which the market and economic feasibility of an ancillary fishing concession operated in conjunction with the lake was examined, and in which community sensitivities and preferences were ascertained through appropriate public representatives, a set of planning and design considerations for which any rehabilitation program must account has emerged. These principal rehabilitation issues are briefly summarized here following.

- Shoreline Erosion

  After almost six decades of wave action, stormwater sheetflow, and heavy pedestrian use, the lake banks are seriously eroded. This process has caused siltation around the shoreline adversely reducing the water profile and adversely affecting the environmental character of the near-shore habitat. Simultaneously, erosion has reduced the amount of usable area around the lake, particularly where roadways closely parallel the shoreline, and has had damaging impact upon some vegetation. Efforts to retard erosion have been only marginally successful and contribute some of the lake's most unattractive characteristics.

- Shallow Lake Topography

  Due to the distribution of an estimated 100,000 cubic yards of siltation deposits throughout the lake bottom displacing roughly 30% of the original lake volume, lake topography is quite shallow, averaging roughly five feet deep, and nowhere greater than nine feet. Such uniformly shallow conditions promote warmer water temperatures and lower dissolved oxygen content and provide a narrow range of habitat characteristics inconducive to a self-sustaining multispecies fishery.

  ~10 ft avg See previous note

- Lake Evans' Flood Control Role

  Lake Evans is a flood control facility serving a tributary watershed of some 17-square miles, and recipient to storm flows of approximately 2,900 and 920 cfs during the 100-year and 10-year storm events, respectively, and nuisance flows the year around. This role has a significant impact upon the lake environment, with storm flows transporting large quantities of sediment into the lake with damaging impact upon lake habitat, and nuisance flows contributing potentially significant contaminant concentrations.

- Sedimentation Rates

  Despite major upstream flood control improvements in the last decade appreciably reducing the University Wash system's sediment transport capacity, sedimentation is nonetheless estimated to be continuing at a conservative rate of 2.5 to 3.5 acre feet per year. The upper end of this range is enough to fill some 17% of the existing lake in a ten-year period.

- Water Quality

  The lake's water quality has been found to be comparatively good during the rainy season with adequate dissolved oxygen content and a surprisingly low biochemical oxygen demand level. This status is attributed to the extensive purging and replacement of lake water during major seasonal storms. However, in the absence of mechanical aeration and circulation assistance or significant infusion of well water, there is concern that lake water quality would seriously decline during the dry warmer months. In addition, very high concentrations of heavy metals, well over allowable hazardous waste limits, were found within the large mass of soft lake deposits distributed across the lake bottom.

- Supplemental Water

  During the dry months, the City has been supplying the lake with an estimated annual average of 2,300 acre feet of water to replace evaporation and percolation losses and, more importantly, to provide lake circulation and a lake water exchange mechanism. The annual evaporation loss alone is estimated at 325 acre feet per year.

- Waterfowl Population

  The lake presently sustains a permanent plus temporary waterfowl population estimated at several hundred birds, including resident ducks, migratory fowl, and visiting seagulls and coots, some of which are serious fish predators. This large waterfowl population is making a significant cumulative contribution to nutrient loading in the lake with direct impact on water quality, particularly during the dry season.

- Shoreline Trees

  The large number of trees which crowd the shoreline, and in some instances stand directly in the water, with roughly 25% of their combined canopies overhanging the lake, also contribute to nutrient loading through leaf drop and tree waste.

- Fishery Deficiencies

  In addition to the environmental issues cited above, the lake fishery is beset by the absence of suitable spawning strata for most warmwater fishes, the absence of protection and cover for forage species and for young game species, the lack of protection, cover, and territorial areas for adult fish, and the lack of suitable strata and conditions for the development of fish food organisms.

- Other Ongoing Uses

  The rehabilitation of the lake for fishing purposes must recognize that the lake is also host to other equally viable activities such as sailing on the lake surface and other passive uses along the shoreline. Other passive pleasure boating activities also are not unlikely in future years.

- Market Support for Ancillary Fishing Concessions

  Analysis indicates that development of ancillary concessions such as boat rentals, tackle shop, and snackbar would probably require City subsidization, if not direct City operation, if patronized only by fishing participants.

- Community Design Objectives

  As expressed in numerous public workshops and hearings held by and before designated subcommittees, committees, commissions, and the City Council itself held before and during the rehabilitation planning process, there is overwhelming community desire to minimize the extent to which Lake Evans and Fairmount Park surrounding the lake are altered in favor of rehabilitation.

IV. RECOMMENDED REHABILITATION CONCEPT

A. PRINCIPAL REHABILITATION PROGRAM IMPROVEMENTS

The conceptual rehabilitation program for Lake Evans presented and recommended here following consists of a set of measures and improvements which upon implementation will reestablish and sustain a diverse and productive fishery within the lake. These measures respond to the major and often competitive environmental conditions and deficiencies which presently beset the lake, as well as to the economic limitations anticipated under the State Urban Fishing Program and to community preferences. As will be discussed in the case of several specific design issues, a range of alternative solutions was often identified. And while one alternative within a given range may have offered an optimal solution with regard to that issue, it may have also imposed an unacceptable impact upon another issue or it may have been unacceptably costly from a fiscal standpoint and consequently was rejected in favor of a more appropriate measure. As an integrated program, the consulting team believes that these recommended measures and improvements represent an optimal solution for the rehabilitation of Lake Evans and enhancement of the lake fishery. The recommended plan is presented graphically in Figure 11, and each component of the program is discussed separately.

Flood Control Improvements. Lake Evans' longstanding role as a flood control facility serving a 17-square mile watershed is the major design consideration not contained within the lake body itself or the lake's Fairmount Park setting. For years, planning efforts regarding the lake and park as sponsored by the City of Riverside have noted the desirability of installing a flood control system that bypasses stormwater around the lake. After careful analysis and review of the upstream and downstream hydrological dynamics associated with this watershed system, the consulting team recognized that a bypass system designed to route all storm flows as well as any silt, sediments, nutrients, and contaminants transported by such storm or nuisance flows was clearly the optimal solution for purposes of establishing and maintaining a productive fishery in the lake. Such a flood control bypass system would relieve the lake of its annual siltation burden, the regular inflow of pollutants, and the risk of substantial flood damage. Such a measure would convert Lake Evans into a blue-water lake from its existing seasonal varying green-water brown-water characteristics.

However, the 100% bypass alternative also has several less attractive features. It would terminate the lake's primary source of water to replace evaporation and percolation losses and with which to exchange oxygen depleted lake water and provide circulation. Such a bypass system would have considerable visual and functional impact on Fairmount Park. A bypass carrying 100-year storm flows in the simplest and least expensive flood control facility design would place a fenced rectangular, reinforced concrete channel 35 feet wide and seven feet deep from Market Street to the low side of the levee around the north side of the lake. In addition, the estimated cost of installing a bypass with 100-year storm capacity, approximately $2,000,000 without regard for the additional drainage improvements necessary to pick up flows from the adjoining residential areas, the park, and golf course, is believed to be more than can be justified under the Urban Fishing Program. More attractive designs with the same capacity would be considerably more expensive. Moreover, the absolute reliability of such a system is in doubt since during the 100-year storm, flood waters ponding behind the Santa Ana River levee below the Lake Evans dam are expected to approach the lake's spillway elevation of 789 feet at which level the lower end of the bypass would also be flooded, probably inducing flooding of the lake. For these reasons, this flood control option was found to be unacceptable for the rehabilitation of Lake Evans, despite its obvious beneficial implications for the lake fishery.

Many of the same objections were encountered in consideration of a bypass system with ten-year storm flow capacity. Ten-year flows could be accommodated in a fenced rectangular reinforced concrete channel measuring 12 feet wide and six feet deep or in a covered double, seven-foot by six-foot concrete box culvert. The respective construction costs for these bypass systems are estimated to be some $825,000 and $1,900,000, respectively. While the less expensive configuration is economically acceptable, its impact on the visual and functional character of the park is not. And while the covered configuration would probably be acceptable from visual and functional standpoints, its development cost is considered prohibitive. Nonetheless, such a bypass capacity would successfully divert a large majority of the lake sediments and inflow pollutants which would otherwise accrue, but would also terminate the primary source of water during all but the most unusual storm events.

Recognizing the merits of the priorities established by budgetary constraints and community preferences relative to the tradeoffs offered by the foregoing flood control options, the consulting team recommends a compromise which is still believed to achieve the flood control, sediment control, and water quality objectives for the fishery subject to fiscal constraints. The recommended flood control measures include a bypass facility sized to accept all of the pollutant-ladden nuisance flows and approximately 85% of the runoff generated by the one-year intensity storm, equal to approximately 100 cfs. Also this diversion is expected to carry roughly 50% of the annual silts and sediments presently transported into the lake.

As diagramed in Figure 11, this bypass system will begin with a concrete diversion inlet located immediately north of Market Street, passing beneath that street and proceeding southwesterly beneath Bowling Green Drive in a 48-inch reinforced concrete pipe with a preliminary design slope of 0.005 to a point northeast of the upper lake where it will intercept the 42-inch pipe from the Box Springs Watershed. The bypass is then routed southwesterly beneath the upper lake to an invert elevation which is lower than the bottom of the upper lake, at which point a lateral connected to the lowest point on the upper lake bottom will join the diverter line. From this point beneath the upper lake, the bypass is routed beneath the larger, lower lake at a reduced slope of approximately 0.0015, but in an increased 60-inch pipe diameter to maintain adequate hydraulic capacity. The point of discharge is just below the levee where the existing weirbox currently outlets. The invert on the outlet structure will discharge approximately one foot above the existing streambed level at this location. Throughout the 60-inch reach, the significant tributary flows originating north and south of the lake will be intercepted by catchments, and transported in laterals to the bypass system, eliminating significant surface inflows to Lake Evans. These lateral lines are expected to range from 18- to 24-inches in size.

In addition to the partial bypass system, channel improvements to accommodate the 100-year storm are recommended along the University Wash between Market Street and the upper lake. Designed for compatibility with the circulation and functional activities in this part of Fairmount Park, the channel should be designed with open, greenbelt characteristics possibly including grass lining. The channel should retain a bottom width of approximately 50 feet with 4:1 side slopes and minimum overall depth of six feet, though a wider bottom width would decrease velocity further permitting the deposition of additional silts. As this channel approaches Bowling Green Drive, it will enter an improved culvert or bridge structure. While a quadruple reinforced concrete box structure with each barrel measuring 12 feet wide by 7.5 feet high is indicated, the transitional characteristics of the short reaches between Market Street and Bowling Green Drive may mandate utilization of a bridge structure for hydraulic as well as aesthetic reasons. Between Bowling Green Drive and the upper lake, an open channel with much the same design characteristics is proposed, though a hard bottom may be necessary for channel protection during periodic de-silting operations. A channel slope of 0.0015 in this reach is anticipated and the bottom and sides would be designed to resist significant erosion of the channel itself. Of course, this channel will be dry most of the time, with only rainfall in excess of one inch in 24 hours expected to produce any flows in the channel at all. A schematic illustration of this channel concept is presented in Figure 12.

