

Appendix 2A – JMM 1977 Report

CITY OF NEWPORT BEACH

BIG CANYON RESERVOIR

GROUND WATER STUDY

FINAL TECHNICAL REPORT

July 1977

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NOTE: In Plates 1-3, the "A" series shows water levels for for piezometers within the reservoir property boundaries. The "B" series shows water levels in piezometers outside the reservoir property boundaries. Measurements in "B" series piezometers were discontinued October, 1975.

1A	October 25, 1974 - March 21, 1975
1B	October 25, 1974 - March 21, 1975
2A	March 21, 1975 - June 23, 1975
2B	March 21, 1975 - June 23, 1975
3A	June 23, 1975 - September 29, 1975
3B	June 23, 1975 - September 29, 1975
4	October 1, 1975 - January 3, 1976
5	January 3, 1976 - April 7, 1976
6	April 7, 1976 - July 11, 1976
7	July 11, 1976 - October 14, 1976
8	October 14, 1976 - January 16, 1977
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(a) All plates are located at the end of the report.

CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

This report summarizes the results of ground water studies conducted at Big Canyon Reservoir from November 1974 to June 1977. Chapters 2 through 4 summarize the hydrologic, hydrogeologic and water quality data presented in previous quarterly progress reports; and, include a presentation and evaluation of new data collected from October 1975 to May 1977 which has not been previously analyzed. Chapter 5 presents conclusions and recommendations.

The data collected during water year 1974-75 was analyzed in detail in quarterly progress reports submitted to the City in January, May and August. The Fourth Quarter Progress Report and Draft Final Technical Report were submitted in December 1975.

The work completed was authorized by Professional Services Agreement dated September 1974, a subsequent amendment dated June 1975, and an additional contract for Professional Services - Interim Report, dated June 1977.

SCOPE OF WORK

Professional services on the Big Canyon ground water study were to include the following original and amended contract items of work:

(Original Contract)

Drilling, Logging and Sampling: Complete exploratory test drilling, logging and sampling at 11 sites in the vicinity of Big Canyon Reservoir to depths of forty (40) feet maximum.

Permeability Tests: Conduct permeability tests of various soil samples. A portion of the tests will be run in a laboratory and the remainder in situ at the specific drill site.

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Piezometers: Install two (2) inch diameter piezometers at seven (7) drill sites.

Data Collection and Monitoring: Conduct a comprehensive data collection and monitoring program of; (1) Ground water levels and water quality at the new and existing piezometers; (2) Reservoir water surface elevation and precipitation at a manually measured rainfall gage. This program shall commence within one and one-half (1-1/2) months from the notice to proceed.

Underdrain Discharge Monitoring: Provide general designs for the discharge measurement devices for Big Canyon Reservoir's underdrain system, and the Harbor View Hills subdrain system hereinabove mentioned. When measuring devices have been installed by the City, monitor discharge measurement devices on flows of the Big Canyon Reservoir's East Wall Drain system, its underdrain system and the Harbor View Hills (Bren) subdrain system on Newport Hills Drive East. Monitoring shall continue for one (1) year to analyze a complete hydrologic cycle, on a minimum two (2) week frequency.

Additional Investigations: Conduct and supervise additional investigations as required for tracer studies, temperature surveys and local shallow trenching.

Progress and Final Reports: Submit progress reports of results and initial analysis at the end of each three (3) month period. Ten (10) copies of each progress report shall be provided. Submit a final report including description, conclusions and recommendations from the investigation after the final report shall be provided.

Review: Review elements of the program with City staff at appropriate points during the course of the study. City and Engineer shall mutually determine when review and decisions by City are needed.

The study was modified to include the following additional services:

(Amended Items - June 1975)

Monitoring: Complete data collection and monitoring of piezometers, underdrain discharge monitoring and filing of the third quarterly report, and final progress report as set forth in the above said agreement dated September 9, 1974.

Drain Tests: Perform a dual shutdown and measurement program of the East Wall Drain system to include biweekly monitoring.

Introduction

Water Sampling: Conduct additional ground water sampling and analysis for comparison with original sample analysis to include 10 partial and 4 standard mineral analysis.

Piezometers: Installation of two additional piezometers to be located at the southeast corner of the reservoir.

Hydrologic Studies: Perform a study of irrigation water application in adjacent tributary areas to include runoff, percolation, and evapo-transpiration considerations.

(Additional Items - June 1977)

Data Update: Review and update data and results of the Draft Big Canyon Reservoir Ground Water Study (December 1975). Data collected from December 1975, through April 1977, will be included and plotted into the Report text.

Additional Appendixes: Include in REPORT, as appendixes, the letter reports from the 1976 and 1977 underwater reservoir inspections, and observations of recent readings of Broadmoor Tract piezometers.

Water Quality Analyses: Analyze water quality samples from underdrain systems.

The items of work presented in the foregoing paragraphs were taken directly from letters and documents received by Montgomery from the City of Newport Beach.

CONDUCT OF THE STUDY

The investigations described in the original contract of September 1974 and contract amendment of June 1975, were conducted on a quarterly basis during water year 1974-75. Brief progress reports were submitted to the City on approximately 3-month intervals. The items in the contract dated June 1977, were completed from April through July 1977. The specific items of work accomplished during all these periods are summarized in the following paragraphs.

First Quarter Studies (October 1974 - December 1975)

On October 8, 1974, the firm of Converse Davis and Associates was asked to proceed with a program of exploratory drilling, testing and piezometer construction at eleven sites on and around the reservoir property. Exploratory drilling, logging, and soil and water sampling were initiated on October 22, 1974. While the original exploration program included work at 11 sites,

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it was expanded to 13 sites as drilling proceeded. Hole depth ranged from 33 to 49 feet (24-inch diameter); at each site drive samples were obtained at five-foot intervals. Water injection tests were conducted at four test sites to determine transmissivity of the bedrock section and approximate permeability of the individual fracture zones. Laboratory tests (constant head) for permeability were run on eight samples, and mineral analyses were run on 10 ground water samples. Two-inch diameter PVC piezometer pipes were installed, gravel packed and sealed in test holes at 10 sites. Three of these piezometers were located outside of the reservoir fence on Pacific View Memorial Park property.

In order to measure and monitor ground water intercepted by the Bren Drain in the Harbor View Hills Tract on Newport Hills Drive East, a general design for discharge measurement system was prepared. On November 21, 1974, a comprehensive biweekly program of piezometer measurement was initiated at 30 sites. The data and a summary of First Quarter Studies was submitted to the City in Progress Report No. 1, dated January 1975.

Second Quarter Studies (January - March 1975)

Water level measurement and monitoring at 27 piezometer sites around the reservoir were continued. Piezometers B-9, B-5 and C-11 were silted in during local flooding from rains in the first quarter and could no longer be measured. Measurement of discharge for the Main Reservoir Underdrain, the East Wall Drain and the Bren Drain (Harbor View Hills), and collection of both measured and recorded rainfall data were also initiated. Samples of ground water from piezometers and the Bren Drain were obtained and analyzed for mineral quality. Brief data evaluation, including a graphic representation of hydrologic information collected was completed and presented to the City in Progress Report No. 2, dated May 1975.

Third Quarter Studies (April - June 1975)

Biweekly water level measurements at 27 piezometers in the study area were continued and discharge measurements for the Main Reservoir Underdrain, the East Wall Drain, and Bren Tract Drain were obtained. Review, analysis, and graphical presentation of all rainfall, discharge and water level data was completed and presented in Progress Report No. 3, dated August 1975.

Fourth Quarter Studies (July-September 1975)

In order to more precisely define geologic and hydrologic conditions on the east side of the reservoir, additional subsurface exploration was undertaken. Two additional exploration holes were drilled and piezometers I-40 and I-41 installed on August 6 and 7, as authorized by an amendment to the original contract. Measurement of ground water levels, reservoir stage fluctuations

Introduction

and drain discharges was continued. In addition, detailed East Wall Drain shutdown tests were conducted. These tests were designed to determine the effectiveness of the East Wall Drain, and the magnitude of effect that reservoir stage fluctuations had on adjacent ground water levels when the drain was not in operation. The hydrologic data collected and a detailed analysis of the East Wall Drain test results were presented in a Fourth Quarter Progress Report which was included in the Draft Final Technical report submitted in December 1975.

Fifth Period Studies (October 1975 - May 1977)

The analysis of hydrologic data for this period was authorized by Professional Services contract, dated June 1977. Work was undertaken from April through July 1977. On May 3, 1977, Montgomery staff measured ground water levels at the new Broadmoor tract piezometers H-50 through H-56 and collected underdrain water samples. The water samples were analyzed at the Montgomery laboratory in Pasadena. Data analyses and interpretation were completed in July 1977 and are included in this Final Technical Report.

ACKNOWLEDGEMENTS

During the study, participation, contributions of time and helpful suggestions were received from Messrs. Steve Bucknam, John McDonald, and Ron McClure. The staff of James M. Montgomery expresses their sincere appreciation for that cooperation and helpfulness.

CHAPTER 2

HYDROLOGY

CHAPTER 2

HYDROLOGY

This chapter presents a summary of general hydrologic conditions at Big Canyon Reservoir. The conditions include precipitation, reservoir stage fluctuations, water supply from adjacent watersheds and underdrain discharges. The initial program of hydrologic data collection was undertaken from October 1974 through September 1975. The data were collected by City and Montgomery staff. For the last period of analysis, October 1975 through April 1977, the data were collected primarily by the City staff.

PRECIPITATION

Precipitation data for the study was obtained from the Corona del Mar Station No. 169 on the Big Canyon Reservoir property. The facilities include both a standard-type manually measured gage and a continuous recording rain gage. City personnel at the reservoir are responsible for collecting the data from the standard gage, and personnel from the ENVIRONMENTAL MANAGEMENT AGENCY - Road and Flood Program Division (EMA) collect and tabulate rainfall data from the strip chart of the recording gage. Table 2-1, a rainfall summary, was compiled from EMA records. Rainfall totals are computed by water year, from October 1 to September 30. During the 2-1/2 years of data collection, the highest rainfall was 13.75 inches, recorded during water year 1974-75. The rainfall through April for the current water year (1976-77) is only 6.29 inches, which is about 7.5 inches less than for the same period in 1974-75. The greatest amount of rainfall generally occurs in the winter and spring months.

TABLE 2-1 - RAINFALL SUMMARY

Water Year	RAINFALL:											
	Monthly Total											Cumulative Water Year Total
	O	N	D	J	F	M	A	M	J	J	A	S
1974-75	0.41	0.11	4.72	0.42	1.88	3.65	2.47	0.07	0.01	0.00	0.00	0.01
	0.41	0.52	5.24	5.66	7.54	11.19	13.66	13.73	13.74	13.74	13.74	13.75
1975-76	0.44	0.23	0.37	0.00	2.39	1.50	2.03	0.03	0.43	0.00	0.00	2.21
	0.44	0.67	1.04	1.04	3.43	4.93	6.96	6.99	7.42	7.42	7.42	9.63
1976-77	0.16	0.83	0.26	2.97	0.9	1.13	0.00					
	0.16	0.99	1.25	4.22	5.12	6.25	6.25					

Hydrology

RESERVOIR STAGE FLUCTUATIONS

The water surface elevation at Big Canyon Reservoir is measured daily by the City staff. The measurements taken from October 1974 through April 1977 are shown on Plates 1 through 10, along with piezometer levels, daily and cumulative rainfall and drain discharge measurements. The operating level in the reservoir generally varies between elevations 285 and 302 feet. During this study within any single water year, the lowest operating levels occurred between December and April and varied from elevation 285 to 290 feet. During April or May, reservoir filling usually began and continued until the water stage rose to a maximum elevation of about 302 feet by the end of June. Summer and fall operating levels varied between about 292 and 297 feet. Between October 14 and December 18, 1976, the reservoir was emptied for cleaning and inspection. Subsequent refilling to elevation 297 feet was completed by January 5, 1977.

Of major interest in this study are the large fluctuations in reservoir stage (greater than 5 feet) which occur within a few days. As will be seen in later sections of this report, these changes in stage produce the largest fluctuations in local ground water levels.

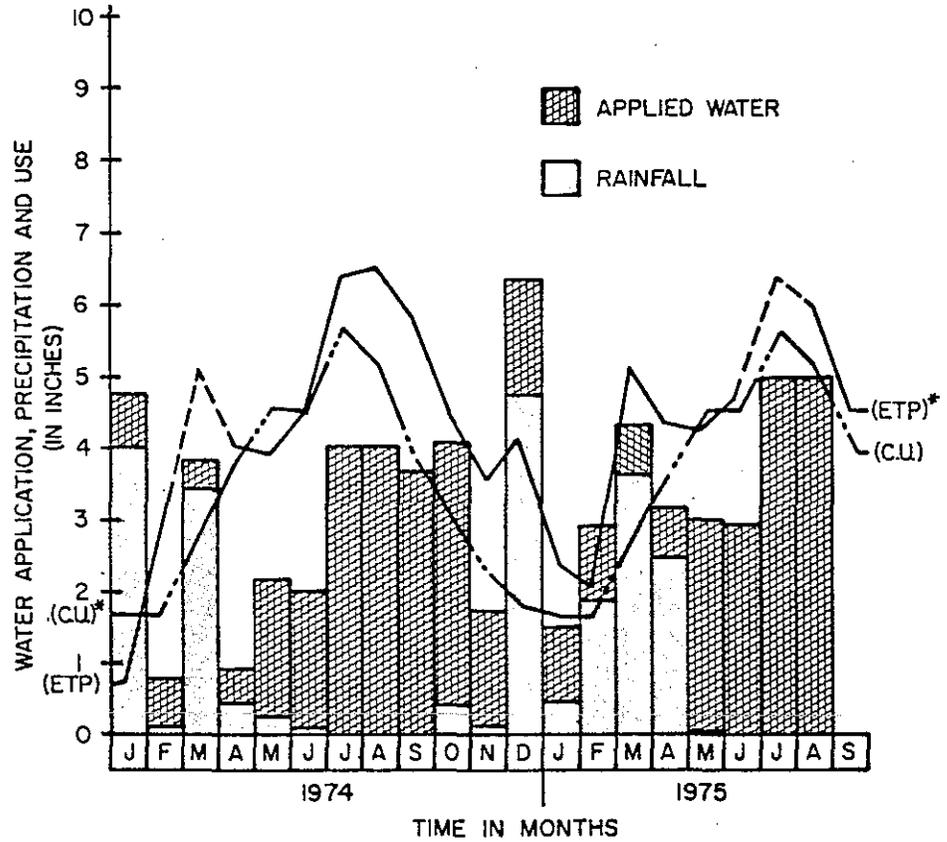
SUPPLY FROM ADJACENT WATERSHEDS

A brief analysis was made of rainfall, irrigation, evapo-transpiration and consumptive use on a 22.5 acre portion of the Pacific View Memorial Park adjacent to the reservoir. Precipitation information was summarized from data at the Corona del Mar Station (No. 169) at the south end of the reservoir. Water application information for the cemetery, available on a two-month basis, was divided equally, and added to monthly rainfall to estimate the total monthly water supply. This resulted in a "rounding out" of the water application over time.

A specially constructed floating evaporation pan is maintained and measured on the reservoir surface by the City staff. A U.S. Geological-Type floating pan has been shown to have a relationship to actual lake surfaces of about 0.8.^(a) However, studies at the reservoir indicate that actual evaporation from the water surface approximates a factor of 1.0 to the special floating pan. This calculated value for reservoir water surface evaporation is considered to approximate the maximum evapo-transpiration potential (ETP). Evapo-transpiration potential is defined as that water loss which would occur if at no time there is a water deficiency in the soil for use by vegetation. ETP values for 1974 and 1975 are plotted and appear as the upper curve on Figure 2-1.

(a) Evaporation relationships are presented in "Evaporation from Water Surfaces", California Department of Water Resources, Bulletin 73, 1959.

WATER SUPPLY AND CONSUMPTIVE USE PACIFIC VIEW MEMORIAL PARK



SURPLUS OR DEFICIENCY OF SUPPLY FOR RUNOFF AND PERCOLATION (IN ACRE FEET)

J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A
3.14	0.86	1.08	2.95	2.36	2.51	1.60	1.06	0.23	1.02	0.61	4.57	0.15	1.30	1.60	0.35	1.48	1.52	0.67	0.13
+	-	+	-	-	-	-	-	-	+	-	+	-	+	+	-	-	-	-	-

* (ETP) Evapotranspiration Potential (From Floating Pan Evaporation)
 (C. U.) Consumptive Use of Grasses (From Irvine Test Plot data modified for coastal climate)

FIGURE 2-1

Hydrology

Values for actual measured consumptive use for turf, grasses and pasture over a 9-year period were obtained from the University of California-Agricultural Extension Service in Riverside, and from the Extension Services Field Station in Irvine. Estimates of probable actual Orange County Coastal evapo-transpiration were also obtained from specialists at the University of California at Irvine, and from the California Department of Water Resources in Los Angeles. The average of the values is 40.68 inches per year. The average was broken into monthly totals based upon a ratio of monthly consumptive use at the Irvine station. These values are plotted as the lower curve labeled C. U. on Figure 2-1.

A comparison of these data indicates that total consumptive use exceeded water supply. For example, during 1975 the total deficiency in supply was 2.37 inches or approximately 53 acre feet of water over the cemetery area. This trend continued into 1975 with a cumulative deficiency of 1.4 inches by the end of August.

It should be noted that data for several individual months exhibit significant surplus. During those months runoff probably occurred. In 1974, two storms in January, one in March and two in December contributed more than 1 inch in 24 hours, and probably resulted in potentially measurable quantities of surface runoff. Small quantities of this runoff may have percolated in the drainage ditch around the east side of the reservoir. Some of the excess supply also replenished soil moisture deficiencies, which had developed during months of insufficient supply. However, the principal thrust of the data presented in Figure 2-1 is that during 1974 and a major part of 1975, significant quantities of water were not available for percolation and ground water recharge from the Pacific View Memorial Park area.

SUB-DRAIN DISCHARGES

Bren Drain

Initial measurements of the Bren Drain discharge began in March and continued through September 1975. The flows increased generally from 3 gallons per minute (gpm) in the spring, to about 3.5 gpm in mid-summer, to a little over 4 gpm in September. This trend does not correlate with precipitation or with changes in reservoir stage. The increasing discharges may have been due, however, to increased garden irrigation by local overlying homeowners. No drain measurements were taken from October 1975 to October 1976. The City began discharge measurement again on November 12, 1976. Between November 1976 and April 1977, drain discharges ranged from 1.8 to 3.0 gpm. The average discharge for the period was 1.95 gpm. The average discharge during April 1977 was 1.6 gpm. This is 1.34 gpm lower than the average discharge measured in April 1975.

Hydrology

Reservoir Main Underdrain

From January to October 1975, the average Main Underdrain discharges varied from 3.75 to 6.27 gpm. These discharge fluctuations do not correlate well with changes in reservoir stage. No totalizer readings were taken during the 1975-76 water year. From November 1976 to May 1977, the average drain discharge varied from 4.3 to 5.7 gpm. The average discharge for the period was 5.0 gpm, compared to 5.26 gpm for a similar period in 1975.

Reservoir East Wall Drain

East Wall Drain discharges have been measured by City staff since April 1974. Measurements show clearly that average daily discharges fluctuate directly with the changing reservoir stage. Between April 1974 and September 1975, the daily discharges ranged from 3 gpm when the reservoir was nearly empty, to peaks of as much as 18.5 gpm when the reservoir fluctuated between elevation 296 and 302 feet. From June 24 - July 8, and again from August 9 - August 21, 1975, the drain was closed to determine (1) the drain's effective capacity for removing leakage along the east wall, and (2) the effect of reservoir stage fluctuations on adjacent ground water levels when the drain was not operating. A detailed analysis of the results of these tests and a discussion of the effectiveness of the East Wall Drain are presented in Chapter 3.

Between November 27 and December 18, 1976, the reservoir was drained, cleaned and repaired. While the reservoir was empty (See Plates 7 through 9), the average drain discharge was about 7.5 gpm. Since refilling, the average drain discharges have been as much as 30 percent lower than those recorded prior to reservoir liner repairs during periods of comparable reservoir stages.

CHAPTER 3

HYDROGEOLOGY

CHAPTER 3

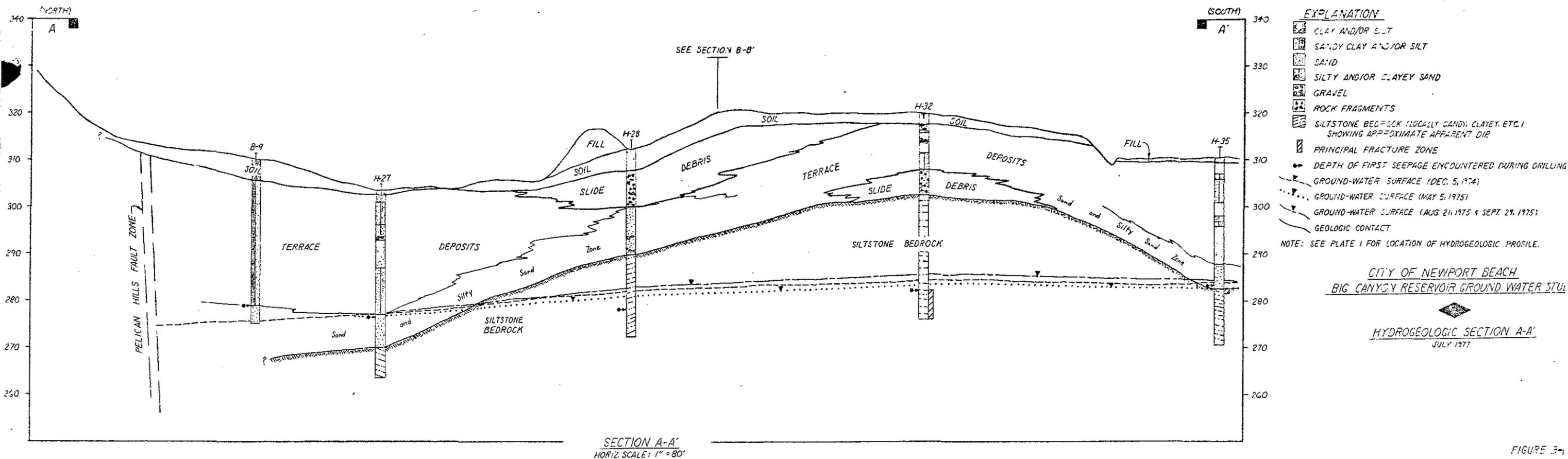
HYDROGEOLOGY

This section includes (1) a lithologic description of the soils and geologic formations encountered during exploratory drilling, (2) a summary of the results of field and laboratory tests of formation permeability, (3) a summary description of ground water level fluctuations, (4) a detailed analysis of East Wall Drain test results, (5) an analysis of the effectiveness of the East Wall Drain and, (6) a discussion of ground water flow and reservoir leakage.