As a preliminary step in the final design phase of the rehabilitation program, an extensive hydrological study routing storms of various intensity through the three-tier reservoir system formed by the upper and lower lakes and the floodplain between the dam and the Santa Ana River levee will be necessary for complete understanding of this hydraulic system prior to design. In particular, greater flow capacity from the upper lake into the larger lake will be necessary during larger storms to prevent extensive flooding of the park.

As compared with bypass designs for 10-year and 100-year storms, these flood control recommendations will significantly improve the lake environment both for the intended fishery enhancement purpose and from a standpoint of general visual character, all at an acceptable cost.

Siltation Control. Considering that the recommended bypass system will accommodate only an estimated 50% of the silts and sediments transported annually into the lake, additional facilities must be installed for the settling, siltation, and periodic removal of the accumulated sediments which continue to move down the upstream flood control system. The remaining siltation volume not served by the bypass system is conservatively estimated at 1.25 to 1.75 acre feet per year. While it is possible and clearly most desirable from the standpoints of fishery design and park usage to place the siltation facilities in the vacant land north of Market Street, this property is outside of the City's control and would necessitate high acquisition expenditures beyond the level justifiable under the program. Consequently, the focus of alternative solutions was limited to the existing channel and lake body.

The resulting recommendations propose a two-level desilting system intended to restrict the overwhelming majority of remaining sediments from reaching the main body of the lake under all but the very largest storm frequencies. The first level of recommended desilting capability is within the proposed reconfigured storm channel between Market

Street and the upper lake, but more particularly from Bowling Green Drive to the lake. The design of this channel is intended to increase its current capacity while reducing current velocities, thereby permitting heavier sediments to fall out of suspension and build up within the channel bottom over a two to three year period. It is further recommended that the channel, particularly the lower reach, be lined with soil cement or some other similar hard bottom surface capable of withstanding periodic clean out by heavy equipment.

The second level of recommended siltation capacity is a settling and siltation basin of some 2.5 surface acres to be located in the upper lake where it will receive direct channel flows (see Figure 11). Also lined with a hard bottom to permit excavation by heavy equipment, this basin should have an average depth of 4.5 to five feet and a maximum depth of approximately eight feet below the remainder of the upper lake bottom. This provides a desilting basin with a capacity of approximately ten to 12.5 acre feet. As previously discussed, the basin is also proposed with a lateral and valve assembly installed at the deepest point to permit drainage and desilting by hydraulic slushing. However, in addition, the upper lake should be fitted with a temporary closure facility across the passage into the larger lake to allow dewatering of the basin while maintaining the water level elsewhere in the lake. After a dewatering and drying period of from 30 to 60 days, excavation of the siltation basin would then be quickly accomplished in two to three weeks. Given the annual siltation rate of roughly 1.25 to 1.75 acre feet per year, the sediment holding capacity of the channel, and the desilting basin's hydraulic slushing feature, drainage and excavation of the basin should only be necessary once or twice per decade.

<u>Lake Configuration and Topography</u>. With the exception of filling in the existing Box Springs storm ditch inlet at the southeast corner of the upper lake, very little modification to the lake's basic configuration is recommended. However, in order to provide the lake mass, depth, and bottom variety considered necessary to sustain a production multi-species warmwater fishery, an ambitious excavation program is recommended for the upper and lower lakes as well as Brown Lake. The proposed contours resulting from this excavation are depicted in Figure 11.

This excavation would leave the upper lake with a maximum depth of approximately nine feet in the siltation basin while the remaining upper lake bottom would be roughly three feet deep. In the lower lake, the greatest change is recommended in the area around the islands where depths of eight and nine feet are proposed compared with one- to four-foot depths presently. The deepest points are proposed in an area almost an acre in size just westward of the larger island with depths of approximately 20 feet, or over twice the greatest existing depth in the lake. The remainder of the larger lake's western half will be excavated to fairly uniform nine and ten-foot depths, and even Brown Lake would be taken down to some ten feet. Around the entire lake perimeter and the two islands, bottom slopes of four to five horizontal feet to one vertical foot are recommended.

As recommended, this excavation will necessitate the removal of an estimated 185,000 cubic yards of material from the lake bottom, of which approximately 100,000 cubic yards consist of the soft, heavily polluted lake deposits. Though clearly indicated for purposes of fishery enhancement, the feasibility of this excavation program will be influenced by two variables which cannot be precisely determined at this time. The first variable concerns the possible classification of the polluted bottom deposits as a hazardous waste, the determination of which cannot be accomplished until the lake has been fully drained and dewatered. In this event, removal to a Class I sanitary landfill licensed to accept such wastes may be mandated at enormous total hauling and dumping charges. However, even assuming that the bottom deposits can be excavated, hauled aside and dried for later replacement on the new lake bottom which would then require over-excavation totaling 100,000 cubic yards, the second variable comes into play, namely, how to dispose of the 185,000 cubic yards of clean alluvail materials taken from beneath the existing lake. If a local contractor can be identified who needs such suitable fill material at the time it is available from the lake bottom, or if the excavation mass can be deposited in the very nearby vicinity such as the floodplain below the lake levee, then the recommended excavation program will be feasible within the projected budget. However, if neither condition can be satisfied, then the excavation mass will have to be reduced or the budget expanded.

Regardless of the exact extent of the excavation, it will have to be preceeded by a complete draining and dewatering of the lake as hydraulic dredging is considered prohibitively expensive ($7.00 per cubic yard in 1979 and 1981). Due to the high local water table throughout the Santa Ana River Floodplain, it is believed the only feasible means of dewatering the lake bottom to the depths of the proposed excavation will be via the construction of an estimated 46 shallow wells around the perimeter of the entire lake and also in the area of deepest excavation. Each well would be extended to a depth of approximately 20 feet and equipped with a 7.5 horsepower pump. A dewatering period of some 30 days is expected to be sufficient for the anticipated excavation operation.

Shoreline Design. In order to build up and stabilize the lake's severely eroded shoreline, the consulting team first recommends the removal of the various concrete and masonry retention walls and lakeside steps and walks now falling into disrepair as well as the unsightly concrete demolition which has been placed throughout the shoreline areas. Such removal should be followed by the installation of a hard shoreline surface comprised of a natural-looking material such as soil cement or concrete that is colored, sculptured, and eroded to match the surrounding terrain. This new shoreline should extend some four inches above the water line to deter waterfowl movement into the park, and should provide approximately 12 inches of vertical water depth at the shoreline all around the lake to enhance water circulation, temperature, and other habitat characteristics in the nearshore area of the lake. Further, the hard surface should extend out into the lake to depths of four or five feet to resist erosion from wave action and to prevent the growth of rooted acquatic plants.

In general, the shoreline configuration should be regular and rounded with few corners, small bays, and other areas that impede circulation and collect debris. Within the context of the general design specifications cited above, a variety of shoreline treatments are recommended as schematically illustrated in Figure 13. In addition, it is recommended that the existing shoreline be moved inward variously five to ten feet in some places and 25 to 30 feet in others, as noted in Figure 11, for several purposes. The addition of area immediately behind the shoreline in this fashion will increase the lakeshore's functional attractiveness in areas where the park roads are aligned very close to the lake edge at present. This also allows a separation of shoreline fishing activity from other passive uses such as reading or resting which might be just as well placed beneath the trees, but a little further from the water. In addition, moving the shoreline in some areas out from beneath the existing tree canopy would beneficially avoid some of the leaf and tree debris drop that now goes directly into the lake, contributing to nutrient buildup and water quality deficiencies. This is particularly important around the islands where poor access makes maintenance difficult. Finally, moving the shoreline in the recommended manner permits the placement of some of the excavation mass on-site as fill, thereby reducing the amount of exportation.

Percolation Control. With the recommended removal of the silty lake deposits which partially seal the lake bottom and reduce seepage, the rate of percolation through the ancient alluvial sediments beneath the lake bottom would be expected to increase significantly in the absence of a control mechanism. These prospective percolation losses are made all the more significant by the proposed flood control bypass measures which will appreciably reduce the extent to which the lake is replenished with stormwater run-off. In order to control these losses, it is recommended that the entire lake bottom be lined with an impervious plastic membrane that is sufficiently flexible to withstand lake bottom movement. This plastic liner should be placed on the lake bottom upon the completion of the excavation operation and should be recovered with at least 12 inches of earth to provide mechanical protection for the liner.

Water Quality Maintenance. Although the lake's water quality will be significantly improved by the recommended bypass installation which will route contaminated nuisance flows as well as most of the automotive emissions, residues, and other pollutants flushed from the streets during the initial rains of each storm around the lake entirely, additional measures are necessary to insure that good water quality is maintained throughout the lake. For these purposes, it is recommended that an aeration and circulation system be installed in the lake with the capacity to turn the lake's entire water volume over at least once per week. This system should be designed to insure water movement throughout the lake, eliminating the dead spots and backwaters that presently exist. Aeration will aid in moving water low in oxygen content from the bottom to the surface where it will contact air and accept additional oxygen. In addition, the circulation will aid in the distribution of any chemicals that might be needed for the control of algae, which in turn maintain the lake's water volume and reduce the temperature fluctuation which can occur when lake masses are depleted with algae.

A partial alternative that bears consideration by the City from a cost/effectiveness standpoint is the use of large volumes of well water to provide circulation and exchange. At present the City is pumping over seven times the lake's estimated annual evaporation loss into the lake for this purpose, most of which passes through the weirbox where it reenters the water table below the lake levee. While the direct pumping costs for this water volume are probably considerably greater than the costs of operating the recommended aeration/circulation system, the City gains the added benefit of maintaining a high water use rate which may be highly valuable in any future adjudication proceeding of water rights in the basin. However, regardless of which system is implemented, supplemental water to replace evaporation losses at least will be necessary. Thus, the well water inlets should be placed to provide maximum recirculation benefit in any case, with at least one inlet in the upper lake.

Fishery Habitat and Management. The fisheries management plan for Lake Evans is contingent upon compatibility within Fairmount Park's multi-recreational purpose context. A plan to maximize the fishery benefits would ignore other park uses and infringe upon some of them. Lake Evans is suitable for the development of a self-sustaining warmwater fishery, which in the Southern California area means a combination of bass, sunfish, catfish, and one or more forage minnows in the majority of waters. This combination is capable of producing good to exceptional fishing given the proper circumstances, but in an urban water as heavily fished as Lake Evans it is unrealistic to expect this quality of angling on a self-sustaining basis. This does not mean that the fishery cannot be improved and improved quite dramatically. If the present yield is on the order of 25 pounds per surface acre per year, it is not at all unrealistic to expect a 400 to 600 percent improvement, and if the 25 pound estimate is somewhat high, an 800 percent improvement is not impossible. In order to achieve this type of improvement the lake physical features will have to change, and a plan to manage the fish populations themselves will have to be implemented.