DESCRIPTION OF LITHOLOGIC UNITS

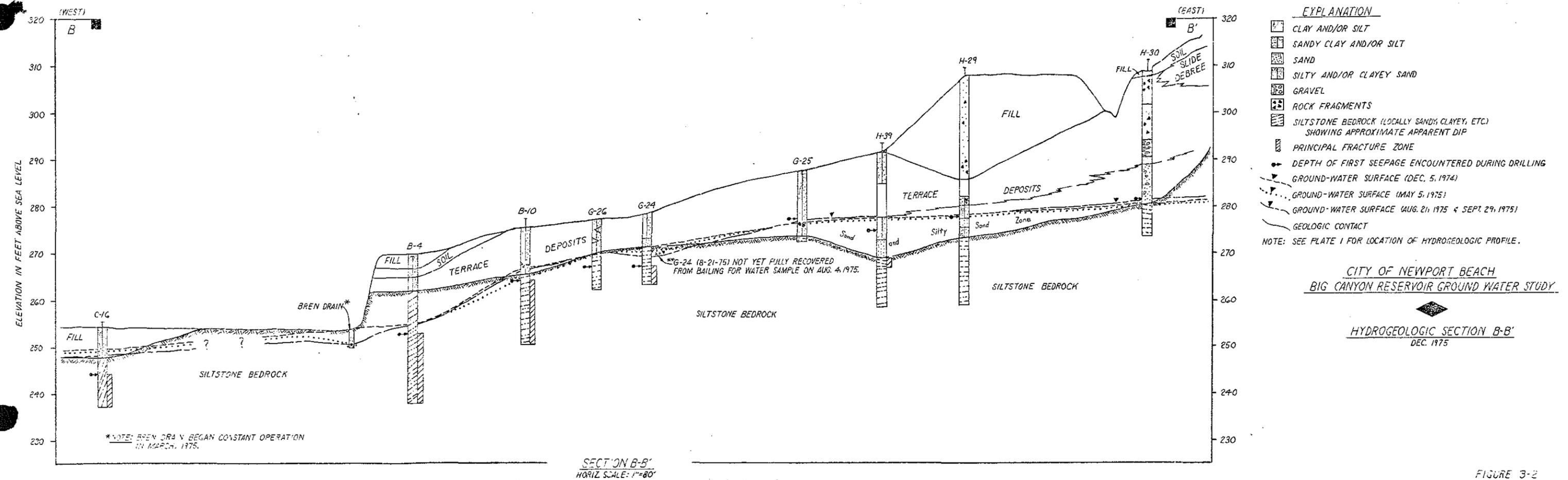
Deposits penetrated in the exploratory boreholes include surface soils, compacted fill, slope wash, landslide debris, terrace deposits and siltstone bedrock. Compacted fills comprise black to brown sandy silt, silt and silty clay. Slope wash includes silty and clayey sand and silty clay with gravel and cobbles, while local slide debris is composed of brown and black silty clay with fractured siltstone and shale fragments. The relationship of these units is shown on Hydrogeologic Sections A-A' through D-D', Figures 3-1 to 3-4.

From a water-bearing standpoint, the lithologic units of major importance include the Quaternary age terrace deposits, and the Tertiary age Monterey Formation which forms the siltstone bedrock. The terrace deposits were laid down directly on the beveled and eroded bedrock during mid-Quaternary time. These materials are red-brown to gray and black, and comprise fine silty and clayey sands and sandy or silty clays. The underlying Miocene age Monterey Formation includes siltstone with thin interbeds of silty claystone, silty sandstone and hard cemented sandstone. These marine deposits are moderately to highly weathered, especially near the terrace-bedrock contact. Locally, the bedrock is intensely fractured and contorted. Where fracture zones are open, the bedrock conducts and transmits significant quantities of ground water.



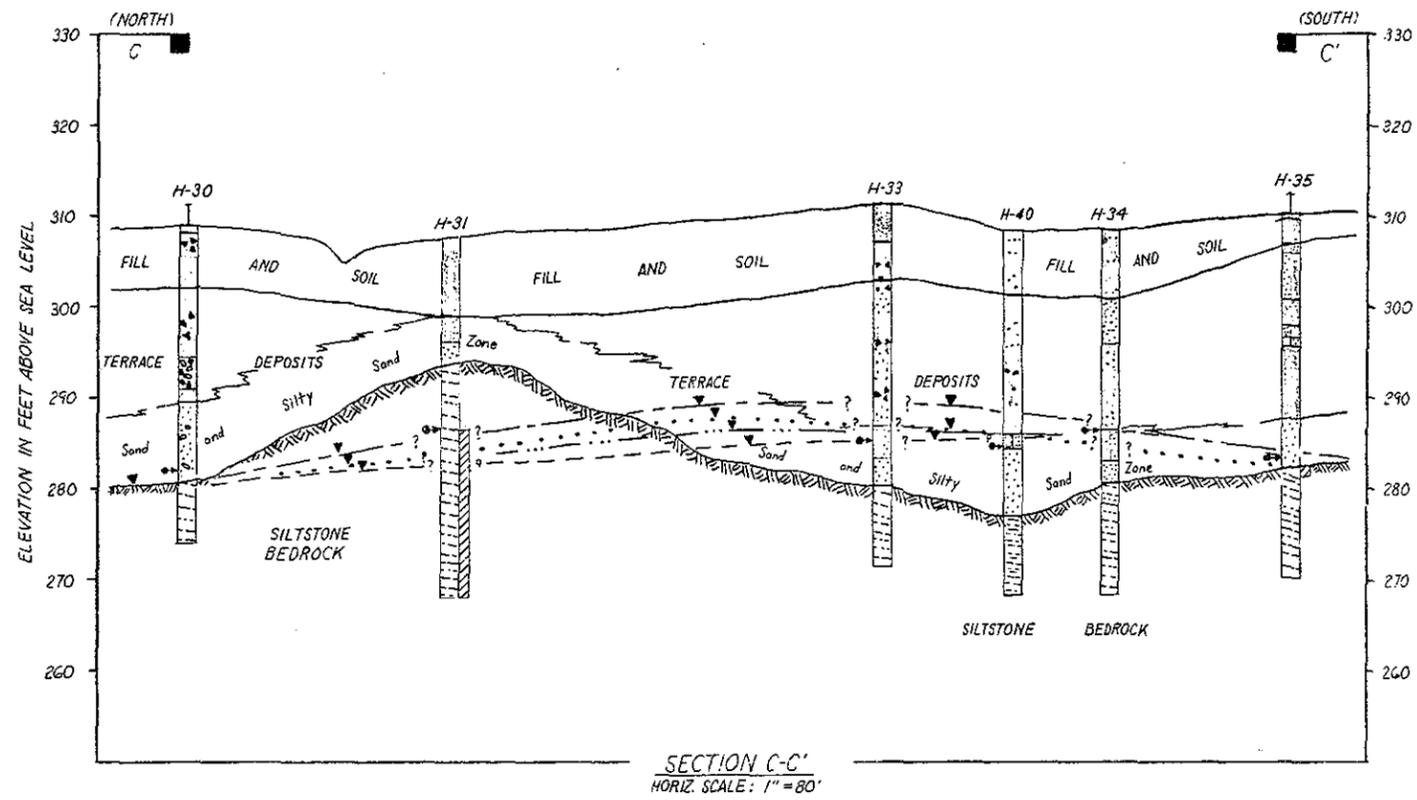
SECTION A-A'
HORIZ. SCALE: 1" = 80'

FIGURE 3-1



SECTION B-B'
HORIZ. SCALE: 1" = 80'

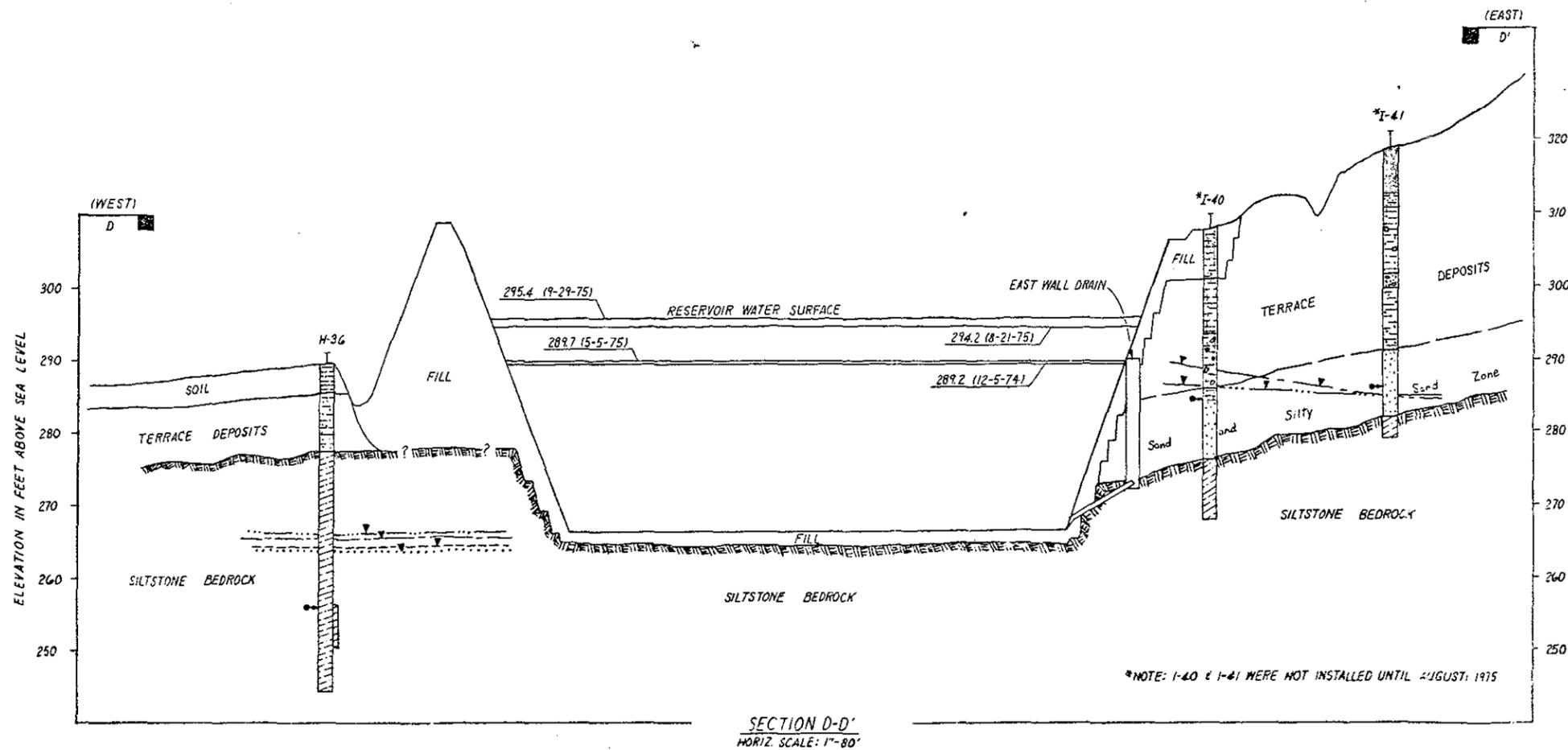
FIGURE 3-2



- EXPLANATION**
- CLAY AND/OR SILT
 - SANDY CLAY AND/OR SILT
 - SAND
 - SILTY AND/OR CLAYEY SAND
 - GRAVEL
 - ROCK FRAGMENTS
 - SILTSTONE BEDROCK (LOCALLY SANDY, CLAYEY, ETC) SHOWING APPROXIMATE APPARENT DIP
 - PRINCIPAL FRACTURE ZONE
 - DEPTH OF FIRST SEEPAGE ENCOUNTERED DURING DRILLING
 - GROUND-WATER SURFACE (DEC. 5, 1974)
 - GROUND-WATER SURFACE (MAY 5, 1975)
 - GROUND-WATER SURFACE (AUG. 21, 1975)
 - GROUND-WATER SURFACE (SEPT. 29, 1975)
 - GEOLOGIC CONTACT

NOTE: SEE PLATE 1 FOR LOCATION OF HYDROGEOLOGIC PROFILE.
 CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
 HYDROGEOLOGIC SECTION C-C'
 DEC. 1975

FIGURE 3-3



- EXPLANATION**
- CLAY
 - SILT
 - SAND
 - GRAVEL
 - SILTSTONE BEDROCK (LOCALLY SANDY, CLAYEY, ETC) SHOW APPROXIMATE APPARENT DIP
 - PRINCIPAL FRACTURE ZONE
 - DEPTH OF FIRST SEEPAGE ENCOUNTERED DURING DRILLING
 - GROUND-WATER SURFACE (DEC. 5, 1974)*
 - GROUND-WATER SURFACE (MAY 5, 1975)*
 - GROUND-WATER SURFACE (AUG. 21, 1975)
 - GROUND-WATER SURFACE (SEPT. 29, 1975)
 - GEOLOGIC CONTACT

NOTE: SEE PLATE 1 FOR LOCATION OF HYDROGEOLOGIC PROFILE.
 CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
 HYDROGEOLOGIC SECTION D-D'
 DEC. 1975

*NOTE: I-40 & I-41 WERE NOT INSTALLED UNTIL AUGUST, 1975

FIGURE 3-4

Hydrogeology

WATER TRANSMISSION CHARACTERISTICS

During drilling at 15 of the exploratory test sites, drive samples were obtained for examination and for possible later permeability analysis. Constant head laboratory permeability tests were subsequently run by the consulting soils engineer on four samples of fine sand comprising the terrace deposits, and four samples of clayey siltstone and siltstone comprising the Miocene bedrock. These tests yielded average permeability values of 1.34×10^{-3} cm/sec (28.4 gpd/ft²) for the uncemented terrace deposits, and 2.7×10^{-8} cm/sec (5.7×10^{-4} gpd/ft²) for the Miocene bedrock. Tests were run for 180 hours in the siltstones and for 44 to 71 hours in the unconsolidated sands. Permeability values are shown on Table 3-1.

TABLE 3-1

SUMMARY OF PERMEABILITY VALUES^(a)

Test Site	Depth Interval (in feet)	Material	Permeability	
			cm/sec	gpd/ft ²
29	30.8-21.6	Fine Sand	6.2×10^{-4}	13.1
31	9.0-9.8	Silty Sand	1.0×10^{-3}	21.2
32	24.0-24.8	Siltstone	4.0×10^{-8}	0.00085
34	24.0-24.8	Silty Sand	2.4×10^{-3}	50.9
36	34.0-34.8	Clayey Siltstone	8.0×10^{-9}	0.00017
37	19.0-19.8	Fine Sand (sl. cemented)	1.8×10^{-5}	0.382
38	39.0 x 39.8	Siltstone	2.0×10^{-8}	0.00042
39	24.0-24.8	Siltstone	4.0×10^{-8}	0.00085

(a) Constant head laboratory tests.

Hydrogeology

In order to obtain an understanding of ranges in secondary permeability within the fractured portions of the siltstone bedrock, field tests were run in four boreholes. Measured volumes of water were injected for both constant head measurements, and also to partially fill the hole for subsequent falling head tests. Water level changes were measured on Stevens Type F recorders. These data were analyzed for coefficients transmissivity and permeability by the recovery and slug test methods of C. V. Theis, C. E. Jacob and H. E. Skibitzke.^(a) Constant head data were also analyzed by well specific capacity methods.^(b) Values calculated are shown on Table 3-2.

Transmissivity values represent the quantity of water moving through a strip one-foot wide, by the thickness of the aquifer. Permeability coefficient is found by dividing transmissivity by aquifer thickness. Within the sand and silty sand terrace deposits, aquifer thickness is represented by the saturated thickness. However, in the siltstone bedrock, only the zones of open fractures represent the aquifers. These bedrock fracture zones are delineated on the lithologic logs shown in Appendix A and on Table 3-2.

TABLE 3-2
SUMMARY OF FIELD TRANSMISSIVITY
AND PERMEABILITY VALUES^(c)

Test Site	Estimated Thickness of Fracture Zone (ft)	Transmissivity Values (gpd/ft)		Permeability Values	
		Range	Average	gpd/ft ²	cm/sec
H-28	3-6	-	406	68-135	3.2 x 10 ⁻³
H-32	+6	72-421	242	40	6.4 x 10 ⁻³
H-36	+6.5	197-566	371	57	1.9 x 10 ⁻³
H-37	+4	83-401	206	52	2.7 x 10 ⁻³
					2.5 x 10 ⁻³

- (a) J. G. Ferris and Others, 1962, "Theory of Aquifer Tests", USGS Water Supply Paper 1536-E.
- (b) J. F. Logan, 1964, "Estimating Transmissibility from Routine Production Tests of Water Wells", Ground Water Journal, National Water Well Association 2:35.
- (c) Constant and falling head field tests. All basic data for these tests and calculations are included in JMM-Irvine files.

Hydrogeology

GROUND WATER LEVELS

In the initial phase of this study, the major potential sources of ground water recharge in the vicinity of Big Canyon Reservoir were considered to be (1) rainfall in excess of soil moisture and plant requirements, (2) irrigation water applied in excess of plant requirements in the cemetery property and residential development east of the reservoir, and (3) water leaking from the reservoir itself. To determine which potential source had the greatest effect on the local ground water regime, water level fluctuations were monitored in a network of 27 piezometers. Plate 11 shows the locations of these piezometers. The lithologic logs of borings available for each piezometer are included in Volume II, Appendix A. Plates 1 through 10 show the water level fluctuations in piezometers for the entire period of study.

During the first 9 months of the study, from November 1974 through June 23, each piezometer was measured at about two-week intervals. Twice weekly and weekly measurements were taken during the period June 23 to September 19, during tests to determine the effectiveness of the East Wall Drain. These measurements and the test results are discussed in more detail in the following 2 sections of this chapter.

The program of piezometer measurement was discontinued from October 1975 to March 1976. Subsequent to completion of the piezometer monitoring program conducted by Montgomery, which ended September 30, 1975, extensive grading and residential development took place in the parcel just north of the reservoir (Broadmoor Tract 4). This development resulted in the destruction of piezometers B-1 through B-8, B-10 and H-27. At the City's request, these piezometers were replaced by the developer. The locations and reference point elevations of new piezometers H-50 through H-56 are included in Appendix G. No lithologic logs or piezometer construction details were available for analysis.

On April 6, 1976, the City re-initiated a program of water level monitoring at selected piezometers within the reservoir property. The measurements taken through April 1977 are shown on Plates 6 through 10. The only measurements available for new piezometers H-50 through H-56 were taken by Montgomery personnel on May 2, 1977; these are included in Appendix G.

During this study, depths to ground water varied from about 7 feet to over 35 feet below the ground surface. The shallowest water table (\pm 7 feet) was usually found in the Bren tract west of MacArthur Blvd. Depths to ground water increased generally up gradient, or eastward of MacArthur Blvd. At I-41 where the ground surface elevation is the highest of any piezometer, the depth to water was generally about 35 feet.

Hydrogeology

Detailed examination of water level fluctuations shown on the figures indicate that (1) there is no significant correlation between major rainfall events and periodic rises in ground water levels, and (2) positive correlation exists between major fluctuations in the reservoir stage and ground water levels in piezometers around the perimeter of the reservoir. This positive correlation is seen most clearly during the East Wall Drain tests in Summer 1975, and during the reservoir drawdown and refilling period in Winter 1976. Reservoir drawdown began October 14, 1976. By October 22, the water levels in all piezometers measured (except H-37 and SL-1) had declined slightly. (a) Figures 3-5 and 3-6 show the relative net changes in piezometer levels during the drawdown period and the reservoir refilling period. The pattern of net changes is consistent with that observed during the East Wall Drain tests described in the following section.

EAST WALL DRAIN TESTS

Two East Wall Drain tests were scheduled and completed during the fourth quarter studies. The purpose for closing the drain was to test directly the drain's capacity to remove ground water along the reservoir east wall, and to determine the magnitude of effect the changing reservoir stage would have on surrounding ground water levels if the drain were not in operation. The first shutdown test was conducted from June 24 to July 8, 1975 when the drain was closed as the reservoir was being filled to its annual maximum (301.0 feet) and was then drawn down to its average summer operating level of about elevation 294.8 feet. During the second test the reservoir stage was held relatively constant, so that only the drain function would affect adjacent ground water levels. Table 3-3 summarizes these testing schedules.

-
- (a) Abrupt and erratic water level changes were recorded at 3 piezometers during the drawdown period:

<u>Date</u>	<u>Piezometer No.</u>
October 22	I-41
November 12	I-41
November 12	H-37
November 29	H-39

These fluctuations are considered to have been caused by an error in measurement during a period when the usual measuring device was not working properly or under repair.

NET CHANGE CONTOUR MAP

OCT. 8 — DEC. 27, 1976

NET WATER
LEVEL DECLINE
(feet)

	1 - 3
	3 - 5
	> 5

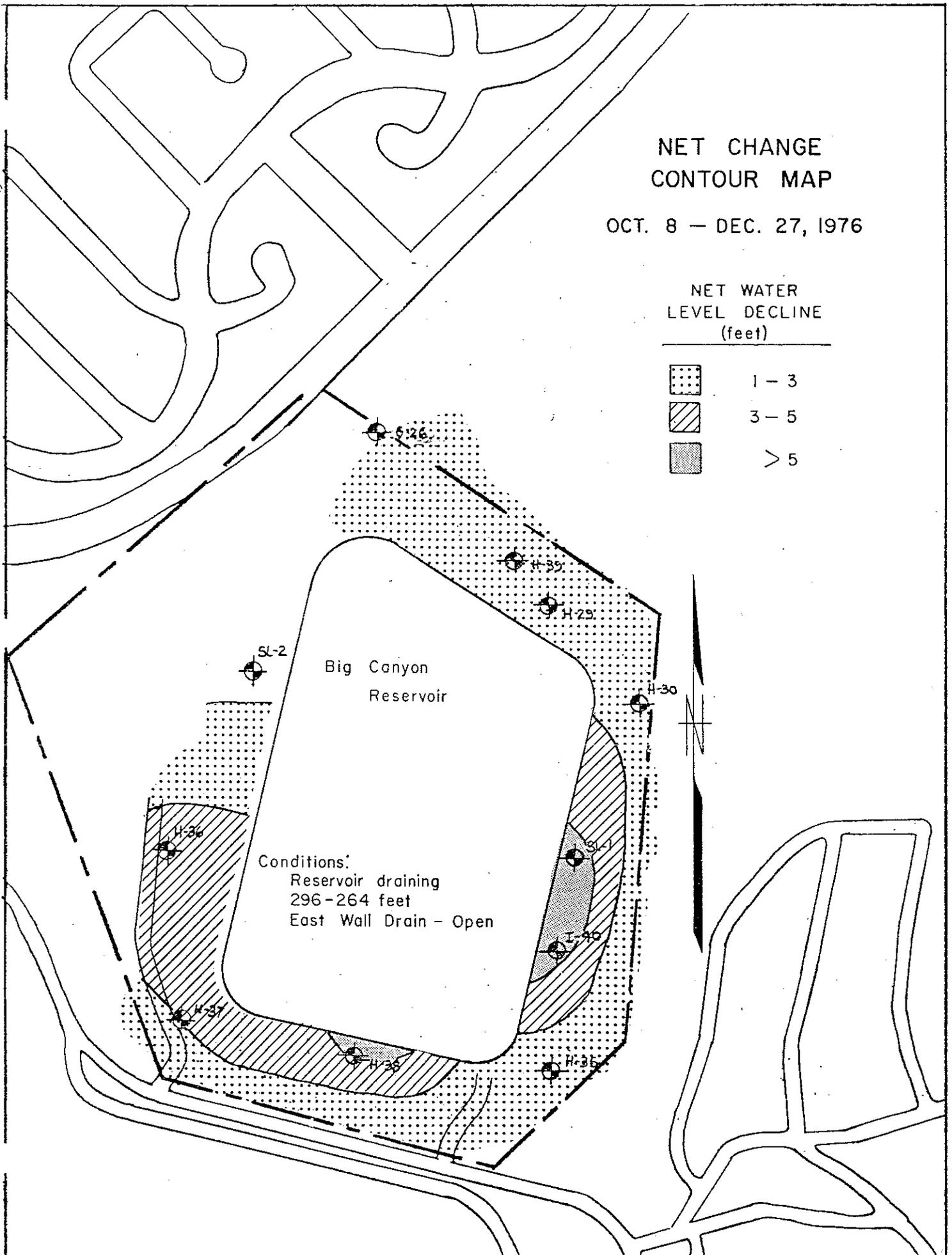


FIGURE 3-5

NET CHANGE CONTOUR MAP

DEC 27, 1976 —
FEB 25, 1977

NET WATER
LEVEL RISE
(feet)

	1 - 3
	3 - 5
	5 - 7

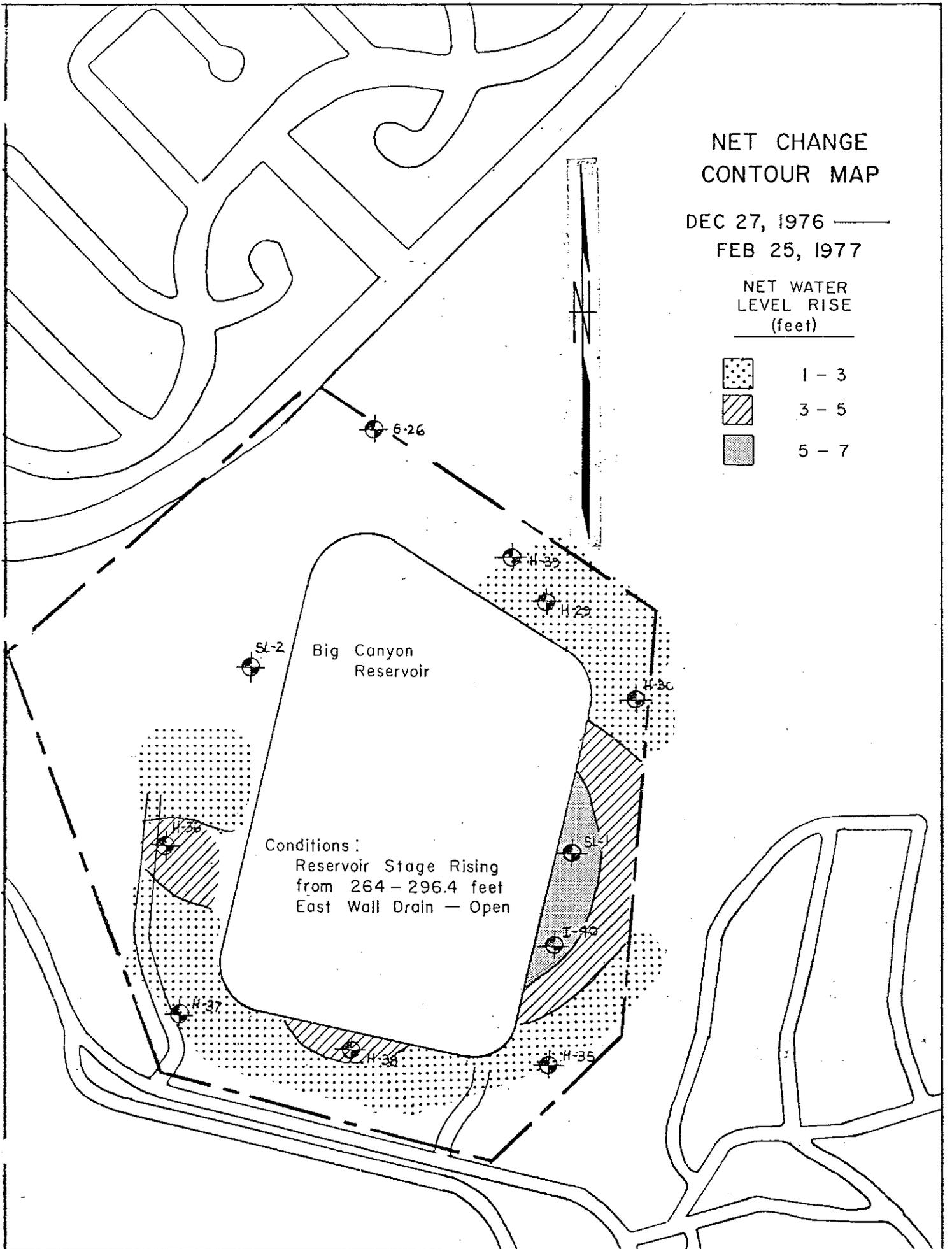


FIGURE 3-6

Hydrogeology

TABLE 3-3

EAST WALL DRAIN TESTS

Test No.	Drain Function	1975 Dates	Reservoir Stage (Elev. in feet)	Number of Weekly Piezometer Measurements
-	Open	6/24-6/30	301.4-301.9	-
1 - Part 1	Closed	7/1-7/8	301.9-295.4	2
1 - Part 2	Open	7/8 - 8/4	295.4-294.3	1
2 - Part 1	Closed	8/4 - 8/21	294.3-294.2	2
2 - Part 2	Open	8/21-9/5	294.2-295.0	2

The analysis of water level fluctuations began about May 5, 1975 so that ground water responses to the substantial rise in reservoir stage from May 5 - June 30 could be included. The piezometers were divided into two main groups. Group I piezometers responded directly to the reservoir stage increase in May and June; Group II piezometers did not. Net changes for these groups are shown on Table 3-4.

From May 5 to September 29 the net rise in water levels around the reservoir ranged from 0.57 to 4.39 feet. Most piezometers north of the reservoir property continued to decline from 0.1 to 0.69 feet, during the same period. These net changes are shown graphically on Figure 3-7 so that the areas of greatest change can be more easily identified.

The most significant features are those areas of greatest rise, as they relate directly to leakage from the reservoir. To investigate this potential in more detail, the summer's ground water level measurements were divided into seven periods and analyzed separately. The net changes for each peizometer in each period were then compared to the reservoir stage, and to the condition of the East Wall Drain, whether it was open or closed. Figures 3-8 through 3-12 show these changes.

Figure 3-8 (May 5 to June 23), shows those piezometers which responded directly to the rise in reservoir stage from May 5 to June 23 with the East Wall Drain open. Rises greater than one foot were generally found in east wall piezometers and at H-36, 37 and 38. The rises were less than a foot in piezometers along the northern perimeter of the reservoir. Water levels remained the same, or continued to decline in piezometers north of the reservoir property boundary.

Hydrogeology

TABLE 3-4

NET CHANGES IN PIEZOMETER WATER LEVELS

May 5 through
September 29, 1975

	PIEZOMETER	NET CHANGE
Group I	SL-1	+4.39
	H-35	+1.77
	H-30	+1.10
	H-38	+2.46
	H-29	+0.69
	H-39	+0.75
	G-25	+0.57
	H-37	+1.63
	H-36	+1.88
	H-32	+2.12
	H-28	+1.67
Group II	H-27	+0.20
	G-22	+0.20
	G-24	-1.0
	G-26	Negligible (-.03)
	B-1	-0.4
	B-2	-0.16
	B-3	-0.49
	B-4	-0.29
	B-6	+0.59
	B-7	-0.11
	B-8	-0.23
	B-10	-0.22
	C-12	Negligible (-.03)
	C-16	-0.69
	SL-2	+0.41
B-23	+0.47	

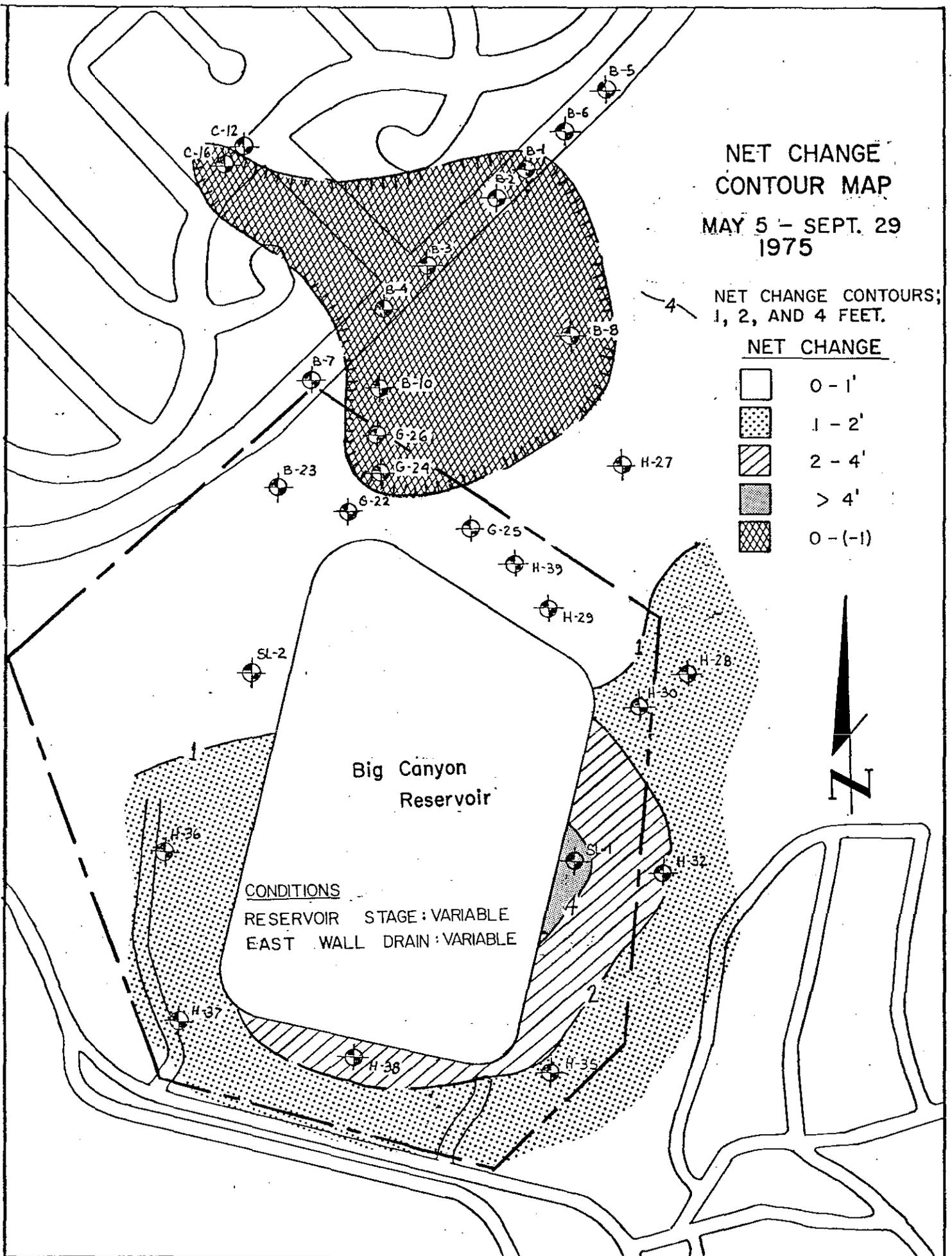


FIGURE 3-7

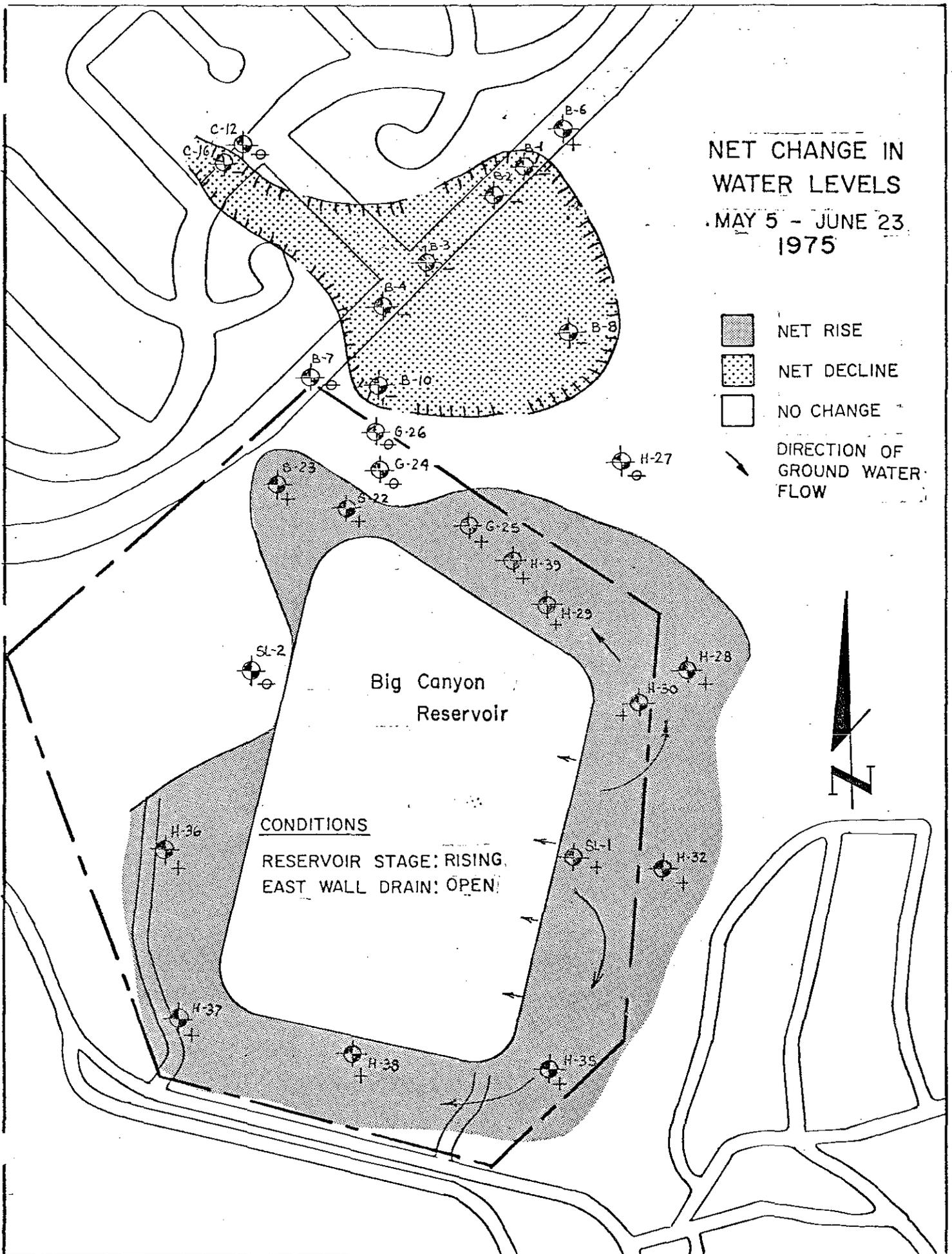


FIGURE 3-8

Hydrogeology

Figure 3-9 (June 30 to July 7). During this period, the reservoir stage declined rapidly and the East Wall Drain was closed. Water levels in SL-1 and H-36 declined with the reservoir level. Water levels in the other Group I piezometers continued to rise slightly from 0.16 to 0.56 feet.

Figure 3-10 (July 7 to August 4). By July 9, the reservoir level was drawn down to about 294 feet and remained at that approximate level throughout the remainder of the period. On July 8th, the drain was opened again. Of all the piezometers, the greatest net decline was recorded at SL-1 (3.75 feet). H-35 and H-37 continued to rise 0.19 and 0.15 feet, respectively. The remaining Group I piezometers declined from 0.08 - 0.23 feet.

Figure 3-11 (August 4 to August 21). During this period, the reservoir level remained at approximately 294 feet. The East Wall Drain was closed throughout the period. The net changes in ground water levels were negligible in most piezometers, but SL-1, H-35, H-32 and H-28 showed net rises of 3.06, 0.41, 0.54 and 0.29, respectively. Two new piezometers were drilled and completed during this interval (I-40 and I-41). These piezometers recorded rises of 0.65 and 0.33 feet, respectively.

Figure 3-12 (August 21 to September 5). The reservoir stage averaged about 294.5 feet during this period. The East Wall Drain was opened on August 22. SL-1, H-28 and I-40 declined 2.72, 0.17 and 1.93 feet, respectively. The net change in H-35, H-30, H-29, H-32 and I-41 was negligible, and piezometers H-38, H-39, G-25, H-37 and H-36 recorded net rises from 0.09 to 0.23 feet.

These data indicate that a ground water mound adjacent to the east wall forms in direct response to leakage from the reservoir. Those piezometers most directly affected by that leakage and also the opening and closing of the East Wall Drain are SL-1 and I-40. The other piezometers along the east wall generally respond with a slight lag time or somewhat attenuated change. H-36, 37 and 38 levels increased with the initial reservoir rise early in the summer, but were not consistently affected by the opening and closing of the East Wall Drain.