Local fish habitat consists of shallow protected areas for some fishes and moderate to steep slopes in deeper waters elsewhere for other species. The recommended excavation and recontouring program already provides excellent topographic diversity to accommodate a variety of fish species. Also, previous recommendations already ensure good water quality throughout the lake the year around. In addition, fish like nooks, crannies, reefs, and other "relief features" for hiding, loafing, feeding areas and as a "home territory." These are best constructed of stable materials such as old tires tied as "stars" or reefs, loose piles of concrete block and cement or clay pipe, broken pieces of cement sidewalk or street piled or laid loosely together to form various sized "caves" or "shelters" or any similar material. Fish habitat structures of this nature can be constructed from shallow areas near shore out into the deepest areas.

With such structures it is important that they be placed so as to avoid interference with other lake uses, such as sailboating or even fishing, for example. In most areas of the lake except those reserved especially for fish habitat enhancement, the structure should be positioned so as to allow a minimum clearance of three feet between the top of the habitat and normal water surface elevation.

The underwater shoreline around the islands is an excellent place for loosely positioned, concrete sidewalk slab rip-rap found in quantity around the existing shoreline. This will not be visible, it will protect the shoreline from erosion, and will offer excellent fish habitat. Sections of broken concrete pipe from 12 to 30 inches in diameter serves a dual function of habitat and for channel catfish spawning. All of these hard strata habitats encourage the development of various insects, crustaceans, etc. that are important components of the fishes food web. Reefs and other "fish attractors" offer the added advantage of concentrating game fish in areas accessible to angling.

Different fishes have differing requirements for preferred spawning habitats. The fathead minnow attaches its eggs to the underside of a board or the underside of a horizontal concrete building block or the inside top of a piece of open pipe. Channel catfish dig holes in dirt banks, or utilize the interior of a five-gallon bucket in a "tipped over" rather than upright posture, or a piece of irrigation pipe, etc. Bluegill and, to a lesser degree, largemouth bass dig shallow nests in clay, gravel, or hard bottom areas in water up to five or six feet deep.

Many habitat devices serve dual or triple functions because they furnish food organisms and shelter in addition to the spawning function. Simple and effective devices are old tires with various sized gravel in the center up to or nearly to the level of the upper bead. Loose piles of sand, gravel, and rock are also utilized. Loosely piled broken concrete building block, short lengths of PVC pipe an inch in diameter or larger, telephone multiconduit and other such scrap building material can all be used to create areas for spawning and refule. However, care should be taken in planning these structures to avoid loss due to excessive siltation.

Planters for rooted aquatic plants such as water iris, cattails, etc. should be provided in areas less than four feet deep around selected shoreline areas. The planters should contain about two feet of dirt that extends to within three to six inches of the top of the planter which in turn should be three to nine inches below normal water surface elevation. The function of these planters is to provide refuge, nursery, and breeding areas for forage fish and refuge feeding areas for small game fishes.

Relative to fisheries management, there are several possible variations to the standard largemouth bass, bluegill, and channel catfish warmwater fishery that bear investigation. DFG is experimenting with the use of other bass species instead of the largemouth, with redear sunfish in place of bluegill, and with several other combinations also. The major difficulty in planning the use of these species for Lake Evans is the uncertain availability of the requisite numbers and sizes of fish to start the program properly. The possibility of using some of these fishes for Lake Evans is being explored with the Department.

Details as to sizes and numbers of each species to be stocked, and the time of stocking, will depend upon the time of year the rehabilitated lake will be ready to receive fish. In general, the forage fishes such as mosquitofish and several minnow species should be stocked first and given time to multiply and provide a food base before predator-sized bass and channel catfish are stocked. This time interval also gives the lake water an opportunity to age and provides time for development of a healthy natural food web without undue demands during the developmental period.

Waterfowl Management. The resident plus transient waterfowl population of ducks, coots, geese, and sea gulls is estimated to be ten to twenty times the recommended population of 20 to 40 resident fowl for a lake the size of Lake Evans, resulting in potentially significant nutrient loading of the lake. It is recommended that the existing resident population be reduced by whatever means necessary, though preferably by trapping and re-establishing the individuals in other local water features. Subsequent management of the resident population will also be necessary as a continuing water quality maintenance measure.

Shoreline Tree Irrigation. There is concern that, although the many Montezuma Cypress and other trees which exist in close proximity to the existing shoreline would ordinarily extend large tap roots down very deep in order to access the natural water table these trees may now be largely reliant on the shallow water that has for decades percolated horizontally from the lake body. Thus, with the installation of the recommended hard shoreline and impervious bottom membrane to control percolation, these trees may be damaged as this shallow water source dries up. In order to insure that this does not occur and that the near surface water supply is retained, a reverse french drain system is proposed in which a buried perforated pipe will be installed all around the lake perimeter with numerous supply laterals reaching back to the lake body. A combination of gravity and hydraulic pressure from the lake mass will effectively drive water into the area at the base of the trees as diagramed in Figure 13.

Ancillary Fishing Concessions. At present there is virtually no angling done from boats and consequently some of the best fishing water is never fished. After rehabilitation and the establishment of a going fishery a small fleet of rental boats should be provided. Boats used for fishing should be restricted to rowboats and rowboats assisted by an electric trolling motor. No gasoline engine powered boats should be allowed on the lake. Conspicuous bouys should be placed to mark the area within which fishing boats are permitted to operate, and both fishing and sail boats should not be allowed to operate close enough to shore to interfere with anglers fishing from shore. Should the use of rental fishing boats cause a conflict with the present use of sailing boats, the conflict may be resolved by time zoning.

A complete ancillary fishing concession will also provide tackle supplies and various food products as a convenience to fishing participants in addition to boat rentals. Recognizing, however, that such a concession probably will not be adequately supported by the fishing population alone, it is recommended that this concession be designed and operated to provide boat rentals and snacks to pleasure boaters and other park users. This expansion of the concession's focus is considered necessary to provide any such facility for fishing participants, though the park in general would also benefit from such an establishment.

V. ACKNOWLEDGEMENTS

DJ 11/24/82 D-5/15-2/RA

File: Riverside - Lake Evans

Subject: Meeting 11/24/82

1. Sediment is not toxic and can be used at Class II-2 landfill (letter 11/18/82) or for fill near lake or islands.

2. Dredging and/or excavation will be at least to eleven feet which is the ground water elevation in the area of the lake. (p9 - 11/82 Report). It was recommended that no lake bottom seal or liner be used.

3. The City Public Works will evaluate sediment removal and flood control work costs and advise Parks Dept.

4. The next meeting will be a schedule of further activities and when permits will be needed.

[signature]

4

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SANTA ANA REGION

6809 INDIANA AVENUE, SUITE 200
RIVERSIDE, CALIFORNIA 92506

PHONE: (714) 684-9330

November 18, 1982

Mr. Wayne M. Florian
Florian/Martinez Associates
13132 Newport Avenue, Suite 110
Tustin, CA 92630

Dear Mr. Florian:

We have reviewed the laboratory results for the composite soil samples provided in the report entitled, "Lake Evans Rehabilitation Study", dated November, 1982, by Scott Soule and Associates. Based upon this review, we find that the soils are not hazardous in accordance with RCRA standards. Therefore, they may be disposed of at any Class II-2 Landfill if they are dewatered to a 50 percent solids level.

If there are any questions, please feel free to contact this office.

Sincerely,

John M. Zasadzinski
Senior Engineer

cc: David Wigginton
City of Riverside Parks Department

JMZ:kyb

OUH

CITY OF RIVERSIDE

INTEROFFICE MEMO

TO: Technical Advisory Committee

DATE: November 15, 1982

FROM: David L. Wigginton
Park Planner

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NOV 16 1982
SANTA ANA REGION

SUBJECT: FAIRMOUNT LAKES REHABILITATION

Enclosed for your review please find the latest report relative to the quantity and quality of sediment beneath the lakes within Fairmount Park. It has been determined that the sediment will not require disposal in a class one dump site.

Our next committee meeting is scheduled for Wednesday, November 24, 1982, at 10:00 a.m., on the fourth floor in City Hall. A representative from Senator Presley's office will attend to discuss the possibility of acquiring additional funds for this project. Please be prepared to discuss the project in its entirety. There is a very good chance that an additional $500,000 will be available for rehabilitation.

<u>Committee</u>:

Louis Hernandez, Park and Recreation Director
Bob Wales, Public Works Director
Merle Gardner, Planning Director
Gordon K. Anderson, Water Quality Control
Ken Edwards, County Flood Control

2/M6/Wc

cc: Bob Johnson
Dee Bachman

Report title:
"Lake Evans Rehabilitation Study"
filed inside expando.

LANDSCAPE ARCHITECTURE AND PLANNING, 13132 NEWPORT AVENUE, SUITE 110, TUSTIN, CALIFORNIA 92680, TELEPHONE 714/731-6011

FLORIAN/MARTINEZ ASSOCIATES

November 5, 1982

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
NOV - 8 1982
SANTA ANA REGION

Mr. James Anderson, Executive Officer
California Regional Water Quality
Control Board
Santa Ana Region
6809 Indiana Avenue, Suite 200
Riverside, California 92506

Reference: Lake Evans, Riverside, California

Dear Mr. Anderson:

With this letter we are enclosing two (2) *copies of the results of our consultant's latest soil tests to determine contamination levels of the lake bottom sediments and sub-sediment areas of Fairmount Lake, Lake Evans and Brown Lake.

During our meeting of October 29, 1982 at your office, we presented documentation which showed that the levels of contamination in the bottom sedimentation and in the soil below the sediment deposits were well within acceptable levels. If you concur with the enclosed report that these soils present no environmental hazards, we would appreciate a letter from your office stating that we are free to place this soil wherever an acceptable disposal area can be located.

Should you have any additional questions, please do not hesitate to call me.