In summary, the water level data indicate that local ground water mounds build up along the east, south and southwestern reservoir walls in response to rises in the reservoir level. The greatest measured effects, however, are produced along the East Wall. The mounds dissipate as ground water flows down gradient into adjacent areas and as the reservoir stage declines.^(a)

(a) After the reservoir was drained in late November 1976, the bottom and sides were usually inspected on December 7. At that time, several cracks and holes in the asphalt liner exposed the underlying clay blanket along the east wall. (Footnote continued at bottom of page 3-9)

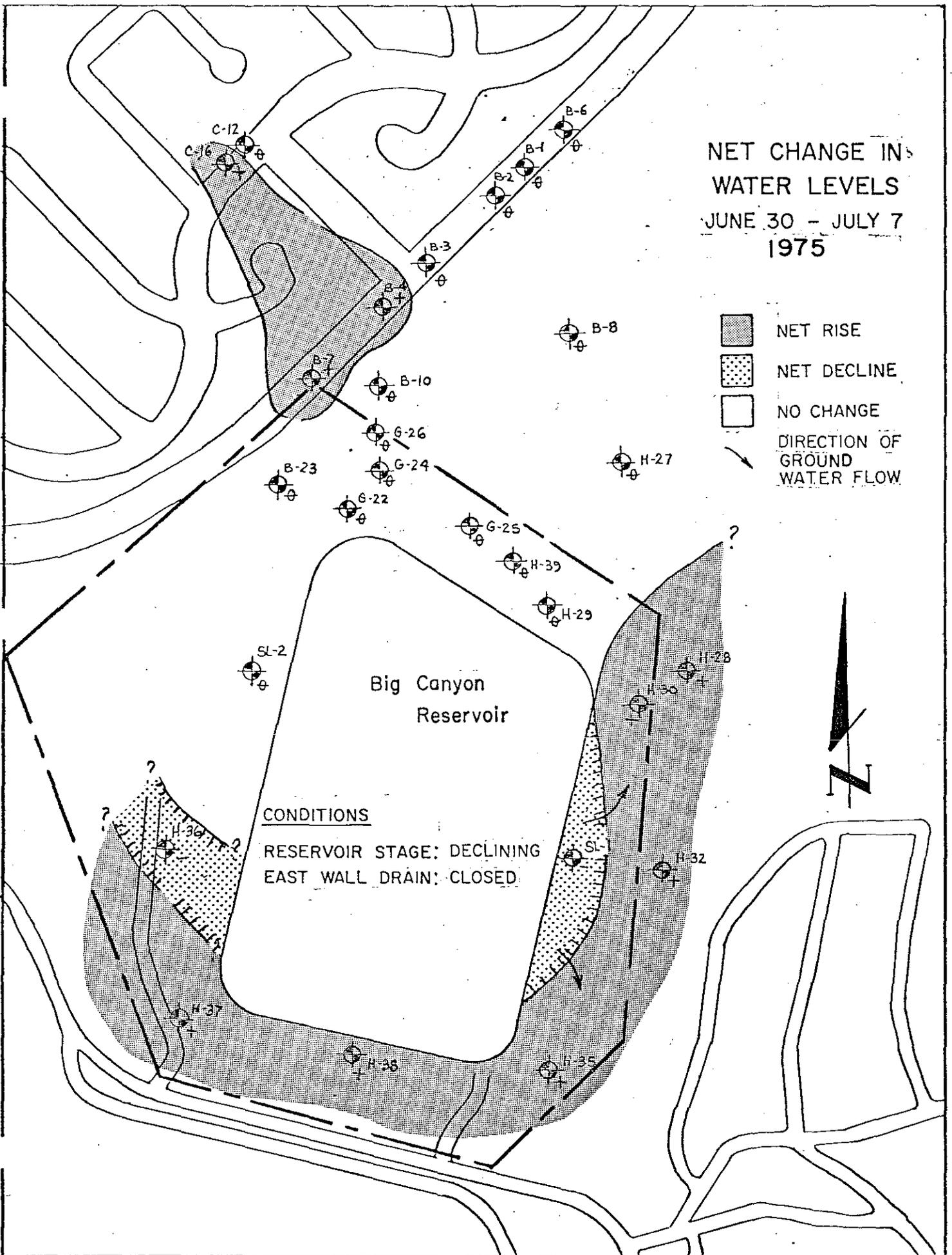


FIGURE 3-9

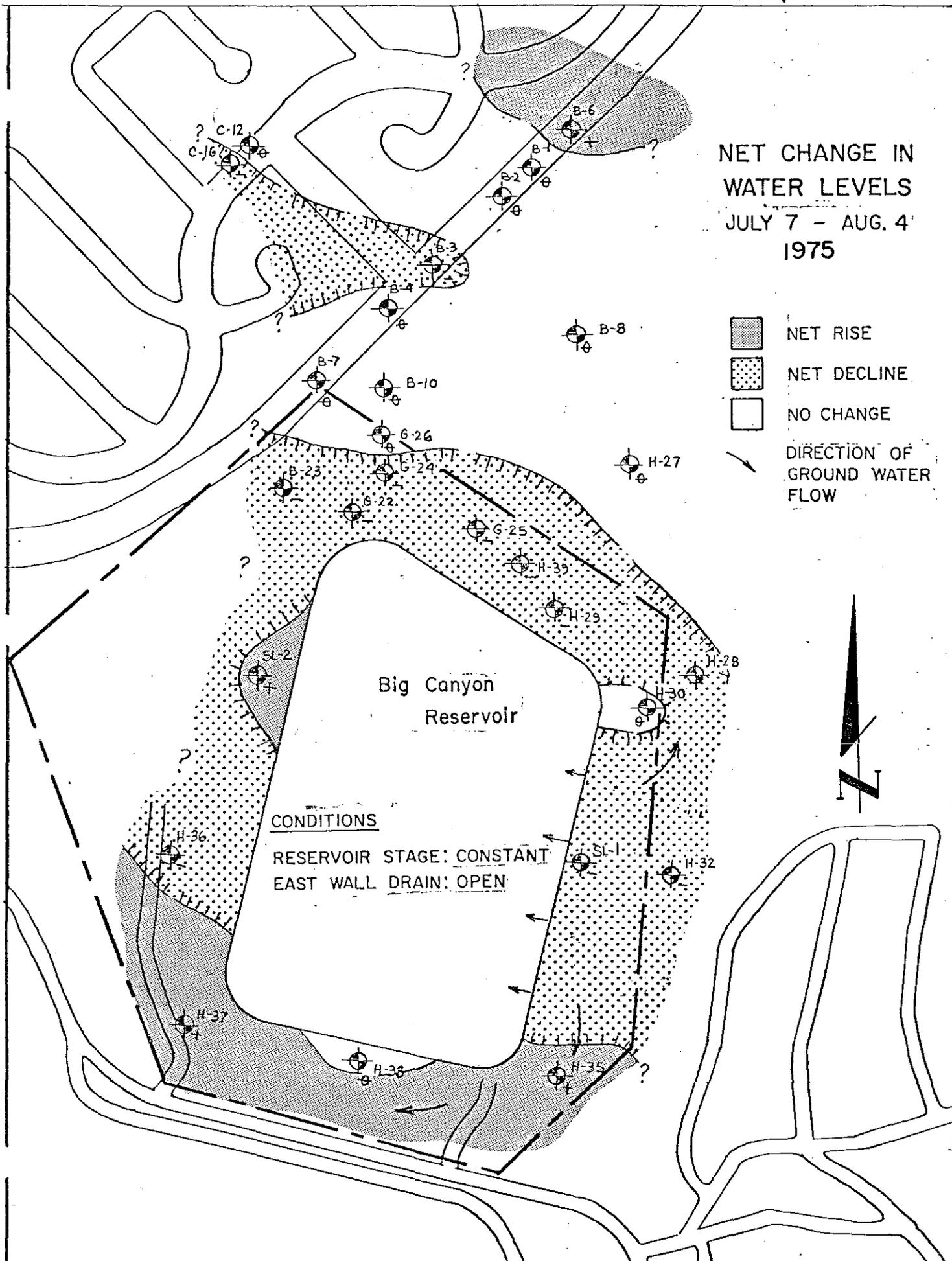


FIGURE 3-10

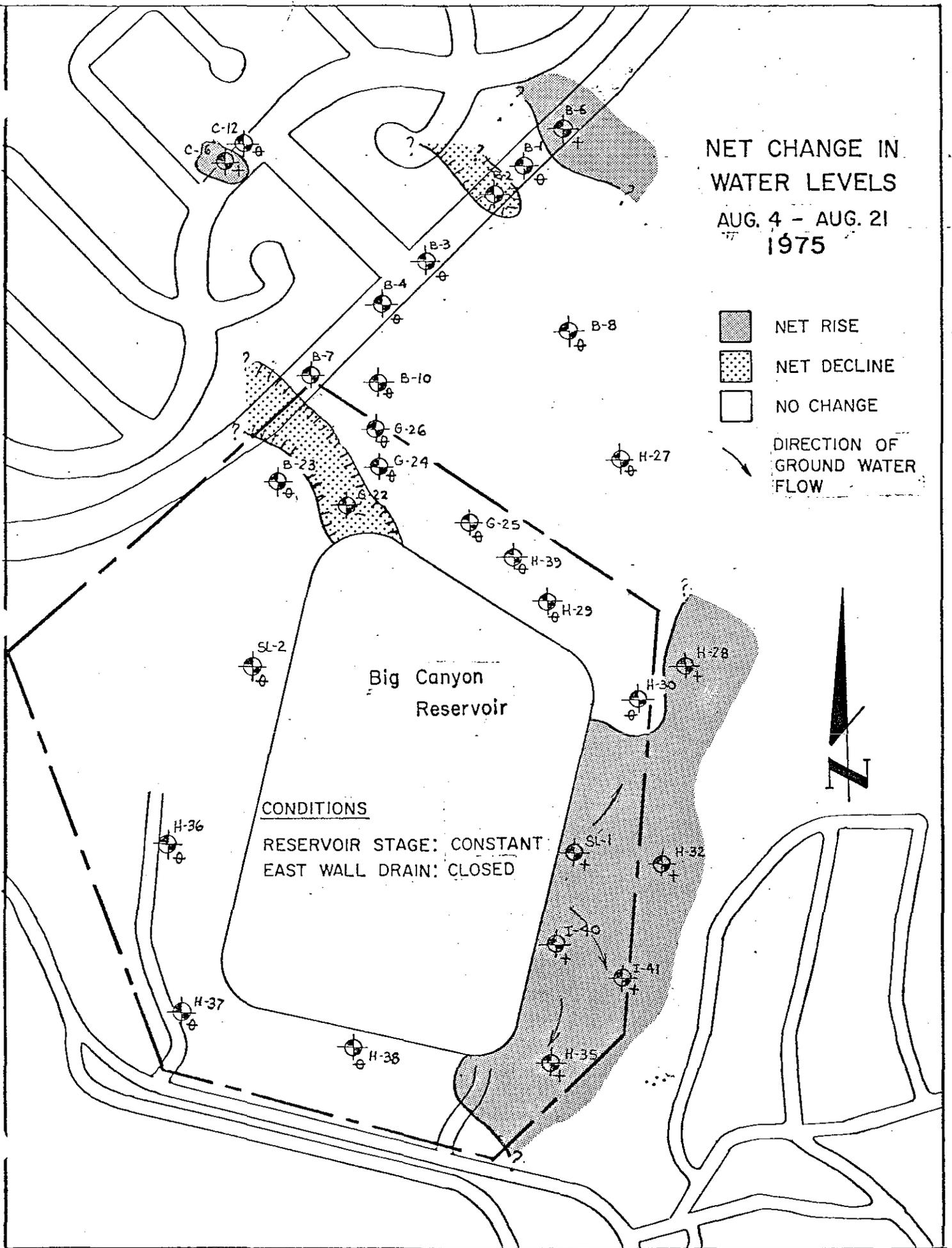


FIGURE 3-II

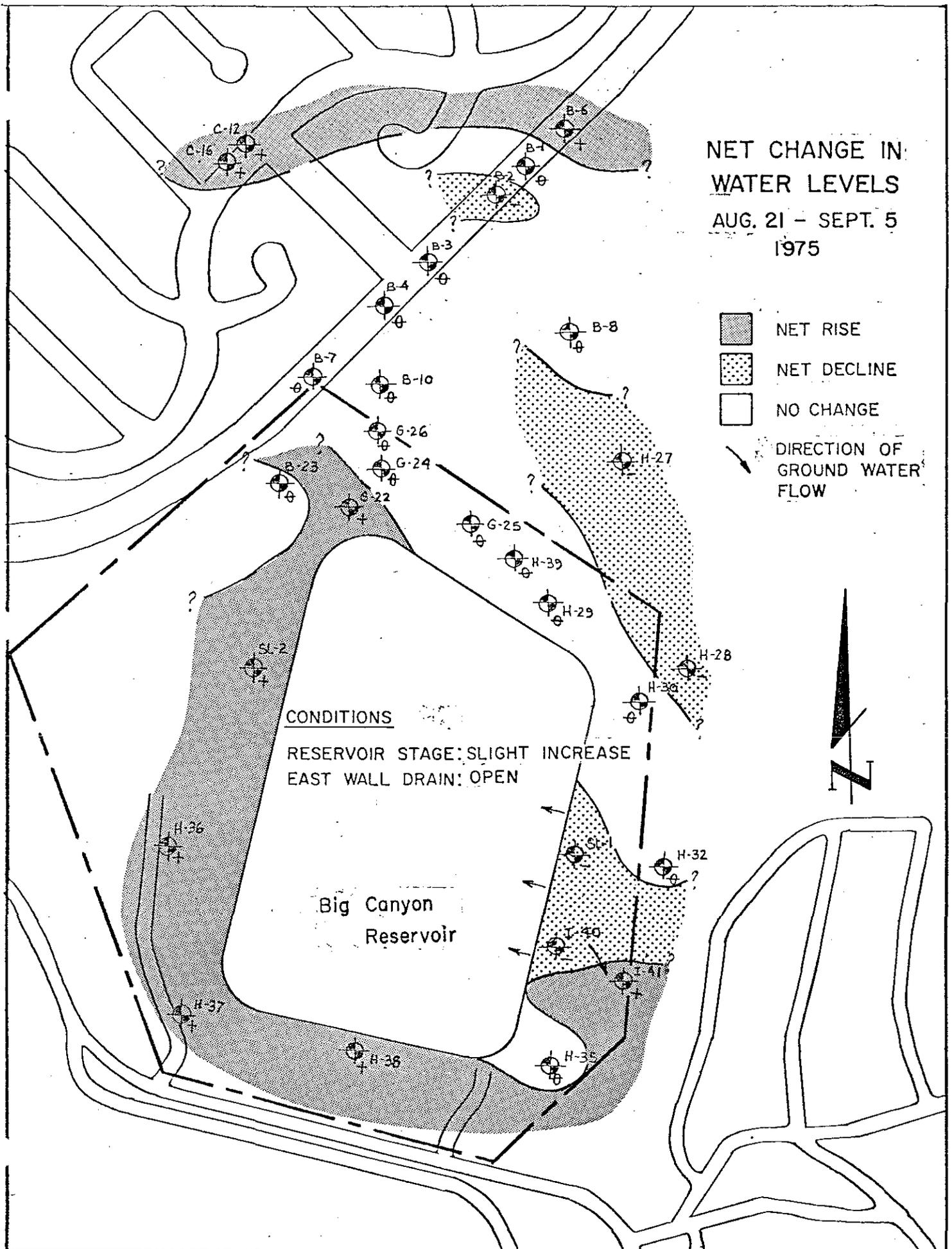


FIGURE 3-12

GROUND WATER FLOW AND RESERVOIR LEAKAGE

Based upon analysis of drilling data, laboratory and field tests of rock and soil permeability, and ground water levels and gradients of August 21, 1975 (Plate 11), estimates of the magnitude of subsurface ground water flow were made at four locations. For those gradients, the quantity of ground water moving northwesterly near H-37 (reservoir crest to the property fence) was about 1,300 gallons per day (0.9 gpm). On the southeast of the reservoir, water moving out into the formations was estimated at about 3,400 gallons per day or 2.4 gpm. On the northeast corner of the reservoir, between H-29 and H-30, flows along the side of the reservoir were about 1,300 gallons per day (0.9 gpm). From the north reservoir fence to the Pelican Hills fault zone, normal to a section through H-27, northwesterly subsurface flow was estimated to be about 2,300 gallons per day (1.6 gpm).

Estimates of subsurface flow for the east side of the reservoir are considered to be maximum values because of higher levels associated with the East Wall Drain shutdown tests. The remaining subsurface flow estimates are considered to represent average discharges. These flow estimates together with the shape of the water level contours on Plate 11, indicate that although the total volume is relatively small, the major source of ground water moving through the terrace sands and fractured bedrock in the vicinity of the reservoir is the reservoir itself.

EFFECTIVENESS OF THE EAST WALL DRAIN

The response of piezometer SL-1 to closing the East Wall Drain demonstrates that the drain does in fact remove a considerable portion of the water leaking through the reservoir wall. During both tests, when the drain was closed, SL-1 rose abruptly. It also declined rapidly when the drain was re-opened. The response of I-40 during the second test was similar to SL-1, but of lesser magnitude.

(a) ...continued from previous page...

Seepage in small quantities was occurring through the liner back into the reservoir at two sites along the east wall. Seepage through the bottom of the liner was indicated by shallow ponds in the southeast corner of the reservoir. In the southwest corner, the asphalt liner was moist but exhibited no ponds. Five pronounced ponds were noted at the base of the north wall from north central to northeast corner of the reservoir. A spongy condition was observed in and around ponds at the northeast corner of the reservoir floor.

Hydrogeology

It is interesting to note that although the reservoir rose and fell several times from November 25 - April 30, SL-1 showed little response. Only twice during that period did SL-1 appear to respond to the changing stage. In both cases, the rise that corresponded to the reservoir rise was slight and lagged behind from 4 to 10 days. During that period the reservoir fluctuated below 290 feet. When the reservoir rose above 290 feet in May, SL-1 began to show a substantial rise itself, suggesting that above 290 feet considerably more leakage may occur from the reservoir.

Based upon estimates of subsurface ground water flow away from the east side of the reservoir as described in the previous section, the East Wall Drain appears to remove 80 to 90 percent of the water which leaks through the eastern side of the reservoir.

CHAPTER 4

GROUND WATER QUALITY

CHAPTER 4

GROUND WATER QUALITY

Laboratory analysis of the dissolved mineral constituents for 38 ground water samples were conducted during the study (December 1973, March 1974, and August 1975). The results are presented in Appendix C. Selected mineral constituents are shown in Table 4-1.

The analyses indicate that total dissolved solids (TDS) increase markedly, as those waters flow down-gradient to the northwest, with lowest concentrations of about 900 to 1,100 milligrams per litre (mg/l) at sites H-33, H-34 and at piezometer SL-1. Downstream concentrations in and near the Harbor View Hills Tract, range from about 10,000 to 15,000 mg/l, TDS. To the west of the reservoir, at piezometers SL-2 and G-23, TDS concentrations range from 15,500 to 18,900 mg/l.

An examination of the ratio of electrical conductivity ($EC \times 10^6 @ 25^\circ C$) to bicarbonate concentration (HCO_3), here designated "R", indicates that waters most resembling reservoir supply and applied water (where $R = 4$), occur in piezometers SL-1, H-29, H-31, H-33, H-34, H-38 and the East Wall Drain ($R = 6.5$ to 8.3). Most dissimilar waters ($R = 50.0$ to 89.8) were found at sites B-4, B-7, B-23 and the Bren Drain, with the remainder of samples exhibiting intermediate values. The magnitude of the "R" ratio appears to indicate the general magnitude of the distance from the recharge source.

Nitrate concentrations in present-day sea water are generally less than 1 milligram per litre. Thus, it is probable that native connate water (and evaporated salt) in the Miocene siltstones contains very low concentrations of NO_3 . Nitrate concentrations in both reservoir water and locally applied water are less than 2 mg/l. NO_3 concentrations which appear in local ground waters probably originate as leachate from applied fertilizers and/or from natural animal wastes on the ground surface. Ground waters with the highest nitrate concentrations occur at piezometers G-24 and B-7, and the Bren Drain, while lowest values were found in piezometers SL-2, G-25, H-33, H-34, H-38, H-39, and in the East Wall Drain flow. East of the reservoir, all of the most current samples from exploratory holes south of H-31 exhibit nitrate values of less than 7.5 mg/l with average less than 3.5 mg/l.

Ground Water Quality

TABLE 4-1

GROUND WATER MINERAL ANALYSES
SELECTED MINERAL CONSTITUENTS

Sample Location	Total Dissolved Solids (mg/l)		Electrical Conductivity (Micromhos @25°C)		Ratio: Electrical Conductivity Bicarbonate Concentration		Nitrate Concentration (mg/l)	
	S a m p l i n g P e r i o d (a)							
	1	2	1	2	1	2	1	2
SL-1	(1,100)	(1183) ^(b)	1,590	1690	6.5	7.1	8.9	5.98
SL-2	(15,500)		22,080		27.6	15.1	0.22	
B-1	(10,200)		14,600		44.7		0.66	
B-2	(8,500)		12,100		41.3		4.87	
B-4	(3,700)		5,300		50.0		7.8	
B-7	(15,500)		22,100		70.2		38.5	
C-16	(10,000)	(10780)	14,400	15,400	21.9	20.2	4.3	7.53
G-23	(18,900)		26,940		89.8		7.3	
G-24	(2,600)	(5432)	3,750	7760	13.5	15.3	20.8	1.99
G-25	(5,400)	(3584)	7,730	5120	13.4	11.3	0.22	0.22
G-26	(5,400)		7,730		18.3		3.8	
H-27	2,600	(2856)	4,080	4080	12.4	11.3	6.2	9.3
H-29	1,893	(2891)	2,850	4130	7.3	10.4	0.22	10.9
H-30	4,613	(4039)	6,350	5770	20.0	17.8	22.2	33.4
H-31	2,198		3,130		9.6		7.53	
H-32	2,121		3,410		11.8		3.32	
H-33	904		1,330		6.8		1.77	
H-34	1,106		1,660		8.3		0.22	
H-35		3094		4180		14.5		6.87
H-36	6,169		7,210		20.4		4.87	
H-37	9,203		12,300		31.5		5.54	
H-38		(1708)		2440		7.4		1.55
H-39	4,068	4942	6,260	7060	18.9	17.5	10.6	1.55
I-40		1673		2640		14.5		3.32
Main Underdrain	(6,600)	(6545)	9,490	9350	22.1	21.9	12.9	7.09
I-41		1898		3010		13.4		7.4
Bren Drain	13,430	(9821)	19,200	14,030	62.9	41.3	26.6	28.8
East Wall Drain		793		1195		7.2		0.22

(a) Period 1, December 1973 through March 1974.
Period 2, August 1975.

(b) (1,100) Total dissolved solids figures in brackets were calculated from $EC \times 10^6 @ 25^\circ C$.

Ground Water Quality

As indicated above, nitrate concentrations when present, may be indicators of water from the surface as opposed to water from the reservoir. Fluctuations in NO₃ concentrations showed a mixed pattern. Marked increases occurred at H-29 (0.22 to 10.9), H-30 (22.3 to 33.4), C-16 (4.3 to 7.5) and H-27 (6.2 to 9.3). Decreases of similar value occurred at G-24 (20.8 to 1.99) and H-39 (10.6 to 1.55).

Relative to fluctuations in dissolved mineral constituents during the study, marked increases in salinity occurred between December 1973 and August 1975 at H-29 and G-24. The Bren Drain exhibited about the same concentration of total dissolved solids. Slight rises occurred at C-16 and H-39. Fluctuations in the EC/HCO₃ ratio "R" were relatively minor. Considering the range of 7 to 70, the only really significant change occurred in samples from the Bren Drain. Downward fluctuations from "R" values of 63 and 41 suggest an increasing percentage of applied water or precipitation which has percolated in the vicinity of that drain.

Mineral analyses of underdrain samples collected in May 1977 are included in Appendix C, Volume II of this report. Table 4-2 summarizes selected mineral constituents. As shown, the partial mineral analyses for water from the Bren and Broadmoor drains are almost identical. Compared to drain samples analyzed in August 1975, the 1977 analyses exhibit no significant changes in water quality.

TABLE 4-2

GROUND WATER MINERAL ANALYSES PRINCIPAL SUB-DRAINS (SELECTED MINERAL CONSTITUENTS)

Underdrain	Sample Date	Total Dissolved Solids (mg/l)	Electrical Conductivity μ mhos @ 25° C	Ratio: Electrical Conductivity Bicarbonate Concentration	Nitrate Concentration (mg/l as N)
Broadmoor	4/29/76	-	12,900	-	4.10
Broadmoor	4/30/76	-	13,600	-	5.00
Broadmoor	5/3/77	-	10,940	31.4	4.10
Bren	5/3/77	-	14,400	39.0	5.10
Main	5/3/77	-	7,840	17.0	1.05
Eastwall	5/3/77	-	1,140	6.8	0.05

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The findings from this ground water investigation in the Big Canyon Reservoir area are summarized in separate quarterly progress reports and this final technical report. Based upon these findings, and an analysis of data collected from October 1975 to May 1977, the following general conclusions are made:

1. Based upon evaluation of exploratory drilling and testing at 15 sites, ground waters move around the reservoir locally in both the fractured siltstone bedrock and in the overlying terrace deposits.
2. Saturated terrace deposits composed of sand and silty sand underlie a portion of the northeast reservoir berm; those saturated sediments could pose a potential hazard of settlement in a portion of that berm, during periods of intense ground motion or cyclic stress.
3. Based upon an analysis of water level fluctuations and precipitation data during the study period, ground water recharge from rainfall was of minor significance to the overall ground water supply in the vicinity of the reservoir.
4. Based upon evaluation of precipitation, applied water, and consumptive use conditions at Pacific View Memorial Park during the period from January 1974 to September 1975, irrigation at the cemetery did not result in any significant recharge to the ground water body around the reservoir.
5. Ground water level fluctuations of greatest magnitude occur in piezometers just east of the reservoir. These fluctuations result from leakage of water stored in Big Canyon Reservoir and from opening and closing of the East Wall Drain.

Conclusions and Recommendations

6. During the study period, the major portion of the ground water flowing in the vicinity of Big Canyon Reservoir is supplied by leakage from the reservoir. Analysis of ground water gradients and aquifer transmissivities determined during this study indicate that the quantity of ground water moving away from the reservoir east wall is about 3,400 gallons per day.
7. The principal leakage from the reservoir is occurring along the east wall from about mid-reservoir southward to the southeast corner. However, field observations and water level fluctuations at piezometers H-38 and H-36 along the south and west walls suggest that additional leakage may be occurring from other locations (walls or floor) in the southern part of the reservoir.
8. The East Wall Drain appears to be quite effective in removing waters which have leaked through the east reservoir wall. Estimates of subsurface ground water flow away from that location indicate that the drain captures 80 to 90 percent of total leakage.
9. Monthly discharge data from the East Wall Drain since December 1976, suggest that the repair of cracks in the reservoir liner along the east wall may have reduced East Wall Drain discharges by as much as 30 percent, compared to pre-repair periods of equivalent reservoir stage.
10. Ground waters most similar to reservoir water from a standpoint of dissolved minerals and chemical character, occur in discharge water from the East Wall Drain, and at sites H-31, H-33, H-34 and H-38, all on the eastern and southern side of the reservoir. Based upon a study of ground water samples collected, ground waters appear to have originated in the reservoir, and to have traveled relatively short distances in the aquifer zones.
11. A decrease in average discharge recorded at the Bren Drain in Spring 1977 may represent that portion of underground flow which is now being intercepted and diverted by the new Broadmoor Drain installed along MacArthur Boulevard. Future discharge measurements at both the Bren and Broadmoor Tract drains will help verify this possibility.

Conclusions and Recommendations

RECOMMENDATIONS

In consideration of the findings developed during this ground water study and the conclusions summarized in the foregoing paragraphs, the following general recommendations are made:

1. The present City monitoring program at Big Canyon Reservoir which includes measurement of the Main Reservoir Underdrain, East Wall Drain, Bren Drain, piezometers SL-1, SL-2, G-26, H-30, H-35, H-36, H-37, H-38, H-30, I-40, I-41 and reservoir stage, should be expanded to include periodic water level measurement at new piezometers H-50 through H-56 (Broadmoor Tract) and discharge measurement of the Broadmoor Drain.
2. Potential geologic hazards related to the possible settlement of berms above the saturated terrace deposits in the northern part of the reservoir should be evaluated by an engineering geology and soils consultant specialist.
3. Careful monitoring and analysis of East Wall Drain discharge fluctuations may now provide the City with a means to qualitatively assess the need for liner repairs along the east wall. Daily or at least weekly measurements should be taken so that any future discharge increases can be related to either time or increased reservoir stage.
4. At approximately two-year intervals, when the reservoir is drained for cleaning, a regular program of inspection and liner repair should be continued. Special attention should be given to the south and central portions of the east wall and to those areas on the reservoir floor where shallow ponding occurs or where a "spongy" bottom condition is encountered.
5. If marked increases in reservoir leakage are measured in the East Wall Drain, and subsequent repair efforts fail to stabilize or reduce that leakage, a system of shallow wells should be designed and installed to dewater the aquifers at selected sites around the reservoir.

APPENDIX A

LITHOLOGIC LOGS
OF BORINGS

SUMMARY — BORING NO. 27 (Piezometer installed)

DATE DRILLED: Nov. 7, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:										
0												
FILL	CL	dry	very stiff	dark gray	SILTY CLAY sandy							
S L O P E W A S H	1	moist	loose	gray brown	SILTY SAND	4						
			medium dense									
	2		stiff	brown	SANDY CLAY	11						
			very stiff									
	3		SC	very dense			CLAYEY SAND	22				
					light brown		SILTY SAND gravelly slightly cemented					
	4		SM				+ freq. cobbles		14			
							CL			very stiff	black gray	SILTY CLAY sandy slightly cemented
							SC			& very dense	dark gray & brown	+ alternating merging silty sand pockets
	5		CL		very stiff		red brown		SANDY CLAY slightly cemented	13		

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 2

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-

SUMMARY — BORING NO. 27 (continued)

DRILLED: Nov. 7, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

20
S
L
O
P
E
W
A
S
H
T
E
R
P
O
S
I
T
S
30
B
E
D
R
O
C
K
35
40

6	CL & SM	moist	very stiff & very dense	red brown	SANDY CLAY + alternating merging streaks to 3" silty sand with traces of clay
				light brown	
	SM	wet	dense		SILTY SAND SAND fine
7	SP/ SM				
8	ML & CL	very moist	soft & medium hard streaks	brown & gray streaked	SILTSTONE & SILTY CLAYSTONE very weathered & intensely fractured + calcium cement streaks
9					very thinly bedded streaks

11

▼

Ground water
encountered at
27 feet. Collected
sample and
drove casing to
continue

7

← saturated interval

33

17

DIPS
35° SW

PERFORATED PIPE

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO.
3

SUMMARY — BORING NO.28 (Piezometer installed)

DATE DRILLED: Nov. 7, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:				
0						
1	CL/CH	dry & slightly moist	v. stiff firm	black & gray brown	CLAY adobe with frequent fine 1/4" bits shale	6
		moist	stiff			
5				black gray brown	CLAY adobe SILTY CLAY gravelly with shale fragments	8
Talus or slide	CL				with hard cemented rock fragments	
10						9
	SM		dense		SILTY SAND	
15		slightly moist	very dense	light brown	SAND fine	10
	SP/SM					
					gravelly	
20	SW					14

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

4

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-1

SUMMARY — BORING NO. 28 (continued)

DATE DRILLED: Nov. 7, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DEPTH IN FEET

SAMPLES SYMBOL

DRIVE ENERGY FT. KIIPS/FT.

20	SW	slightly moist	very dense	light brown	SAND fine to coarse gravelly	
BEDROCK	ML	moist to very moist streaks	soft to medium hard	gray & brown streaked	very to moderately weathered streaks interbedded SILTSTONE very thinly bedded SILTY CLAYSTONE intensely fractured + occasional very fine 1" streaks very fine SILTY SANDSTONE & frequent streaks very fine SANDY SILTSTONE	5
	CL & SM		medium hard			
30				& hard streaks		31
35		& wet streaks				37
40						19

Slight seepage into hole

No significant ground water encountered

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 5

PERFORATED PIPE

SUMMARY — BORING NO. 29 (Piezometer installed)

DATE DRILLED: Oct. 24, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

DEPTH IN FEET	SAMPLES SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	DRIVE ENERGY (FT. KIPS/FT.)
0	CL SM	dry	stiff & dense	dark gray brown	SANDY CLAY & SILTY SAND mixed	
1		moist	stiff to very stiff	brown & light brown gray & dark gray & occ. black gray	SILTY CLAY with fractured shale & cemented siltstone SANDY SILT mixed + occ. mixed clay	4
5	CL ML & occ. CL/CH					6
10						6
15	& SM		& dense		+ mixed silty sand	4
20		very moist				4

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.
6

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628

SUMMARY — BORING NO. 29 (continued)

DRILLED: Oct. 24, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES	SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	DRIVE ENERGY (FT. KIPS/FT.)
20	FILL	CL ML SM	very moist	stiff very stiff & dense	brown & lt. brn. gray & dr. gray	SILTY CLAY, SILT, SANDY SILT, & SILTY SAND mixed	+ shale frags. & cemented siltstone
6	Terrace	CL	moist	very stiff	red brown	SILTY CLAY	9
25							
7	D	SC			brown	SANDY CLAY	13
7						CLAYEY SAND	
30	S	SM	very moist wet	very dense	dark brown	SILTY SAND	with frequent fine bits of charcoal stained streaks
8					gray brown		
8		SP/ SM				SILTY SAND	
35	BED ROCK	ML	moist to very moist streaks	soft	gray & brown & light brown	SILTSTONE CLAYEY- SILTSTONE & SANDY SILTSTONE very fine	very weathered & int. fract.
9		ML/ CL		medium hard to hard streaks			mod. weathered to very weathered very thinly bedded & very fractured & occasional silty sandstone lenses
40		& SM					16

First H₂O. Water level rose to 30' in 5 minutes

saturated interval

PERFORATED PIPE

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 7

SUMMARY — BORING NO. 29 (continued)

DATE DRILLED: Oct. 24, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL						
40		moist & very moist	medium hard to hard streaks	gray & brown & light brown	SILTSTONE CLAYEY-SILTSTONE SANDY-SILTSTONE very fine & SILTY-SANDSTONE	moderately to very weathered streaks, very thinly bedded & very frac. + occasional fine 1" cemented streaks below 40'-9"	
45	11						31
50	12						47
55							
60							

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

8

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-

SUMMARY — BORING NO. 30 (Piezometer installed)

DRILLED: Oct. 29, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

DEPTH IN FEET	SAMPLES SYMBOL	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	DRIVE ENERGY (FT. KIPS/FT.)
0	ML	dry	very soft	gray brown	SANDY SILT + fractured shale	
	CL		stiff	black	SILTY CLAY	
1	CL/CH	moist		dark gray	CLAY - ADOBE cracked- 1/2" voids + fractured shale	4
5						2.8
10	CL		very stiff	brown	SILTY CLAY + fractured shale & siltstone	13
15						14
				light brown	GRAVELLY CLAY + fractured shale & siltstone	
					SILTY CLAY	
20	SP/SM		v. dense	lt. gray	SAND fine	13

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

9

SUMMARY — BORING NO. 30 (continued)

DATE DRILLED: Oct. 29, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KI/PS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

T e r r a c e D e p o s i t s	20		moist	very dense	light gray brown	SAND fine		
	25	6	SP/SM				with occ. gravel	
B R O C K	30	7	very moist	medium hard & hard streaks	gray & brown & light brown	interbedded SILTSTONE & SILTY CLAYSTONE	moderately to slightly weathered, intensely fractured, very thinly bedded with alternating cemented streaks & layers	16
	35	8	& SM				+ occasional streaks silty sandstone	30
	40							49

saturated interval

Water

PERFORATED PIPE

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 10

SUMMARY — BORING NO. 31 (continued)

DATE DRILLED: Oct. 24, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist wet	medium hard to hard	gray & brown	interbedded SILTSTONE to SHALE & SILTY CLAYSTONE	moderate to slightly weathered, very thinly bedded, very fractured	
20							
B							seepage
E							
D							
R	6			& light gray		+ diatoms with siltstone	16
O		ML CL					stronger water flow
C							
K							
30	7		& very hard streaks	& gray brown		+ hard cemented streaks	30
35	8						33
						saturated interval	
40	9						42

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

12

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-

SUMMARY — BORING NO. 32 (Piezometer installed)

DATE DRILLED: Nov. 1, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:	MOISTURE	CONSISTENCY	COLOR	DESCRIPTION	DRIVE ENERGY (FT. KIPS/FT.)
0			dry	v. soft	black	CLAY - ADOBE	
1	CL/CH		moist	firm		cracked fine 1/2" voids	28
				stiff		with pea gr. 1/2" frac. shale	
	CL				brown	SANDY CLAY + pea gravel	
	SM			dense	light brown	SILTY SAND + gravel & cobbles	
5				stiff	brown	SILTY CLAY	11
2				very stiff	red brown	CLAY	
	CL					SILTY CLAY + pea gravel	
					yellow brown		
10	SM			very dense	light brown	SILTY SAND	16
3	& SC				& gray brown	+ alt. stks. clayey sand & occ. pea gr.	
						large boulder 12 to 24" +	
15	ML CL				gray brown	slide debris SILT & SILTY CLAY mixed	9
4						fractured shale & siltstone	
				soft		SILTSTONE & SILTY CLAYSTONE & very fine SANDY SILTSTONE	11
5						mixed v. weathered, v. fract. indistinct bedding	

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

13

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-A

SUMMARY — BORING NO. 32 (continued)

DATE DRILLED: Nov. 1, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist	soft to medium hard streaked & occ. hard streaks	brown & gray streaked	interbedded SILTSTONE, SILTY CLAYSTONE very fine SANDY SILTSTONE with occasional cemented fine streaks	very to slight weathered thin bedded intensely fractured	
20							
25	6 DIPS 30° SW						11
30	7 DIPS 33° W	ML & CL	medium hard to hard streaks			moderately to slightly weathered with frequent hard cemented streaks	32
35	8 DIPS 33° W		& very hard streaks				47 H ₂ O sample water at 35'-3" after 20 minutes
40	9	very moist wet			+ alt. hard cem. silty sandstone streaks		47 1st water in hole

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 14

DEPLETED PIPE (26 - 41')

SUMMARY — BORING NO. 32 (continued)

DATE DRILLED: Nov. 1, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA REPRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DEPTH
IN
FEET

SAMPLES
SYMBOL

DRIVE ENERGY
FT. KIPS/FT.

BED ROCK ↓	40	ML CL SM	wet	medium hard to hard & very hard	brown & gray & light brown	interbedded SILTSTONE, SILTY CLAYSTONE, very fine SANDY SILTSTONE & SILTY SANDSTONE	very thinly bedded, intensely fractured, moderately slightly weathered	to	saturated interval
	10								
	45								
	50								
	55								
	60								

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING

NO

15

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ.
NO.

A-74-628-1

SUMMARY — BORING NO. 33

DATE DRILLED: Oct. 28, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:	MOISTURE	COLOR	DESCRIPTION	DRIVE ENERGY (FT. KIPS/FT.)
0			dry	black	CLAY - ADOBE	
1	CL/CH		very soft		disturbed	
			stiff		cracked fine 1/2" voids	
			slightly moist		with much fine 1/4" calcareous fragments	6
5			moist			
2						
					fragments of shale	11
10				dark gray		
3	CL				sandy	9
				gray brown		
15					SILTY CLAY	
4						
					+ shale fragments	11
					sandy	
				dark brown		
				brown		
20						11

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

16

SUMMARY — BORING NO. 33 (continued)

DATE DRILLED: Oct. 28, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

20 Top wash ↓ Terrace ↓ Deposit ↓ BED ROCK ↓ 40		moist	very stiff	brown	SILTY CLAY sandy	+ freq. bits & very fine lenses		
		CL						
		CL/CH			dark brown & brown	CLAY		
		CL/SC				SILTY CLAY CLAYEY SAND	sandy	
	6	SM	v. moist wet	very dense	light brown	SILTY SAND		13
		SP/SM				SAND fine		
	7							21
	8	ML & CL <i>DIPS 35° SSE</i>	moist	medium hard to hard streaks	brown & light brown & gray streaked	interbedded SILTSTONE, SILTY CLAYSTONE	moderately to slightly weathered, very thinly bedded, intensely fractured with cemented layers & streaks	19
9						+ frequent streaks very fine sandy siltstone	31	

H₂O sample

Water
at 24' after
16 hours

First water

saturated interval

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO
17

SUMMARY — BORING NO. 34 (Piezometer installed)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

F I L L	0	CL	dry	stiff	dk. brn.	SILTY CLAY	3
		SM		dense	dk. gr.	SILTY SAND	
	1		moist	stiff	brown & black, gray	SILTY CLAY	
		CL					
	5	2	& SM			mixed silty sand	
P E W A S H ?	10	3		dense to very dense	light brown & brown	SAND, fine & SILTY SAND	11
						+ clayey sand	
?	15	4		very stiff	red brown	SILTY CLAY sandy	8
	20	5	& ML		& brown	+ streaks to 3" sandy silt with some clay	

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO.

18

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ.
NO.

A-74-628-

SUMMARY — BORING NO. 34 (continued)

DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist	stiff	brown			
20	CL & ML	moist	stiff	brown	SILTY CLAY + frequent merging streaks		
					SANDY SILT with trace clay		
25	SM	wet	dense		SILTY SAND	saturated interval	3.3
30	SP/SM				SAND fine		
35		wet & alt. moist streaks	soft & hard	brown & light brown & gray	interbedded SILTSTONE & SILTY CLAYSTONE & very fine SANDY SILTSTONE	very thinly bedded; moderately fractured with alt. very weathered to hard cemented streaks & layers	23
	ML & CL		medium hard to alt. hard streaks				
40			medium hard				24
45							
50							17

H₂O after 1 min.

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.
19

SUMMARY — BORING NO. 35 (Piezometer installed)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

S L O P E S H	0		dry	v.soft	gr. brn.	SILT & SILTY CLAY mixed	3	
	1	ML CL	slightly moist	firm	black gray	CLAY - ADOBE very cracked & fine		
		CL	moist		dk. gray brown	SILTY CLAY		
		SM		dense	gray brown	SILTY SAND		
	2	CL		very stiff	brown	SILTY CLAY SANDY CLAY		
		& SM & SC		& very dense	& light brown	+ alternating streaks & layers silty sand & clayey sand		
	3							3
	10	CL		very stiff	dark brown	CLAY		
					brown	SANDY CLAY		
	4	SM				SILTY SAND varying streaks		18
15	CL			dark brown	SILTY CLAY			
				& gray brown				
5						3		
20								

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO.

20

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ.
NO.