Sincerely,

FLORIAN/MARTINEZ ASSOCIATES

Wayne M. Florian
A.S.L.A., Lic. #1161

*Filed inside expando

WMF:ggb

cc: David Wigginton, City of Riverside

City of Riverside Fairmount Park

CROSBY LABORATORIES

RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639-3821

LAB NO. 43589

SUBMITTED NOVEMBER 1, 1982

REPORTED NOVEMBER 3, 1982

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE IDENTIFICATION:

BOTTOM MUCK, SAMPLE D

RESULTS:

PARAMETER	WEIGHT GRAMS	% OF DRY WEIGHT	% OF WET WEIGHT
WET SAMPLE	22.3015	--	100.00
MOISTURE (LOSS @ 104° C)	7.7493	--	34.75
DRY SAMPLE, 104° C	14.5522	100.00	65.25
VOLATILE SOLIDS (LOSS @ 550° C)	0.3381	2.32	1.51
ASH, 550° C	14.2141	97.68	63.74

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

Approved by: State of California, Department of Health Services, Laboratory Section

ASSOCIATED LABORATORIES

806 North Batavia - Orange, California 92668 - 714/771-6900

CLIENT

CROSBY LABORATORIES
625 W. KATELLA #4
ORANGE, CA 92667

LAB NO. C10947

REPORTED 10/14/82

SAMPLE SOIL

RECEIVED 10/8/82

IDENTIFICATION AS BELOW

BASED ON SAMPLE AS SUBMITTED

SAMPLE #	BARIUM MG/L	CADMIUM MG/L	CHROMIUM MG/L	LEAD MG/L	MERCURY MG/L
43194	0.53	ND <0.01	ND <0.01	ND <0.01	ND <0.0005
43195	0.80	ND <0.01	ND <0.01	ND <0.01	ND <0.0005
43196	0.91	ND <0.01	ND <0.01	0.03	ND <0.0005
43242 (242)	0.04	ND <0.01	ND <0.01	ND <0.01	ND <0.0005
43307	0.21	ND <0.01	ND <0.01	ND <0.01	ND <0.0005
43308	0.33	ND <0.01	ND <0.01	ND <0.01	ND <0.0005
43309	0.16	ND <0.01	ND <0.01	ND <0.01	0.0016
43310	0.88	ND <0.01	ND <0.01	ND <0.01	0.0012
43311	0.27	ND <0.01	ND <0.01	ND <0.01	0.0013
43312	0.28	ND <0.01	ND <0.01	ND <0.01	0.0022

ASSOCIATED LABORATORIES

Edward Behare

EDWARD S. BEHARE

ESB/DSV

TESTING & CONSULTING
Chemical •
Microbiological •
Environmental •

C-1 10M

ASSOCIATED LABORATORIES

806 North Batavia - Orange, California 92668 - 714/771-6900

CLIENT Crosby Laboratories
625 W. Katella #4
Orange, CA 92667

LAB NO. D00034

REPORTED 10/20/82

SAMPLE Soil

RECEIVED 10/13/82

IDENTIFICATION As Below

BASED ON SAMPLE As Submitted

	#443386	#44387	#43388	#43389
Barium	0.09	0.22	0.04	0.12
Cadmium	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Chromium	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Lead	ND<0.01	ND<0.01	ND<0.01	ND<0.01
Mercury	ND<0.0005	ND<0.0005	0.0006	ND<0.0005

NOTE: All results reported as mg/l.

ASSOCIATED LABORATORIIES

Edward S. Behare

ESB/dsv

TESTING & CONSULTING
Chemical •
Microbiological •
Environmental •

TO:
CROSBY LABORATORIES
625 W. Katella, Unit 4
Orange, CA 92667

(213) 838-5939 (213) 870-3749

Pacific Spectrochemical Laboratory, Inc.
Chemical and Spectrographic Analysis
2558 Overland Avenue
Los Angeles, California 90064

PURCHASE ORDER NO. 7454

October 21, 1982

SEMIQUANTITATIVE ANALYSIS

	43194	43195	41396	43242	43307	43308
Si	23.%	21.%	21.%	25.%	22.%	25.%
Fe	4.2	4.9	3.7	2.0	3.2	2.5
Al	9.9	10.	12.	10.	11.	11.
Ca	6.2	7.8	5.6	2.7	5.2	3.1
Na	5.0	4.4	5.3	7.2	5.9	6.4
Mg	1.3	1.6	1.5	0.75	0.90	0.75
K	3.2	2.3	3.5	3.5	3.8	2.4
Ti	0.70	0.99	0.62	0.38	0.80	0.45
Mn	0.037	0.044	0.037	0.037	0.029	0.047
Pb	0.028	0.031	0.098	ND<0.01	TR<0.01	ND<0.01
Ba	TR<0.10	TR<0.10	TR<0.10	TR<0.10	ND<0.10	TR<0.10
Ga	0.0050	0.0059	0.0065	0.0048	0.0057	0.0033
V	0.0073	0.0086	0.0068	0.0058	0.0069	0.0065
Cu	0.0097	0.016	0.011	0.0052	0.0029	0.0022
Ni	0.0023	0.0030	0.0021	0.0012	0.00073	0.0013
Zr	0.025	0.034	0.028	0.018	0.014	0.019
Co	0.0025	0.0036	0.0029	TR<0.001	TR<0.001	TR<0.001
Sr	0.021	0.012	0.046	0.044	0.050	0.059
Yb	TR<0.004	TR<0.004	TR<0.004	ND<0.004	0.0049	ND<0.004
Cr	0.020	0.023	0.024	0.0092	0.0081	0.010
Other elements	nil -->					

CROSBY LABS

October 21, 1982

SEMIQUANTITATIVE ANALYSIS

	43309	43310	43311	43312
Si	27.%	21.%	27.%	23.%
Fe	4.6	5.3	2.3	3.0
Al	8.6	9.2	7.8	10.
Ca	3.2	8.5	3.7	4.1
Na	4.9	5.2	6.1	6.1
Mg	1.1	1.1	1.1	1.2
K	2.3	3.4	4.0	4.3
Ti	0.62	0.77	0.58	0.69
Mn	0.059	0.050	0.036	0.037
Pb	ND<0.01	TR<0.01	ND<0.01	ND<0.01
Ba	TR<0.10 -----	-----	-----	----->
Ga	0.0059	0.0066	0.0054	0.0062
V	0.0090	0.0076	0.0080	0.0098
Cu	0.00081	0.0051	0.0018	0.0023
Ni	0.0020	0.0016	0.0018	0.0020
Zr	0.021	0.040	0.032	0.027
Co	TR<0.001	TR<0.001	0.0023	0.0019
Sr	0.033	0.033	0.027	0.023
Yb	ND<0.004	ND<0.004	TR<0.004	TR<0.004
Cr	0.015	0.014	0.020	0.020
Other elements	nil -----	-----	-----	----->

CROSBY LABS October 21, 1982

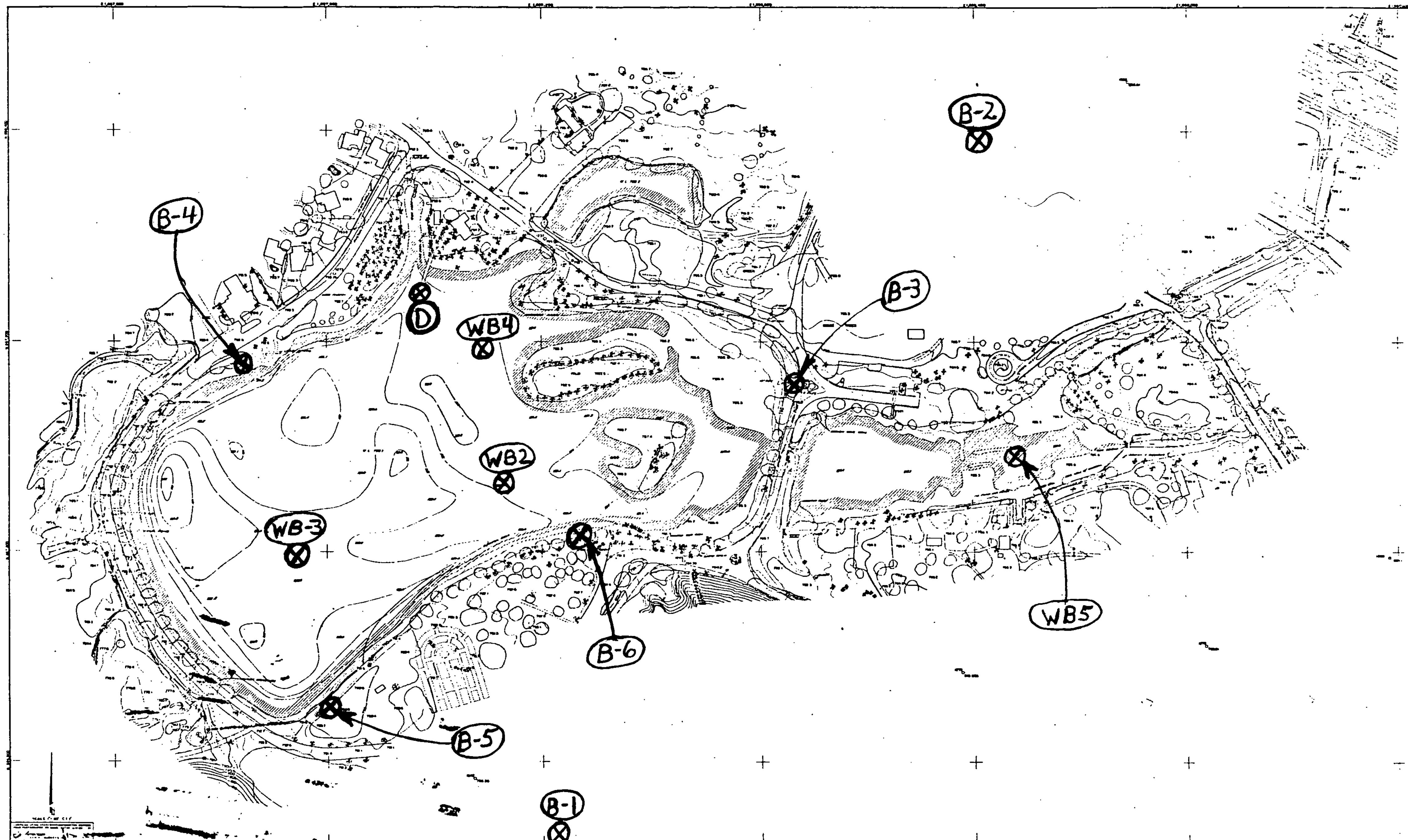
SEMIQUANTITATIVE ANALYSIS

	43386	43387	43388	43389
Si	23.%	21.%	23.%	26.%
Fe	4.2	3.7	3.6	3.0
Al	8.9	10.	8.6	10.
Ca	3.3	7.9	3.1	1.4
Na	7.5	4.5	7.2	6.0
Mg	0.76	1.7	1.0	0.54
K	4.0	2.7	5.3	4.5
Ti	0.71	0.95	0.70	0.37
Mn	0.079	0.044	0.044	0.032
Pb	ND<0.01 --->			
Ba	TR<0.10	TR<0.10	TR<0.10	ND<0.10
Ga	0.0052	0.0053	0.0034	0.0072
V	0.012	0.0086	0.011	0.0070
Cu	0.012	0.0075	0.027	0.019
Ni	0.0015	0.0018	0.0020	0.0013
Zr	0.047	0.035	0.056	0.035
Co	ND<0.001	0.0024	0.0025	ND<0.001
Sr	0.047	0.023	0.032	0.044
Yb	ND<0.004	TR<0.004	TR<0.004	ND<0.004
Cr	0.024	0.014	0.025	0.0091
Other elements	nil --->			

Respectfully submitted,

Hallie Johnson

PACIFIC SPECTROCHEMICAL LABORATORY, INC.