A-74-628-

SUMMARY — BORING NO. 35 (continued)

DATE DRILLED: Oct. 25, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist	very stiff	gray brown	SILTY CLAY		
20	CL & SM	moist & very moist	very stiff	gray brown & brown	SILTY CLAY		
					+ alt stks. silty sa		
25	6 SP & SM	& wet	very dense	light brown & light gray brown	SAND fine		3
30	7 ML CL	very moist moist	soft medium hard & hard streaks	gray & brown & light brown & yellow	interbedded SILTSTONE, SILTY CLAYSTONE, & very fine SANDY SILTSTONE + occasional cemented streaks	very to slightly weathered streaks, very thinly bedded, very fractured	22
35	8 & SM				+ frequent very fine streaks silty sandstone		23
40	9 DIPS 15°S						17

First H₂O encountered

PERFORATED PIPE

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 21

SUMMARY -- BORING NO. 36 (Piezometer installed)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:				
0	SM	dry	dense	black	SILTY SAND	
			very stiff	gray	CLAY	
1	CL		dense	gray brown	SILTY SAND	8
	SC		very dense	dark brown	CLAYEY SAND	
5		moist		light brown	SILTY SAND	
2					with trace of clay	14
3	SM					16
10						
15	ML & ML/CL		soft to medium hard & hard	gray & brown streaked	interbedded SILTSTONE & CLAYEY SILTSTONE with alternating hard cemented streaks	13
	R		very hard	gray brown	SILICEOUS cemented rock very fractured	
20	ML ML/C		soft	gray & gr/brown	SILTSTONE & CLAYEY SILTSTONE interbedded	

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

22

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-A

SUMMARY - BORING NO. 36 (continued)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES	SYMBOL	moist	soft	gray & brown	interbedded SILTSTONE & CLAYEY SILTSTONE & SANDY SILTSTONE	very weathered & very fract. contorted very thin bed	
20	5							11
				medium hard & occ. hard streaks			very weathered moderately fractured very thinly bedded + frequent fine 1" streaks slightly weathered & hard	11
25	6	ML & ML/CL	& very moist					
30	7		& occ. wet streaks					15
					& light brown		+ occasional fine streaks silty sandstone	
35	8							12
							saturated interval	
40	9		moist					29

H₂O sample
H₂O rose to 30' by the end of drilling

First H₂O

PERFORATED PIPE

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 23

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-A

SUMMARY — BORING NO. 36 (continued)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

BEDROCK	40	ML	moist to wet streaks	medium to occ. hard streaks	gray & brown	interbedded SILTSTONE CLAYEY SILTSTONE & SANDY SILTSTONE	very to slightly fractured stks. very to slightly weathered, + hard cemented streaks, very thinly bedded	27
	45				10		black	
	50							
	55							
	60							

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 24

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628

SUMMARY — BORING NO. 37 (Piezometer installed)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

S O I L T E R R A C E J E P O S I T	0	CL	dry	very stiff	dark brown	CLAY	
	1		slightly moist	very dense	brown	SILTY SAND with some clay	9
			moist		light brown & gray streaked	SILTY SAND	alternating merging streaks with occasional fine 1" streaks with some clay
	2	SM					
	3	& SP/SM				& + alternating merging streaks sand, fine	14
4				light brown	SAND fine		18
5	SP/SM			light gray brown			18

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING

NO

25

SUMMARY — BORING NO.37 (continued)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES	SYMBOL	moist	very dense	light brown & light gray brown	SAND fine		
20								
25	6	SP/SM ML/CL		soft	gray & brown streaked	CLAYEY SILTSTONE	very weathered very fractured	8
30	7	SM & ML		& medium hard	light brown & gray streaked & brown streaked	SILTY SANDSTONE	+ interbedded very fine 3" streaks siltstone, clayey	29
35	8	ML & SM		medium hard to hard streaks	gray & dark gray & brown	interbedded SILTSTONE & CLAYEY SILTSTONE with occ. very fine 1" streaks SILTY SANDSTONE with frequent fine 1" cemented streaks	very fine 1" streaks moderately weathered, moderately fractured, very thinly bedded	14
40	9	& CL	& moist			streaks silty claystone		26

saturated interval

H₂O seepage

H₂O level after four hours

PERFORATED PIPE

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

26

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ. NO.

A-74-628-A

SUMMARY — BORING NO. 37 (continued)

DATE DRILLED: Oct. 22, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL				interbedded SILTSTONE & SILTY CLAYSTONE with occasional to frequent cemented streaks	slightly weathered, moderately fractured, very thinly bedded	DRIVE ENERGY FT. KIPS/FT.	H ₂ O sample
		moist to very moist	medium hard to hard streaked	gray & dark gray & brown streaked				
40								
45	10					19		
50								
55								
60								

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO.

27

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ.
NO.

A-74-628-A

SUMMARY — BORING NO. 38 (Piezometer installed)

DATE DRILLED: Oct. 30, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:					
0		dry	soft	dark gray & brown & black gray	SILTY CLAYS & SANDY SILT mixed, varying	with pea gr. fractured + shale & occ. fragments to 6"	6
1	CL	moist	stiff				
2	& SM		& dense			+ mixed silty sand	8
3							8
4							6
5	SM	very moist to moist streaks	dense	brown & dark brown streaks	SILTY SAND		
	SP/SM	moist	very dense	light brown	SAND very fine		
20							18

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO
28

SUMMARY — BORING NO. 38 (continued)

DATE DRILLED: Oct. 30, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

20
T
E
R
P
R
O
C
E
I
T
S
25
B
E
D
R
C
30
K
35
40

moist very moist	very dense	light brown	SAND very fine
SP/SM			
6 & SM ML CL	wet dense & stiff	& brown & gray	+ merging fine streaks silty sand & silt, & silty clay + occasional fine shale fragments
7 ML CL	very moist & moist streaks	soft gray & brown	interbedded SILTSTONE & SILTY CLAYSTONE very weathered, intensely fractured, bedding indistinct
8	& medium hard streaks		+ occasional bedding streaks, very to moderately weathered
9			+ occasional streaks sandy siltstone

H₂O seepage
w.l. not stabilized

sat'd. int.

PERFORATED PIPE

DIPS
14°N

BIG CANYON RESERVOIR STUDY
for City of Newport
in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO
29

CONVERSE, DAVIS AND ASSOCIATES

Consulting Engineers and Geologists

PROJ.
NO.

A-74-628-1

SUMMARY — BORING NO.39 (Piezometer installed)

DATE DRILLED: Oct. 30, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH
IN
FEET

SAMPLES
SYMBOL

ELEVATION:

S L O P E W A S H	0		dry	stiff	brown	SILTY CLAY sandy	4		
	1	CL							
	5	2	SC & SM & ML	moist	dense & stiff	& gray	CLAYEY SAND & SILTY SAND with trace clay + alternating fine 3" streaks sandy silt with some clay		3
		3	CL & CL/CH		very stiff	dark brown	SILTY CLAY + alternating streaks clay		11
	10	CL			brown				
15	4	SM & ML/CL	very moist			SILTY SAND & CLAYEY SILT sandy, alternating merging streaks	9	H ₂ O sample H ₂ O rose to 15' within 15 minutes	
	20	5	SM	wet	very dense	gray	SILTY SAND	← First H ₂ O	
		SP/SM			gray brown	SAND fine	← saturated interval	9	

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING
NO
30

SUMMARY — BORING NO. 39 (continued)

DATE DRILLED: Oct. 30, 1974

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL						
20	SP/SM	wet	very dense	light brown	SAND very fine		
BED ROCK	ML & CL	very moist	soft	gray & brown streaks	interbedded SILTSTONE, SILTY CLAYSTONE & very fine SANDY SILTSTONE	very weathered	saturated interval
		moist	& medium hard & hard streaks			very to moderately weathered, intensely fractured, thinly bedded with hard cemented streaks below 25.5'	
25							8
30							24
35							26
40							

PERFORATED PIPE

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

31

SUMMARY — BORING NO. 1-40 (Piezometer Installed)

DATE DRILLED: August 6, 1975

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:					
0		moist	stiff	dark gray brown & brown gray light brown & black gray	mixed SANDY SILT, SILTY CLAY & CLAY	+ fragments shale to 6"	
1	ML & CL						3
2	CL / CH						4
5		very moist					
	CH & SM		stiff & dense	black & brown & gray & light brown	CLAY-ADOBE + alt. stks. silty sand		
3	CL & SM				SILTY CLAY	+ alt. fine 6" stks. & layers silty sand	8
10		moist				+ stks. to 3" sand, fine	
	& SP / SM						
4			very stiff	red brown	SILTY CLAY	gravelly	8
15	CL			brown			
5							9
20							

(continued)

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.

36

SUMMARY — BORING NO. 1-40 (continued)

DATE DRILLED: August 8, 1975

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist	very stiff	brown			
SLOPE TERRACE DEPOSIT	CL	moist	very stiff	brown	SILTY CLAY		
	SC		dense		CLAYEY SAND		▼ H ₂ O Level after 2 hours at 21.0'
	SM	v. moist wet			SILTY SAND		
25	6			light brown	SAND fine	11	▽ First H ₂ O encountered at 23.4'
DEPOSIT	SP/SM						
	7				micaceous	4	+ frequent fine 3" fragments shale
BEDROCK	ML & CL		soft to medium	brown & gray & light brown	interbedded SILTSTONE, SILTY CLAYSTONE + very fine SANDY SILTSTONE with occ. cemented streaks	6	moderately weathered, very thinly bedded intensely fractured & jointed, with freq. polished surfaces on joints
	8						
35	9				Bedding Indistinct	7	
40							

PERFORATED PIPE

BIG CANYON RESERVOIR STUDY

for City of Newport

in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO

37

SUMMARY — BORING NO. 1-41 (Piezometer Installed)

DATE DRILLED: August 6, 1975

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	ELEVATION:					DRIVE ENERGY FT. KIPS/FT.
		dry	firm				
0	1 CH.	dry	firm	black	CLAY-ADOBE	+ occ. pea gravel to 2"	6
		moist	stiff	gray		slightly porous	
5	2						1.3
	SM		dense	gray	SILTY SAND	+ occ. pea gravel to 1"	
					brown		
10	3		very stiff	dark gray	SILTY CLAY sandy	gravelly	11
	4 CL			gray & brown streaks		+ occ. merg. stks. sandy clay	11
15							
	5			brown	SANDY CLAY	gravelly to 3"	11
20					SILTY CLAY sandy	gravelly	

(continued)

BIG CANYON RESERVOIR STUDY
for City of Newport for City of Newport
in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO.
38

SUMMARY — BORING NO. I-41 (continued)

DATE DRILLED: August 7, 1975

THIS SUMMARY APPLIES ONLY AT THE LOCATION OF THIS BORING AND AT THE TIME OF DRILLING. SUBSURFACE CONDITIONS MAY DIFFER AT OTHER LOCATIONS AND MAY CHANGE AT THIS LOCATION WITH THE PASSAGE OF TIME. THE DATA PRESENTED IS A SIMPLIFICATION OF ACTUAL CONDITIONS ENCOUNTERED.

DRIVE ENERGY
FT. KIPS/FT.

DEPTH IN FEET	SAMPLES SYMBOL	moist	stiff	brown			
20	CL				SILTY CLAY sandy	+ occasional pea gravel	
25	6 & SM					+ alternate streaks & layers to 6" silty sand, slightly porous	8
			& dense	& light brown			
	SM		very dense	light brown	SILTY SAND SAND fine		
30	7						5
	SP/SM	wet					
35	8					micaceous	4
							▽ H ₂ O at 33.8' after 1 hour
	ML & CL	moist	stiff	gray brown & light brown & white	interbedded SILTSTONE & SILTY CLAYSTONE fine stks. v.f. sandy siltstone, cemented streaks	very weathered moderately weathered	
40	9 Dips 15° W		medium hard to hard streaks				4

PERFORATED PIPE

Water encountered at 33.8'

BIG CANYON RESERVOIR STUDY
for City of Newport
in cooperation with James M. Montgomery, Consulting Engineers, Inc.

DRAWING NO. 39

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. A Location New MacArthur & Port Sutton

WO 465-00 Drill Date 12-14-72

Surface Elev. Logged by JAS

Driving Weight

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>ROAD FILL:</u> Light brown SILTY SAND (SW).					
	5		<u>TOPSOIL:</u> Dark brown, SANDY CLAY, moderately firm, slightly moist. At 2 feet. Becoming brown, firm to hard, dry. At 3 feet. Becoming softer, slightly moist.					
	10		<u>TERRACE DEPOSITS:</u> Brown CLAYEY SAND (SC). At 4½ feet. Becoming softer, slightly moist. At 5 feet. Light brown SAND, dense, slightly moist, hard.					
	15		<u>BEDROCK:</u> Brown SILTSTONE, firm, slightly moist. Between 10 and 11 feet. Becoming moist.					
	20	//////	T.D. 20 feet. Water at 20 feet. W.L. at 12.8 feet, 12-28-72 Hole caved in February 1973.					
	25							
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 2 Location See Plan

W.O. 465-00 Drill Date 12-14-72

Surface Elev. - Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>FILL</u> : Brown SANDY CLAY.					
	5		<u>TERRACE DEPOSITS</u> : SILTY SAND, gray to reddish-brown, medium dense, slightly moist.					
	10		<u>BEDROCK</u> : SILTSTONE, dark gray, highly fractured, medium hard to hard, moist. N. 70° W. 72° N.E. Occasional thin (1"±) reddish-brown SANDSTONE bed.					
	15		B: N84E; 63NW. J: N10W; 62SE. B: N57W; 67NE. J: N15W; 64NE. B: N32W; 64NE. Very hard SILTSTONE. Seepage from joints and fractures. N50W; 71NE.					
	20		B: N60W; 69NE. Moderate to heavy seepage from fractures and bedding.					
	25		B: N49W; 64NE.					
	30		T.D. 31 feet, No caving. Water seepage below 17 feet. W.L. at 11 feet, 12-15-72 Piezometer installed.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 3 Location See Plan

WO 465-00 Drill Date 12-14-72

Surface Elev - Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B- Bedding F-Fault J- Joint RS-Rupture Surface C- Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
		Fill	<u>FILL</u> : SANDY CLAY, brown, moist, stiff. At 1 foot. Dry. At 1½ foot. CLAYEY SAND brown, dense.					
	5	Soil (?)						
	10		<u>TERRACE DEPOSITS</u> : Soft SILTY SAND, brown, mottled, locally coarse with pebbles. Dense and moist.					
	15		<u>BEDROCK</u> : SILTSTONE, gray to reddish-brown. At 11 feet. N22E; 20NW. At 14 feet. J: 50E; 62NE, slicks.					
	20		At 18 feet. Slight seepage, N15E; 37NW. B: N20E; 45NW. B: N14E; 48NW. B: N10E; 44NW.					
	25		B: N25E; 25NW, heavy seepage along bedding. J: N35E; <u>vertical</u> , <u>seepage along joint</u>					
	30		T.D. 32 feet. Water seepage below 18 feet. W.L. at 12 feet, 12-15-72 Piezometer installed.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 4 Location See Plan W.O. 465-00 Drill Date 12-15-72

surface Elev - Logged by WR Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B- Bedding F- Fault J- Joint RS- Rupture Surface C- Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
			<u>FILL:</u> CLAYEY SAND, gray-brown, at 1-4 feet, SAND, gray, reddish-brown, medium dense.					
	5		<u>SOIL:</u> SANDY CLAY, chocolate brown, stiff, orange. <u>TERRACE DEPOSITS:</u> SILTY SAND, reddish- brown.					
	10		<u>BEDROCK:</u> SILTSTONE, gray with reddish- brown streaks. B: N30E; 31NW. At 11½ feet. Hard SILTSTONE fragments with soft SILT matrix. At 12½ feet; J: N7W; 35SW.					
	15		J: N55W; vertical. J: N45W; 28SW; slicks, slight seepage. B: N45E; 21NW. B: N50E; 26NW.					
	20							
	25		At 23 feet. Strong-seepage from bed- ding. B: N70E; 41NE.					
	30		B: N67E; 37NE. Note: Slicks on most joint and frac- ture surfaces. T.D. 32 feet. Water seepage below 17 feet. W.L. at 13½ feet on 12-28-72 Water samples at 23 feet. Piezometer installed.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren, Co.

Boring No. 5 Location See Plan

W.O. 465-00 Drill Date 12-15-72

Surface Elev -

Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>FILL:</u> 0 to 2 feet. SAND, brown. At 2 feet. CLAYEY SAND, chocolate brown, dense, slightly moist to 4 feet.					
	5	<i>Soil</i>	<u>SOIL:</u> At 4 feet, moist.					
	10		<u>TERRACE DEPOSITS:</u> SILTY SAND, reddish-brown, medium dense to dense, moist.					
	15		<u>BEDROCK:</u> SILTSTONE, gray to light brown, hard. Slix on many joints and fractures. (N.E. side of hole.) At 12 feet, SANDSTONE. At 13 feet. B: N72W; 48NE. At 14 feet. J: N30W; 65NE, slicks.					
	20		F: <u>N65W; vertical.</u> Fault runs to bottom (12 to 23 feet).					
	25		T.D. 23 feet. No water.					
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 6 Location See Plan

W.O. 465-00 Drill Date 12-18-72

Surface Elev - Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B- Bedding F- Fault J- Joint RS- Rupture Surface C- Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>FILL:</u> <i>SOIL</i>					
	5		<u>TERRACE DEPOSITS:</u> CLAYEY SAND, chocolate brown, moderately dense to dense, moist. <i>TERRACE DEP.</i> <u>SILTY SAND</u> , reddish-brown, moderately dense and moist.					
	10		<u>BEDROCK:</u> SANDSTONE, brown, medium coarse, massive with SILTSTONE fragments, hard.					
	15		J: N17E; 74SE. At 15½ feet, SILTSTONE, gray to yellow-brown, massive, highly disturbed and fractured with slicks on fractures, moderately hard and moist.					
	20		At 17 feet. SANDSTONE cobble 12" diameter. At 19 feet. B: 50W; 24SW (poor). At 20 feet. J: N37W. 74SW.					
	25		B(?): B: N25W; 15SW.					
	30		T.D. 31 feet. No water. No caving.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 7 Location See Plan

W.O. 465-00 Drill Date 12-18-73

Surface Elev. -

Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B- Bedding F- Fault J- Joint RS- Rupture Surface C- Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
			<u>TERRACE DEPOSITS:</u> SILTY SAND, red-brown, medium dense, moist, cobbles at base up to 2 inches diameter.					
	5		<u>BEDROCK:</u> Gray to yellow brown SILTSTONE, moderately hard, moist, well bedded, occasional SILTSTONE layers. At 3 feet. B: N32E; 27NW. At 6 feet. B: N37E; 22NW. At 8 feet. B: N42E; 9NE. At 9 feet. J: N20W, <u>vertical</u> . At 11 feet. B: N19E; 7NW.					
	10							
	15		At 15 feet. B: N14E; 12NW.					
	20							
	25		Heavy water flow at 24 feet from bedding and fractures. T.D. 31 feet. Water sample at 24 feet. Water seepage below 24 feet. W.L. at 17.4 feet, 12-28-72					
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 8 Location 27' above T.C. @ B-2 WO# 65-00 Drill Date 12-21-73

Surface Elev - Logged by W.R. Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		SOIL: Bulky SANDY CLAY, stiff, moist.					
	5		TERRACE DEPOSITS: 3½ feet, CLAYEY SAND, reddish-brown, dense and moist.					
	10							
	15		Very moist.					
	20		At 17 feet. Loose, wet, caving.					
	25		At 22 feet. Seepage, moderate, becomes heavier with depth.					
	25		At 25 feet. Cobbles.					
	25		At 26 feet. BEDROCK: Bedded SILTSTONE (Monterey Formation).					
	25		T.D. 27 Feet.					
	25		Water sample at 22 feet.					
	25		Note: Hole not logged below 20 feet because of caving.					
	25		Water seepage below 17 feet.					
	30		Piezometer installed, however, damaged and unable to use.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 9 Location 22' above B-8 W.O. 465-00 Drill Date 12-21-72

Surface Elev. - Logged by WR Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<p><i>Sil</i> Brown SANDY CLAY, moist and stiff.</p> <div style="border: 1px solid black; padding: 5px; margin: 5px 0;"> <p>TERRACE DEPOSITS: At 4½ feet. CLAYEY SAND, reddish-brown to yellow-brown, medium dense to dense, moist.</p> </div> <p>At 11 feet. Dark reddish-brown. Clayey.</p>					
	5							
	10							
	15							
	20							
	25							
	30		At 31 feet. SAND(SP) yellow-brown, soft to loose, wet, caving.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 9 Location 22' above B-8

W.O. 465-00 Drill Date 12-21-72

Surface Elev

Logged by WR

Driving Weight

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	30							
			Loose running SAND at 31 feet. Moderate seepage at 33 feet.					
	35	//////	Heavy seepage at 35 feet.					
			T.D. 35 feet.					
			Unable to penetrate further due to caving sand.					
	40		Water seepage below 31 feet.					
			Piezometer installed to 30 feet.					
			W.L. below 30 feet (?).					
	45							
	50							
	55							
	60							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. 10 Location See Plan

W.O. 465-00 Drill Date 12-21-73

Surface Elev - Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
			<p><u>SILTY SAND</u>, reddish-brown, medium dense, moist.</p> <p>At 3 feet, <u>CLAYEY SAND</u>, reddish-brown to yellow-brown, dense.</p> <p>At 8 feet. Cobbles.</p>					
	5							
			<p><u>SILTSTONE</u>, gray to reddish-brown.</p> <p>At 11 feet. Light seepage from fractures.</p> <p>At 12 feet. B: 72E; 14NW.</p> <p>At 13 feet. Moderate seepage. B: 87E; 13NW.</p> <p>At 18 feet. B: 77E; 10NW.</p> <p>Moderate to heavy seepage from 20 feet to T.D.</p>					
	10							
	15							
	20							
	25	////	<p>T.D. 25 feet.</p> <p>Water seepage below 11 feet.</p> <p>W.L. at 9.6', 12-28-72</p>					
	30							

PRELIMINARY

SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. C-11 Location Port Carne Place & Newport Hills Drive East

W.O.465-00 Drill Date 3-9-73

Surface Elev -

Logged by JAS

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>FILL</u>: SILTY SAND and SANDY SILT, mottled brown and gray. Very moist and moderately firm to 2.0 feet. Moist and stiff below.</p> <p>Rocks at 7.0 feet.</p> <p>At 9 feet. Dark brown layer, scattered organics, slightly moist. At 10 feet. Fill as above.</p> <p><u>CLAYEY SAND</u>, yellowish light brown, moist dense.</p>					
	10							
	15							
	20							
	25		<p>At 23 feet. Dark brown SANDY CLAY, slightly moist, scattered organics.</p>					
	30		<p><u>BEDROCK</u>: SANDSTONE, light brown, very hard. Unable to penetrate.</p>					
			<p>T.D. 28 feet. No water. No caving.</p>					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.
GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Date 3-9-73

Boring No C-12 Location Port Sutton & Newport Hills Dr. East W6465-00 Drill Date 3-10-73

Surface Elev - Logged by JAS & WR Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>FILL</u> : SILTY SAND and SANDY SILT, brown to gray, moist, firm.					
	5		SILTY CLAY, reddish-brown, very moist, firm.					
▽			<u>WEATHERED BEDROCK</u> : Highly fractured shale, light brown, wet, firm.					
	10		<u>MONTEREY FORMATION</u> : Interbedded shale and SANDSTONE, light brown and gray, slightly moist, hard.					
	15							
	20		Becoming very hard.					
	30							
	40		T.D. 40 feet. Moderate to heavy water seepage at 7½ feet and caving. Piezometer installed. NOTE: Hole redrilled and deepened from 20 to 40 feet.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. C-15 Location Newport Hills Drive

W.O. 465-00 Drill Date 4-11-73

Surface Elev - Logged by WR

Driving Weight -

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay, color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		<u>FILL:</u> SILTY SAND, brown, medium dense, most.					
	5		<u>WEATHERED DIABASE:</u> Light reddish-brown to dark gray, damp.					
	10							
	15		Diabase becomes gradually less weathered with depth. J: N10W; 26SW.					
	20							
	30		J: N20W; 65NE.					
	40							
			T.D. 40 feet. No water.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG · GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. C-16 Location Newport Hills Drive & Port Bishop Place

W.O. 465-00 Drill Date 4-11-73

Surface Elev. - Logged by WR

Driving Weight 3000 lbs.