B-2
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WB5
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LAB NO. 43194

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: A (1, 2, 3, 6, 7,10)*

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.53	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	25.9403	GRAMS
MOISTURE (WT. LOSS @ 104° C)	33.41	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	66.59	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	2.79	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	63.80	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	4.2
ALUMINUM	AL	9.9
CALCIUM	CA	6.2
SODIUM	NA	5.0
MAGNESIUM	MG	1.3
POTASSIUM	K	3.2
TITANIUM	TI	0.7
MANGANESE	MN	0.037
LEAD	PB	0.028
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0050
VANADIUM	V	0.0073
COPPER	CU	0.0097
NICKEL	NI	0.0023
ZIRCONIUM	ZR	0.025
COBALT	CO	0.0025
STRONTIUM	SR	0.021
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 6 SEPARATE SAMPLES.

[signature]

EDWIN S. CROSBY, PHD.
DIRECTOR

Approved by: State of California, Department of Health Services, Laboratory Section

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LAB NO. 43195

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SUITE K
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SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B (4, 5) *

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.80	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	19.8905	GRAMS
MOISTURE (WT. LOSS @ 104° C)	38.86	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	61.14	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	4.76	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	56.38	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	4.9
ALUMINUM	AL	10.0
CALCIUM	CA	7.8
SODIUM	NA	4.4
MAGNESIUM	MG	1.6
POTASSIUM	K	2.3
TITANIUM	TI	0.99
MANGANESE	MN	0.044
LEAD	PB	0.031
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0059
VANADIUM	V	0.0086
COPPER	CU	0.016
NICKEL	NI	0.0030
ZIRCONIUM	ZR	0.034
COBALT	CO	0.0036
STRONTIUM	SR	0.012
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.023
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 2 SEPARATE SAMPLES.

[signature]

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LAB NO. 43196

SCOTT SOULE & ASSOCIATES
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SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED SEPTEMBER 29, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: C (8, 9) *

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.91	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	0.03	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	15.3054	GRAMS
MOISTURE (WT. LOSS @ 104° C)	33.36	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	66.64	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	3.30	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	63.34	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	3.7
ALUMINUM	AL	12.0
CALCIUM	CA	5.6
SODIUM	NA	5.3
MAGNESIUM	MG	1.5
POTASSIUM	K	3.5
TITANIUM	TI	0.62
MANGANESE	MN	0.037
LEAD	PB	0.0098
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0065
VANADIUM	V	0.0068
COPPER	CU	0.011
NICKEL	NI	0.0021
ZIRCONIUM	ZR	0.028
COBALT	CO	0.0029
STRONTIUM	SR	0.046
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.024
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

* COMPOSITE OF 2 SEPARATE SAMPLES.

EDWIN S. CROSBY, PHD.
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LAB NO. 43242
SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED SEPTEMBER 30, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B5

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.04	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	16.2635	GRAMS
MOISTURE (WT. LOSS @ 104° C)	17.85	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	82.15	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.50	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	81.65	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	25.0
IRON	FE	2.0
ALUMINUM	AL	10.0
CALCIUM	CA	2.7
SODIUM	NA	7.2
MAGNESIUM	MG	0.75
POTASSIUM	K	3.5
TITANIUM	TI	0.38
MANGANESE	MN	0.037
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0048
VANADIUM	V	0.0058
COPPER	CU	0.0052
NICKEL	NI	0.0012
ZIRCONIUM	ZR	0.018
COBALT	CO	TR<0.001
STRONTIUM	SR	0.044
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.0092
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

Approved by: State of California, Department of Health Services, Laboratory Section

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LAB NO. 43307

SCOTT SOULE & ASSOCIATES
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SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES

SUBMITTED OCTOBER 5, 1982

REPORTED OCTOBER 26, 1982

SOULE ID: WB-1

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.21	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	14.3565	GRAMS
MOISTURE (WT. LOSS @ 104° C)	13.23	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	86.77	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.08	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	85.69	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	22.0
IRON	FE	3.2
ALUMINUM	AL	11.0
CALCIUM	CA	5.2
SODIUM	NA	5.9
MAGNESIUM	MG	0.9
POTASSIUM	K	3.8
TITANIUM	TI	0.8
MANGANESE	MN	0.029
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0057
VANADIUM	V	0.0069
COPPER	CU	0.0029
NICKEL	NI	0.00073
ZIRCONIUM	ZR	0.014
COBALT	CO	TR<0.001
STRONTIUM	SR	0.050
YTTERBIUM	YB	0.0049
CHROMIUM	CR	0.0081
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

[signature]

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LAB NO. 43308

SCOTT SOULE & ASSOCIATES
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SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-2

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.33	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	13.8289	GRAMS
MOISTURE (WT. LOSS @ 104° C)	19.58	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	80.42	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.01	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	79.41	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	25.0
IRON	FE	2.5
ALUMINUM	AL	11.0
CALCIUM	CA	3.1
SODIUM	NA	6.4
MAGNESIUM	MG	0.75
POTASSIUM	K	2.4
TITANIUM	TI	0.45
MANGANESE	MN	0.047
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0033
VANADIUM	V	0.0065
COPPER	CU	0.0022
NICKEL	NI	0.0013
ZIRCONIUM	ZR	0.019
COBALT	CO	TR<0.001
STRONTIUM	SR	0.059
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.010
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

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LAB NO. 43309

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SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-3

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.16	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0016	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	14.4301	GRAMS
MOISTURE (WT. LOSS @ 104° C)	17.10	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	82.90	% OF WET SAMPLE
VOLATILE SOLIDS (LOSS @ 550° C)	1.11	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	81.79	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	27.0
IRON	FE	4.6
ALUMINUM	AL	8.6
CALCIUM	CA	3.2
SODIUM	NA	4.9
MAGNESIUM	MG	1.1
POTASSIUM	K	2.3
TITANIUM	TI	0.62
MANGANESE	MN	0.059
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0059
VANADIUM	V	0.0090
COPPER	CU	0.00081
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.021
COBALT	CO	TR<0.001
STRONTIUM	SR	0.033
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.015
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

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LAB NO. 43310

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SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-4

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.88	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0012	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.0140	GRAMS
MOISTURE (WT. LOSS @ 104° C)	25.76	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	74.24	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	1.46	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	72.78	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	5.3
ALUMINUM	AL	9.2
CALCIUM	CA	8.5
SODIUM	NA	5.2
MAGNESIUM	MG	1.1
POTASSIUM	K	3.4
TITANIUM	TI	0.77
MANGANESE	MN	0.050
LEAD	PB	TR<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0066
VANADIUM	V	0.0076
COPPER	CU	0.0051
NICKEL	NI	0.0016
ZIRCONIUM	ZR	0.040
COBALT	CO	TR<0.001
STRONTIUM	SR	0.033
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.014
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

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LAB NO. 43311

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SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-5

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.27	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0013	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	16.8671	GRAMS
MOISTURE (WT. LOSS @ 104° C)	15.65	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	84.35	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.97	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	83.38	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	27.0
IRON	FE	2.3
ALUMINUM	AL	7.8
CALCIUM	CA	3.7
SODIUM	NA	6.1
MAGNESIUM	MG	1.1
POTASSIUM	K	4.0
TITANIUM	TI	0.58
MANGANESE	MN	0.036
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0054
VANADIUM	V	0.0080
COPPER	CU	0.0018
NICKEL	NI	0.0018
ZIRCONIUM	ZR	0.032
COBALT	CO	0.0023
STRONTIUM	SR	0.027
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby
EDWIN S. CROSBY, PHD.
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Approved by: State of California, Department of Health Services, Laboratory Section

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LAB NO. 43312

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SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 5, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: WB-6

CHEMICAL ANALYSES

		CONCENTRATION	UNITS
INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)			
BARIUM	BA	0.28	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0022	MG/L

SOLIDS - WET SAMPLES		
SAMPLE ALIQUOT, WET WEIGHT	15.9993	GRAMS
MOISTURE (WT. LOSS @ 104° C)	20.23	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	79.77	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.24	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	79.53	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	3.0
ALUMINUM	AL	10.0
CALCIUM	CA	4.1
SODIUM	NA	6.1
MAGNESIUM	MG	1.2
POTASSIUM	K	4.3
TITANIUM	TI	0.69
MANGANESE	MN	0.037
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0062
VANADIUM	V	0.0098
COPPER	CU	0.0023
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.027
COBALT	CO	0.0019
STRONTIUM	SR	0.023
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.020
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

CROSBY LABORATORIES

RESEARCH AND CONSULTING

Biological • Microbiological • Chemical • Environmental

625 WEST KATELLA AVE., SUITE 4 • ORANGE, CALIFORNIA 92667 • (714) 639-3821

LAB NO. 43386
SAMPLE ID: LAKE EVANS, RIVERSIDE
BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-3

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.09	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	17.0575	GRAMS
MOISTURE (WT. LOSS @ 104° C)	12.57	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	87.43	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.51	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	86.92	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	4.2
ALUMINUM	AL	8.9
CALCIUM	CA	3.3
SODIUM	NA	7.5
MAGNESIUM	MG	0.76
POTASSIUM	K	4.0
TITANIUM	TI	0.71
MANGANESE	MN	0.079
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0052
VANADIUM	V	0.012
COPPER	CU	0.012
NICKEL	NI	0.0015
ZIRCONIUM	ZR	0.047
COBALT	CO	ND<0.001
STRONTIUM	SR	0.047
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.024
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

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LAB NO. 43387

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-4

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.22	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	17.8757	GRAMS
MOISTURE (WT. LOSS @ 104° C)	15.28	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	84.72	% OF WET SAMPLE
VOLATILE SOLIDS (LOSS @ 550° C)	7.10	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	77.62	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	21.0
IRON	FE	3.7
ALUMINUM	AL	10.0
CALCIUM	CA	7.9
SODIUM	NA	4.5
MAGNESIUM	MG	1.7
POTASSIUM	K	2.7
TITANIUM	TI	0.95
MANGANESE	MN	0.044
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0053
VANADIUM	V	0.0086
COPPER	CU	0.0075
NICKEL	NI	0.0018
ZIRCONIUM	ZR	0.035
COBALT	CO	0.0024
STRONTIUM	SR	0.023
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.014
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

Approved by: State of California, Department of Health Services, Laboratory Section

CROSBY LABORATORIES

RESEARCH AND CONSULTING

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LAB NO. 43388

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-5

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.04	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	0.0006	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.2328	GRAMS
MOISTURE (WT. LOSS @ 104° C)	16.67	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	83.33	% OF WET SAMPLE
VOLATILE SOLIDS(LOSS @ 550° C)	0.38	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	82.95	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	23.0
IRON	FE	3.6
ALUMINUM	AL	8.6
CALCIUM	CA	3.1
SODIUM	NA	7.2
MAGNESIUM	MG	1.0
POTASSIUM	K	5.3
TITANIUM	TI	0.7
MANGANESE	MN	0.044
LEAD	PB	ND<0.01
BARIUM	BA	TR<0.10
GALLIUM	GA	0.0034
VANADIUM	V	0.011
COPPER	CU	0.027
NICKEL	NI	0.0020
ZIRCONIUM	ZR	0.056
COBALT	CO	0.0025
STRONTIUM	SR	0.032
YTTERBIUM	YB	TR<0.004
CHROMIUM	CR	0.025
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