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pct	MOISTURE CONTENT (%)
	0		<u>FILL:</u> CLAYEY SAND, brown to black, soft to medium dense, very moist.					
	5							
	10	▽	<u>BEDROCK:</u> (Tm) Siliceous shale and SANDY SILTSTONE, gray to brown, hard, brittle, damp to moist, highly fractured with slicks on fractured surfaces. Light to medium seepage at 10 feet from N.W. Side of hole relatively dry at this point. Fault runs vertically down hole with 3 inch gauge zone. F: N50W, vertical. At 12 feet. B: N75E; 65NW At 17 feet. B: N70E; 79NW. Note: Free water on some fractured surfaces.					
	15							
	20							
	25							
	30	////	T.D. at 30 feet. No water seepage during drilling.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No C-19 Location Parkway - Port Bishop Place

W 0465-00 Drill Date 3-28-73

Surface Elev 242.5+ Logged by JH

Driving Weight 3000 lbs.

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0		FILL: Reddish-brown to brown SANDY CLAY, moist, abundant rock fragments, firm.					
	5							
	10		At 10 feet. Becoming lighter brown, CLAYEY SAND, damp to moist.					
	12		At 12 feet. Layer of dark brown SANDY CLAY.					
	14		At 14 feet. Becoming damp, Terrace fill material.					
	15							
	20		At 20 feet. Scattered organics.					
	25							
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Donald L. Bren Co.

Boring No. C-19 Location (continued)

W.O. 465-00 Drill Date 3-28-73

Surface Elev 242.5±

Logged by JH

Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	30		FILL continues as above.					
	35							
	40							
	45							
	50							
	55		At 52 feet. Dark gray CLAYEY SILT, scattered organics, small amount of pea gravel. At 54 feet. Brown to dark brown CLAYEY SILT, moderately firm, damp.					
	60	//////	<u>BEDROCK</u> : Topanga Formation: Highly sheared, brown CLAYEY SILTSTONE. At 59 feet. Diabase.					
	60		TtD. 60 feet. No water. No caving.					

PRELIMINARY

SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. F-21 Location Edge of Park, N. of Port Bishop W.O. 465-00 Drill Date 8-28-73

Surface Elev. _____ Logged by MB Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>FILL</u>: SANDY CLAY and SILTY CLAY, brown to reddish-brown, moist, stiff, medium stiff.</p> <p>At 7 feet. Piece of wire 1/2" strand.</p> <p>At 10 feet. Fragments medium gray, to light brown, diabase mixed into fill.</p> <p>At 13 feet. Dark reddish-brown SILTY SAND.</p> <p>At 16 feet. Light brown SILTY SAND.</p>					
	10							
	15							
	20		<p>At 20 feet. Dark brown CLAYEY SILT with minor grass and roots.</p>					
	25		<p><u>BEDROCK</u> (Tompanga Formation): SILTSTONE, light gray to brown, highly fractured and sheared, manganese staining on fractures.</p>					
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.
GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. F-21 Location Edge of Park, N. of Port Bishop W.O. 465- Drill Date 8-28-73

Surface Elev. _____ Logged by MB Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	30							
	35		SILTSTONE continued, becoming medium gray and brown.					
	40							
	42		At 42 feet. Water seepage.					
	45		At 45 feet. Dark gray SILTSTONE (unoxidized).					
	50							
			T.D. 50 feet. Water seepage below 42 feet. Minor caving. *Water levels: 37.6' - 8-29-73 26.7' - 8-30-73 14.9' - 9- 4-73 14.75' - 9-10-73					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.
GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. F-28 Location Edge of Park North Port Bishop

W.O. 465-00 Drill Date 8-28-73

Surface Elev. _____ Logged by _____

Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<u>FILL:</u> SANDY CLAY and SILTY SAND, brown to reddish-brown, moist, stiff to medium dense.	CL				
	10		<u>BEDROCK (Topanga Formation):</u> SANDY SILTSTONE and SILTY SANDSTONE, gray to brown, slightly moist, hard. At 10 feet. B: N54W; 41SW. At 12 feet. B: N85E; 35SE At 13 feet. Fault N70E; 32SE, contains 3" gauge. At 15 feet. Seepage.					
	15							
	20		At 20 feet. Fault N35W; 52SW. At 21 feet. Fault N70W; 47SW.					
	25		MONTEREY FORMATION: Shale; light gray, highly fractured, thinly bedded; micaceous and locally diatomaceous with rust stained streaks.					
	30		T.D. 30 feet. Seepage from SW side of hole at 15 feet with local caving - 8" standing water after 1 hr. - water at 14 feet after 24 hours.					

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-22 Location Top of Reservoir

W.O. 465-00 Drill Date 8-29-73

Surface Elev. _____ Logged by WR

Driving Weight 1500 lbs.

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>FILL</u>: SANDY SILT and SILTY SAND, brown, moist, medium dense to dense (derived from Monterey).</p> <p>At 5 feet. SILTY SAND, reddish-brown, medium dense, moist (Terrace derived).</p>			LB		
	10							
	15		<p>At 12 feet. Mixture of above.</p> <p>At 14 feet. SILTY to SANDY CLAY, dark brown to black, medium dense, moist, mixed with above.</p>			LB		
	20							
	25		<p>At 17 feet. Mixture of above.</p> <p>At 25 feet. Becoming very moist.</p>		3	C LB		
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-22 Location Top of Reservoir

W.O. 465-00 Drill Date 8-29-73

Surface Elev. _____

Logged by WR

Driving Weight 1500 lbs.

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	30							
			At 33 feet. SILTY SAND, reddish-brown (Type B).					
	35		At 34 feet. <u>TERRACE DEPOSITS</u> : SAND to SILTY SAND, light reddish-brown to yellowish, medium dense, very moist.					
	40		At 38 feet. <u>BEDROCK (MONTEREY FORMATION)</u> : SANDY SILTSTONE, gray to brown, moderately hard.		4	C		
			T.D. 40 feet. No free water. No caving.					
	20							
	25							

PRELIMINARY

SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-23 Location _____ W.O. 465-09 Drill Date 8-29-73

Surface Elev. _____ Logged by WR Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>FILL?</u>: SILTY SAND, brown, loose to medium dense, slightly moist to moist, fine grained.</p> <p>At 3 feet <u>TERRACE DEPOSITS</u>: SILTY to CLAYEY SAND, medium grained, brown, moist, medium dense.</p>					
	10							
	15		<p>At 10 feet. <u>BEDROCK (Monterey Formation)</u>: SANDY SILTSTONE and shale, gray to light brown, moderately hard to hard, slightly moist.</p>					
	20		<p>Moderate seepage at 20 feet.</p>					
	25		<p>T.D. 25 feet. Seepage at 20 feet. No caving.</p>					
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-24 Location NW Corner of Reservoir W# 65-00 Drill Date 8-29-73

Surface Elev. _____ Logged by WR Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B- Bedding F- Fault J- Joint RS- Rupture Surface C- Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
			<u>FILL</u> : SILTY SAND brown, loose (upper 6") to medium dense, slightly moist to moist.					
	5		At 5 feet. <u>TERRACE DEPOSIT</u> : SAND and SILTY SAND, reddish-brown, medium dense moist.					
			At 7 feet. <u>BEDROCK</u> (Monterey Forma- tion): SANDY SILT and shale, light brown to gray, medium hard to hard.					
	10		At 11 feet. Seepage from south side.					
	15		At 15 feet. Heavy seepage.					
			T.D. 15 feet. Seepage below 11 feet. No caving.					
	20							
	25							
	30							

PRELIMINARY
SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-25 Location N. Side of Reservoir W.O. 465-00 Drill Date 8-29-73

Surface Elev. _____ Logged by WR Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B-Bedding F-Fault J-Joint RS-Rupture Surface C-Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>TERRACE DEPOSIT</u>: SILTY to CLAYEY SAND, brown to dark reddish-brown, loose (upper 6") to medium dense, dry (upper 1') to moist.</p>					
	10		<p>At 10 feet. Very moist to wet.</p> <p>At 11½ feet. Heavy seepage from gravel layer.</p>					
	15		<p>At 14 feet. <u>BEDROCK (MONTEREY FORMATION)</u>: SANDY to SILTY shale, gray to brown, moderately hard, moist.</p>					
	20		<p>T.D. 15 feet. Seepage below 10 feet. Minor caving.</p>					
	25							
	30							

PRELIMINARY

SUBJECT TO REVISION

BORING LOG

GEOLABS, INC.

GEOLOGY AND SOIL ENGINEERING

Project Bren - Groundwater Study

Boring No. G-26 Location NW Corner of Res. Near Fence W.O. 465-00 Drill Date 8-29-73

Surface Elev. _____ Logged by WR

Driving Weight _____

WATER	DEPTH (FEET)	GRAPHIC LOG	UNIT (soil, fill, alluvium, siltstone, etc.) MATERIAL DESCRIPTION (% sand, silt, clay; color, consolidation, etc.) ATTITUDE MEASUREMENTS: B - Bedding F - Fault J - Joint RS - Rupture Surface C - Contact	GROUP SYMBOL U.S.C.S.	PENE. RESIST. BLOWS/FOOT	C-CORE B-BAG	DRY DENSITY pcf	MOISTURE CONTENT (%)
	0							
	5		<p><u>TERRACE DEPOSITS</u>: SILTY SAND and SAND, reddish-brown to yellowish-brown, loose and dry (upper 1') to medium dense, moist.</p> <p>At 5 feet, very moist.</p>					
	10		<p>At 7 feet. <u>BEDROCK</u> (Monterey Formation): SANDY SILTSTONE and shale, gray to brown, moderately hard to hard, moist.</p> <p>At 10½ feet. Heavy seepage from fractures.</p>					
	15							
	20							
	25							
	30		<p>T.D. 15 feet. Seepage at 10 Feet. No caving.</p>					

PRELIMINARY
SUBJECT TO REVISION

APPENDIX B

GROUND WATER
LEVEL FLUCTUATIONS

Big Cyn Reservoir Ground Water Study - Pt. 2 Water Readings

~~SPRINT WATER~~

Date	By	SL1	SL2	G-26	H-30	H-35	H-36	H-37	H-38	H-39	I-40	I-41	Res.	Remarks
4/15/76	JB	284.6	258.5	268.8	279.8	282.7	263.5	269.0	278.3	276.3	283.4	283.5		
4/22/76	JB	283.4	259.8	267.3	280.0	282.7	264.2	269.1	278.7	276.6	283.4	283.4		
5/18/76	JB	283.9	258.5	269.2	280.0	282.6	264.2	269.3	279.9	276.5	283.4	-		I-41 Down
6/11/76	JB	284.6	258.4	269.2	280.1	282.7	264.7	269.4	279.2	276.7	284.5	283.3		
6/14/76	JB	286.2	258.6	269.2	280.3	282.9	265.4	269.9	279.8	276.9	285.8	283.6		
6/28/76	JB	286.0	258.6	269.4	280.7	283.3	265.8	269.3	290.9	277.1	286.9	284.1	300.6	UnAEW 13.
7/14/76	JB	283.5	257.0	269.3	280.7	282.5	265.1	270.5	280.9	276.9	283.6	284.4	293.5	E-12.6, W-5
7/26/76	JB	286.2	258.9	269.4	280.6	282.9	264.9	270.5	280.7	276.9	285.0	284.4	293.7	BAEN - 1.0 E-12.2
8/10/76	JB	285.8	258.5	269.4	280.6	283.6	265.2	270.5	280.5	276.8	285.4	284.4	292.8	W-5.8
9/6/76	QW	285.4	258.8	269.4	280.5	283.5	265.4	270.6	280.6	276.7	285.3	284.2	294.0	E-12.1, W-
9/20/76	QW	286.3	258.9	269.7	280.6	283.8	265.8	270.8	281.2	277.0	285.8	284.6	296.1	GREEN 3.9
10/8/76	QW	284.3	258.9	269.8	280.8	283.7	265.7	271.0	281.4	277.0	285.9	284.6	295.9	E-11.8 GREEN 4.1
10/22/76	QW	285.8	259.1	269.6	280.6	283.5	265.8	271.1	281.0	276.9	285.3	284.4	290.5	E-11.4 GREEN 4.4
11/12/76	JM	283.6	258.9	269.4	280.1	283.5	264.3	260.7	279.9	276.4	283.2	279.3	278.8	E-8.9, W-4.5 GREEN 4.4
11/29/76	JM	281.4	258.7	269.3	279.4	282.8	262.4	269.7	278.3	279.6	281.7	283.8	284.5	E-11.3, W-4.4 GREEN 4.4
12/19/76	QW	280.2	258.7	269.0	278.9	282.5	261.3	268.8	277.0	275.4	280.9	283.3	283.5	E-7.0, W-4.4 GREEN 4.8
12/27/76	QW	280.8	258.6	268.8	278.8	282.3	261.5	268.1	276.3	275.5	280.6	283.0	287.9	E-7.5, W-4.4 GREEN 4.7
1/13/77	QW	284.1	258.4	269.2	279.7	282.4	263.6	268.3	277.7	276.0	284.2	282.9	294.2	E-11.3, W-4.4 GREEN 4.0
1/31/77	QW	285.6	258.5	269.3	280.0	282.6	264.2	268.7	278.4	276.2	285.3	283.5	296.5	E-11.4 GREEN 4.3
2/7/77	QW	286.7	258.5	269.3	280.1	282.2	264.4	268.9	278.9	276.3	286.0	283.5	296.8	E-11.3, W-4.4 GREEN 4.0
2/25/77	QW	287.8	258.5	269.2	280.4	283.2	264.9	269.3	279.7	276.4	286.8	284.0	297.0	E-11.4, W-4.4 GREEN 4.1
3/13/77	QW	288.0	258.6	269.1	280.6	283.9	265.0	269.8	280.5	276.6	287.1	284.6	296.4	E-12.5, W-4.4 GREEN 4.6
3/21/77	QW	288.1	258.5	269.3	280.6	283.8	265.1	269.9	280.5	276.5	287.1	284.6	297.0	E-12.3, W-4.4 GREEN 4.6

JM

APPENDIX C

MINERAL ANALYSES
OF
GROUND WATER SAMPLES

REPORT OF
 WATER ANALYSIS

Lab No. 75-096

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 4 l clear liquid
Big Canyon Bren Drain

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	340.1	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	4514	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	28.8	
			Nitrite		
			Orthophosphate		
			Sulfate	2480	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 278.8
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 14030
 Hardness, total _____
 (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnplennig
 Raymond G. Zehnplennig

REPORT OF
 WATER ANALYSIS

Lab No. 73-344

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 2 qt turbid liquid

Subdrain manhole pump discharge plus 10% surface drainage

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	429.4	7.04
Calcium	460.0	22.95	Borate (as B)		
Magnesium	389.0	31.99	Carbonate		
Potassium	17.2	0.44	Chloride	2183	61.58
Sodium	1190	51.76	Fluoride	1.27	0.07
			Hydroxide		
			Nitrate	12.9	0.21
			Nitrite		
			Orthophosphate		
			Sulfate	1850	38.52
Total Cations		107.14	Total Anions		107.42

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 352.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 9490
 Hardness, total 2750
 n (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.00
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - musty

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Schaffner
 Raymond G. Schaffner

REPORT OF
 WATER ANALYSIS

Lab No. 74-065

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 gal clear liquid

Big Canyon Reservoir, Drain Discharge below reservoir

Date sample taken: 3/15/74

Sampled by: K. Wiebe

Date received: 3/18/74

Sample analyzed by: R. Z.

Date of analysis: 3/18-20/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	183.0	3.00
Calcium	128.0	6.39	Borate (as B)		
Magnesium	68.1	5.60	Carbonate		
Potassium	6.9	0.18	Chloride	341.4	9.63
Sodium	240.0	10.44	Fluoride	0.78	0.04
			Hydroxide		
			Nitrate	1.06	0.02
			Nitrite		
			Orthophosphate		
			Sulfate	536.0	11.16
Total Cations	443.0	22.61	Total Anions	968.9	23.85

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 150.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 11
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 2100
 Hardness, total 600
 Iron (Fe) 0.25

Lead (Pb) _____
 Manganese (Mn) 0.01
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.95
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 1428
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 18.5
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) 1.4
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond Zehpfennig
 Raymond G. Zehpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 75-097

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 4 l clear liquid
Big Canyon main underdrain

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	426.4	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	2698	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	7.09	
			Nitrite		
			Orthophosphate		
			Sulfate	2080	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 349.5

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 9350

Hardness, total _____

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnpfening
 Raymond G. Zehnpfening

REPORT OF
 WATER ANALYSIS

Lab No. 75-095

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 4 l clear liquid

Big Canyon East Wall Drain

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	165.1	2.71
Calcium	80.0	3.99	Borate (as B)		
Magnesium	31.6	2.60	Carbonate		
Potassium	4.8	0.12	Chloride	106.9	3.02
Sodium	145.0	6.31	Fluoride	0.41	0.02
			Hydroxide		
			Nitrate	0.22	0.00
			Nitrite		
			Orthophosphate		
			Sulfate	340.0	7.08
Total Cations	261.4	13.02	Total Anions	612.6	12.83

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 135.3
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 4
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 1195
 Hardness, total 330
 (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 793
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) 0.15
 Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by: _____

Raymond G. Zehnpfening
 Raymond G. Zehnpfening

REPORT OF
 WATER ANALYSIS

Lab No. 73-338

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 pt slightly turbid liquid
Piezometer B-1

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	327.0	5.36
Calcium	850.0	42.42	Borate (as B)		
Magnesium	821.0	67.52	Carbonate		
Potassium	21.0	0.54	Chloride	4433	125.0
Sodium	1660	72.21	Fluoride	1.16	0.06
			Hydroxide		
			Nitrate	0.66	0.01
			Nitrite		
			Orthophosphate		
			Sulfate	2060	42.89
Total Cations		182.7	Total Anions		173.3

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 268.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 14600
 Hardness, total 5250
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - slightly musty

* All values in mg/l unless otherwise noted.

Submitted by:

Raymond Zehaffen
 Raymond G. Zehaffen
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-335

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 pt greenish liquid
Piezometer B-2

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	292.8	4.80
Calcium	740.0	36.93	Borate (as B)		
Magnesium	462.0	38.00	Carbonate		
Potassium	21.0	0.54	Chloride	3223	90.92
Sodium	1550.0	67.42	Fluoride		
			Hydroxide		
			Nitrate	4.87	0.08
			Nitrite		
			Orthophosphate		
			Sulfate	2110	43.93
Total Cations		142.89	Total Anions		139.73

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 240.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 12,100
 Hardness, total 3750
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.75
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile-dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - slightly musty

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 73-336

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 pt turbid liquid

Piezometer B-4

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	106.1	1.73
Calcium	182.0	9.10	Borate (as B)		
Magnesium	135.0	11.10	Carbonate		
Potassium	7.7	0.20	Chloride	1273.0	35.90
Sodium	740.0	32.19	Fluoride		
			Hydroxide		
			Nitrate	7.8	0.12
			Nitrite		
			Orthophosphate		
			Sulfate	660.0	13.74
Total Cations		52.59	Total Anions		51.49

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 87.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 5300
 Hardness, total 1010
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.45
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - none

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zemp
 Raymond G. Zemp
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-337

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 pt turbid liquid
Piezometer B-7

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K.M.

Date of analysis: 12/14 - 21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	314.7	5.16
Calcium	860.0	42.91	Borate (as B)		
Magnesium	814.7	67.00	Carbonate		
Potassium	17.5	0.45	Chloride	6002	169.31
Sodium	3260	142.36	Fluoride	1.14	0.06
			Hydroxide		
			Nitrate	38.5	0.62
			Nitrite		
			Orthophosphate		
			Sulfate	2720	56.63
Total Cations		252.72	Total Anions		231.78

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 258.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 22,100
 Hardness, total 5500
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.20
 Phenols _____
 Phosphorus, total (P) _____
 Residue
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - slightly musty

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnpennig
 Raymond G. Zehnpennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-346

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 3 pt slightly turbid liquid - sulfide odor

Piezometer B(6)23

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-24/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	300.1	4.92
Calcium	835.0	41.67	Borate (as B)		
Magnesium	1048.0	86.18	Carbonate		
Potassium	24.0	0.61	Chloride	7642	215.58
Sodium	3680	160.06	Fluoride	1.05	0.06
			Hydroxide		
			Nitrate	7.3	0.12
			Nitrite		
			Orthophosphate		
			Sulfate	3200	66.63
Total Cations		288.53	Total Anions		287.30

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 246.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 26,940
 Hardness, total 6400
 (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.40
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - slightly musty

* All values in mg/l unless otherwise noted.