EDWIN S. CROSBY, PHD.
DIRECTOR

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LAB NO. 43389

SCOTT SOULE & ASSOCIATES
856 NORTH ELM STREET
SUITE K
ORANGE, CALIFORNIA 92667

SAMPLE ID: LAKE EVANS, RIVERSIDE BOTTOM SAMPLES
SUBMITTED OCTOBER 13, 1982
REPORTED OCTOBER 26, 1982
SOULE ID: B-6

CHEMICAL ANALYSES

INORGANICS - E.P. EXTRACTED SAMPLES (ATOMIC ABSORPTION ANALYSIS)

		CONCENTRATION	UNITS
BARIUM	BA	0.12	MG/L
CADMIUM	CD	ND<0.01	MG/L
CHROMIUM	CR	ND<0.01	MG/L
LEAD	PB	ND<0.01	MG/L
MERCURY	HG	ND<0.0005	MG/L

SOLIDS - WET SAMPLES

SAMPLE ALIQUOT, WET WEIGHT	18.1651	GRAMS
MOISTURE (WT. LOSS @ 104° C)	11.46	% OF WET SAMPLE
DRY SOLIDS (RESIDUE @ 104° C)	88.54	% OF WET SAMPLE
VOLATILE SOLIDS (LOSS @ 550° C)	0.35	% OF WET SAMPLE
ASH (RESIDUE @ 550° C)	88.19	% OF WET SAMPLE

INORGANICS - ASHED SAMPLE (SPECTROGRAPHIC ANALYSIS)

		% OF ASH
SILICON	SI	26.0
IRON	FE	3.0
ALUMINUM	AL	10.0
CALCIUM	CA	1.4
SODIUM	NA	6.0
MAGNESIUM	MG	0.54
POTASSIUM	K	4.5
TITANIUM	TI	0.37
MANGANESE	MN	0.032
LEAD	PB	ND<0.01
BARIUM	BA	ND<0.10
GALLIUM	GA	0.0072
VANADIUM	V	0.0070
COPPER	CU	0.019
NICKEL	NI	0.0013
ZIRCONIUM	ZR	0.035
COBALT	CO	ND<0.001
STRONTIUM	SR	0.044
YTTERBIUM	YB	ND<0.004
CHROMIUM	CR	0.0091
OTHER ELEMENTS	--	NIL

ANALYZED BY A.L., P.S.L. AND C.L.

Edwin S. Crosby

EDWIN S. CROSBY, PHD.
DIRECTOR

STATE OF CALIFORNIA—RESOURCES AGENCY
EDMUND G. BROWN JR., Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SANTA ANA REGION
6809 INDIANA AVENUE, SUITE 200
RIVERSIDE, CALIFORNIA 92506
PHONE: (714) 684-9330

August 23, 1982

Mr. David L. Wigginton
Park and Recreation Department
City of Riverside
3900 Main Street
Riverside, CA 92522

Dear Mr. Wigginton:

Fairmount Lakes Rehabilitation

This letter will confirm the agreements reached in our discussion in your office of August 18, 1982.

The procedure and techniques for sampling and analysis of the lake bottom sediments, as described in Wayne Florian's August 3rd letter to you, are satisfactory. Please submit the data from those tests to us when they are available. In consultation with the California Department of Health Services, we will determine the class of waste (toxic, hazardous, etc.) the dredge spoils will fall into.

When that is done, we will be able to discuss acceptable disposal methods and locations with you.

Sincerely,

Gordon K. Anderson
Environmental Specialist

cc: Florian/Martinez Associates

GKA:kyw

CITY OF RIVERSIDE

INTEROFFICE MEMO

File: City of Riverside / Lk Evans / Fairmount Pk

TO: Fairmount Technical Committee

DATE: August 20, 1982

FROM: Louis M. Hernandez, Park & Recreation Director

SUBJECT: <u>FAIRMOUNT LAKES REHABILITATION</u>

Our next meeting is scheduled for September 8, 1982 at 1:00 p.m. in my office. We have invited Jesse Hubbs and Sons to attend and discuss dredging and excavating the lakes. This firm has dredged the lakes in Fairmount Park in the past.

It is hoped that this meeting will answer all the necessary questions posed at our last meeting so we may continue on with the project.

LMH/cd

Committee Members: Merle Gardner
Bob Wales
Jim Anderson
Ken Edwards

AUG 24 1982

ING, 13132 NEWPORT AVENUE, SUITE 110, TUSTIN

RIAN/MARTINEZ ASSOCIAT

August 3, 1982

Mr. David Wigginton
Riverside Park & Recreation Department
3900 Main Street
Riverside, California 92522

Reference: Lake Evans Refurbishment

Dear David:

Pursuant to your request, I am enclosing a blueline plan indicating the flow line elevation of the 60" pipe running from Fairmount Lake to the west side of the dam on Lake Evans. The line indicated on the enclosed print is located on the shore; but the flow line elevations shown would have been the same whether the pipe was installed in the lake or in the south shore area. The line indicated in the report extended to Market Street. The flow line elevation, if that were to happen, would simply be a straight fall from the inlet elevation at Market Street to the Weir control box noted at elevation 782 on the subject print. Additionally, on this same print, I have indicated both where the original three soils test holes were drilled, and where the eight test holes under the amended Phase 1 contract will be taken.

I have also enclosed the following per your request:

1) One print at 1" = 60' indicating the as-built topographical conditions surrounding the three lakes.

2) One print at 1" = 120' identifying existing areas and facilities in and adjacent to the three lakes.

3) One print at 1" = 60' identifying sediment deposits and existing lake bottom topography.

In answer to your question regarding methodology for performing additional soils tests to more completely determine existing toxicity, please note that these tests will be performed in conformance with the Santa Ana River Water Quality Control Board requirements. We will propose to the Water Quality Control Board that an EP toxicity test be performed in order to determine the leachability of the toxic materials in the soil. Should the Water Quality

David Wigginton
Riverside Park & Recreation Department
August 3, 1982
Page Two

Control Board additionally require a test to determine the total toxic metal content of the soil utilizing nitric acid, we can perform this test also. All tests will be performed in conformance with methodologies as defined per the following:

1) EPA, "Methods for Chemical Analysis and Wastes."

2) APHA-AWWA Standard Methods (Supplement to 15th Edition Selected Analytic Methods, "Applied and Cited by EPA").

3) ASTM (Method for Total Metals).

Should you require additional information, please give me a call.

Sincerely,

FLORIAN MARTINEZ ASSOCIATES

Wayne M. Florian
A.S.L.A., Lic. #1161

WMF:ggb

Enclosures

CITY OF RIVERSIDE

INTEROFFICE MEMO

TO: Fairmount Technical Advisory Committee DATE: August 6, 1982

FROM: Louis M. Hernandez, Park & Recreation Director

SUBJECT: FAIRMOUNT LAKES REHABILITATION

AUG 9 1982

The second Technical Advisory Committee meeting for the subject project is scheduled for Monday, August 16, 1982 at 11:00 a.m. on the Mezzanine Floor of City Hall.

If this presents any inconvenience to you, please contact me.

LMH/cd

Members: Merle Gardner, Planning Director
Bob Wales, Public Works Director
Jim Anderson, Water Quality Control Board
Bob Nelson, County Flood Control

LANE DRAINS REHABILITATION 7/30/82

$1.4 MILLION PROJECT –

City Eng. – Further test on soils –
– data showing heavy metals ?
– Criteria : ∘ PARKS RULES (OK PHASE 1)
• F&G
∘ COUNCIL (OK PHASE 1)

Consultant additional study.

∘ Where and testing method (RB respond)
Florian Mgr

∘ Pipe alignment :
Profile ~~etc~~
Alt – put line in road at less depth –

CITY OF RIVERSIDE

INTEROFFICE MEMO

TO: Fairmount Lakes Technical Advisory Committee

DATE: July 20, 1982

FROM: Louis M. Hernandez, Park and Recreation Director

SUBJECT: FAIRMOUNT LAKES REHABILITATION

You are invited to attend a meeting on July 30, 1982 at 3:00 p.m. on the Mezzanine Floor of City Hall to discuss the subject project. Your charge, as a committee member, will be to assist in defining what rehabilitation efforts will be possible to develop within the project budget.

We will be looking forward to seeing you.

LMH/cd

Committee Members: Bob Wales, Public Works Director
Merle Gardner, Planning Director
Jim Anderson, Regional Water Quality Control
Ken Edwards, County Flood Control

CITY OF RIVERSIDE

CITY COUNCIL MEMORANDUM

HONORABLE MAYOR and CITY COUNCIL

DATE: July 6, 1982

AGENDA ITEM #: 46

SUBJECT: FAIRMOUNT LAKES REHABILITATION

The City Council referred the matter of the Fairmount Lakes Rehabilitation to the Recreation and Cultural Committee for review and recommendation. The committee met with the Park and Recreation Commission Fairmount Park Subcommittee; Wayne Florian and Associates, consultant for the project and City staff. The Park and Recreation Commission Subcommittee expressed their concerns about some of the information and recommendations that resulted from Phase I of the project. The Recreation and Cultural Committee requested that Mr. Florian and his associates respond to these concerns and explain how they arrived at these particular recommendations.

After much discussion, the Recreation and Cultural Committee (all three members present) voted unanimously to recommend to the City Council that Phase I of the Fairmount Lake Rehabilitation Project be approved as submitted (refer to Fairmount Lake Consultant Report). The committee further recommended that staff be authorized to contract with the consultant to perform additional research that was identified in Phase I and needs to be accomplished prior to proceeding with Phase II as outlined in the attached flow chart.

Staff is recommending that a Technical Committee composed of the City's Park and Recreation Director, Public Works Director, Planning Director, the Chief Engineer of the Riverside County Flood Control and Water Conservation District or his designee and the Executive Officer of the Water Quality Control Board or his designee be used to evaluate this additional research and to make the final project recommendation, which will establish the priorities for how the $1.4 million will be spent. These recommendations will be submitted to the Park and Recreation Commission and the City Council for final concurrence prior to proceeding to Phase II.

RECOMMENDATION

That the City Council:

1. Approve the consultant's report on Phase I of the Fairmount Lake Rehabilitation Study.

2. Authorize preparation and execution of an amendment to the existing contract with Florian/Martinez Associates for additional study.

3. Approve the composition of the Technical Committee as outlined above and authorize them to evaluate the results of the research and make final recommendations on how the $1.4 million should be spent, with the understanding that these recommendations will be submitted to the Park and Recreation Commission and City Council for final concurrence before proceeding to Phase II of the project.

Respectfully,

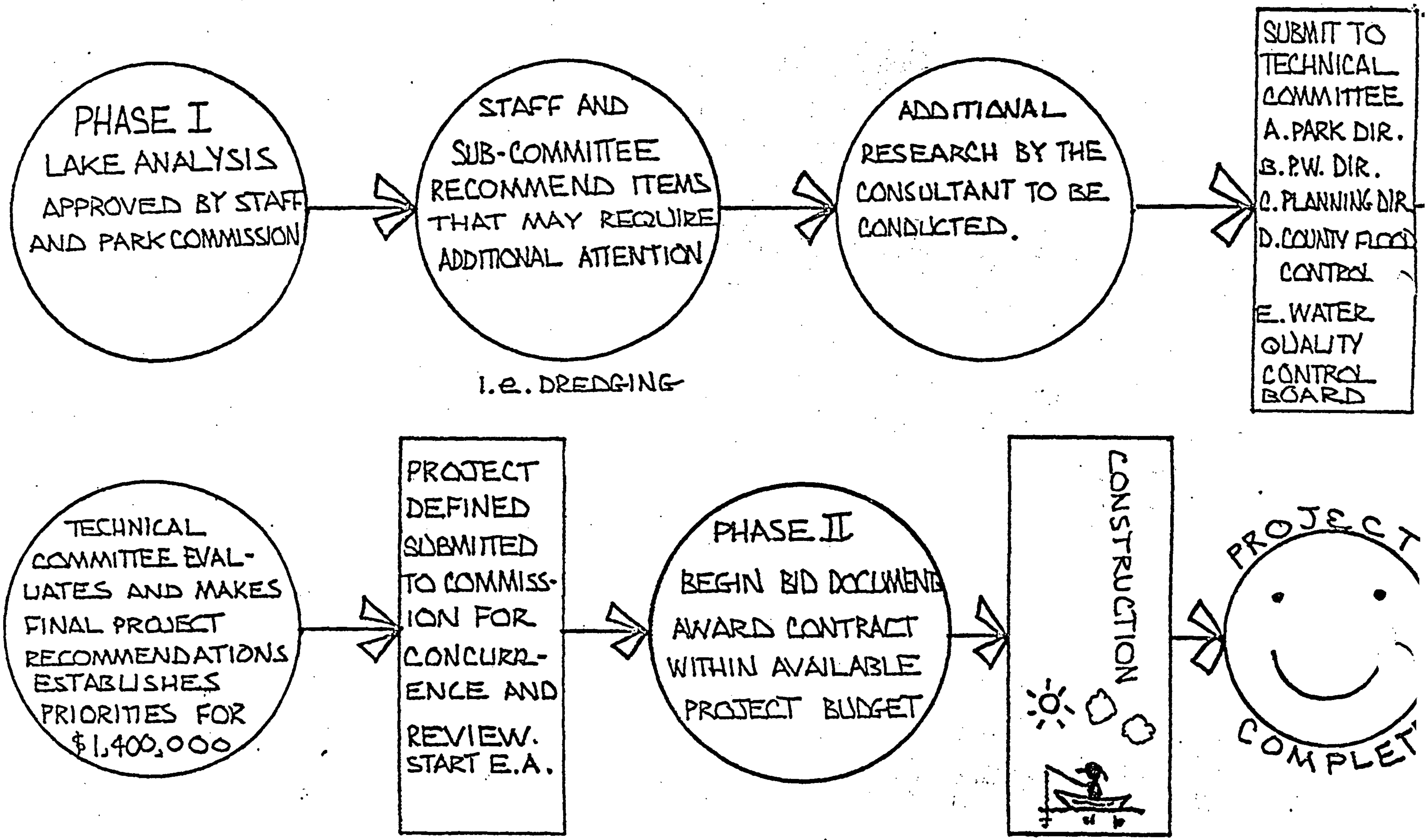
Terry Frizzel, Chairman PKW
Recreation and Cultural Committee

PV/CC1/Ea

cc: City Attorney
City Clerk

7-6-83
1-18-88

FAIRMOUNT LAKES REHABILITATION A written report was submitted from Chairman Frizzel, City Council Recreation and Cultural Committee, recommending that the City Council (1) approve the consultant's report on Phase I of the Fairmount Lakes Rehabilitation Study; (2) authorize preparation and execution of an amendment to the existing contract with Florian/Martinez Associates for additional study; and (3) approve the composition of the Technical Committee as outlined in the report and authorize them to evaluate the results of the research and make final recommendations on how the $1.4 million should be spent, with the understanding that these recommendations will be submitted to the Park and Recreation Commission and City Council for final concurrence before proceeding to Phase II of the project. Park and Recreation Commission Members von Pohle and Stewart expressed concern about some aspects of the consultant's report. Following discussion, the City Council approved the recommendations as presented.	Motion Second All Ayes	X X


PHASE I
LAKE ANALYSIS
APPROVED BY STAFF AND PARK COMMISSION
STAFF AND SUB-COMMITTEE RECOMMEND ITEMS THAT MAY REQUIRE ADDITIONAL ATTENTION
I.e. DREDGING
ADDITIONAL RESEARCH BY THE CONSULTANT TO BE CONDUCTED.
SUBMIT TO TECHNICAL COMMITTEE
A. PARK DIR.
B. P.W. DIR.
C. PLANNING DIR.
D. COUNTY FLOOD CONTROL
E. WATER QUALITY CONTROL BOARD
TECHNICAL COMMITTEE EVALUATES AND MAKES FINAL PROJECT RECOMMENDATIONS ESTABLISHES PRIORITIES FOR $1,400,000
PROJECT DEFINED SUBMITTED TO COMMISSION FOR CONCURRENCE AND REVIEW. START E.A.
PHASE II
BEGIN BID DOCUMENTS
AWARD CONTRACT WITHIN AVAILABLE PROJECT BUDGET
CONSTRUCTION
PROJECT
COMPLET

CITY OF RIVERSIDE

INTEROFFICE MEMO

TO: City Council Recreation and Cultural Committee

DATE: June 25, 1982

FROM: Louis M. Hernandez
Park and Recreation Director

SUBJECT: FAIRMOUNT LAKES REHABILITATION

On August 11, 1981, the City of Riverside entered into an agreement with the State of California in the amount of $1,400,000 to rehabilitate the lakes within Fairmount Park. This project was selected by the State due to its proximity to a highly populated area and the deteriorated condition of the lakes.

On January 13, 1982, the City entered into an agreement with the consulting firm of Florian/Martinez Associates to conduct a lake analysis employing varying testing methods which identify all problems associated with the lakes and what it would ideally take to restore them to an optimum condition. In addition, the consultant was to make recommendations for the solutions of those identified problems.

The lake analysis report has been submitted, reviewed and accepted by both city staff and the Park and Recreation Commission. Before plans and specifications can be developed additional detailed study must be undertaken in certain areas as identified in the Phase One report. Specifically they are sediment disposal and bypass pipe sizing and location. (See attached memo from the Public Works Director.)

The Parks Department proposes to approve the additional required research utilizing the same consulting firm through a contract amendment. When this research has been completed all information will go to a technical committee comprised of the Park and Recreation Director, Public Works Director, Planning Director, and representatives from the County Flood Control District and Regional Water Quality Control Board. The technical committee will define the project and determine what elements should be done within the $1,400,000 project budget.

When this has been accomplished it will be forwarded to the Park and Recreation Commission for review and concurrence. An environmental assessment will then be processed for approval by the Environmental Protection Commission. The consultant will then be given authorization to prepare bidding documents for construction of Phase Two, lake rehabilitation.

Attachments

CITY OF RIVERSIDE

INTEROFFICE MEMO

TO: Louis Hernandez
Park and Recreation Director

DATE: June 25, 1982

FROM: Bob Wales
Public Works Director

SUBJECT: FAIRMOUNT PARK REHABILITATION

I have reviewed the rehabilitation study for the Fairmount Park submitted with your memo of June 15, 1982, and while I believe it adequately addresses those points which the consultant was to cover in Phase I, I do not believe the City should immediately go to Phase II which, as I understand it, was to be detailed specifications and construction drawings for the project. Rather, it is my opinion that the consultant should be requested to do further studies in the following two areas for the following reasons.

1. Additional silt samples should be taken from the bottom of Lake Evans and an analysis run to verify precisely what, if any, amount of those deposits are contaminated to such a degree to require their removal to a Class I landfill. It is my opinion that no further work should proceed until this is accomplished. This is based on the fact that if a significant portion of those silts must be hauled off to a Class I landfill at a cost of $20 to $40 per cu. yd., the budget for the project is significantly underestimated and alternative measures may have to be reviewed.

2. Further studies should also be undertaken on the sizing, location and the function of the bypass storm drain proposed. I am concerned about having a storm drain under the entire reach of Lake Evans and Fairmount Lake. This concern is basically centered around the significant maintenance cost which I feel will be encumbered with that pipe in that location. In addition, the function of that pipe should be one of merely bypassing polluted nuisance storm drain waters around the lake and should not be considered as a silt bypass. Given this criteria, it is also my opinion that the pipe could be down-sized somewhat, thereby reducing its cost.

* * * * *

Once these further studies are completed, I would believe it appropriate to empanel a technical advisory committee comprised of representatives from the City as well as the County Flood Control and the Regional Water Quality Control Board to fully review these studies and propose a recommendation for what portions of the project should be pursued at this time given the funding restraints currently imposed on the project.

Once this committee had prepared its recommendations, I believe it would be appropriate to have those recommendations presented to the Parks and Recreation Commission for their concurrence followed by Council concurrence. Once this was accomplished, an environmental assessment could be made on the project and negotiations entered into with the consultant for the preparation of those plans and specifications necessary to incorporate only that portion of the project which can be constructed at this time with funds available.

I believe through the process I have outlined above, the City can assure itself that any improvements undertaken at Fairmount Lake are not only cost effective but also in keeping with the ultimate park design. If you have any questions on this matter or would like me to discuss it with either your staff or the consultant, please feel free to give me a call.

STATE OF CALIFORNIA—RESOURCES AG :Y EDMUND G. BROWN JR., Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SANTA ANA REGION
6809 INDIANA AVENUE, SUITE 200
RIVERSIDE, CALIFORNIA 92506
PHONE: (714) 684-9330

May 13, 1982

Mr. W. M. Florian
Florian/Martinez Assoc.
13132 Newport Avenue Suite 110
Tustin, Ca 92680

Dear Mr. Florian:

We have reviewed the data provided with your letter dated May 4, 1982 regarding a sampling of silts from Lake Evans.

These analyses indicate exceedingly high concentrations of lead, chromium, cadminum and mercury. Crosby Laboratory was contacted and apparently the correct sample extraction procedures were utilized as set forth in RCRA.

The only item which is still unknown was the sampled locations and the depths of the samples. However, if these samples are representative, they indicate an excessively polluted soil condition and the materials would have to be removed to a proper site, a Class I Disposal site.

We would suggest that your staff arrange a meeting to discuss the sampling techniques and the possibility to resample the site.

If there are any questions, please feel free to contact this office.

Sincerely,

John M. Zasadzinski
Senior Engineer

bcc: Bob Stewart, Stewart's Gun Shop
3830 Jurupa Avenue
Riverside, CA 92506

JMZ:kyb

5/5/82
GKA

Lake Evans Restoration/Rehabilitation

1. Diverting silt-laden [illegible] flows is obviously a good idea if hydraulic dredging [illegible] are [illegible]. The [illegible] [illegible] to derive the dollar value of the bypass structures. Perhaps a larger bypass could be justified by present worth analysis.

2. Discharge of [illegible], perhaps also including dredge spoil dewatering, could [illegible] be [illegible] [illegible].

3. Drawdown of the lake by [illegible] pumps [illegible] [illegible] [illegible] Wouldn't [illegible] get a lot of [illegible] in addition to the water in the lake?

4. Is drag-line dredging less expensive than hydraulic dredging.

5. The lake <u>does</u> need to be rehabilitated, and needs to be effectively removed from the flood control system. Water quality in the lake should be improved and its operation [illegible] long-term detrimental effects on other water resources in the area. The economics of the operation [illegible] should be [illegible].

LANDSCAPE ARCHITECTURE AND PL NING, 13132 NEWPORT AVENUE, SUITE 110, TU N, CALIFORNIA 92680, TELEPHONE 714/731-6011

FLORIAN/MARTINEZ ASSOCIATES

JMZ
8

May 4, 1982

CALIFORNIA REGIONAL WATER
QUALITY CONTROL BOARD

MAY - 6 1982

SANTA ANA REGION

Mr. John Zasadzinski
Regional Water Quality Control Agency
6809 Indiana Avenue, Suite 200
Riverside, California 92506

Reference: Lake Evans Refurbishment

Dear John:

Pursuant to our recent telephone conversation regarding disposal of the silt build-up in both Lake Evans and Lake Fairmount, I have enclosed our chemical analysis of the various metals. We are seeking to determine whether it is possible this material, which in total amounts to 100,000 c.y. wet or approximately 50,000 c.y. dry, can be disposed of on Fairmount Park property.

The chemical analysis of this silt was performed by Crosby Laboratories in conformance with methods recommended by Santa Ana Regional Water Quality Control Agency.

Any comments you might have would be appreciated. I will call you within the next few days to discuss.

Sincerely,

FLORIAN/MARTINEZ ASSOCIATES

Wayne M. Florian
A.S.L.A.

WMF:ggb
Enclosure
cc: Dave Wigginton, Riverside Parks & Recreation Department

B. Chemical Analyses

The chemical analyses were made by Crosby and Associated Laboratories. In addition to heavy metals and pesticides, these samples were also tested for the presence of Polychlorinated Biphenyls, or PCB's, in accordance with AROCHLOR 1254 standard.

C. Evaluation of the Core Sample Analyses

The metals analyses showed a considerable build-up of some of the hazardous metals as listed in the previously referenced EP-Federal Register Table I - Maximum Concentration of Contaminants - see Appendix I. These maximum permitted values are shown below with the results of the bottom core sample analyses:

	Maximum	Bottom Samples (Mg/L)		
Contaminant	Mg/L	A	B	C
Arsenic	5.0	Non detected <1		
Barium	100.0	265	66.5	237
Cadminum	1.0	7.0	1.5	5.5
Chromium	5.0	53.0	19.0	45.5
Lead	5.0	113	34.0	135
Mercury	0.2	0.55	0.15	0.44
Selenium	5.0	Non detected <1		

I believe the program for eliminating nuisance flows is a good one since this source does more ecological harm than silt. However if the channels have been improved the one year storm flow should not be diverted since it will be beneficial. There should be some mechanical bypass available of nuisance flows.

I do not believe the dewatering wells as proposed are feasible since groundwater is very high in this area. A sand + gravel operation in Corona tried to do this and after six months with several 2000 gpm pumps he gave up. A filter type surface pumping can bring the water down to a level where a clam shell can reach most any area.

Info on how the heavy metals concentrations were arrived at not available in report. These were the values the consultant gave me over the phone and their basis must be determined

If the heavy metals level can be mixed out this would be good cover material for the City at its landfill. Since City gets its cover from river this could be the way they would travel from the park to the landfill and cut costs.

TO: Bob Stewart

File
Clean Lakes - LAKE EVANS

1440 DOMINGO ROAD
FULLERTON, CALIF. 92633

ROBERT C. FOX
CONSULTING ENGINEERING GEOLOGIST

RECEIVED
APR 07 1982
FLORIAN ASSOCIATES

April 7, 1982

CALIFORNIA REGIONAL WATER
QUALITY CONTROL BOARD
JUN 08 1982
SANTA ANA REGION

Florian/Martinez Associates
Landscape Architecture and Planning
13132 Newport Avenue, Suite 110
Tustin, California 92680

Attention: Mr. Wayne Florian

Gentlemen:

This letter report has been prepared in order to furnish you with hydrogeologic information required in connection with formulating plans to deepen Lake Evans in the Fairmount Park area.

Items to be addressed include a description of the geologic and hydrologic environment in the vicinity of the Project area; what effect, if any, short-time dewatering will have on vegetation in the immediate vicinity of the shoreline of the Lake; and an estimate of cost for temporarily lowering the ground water table below the Lake so that deepening can be effected.

In connection with dewatering during construction, I met with Mr. Kenneth L. Carnes, Chief Estimator of Stang Hydronics, in Orange. During our meeting, I explained the Project, provided him with a preliminary cost estimate for a dewatering program.

Fairmount Park (Lake Evans) lies in the Riverside Basin Area of the Upper Santa Ana Valley Basins group. The Riverside Basin area lies southwest of the Colton area, occupying the alluvial valley in which Riverside and Arlington are situated. The major part of the area is covered by an old alluvial surface with a deeply weathered reddish-brown soil mantle. This surface is known as Riverside or Grand Terrace. The Santa Ana River, which crosses the northwest corner of the basin, flows on a flood plain one to two miles wide that is cut about 50 feel below the level of the Riverside Terrace.

Riverside and Arlington Basins are formed by a bedrock canyon system heading in the vicinity of Arlington in the southwest part of the area and running northerly, emptying into the deep main partof Santa Ana Basin through the gap between Riverside and Colton where Santa Ana River flows. That is, the ancient local drainage was to the north, almost in an opposite direction from the flow of the present Santa Ana River.

The alluvial fill deposited by Lytle Creek and Santa Ana River covered the old bedrock surface and buried this canyon system. It finally topped the southwest rim of the canyon, and Santa Ana River has since then from time to time flowed out through the Arlington Gap to join Temescal Creek near Corona.

The bedrock floor is granitic Basement Complex like that in the hills around the basin. It slopes from an elevation of a little more than 600 feet at a subsurface divide in the southwest part of the basin near Van Buren street, to a probable elevation of about 200 feet at the northern margin where it is deepest.

Santa Ana River and its tributaries have supplied the major portion of alluvial fill in Riverside Basin. The material is principally crystalline granitic and metamorphic, with occasional hard sandstone pebbles and cobbles. Due to the low and uniform alluvial gradient through the area the average size of gravels in different parts varies only slightly. Cobbles in the coarsest gravels are not commonly more than two to three inches in diameter and probably less than two inches. On the basis of this size distribution, a minimum specific yield value of 20 percent has been assigned to unweathered gravels in the vicinity of Fairmount Park.

Underflow from Colton Basin, to the north, passes into the northeast part of Riverside Basin where it separates. One portion moves southwesterly along the west side of the basin toward Riverside narrows where it appears as rising water. The other moves south from Colton through the east side of the basin and swings west, joining the other portion of the ground water above Riverside narrows. The bedrock hills southwest of Colton separate these two ground water bodies.

The water table beneath the flood plain area of Riverside Basin is about 50 feet below the surface at the upper end of the basin and converges downstream, reaching the surface in the river bed near where the San Bernardino-Riverside county line crosses it. Ground waters in the immediate vicinity of the Project Area are currently replenished by return of irrigation waters, by percolation of sewage effluents and by deep percolation of rainfall, occasional flood flows and subsurface inflow.

Ground water level contour maps previously prepared by the California Department of Water Resources indicate that ground water moves in a southwesterly direction along a hydraulic gradient of 20 feet per mile in the immediate vicinity of the Project area. Between the La Loma Hills, to the northeast and Mount Rubidoux, located immediately downstream from Fairmount Park, ground water level contours are at right angles to the Santa Ana River. During the heavy pumping season, ground water level contours are somewhat distorted due to heavy withdrawls, and near large producing water wells, the contours are concentric around the wells.

In the immediate locale of the Project Area, ground water stands approximately ten feet below ground surface or at elevation 780 feet above sea level as of March, 1982. Ground water elevation in the same area, in the Spring of 1961 was 785 feet. Data indicate that in the Spring of 1933, elevation of the water table in the Project Area was 775 feet.

The most recently prepared water level contour map was in 1965. At this time, the 800 foot contour line was projected from Bloomington Boulevard on the northwest to a point one-half mile south of 8th Street, to the southeast, or a distance of 3.5 miles. The 800 foot contour line passes precisely below Lake Evans.

Ground water levels are so consistent in this locale as to direction of flow and elevation, that even Mount Rubidoux imparts virtually no impact whatsoever on ground water movement. Elevation of ground water on either side of Mount Rubidoux is the same, and the obstruction does not alter the direction of ground water movement at all.

In connection with the proposed plans for deepening Lake Evans, consideration must be given to the fact that ground water will be intercepted at elevation 780 feet, that ground water underlies the entire area for a distance of several miles on either side, and to deepen the Lake, the ground water table in the vicinity of the Lake must be lowered during the entire period of construction. The depth to which ground water must be lowered will depend upon the invert elevation of the Lake to be attained, the nature of the sediments beneath the Lake and their transmissive characteristics and on the dewatering plans that will be developed.

In order to pump the least quantity of water and to effect the greatest drawdown of the water table with the least number of wells, certain aquifer tests will have to be conducted. When these criteria are available, a more definite statement can be made as to how many feet below present elevation the ground water table must be lowered. The importance of determining this ground water elevation with a high degree of accuracy is the lowered water levels impact on vegetation adjacent to the shoreline of the Lake and its ability to withstand a sustained period of lack of soil water.

Based on very preliminary work, it appears that the ground water table will be lowered at least 20 feet for a distance of about 150 feet beyond the entire Lake. This depressed water table will be sustained during the entire period of grading operations which is estimated to require approximately 30 days.

As of the date of this letter, I have not received an estimate of cost for dewatering by Stang. I did talk to Ken Carnes and provided him with additional hydrologic information. He mentioned that I would have his estimate by the end of this week.

Should you have any questions pertaining to the contents of this letter report, please feel free to call upon me for any help I can provide.

Very truly yours,

Robert C. Fox
R.G. 281
C.E.G. 168

RCF/cg