Submitted by:

Raymond G. Zehnpfer
 Raymond G. Zehnpfer
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-339

Client: City of Newport Beach

Job No. 40.54

Description and amount of sample: 2 pt turbid liquid
Piezometer C-16

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	658.8	10.80
Calcium	572.0	28.54	Borate (as B)		
Magnesium	314.0	25.82	Carbonate		
Potassium	8.9	0.23	Chloride	1834	51.73
Sodium	1530	66.55	Fluoride	1.13	0.06
			Hydroxide		
			Nitrate	4.43	0.07
			Nitrite		
			Orthophosphate		
			Sulfate	2720	56.63
Total Cations		121.14	Total Anions		119.29

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 540.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 14,400
 Hardness, total 2720
 (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 6.90
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - none

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Lehmpfenig
 Raymond G. Lehmpfenig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 75-102

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment
Big Canyon C-16

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	764.0	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	5059	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	7.53	
			Nitrite		
			Orthophosphate		
			Sulfate	1960	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 626.2

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 15,400

Hardness, total _____

n (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by: Raymond Zehnpfennig
 Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 73-343

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1-1/2 pt turbid liquid - sulfide odor
Piezometer G-24

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	278.2	4.56
Calcium	115.0	5.74	Borate (as B)		
Magnesium	100.0	8.22	Carbonate		
Potassium	6.9	0.18	Chloride	776.0	21.90
Sodium	560.0	24.36	Fluoride	0.60	0.03
			Hydroxide		
			Nitrate	20.8	0.34
			Nitrite		
			Orthophosphate		
			Sulfate	473.0	9.85
Total Cations		38.50	Total Anions		36.68

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 228.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 3750
 Hardness, total 700
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - slightly musty

* All values in mg/l unless otherwise noted.

Submitted by: Raymond Zehnpfennig
 Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-103

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment

Big Canyon G-24

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	507.6	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	2054	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	1.99	
			Nitrite		
			Orthophosphate		
			Sulfate	780	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 416.1

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 7760

Hardness, total _____

(Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by: _____

Raymond G. Zehnplfennig
 Raymond G. Zehnplfennig

REPORT OF
 WATER ANALYSIS

Lab No. 73-341
 Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 3 pt clear liquid
Piezometer G-25

Date sample taken: 12/13/73
 Date received: 12/14/73
 Date of analysis: 12/14-21/73

Sampled by: K. Wiebe
 Sample analyzed by: R. Z., K. M.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	624.6	10.24
Calcium	94.7	4.73	Borate (as B)		
Magnesium	181.0	14.88	Carbonate		
Potassium	4.8	0.12	Chloride	1854	52.30
Sodium	1350	58.72	Fluoride	1.23	0.06
			Hydroxide		
			Nitrate	<0.22	0.00
			Nitrite		
			Orthophosphate		
			Sulfate	535.0	11.14
Total Cations		78.45	Total Anions		73.74

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 512.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 7730
 Hardness, total 980
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.60
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - none

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Schnepf
 Raymond G. Schnepf, Inc.

REPORT OF
 WATER ANALYSIS

Lab No. 75-104

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment
Big Canyon G-25

Date sample taken: 8/8/75

Sampled by: R. Phranier

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	453.5	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	1307	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	<0.22	
			Nitrite		
			Orthophosphate		
			Sulfate	620.0	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 371.7

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 5120

Hardness, total _____

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-342

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1-1/2 pt turbid liquid
Piezometer G-26

Date sample taken: 12/13/73

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-21/73

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	422.1	6.92
Calcium	145.0	7.24	Borate (as B)		
Magnesium	179.0	14.72	Carbonate		
Potassium	4.3	0.11	Chloride	1830	51.62
Sodium	1460	63.51	Fluoride	0.88	0.05
			Hydroxide		
			Nitrate	3.8	0.06
			Nitrite		
			Orthophosphate		
			Sulfate	960.0	19.99
Total Cations		85.58	Total Anions		78.63

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 346.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 7730
 Hardness, total 1100
 (Ca) _____
 (Mg) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - musty, oily

* All values in mg/l unless otherwise noted.

Submitted by

Raymond G. Schaffner
 Raymond G. Schaffner

**REPORT OF
 WATER ANALYSIS**

Lab No. 74232

Job No. 40.0550

Client: Newport Beach

Description and amount of sample: A74-628A Big Canyon Piezometer, H-27
Newport Beach

Date sample taken: _____
 Date received: _____
 Date of analysis: 12/5/74

Sampled by: _____
 Sample analyzed by: L. Leong
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate		
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride		
Sodium			Fluoride		
			Hydroxide		
			Nitrate	6.2 as NO ₃	
			Nitrite		
			Orthophosphate		
			Sulfate		
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate _____
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) _____
 Hardness, total _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: _____

All values in mg/l unless otherwise noted.

Submitted by: _____
 Raymond G. Zehnpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 74232

Job No. 40.0550

Client: Newport Beach

Description and amount of sample: A74-628A Big Canyon Piezometer, H-27 Newport Beach;
Opaquehigh turbidity

Date sample taken: _____

Sampled by: K. Wiebe

Date received: _____

Sample analyzed by: L. Leong

Date of analysis: _____

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate		
Calcium	47.6		Borate (as B)		
Magnesium	62.0		Carbonate		
Potassium	9.6		Chloride	1023	
Sodium	765		Fluoride	0.48	
			Hydroxide		
			Nitrate	6.2	
			Nitrite		
			Orthophosphate		
			Sulfate	520	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 270mg/L
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 8
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 4080
 Hardness, total 512mg/L
 (Fe) 20ug/L

Lead (Pb) _____
 Manganese (Mn) <50ug/L
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.9
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 2600mg/L
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 40 mg/L
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) 500
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 75-105

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment
Big Canyon H-27

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	359.8	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	914.2	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	9.30	
			Nitrite		
			Orthophosphate		
			Sulfate	540.0	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 294.9
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 4080
 Hardness, total _____
 n (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfeiffer
 Raymond G. Zehnpfeiffer

REPORT OF
 WATER ANALYSIS

Lab No. 74-221

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.

Big Canyon Piezometer H-29

Date sample taken: _____

Sampled by: Karl Wiebe

Date received: 10/24/74

Sample analyzed by: R. Z.

Date of analysis: 10/27-11/8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	390.4	6.40
Calcium	62.0	3.10	Borate (as B)		
Magnesium	62.0	5.10	Carbonate		
Potassium	2.5	0.06	Chloride	516.7	14.58
Sodium	500.0	21.75	Fluoride	1.60	0.08
			Hydroxide		
			Nitrate	< 0.22	0.00
			Nitrite		
			Orthophosphate		
			Sulfate	752.0	15.66
Total Cations	626.5	30.01	Total Anions	1461.6	36.72

Acidity (as CaCO₃) _____

Lead (Pb) _____

Strontium (Sr) _____

Alkalinity _____

Manganese (Mn) _____

Sulfide (S) _____

Hydroxide _____

Mercury (Hg) _____

Sulfite (SO₃) _____

Carbonate _____

Moisture in sludge _____

Surfactants _____

Bicarbonate 320.0

Organic nitrogen _____

Sulfur dioxide (SO₂) _____

Arsenic (As) _____

Oil and Grease _____

Threshold odor No. _____

Barium (Ba) _____

pH (units) 7.70

Turbidity (J. U.) _____

Biochemical Oxygen Demand _____

Phenols _____

Zinc (Zn) _____

(BOD₅) _____

Phosphorus, total (P) _____

Cadmium (Cd) _____

Residue _____

Carbon Dioxide (CO₂) _____

Total solids (TS) _____

Chemical Oxygen Demand (COD) _____

Total suspended solids (TSS) _____

Chlorine Demand _____

Total dissolved solids (TDS) 1893

Chlorine Residual _____

Total fixed solids (TFS) _____

Chromium, hexavalent (Cr^{VI}) _____

Total volatile solids (TVS) _____

Chromium, total (Cr) _____

Fixed dissolved solids (FDS) _____

Color (units) 12

Fixed suspended solids (FSS) _____

Copper (Cu) _____

Volatile dissolved solids (VDS) _____

Cyanide (CN) _____

Volatile suspended solids (VSS) _____

Dissolved oxygen (DO) _____

Settleable solids () _____

Specific conductance (EC) 2850

Selenium (Se) _____

Hardness, total 410.0

Silica (SiO₂) 37.0

(Fe) _____

Silver (Ag) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by:

Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-101

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment

Big Canyon H-29

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., J. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	399.2	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	840.9	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	10.9	
			Nitrite		
			Orthophosphate		
			Sulfate	580.0	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 327.2

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 4130

Hardness, total _____

(Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

REPORT OF
 WATER ANALYSIS

Lab No. 74-223

Job No. 40.0550

Client: City of Newport Beach

Description and amount of samples:

Big Canyon Piezometer H-30

Date sample taken: 10/29/74

Sampled by: Karl Wiebe

Date received: 10/31/74

Sample analyzed by: R. Z. & L. Lee

Date of analysis: 11/1-8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	317.2	5.2
Calcium	264.0	13.17	Borate (as B)		
Magnesium	270.0	22.21	Carbonate		
Potassium	6.7	0.17	Chloride	1936	54.61
Sodium	820	35.67	Fluoride	0.72	0.04
			Hydroxide		
			Nitrate	22.2	0.36
			Nitrite		
			Orthophosphate		
			Sulfate	880.0	18.33
Total Cations		71.22	Total Anions		78.54

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 260.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 7
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 6350
 Hardness, total 1770
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 4613
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 35
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

All values in mg/l unless otherwise noted.

Submitted by:

Raymond G. Zehnpennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-099

Job No. 40-0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment

Big Canyon H-30

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	325.3	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	1592	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	33.4	
			Nitrite		
			Orthophosphate		
			Sulfate	1020	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 266.6
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 5770
 Hardness, total _____
 on (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: _____

*All values in mg/l unless otherwise noted.

Submitted by Raymond Zehnpfennig
 Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 74-222

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.

Big Canyon Piezometer H-31

Date sample taken: 10/25/74/1108

Sampled by: Karl Wiebe

Date received: _____

Sample analyzed by: R. Z.

Date of analysis: 10/27-11/8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	327.0	5.36
Calcium	124.0	6.19	Borate (as B)		
Magnesium	117.0	9.62	Carbonate		
Potassium	7.6	0.19	Chloride	545.1	15.38
Sodium	480.0	20.88	Fluoride	0.66	0.03
			Hydroxide		
			Nitrate	7.53	0.12
			Nitrite		
			Orthophosphate		
			Sulfate	680.0	14.16
Total Cations	728.6	36.88	Total Anions	1393.5	35.05

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 268.0

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) 12

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 3130

Hardness, total 605.0

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) 7.90

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) 2198

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) 39.5

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by: _____

Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 74-226

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.

Big Canyon Piezometer H-32

Date sample taken: 11/1/74

Sampled by: Karl Wiebe

Date received: 11/1/74

Sample analyzed by: R. Z.

Date of analysis: 11/1-8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	290.3	4.76
Calcium	101.0	5.04	Borate (as B)		
Magnesium	130.7	10.75	Carbonate		
Potassium	6.4	0.16	Chloride	797.5	22.50
Sodium	520.0	22.62	Fluoride	0.95	0.05
			Hydroxide		
			Nitrate	3.32	0.05
			Nitrite		
			Orthophosphate		
			Sulfate	450.0	9.37
Total Cations		38.57	Total Anions		36.73

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 238.4
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 7
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 3410
 Hardness, total 790.0
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.80
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 2121
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 35.5
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by:

Raymond G. Zehnpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 74-224

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.

Big Canyon Bore 33

Date sample taken: 10/29/74

Sampled by: Karl Wiebe

Date received: 10/31/74

Sample analyzed by: _____

Date of analysis: 11/1-8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	195.2	3.20
Calcium	64.0	3.19	Borate (as B)		
Magnesium	48.6	4.00	Carbonate		
Potassium	2.5	0.06	Chloride	53.1	1.50
Sodium	170.0	7.40	Fluoride	0.87	0.05
			Hydroxide		
			Nitrate	1.77	0.03
			Nitrite		
			Orthophosphate		
			Sulfate	360.0	7.50
Total Cations		14.65	Total Anions		12.28

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 160.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 7
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 1330
 Hardness, total 350.0
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.80
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 904
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 32.5
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: _____

REPORT OF
 WATER ANALYSIS

Lab No. 74-217

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid
Big Canyon Piezometer H-34

Date sample taken: 10/22/1515

Sampled by: Karl Wiebe

Date received: 10/24/74

Sample analyzed by: R. Z.

Date of analysis: 10/27/11-8/74

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	200.1	3.28
Calcium	64.0	3.19	Borate (as B)		
Magnesium	63.2	5.20	Carbonate		
Potassium	2.6	0.07	Chloride	287.4	8.11
Sodium	212.0	9.22	Fluoride	0.42	0.02
			Hydroxide		
			Nitrate	<0.22	0.00
			Nitrite		
			Orthophosphate		
			Sulfate	376.0	7.83
Total Cations	341.8	17.68	Total Anions	761.9	19.24

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 164.0

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) 7.0

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 1660

Hardness, total 420.0

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) 7.70

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) 1106

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) 31.5

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) _____

Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by: _____

Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-094

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 4 l water with sediment

Big Canyon H-35

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	288.3	4.72
Calcium	240.0	11.98	Borate (as B)		
Magnesium	180.0	14.80	Carbonate		
Potassium	15.0	0.38	Chloride	970.2	27.37
Sodium	600.0	26.10	Fluoride	0.71	0.04
			Hydroxide		
			Nitrate	6.87	0.11
			Nitrite		
			Orthophosphate		
			Sulfate	1000.0	20.82
Total Cations	1035.0	53.26	Total Anions	2119.0	53.06

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 236.3

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand _____

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chlorine Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) 4

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 4180

Hardness, total 1340

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) 7.65

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) 3094

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J. U.) 0.25

Zinc (Zn) _____

Remarks: Because sample required filtration, iron and manganese could not be determined.

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpsfer
 Raymond G. Zehnpsfer

REPORT OF
 WATER ANALYSIS

Lab No. 74-218
 Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.
Big Canyon Piezometer H-36

Date sample taken: 10/22/1330
 Date received: 10/24/74
 Date of analysis: 10/27-11/8/74

Sampled by: Karl Wiebe
 Sample analyzed by: R. Z.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	353.8	5.80
Calcium	720.0	35.93	Borate (as B)		
Magnesium	180.0	14.81	Carbonate		
Potassium	4.3	0.11	Chloride	1412	39.83
Sodium	1050	45.68	Fluoride	0.62	0.03
			Hydroxide		
			Nitrate	4.87	0.08
			Nitrite		
			Orthophosphate		
			Sulfate	2660	55.38
Total Cations	1954.3	96.53	Total Anions	4250.8	101.12

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 290
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 12
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 7210
 Hardness, total 2540
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 6169
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 35.5
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpeffnig

REPORT OF
 WATER ANALYSIS

Lab No. 74-219
 Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.
Big Canyon Piezometer H-37

Date sample taken: 10/22/74
 Date received: 10/24/74
 Date of analysis: 10/27-11/8/74

Sampled by: Karl Wiebe
 Sample analyzed by: R. Z.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	390.4	6.40
Calcium	760.0	37.92	Borate (as B)		
Magnesium	329.5	27.10	Carbonate		
Potassium	20.0	0.51	Chloride	3804	107.31
Sodium	1760	76.56	Fluoride	0.95	0.05
			Hydroxide		
			Nitrate	5.54	0.09
			Nitrite		
			Orthophosphate		
			Sulfate	1860	38.74
Total Cations	2869.5	142.09	Total Anions	5861.8	152.59

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 320.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 71
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 12300
 Hardness, total _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.70
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 9203
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 37.5
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnspennig

REPORT OF
 WATER ANALYSIS

Lab No. 74-227
 Job No. 40,0550

Client: City of Newport Beach

Description and amount of sample: 1 gal muddy liquid.
Big Canyon Piezometer H-39

Date sample taken: 10/31/74
 Date received: 11/1/74
 Date of analysis: 11/1-8/74

Sampled by: Karl Wiebe
 Sample analyzed by: R. Z.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	331.8	5.44
Calcium	146.0	7.29	Borate (as B)		
Magnesium	246.6	20.29	Carbonate		
Potassium	3.1	0.08	Chloride	1809	51.03
Sodium	1010	43.94	Fluoride	0.94	0.05
			Hydroxide		
			Nitrate	10.6	0.17
			Nitrite		
			Orthophosphate		
			Sulfate	900.0	18.75
Total Cations	1405.7	71.60	Total Anions	2883.1	75.44

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 272.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 6
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 6260
 Hardness, total 1160
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.30
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 4068
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) 44.0
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-100

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment
Big Canyon H-39

Date sample taken: 8/8/75
 Date received: 8/11/75
 Date of analysis: 8/11-14/75

Sampled by: R. Phraner
 Sample analyzed by: R. Z., L. L.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	404.2	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	2070	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	1.55	
			Nitrite		
			Orthophosphate		
			Sulfate	980	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 331.3
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 7060
 Hardness, total _____
 (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnpfeiffer
 Raymond G. Zehnpfeiffer

REPORT OF
WATER ANALYSIS

Lab No. 75-092
Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 4 l Water with sediment.
Big Canyon I-40

Date sample taken: 8/8/75
Date received: 8/11/75
Date of analysis: 8/11-14/75

Sampled by: W. Cusineau
Sample analyzed by: R. Z., L. L.
Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	182.4	2.99
Calcium	96.8	4.83	Borate (as B)		
Magnesium	89.0	7.32	Carbonate		
Potassium	3.4	0.09	Chloride	576.5	16.01
Sodium	340.0	14.79	Fluoride	0.69	0.04
			Hydroxide		
			Nitrate	3.32	0.05
			Nitrite		
			Orthophosphate		
			Sulfate	400.0	8.33
Total Cations	529.2	27.03	Total Anions	1060.9	27.42

Acidity (as CaCO₃) _____
Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 149.5
Arsenic (As) _____
Barium (Ba) _____
Biochemical Oxygen Demand (BOD₅) _____
Cadmium (Cd) _____
Carbon Dioxide (CO₂) _____
Chemical Oxygen Demand (COD) _____
Chlorine Demand _____
Chlorine Residual _____
Chromium, hexavalent (Cr^{VI}) _____
Chromium, total (Cr) _____
Color (units) 4
Copper (Cu) _____
Cyanide (CN) _____
Dissolved oxygen (DO) _____
Specific conductance (EC) 2640
Hardness, total 608
Iron (Fe) _____

Lead (Pb) _____
Manganese (Mn) _____
Mercury (Hg) _____
Moisture in sludge _____
Organic nitrogen _____
Oil and Grease _____
pH (units) 7.40
Phenols _____
Phosphorus, total (P) _____
Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 1673
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
Selenium (Se) _____
Silica (SiO₂) _____
Silver (Ag) _____

Strontium (Sr) _____
Sulfide (S) _____
Sulfite (SO₃) _____
Surfactants _____
Sulfur dioxide (SO₂) _____
Threshold odor No. _____
Turbidity (J. U.) 0.85
Zinc (Zn) _____

Remarks: Because sample required filtration, iron and manganese could not be determined.

* All values in mg/l unless otherwise noted.

Submitted by Raymond Zehnpfennig
Raymond Zehnpfennig

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REPORT OF
 WATER ANALYSIS

Lab No. 75 0093
 Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: Very turbid with silty material 1 gallon
 Boring # I-41 Depth 33.8'

Date sample taken: 8/7/75
 Date received: 8/19
 Date of analysis: 8/19-22/75

Sampled by: W. Coosinoux
 Sample analyzed by: L. L.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	225	3.68
Calcium	130	6.49	Borate (as B)		
Magnesium	116	9.54	Carbonate		
Potassium	10.8	0.28	Chloride	568	16.02
Sodium	330	14.36	Fluoride	0.92	.05
			Hydroxide		
			Nitrate	7.4	.12
			Nitrite		
			Orthophosphate		
			Sulfate	500	10.42
Total Cations		30.67	Total Anions		30.29

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 184
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 7
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 3010
 Hardness, total 800
 Calcium (Ca) _____
 Magnesium (Mg) _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) 1898
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks:

* All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Lab No. 75-098

Job No. 40.0550

Client: City of Newport Beach

Description and amount of sample: 1 l turbid liquid with sediment

Big Canyon SL-1

Date sample taken: 8/8/75

Sampled by: R. Phraner

Date received: 8/11/75

Sample analyzed by: R. Z., L. L.

Date of analysis: 8/11-14/75

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	239.0	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	224.0	
Sodium			Fluoride		
			Hydroxide		
			Nitrate	5.98	
			Nitrite		
			Orthophosphate		
			Sulfate	412.0	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 195.9
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 1690
 Hardness, total _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: _____

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnle
 Raymond G. Zehnle
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 73-340

Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 gal turbid liquid

Slope Indicator No. 1 (East)

Date sample taken: _____

Sampled by: K. Wiebe

Date received: 12/14/73

Sample analyzed by: R. Z., K. M.

Date of analysis: 12/14-20/73

Report No.: 1

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	246.4	4.04
Calcium	37.6	1.88	Borate (as B)		
Magnesium	31.1	2.56	Carbonate		
Potassium	1.3	0.03	Chloride	169.0	4.77
Sodium	268.0	11.66	Fluoride	0.77	0.04
			Hydroxide		
			Nitrate	8.9	0.14
			Nitrite		
			Orthophosphate		
			Sulfate	290.0	6.04
Total Cations		16.12	Total Anions		15.03

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 202.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand
 (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 1590
 Hardness, total 222.0
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.65
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor slightly musty

* All values in mg/l unless otherwise noted.

Submitted by

Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig
 Chief Chemist

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REPORT OF
 WATER ANALYSIS

Lab No. 73-345
 Job No. 40.54

Client: City of Newport Beach

Description and amount of sample: 1 qt slightly turbid liquid - sulfide odor
Slope indicator No. 2 (West)

Date sample taken: 12/13/73
 Date received: 12/14/73
 Date of analysis: 12/14-21/73

Sampled by: K. Wiebe
 Sample analyzed by: R. Z., K. M.
 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	800.3	12.90
Calcium	640.0	31.94	Borate (as B)		
Magnesium	899.0	73.93	Carbonate		
Potassium	7.1	0.18	Chloride	5987	168.88
Sodium	2880	125.27	Fluoride	2.75	0.14
			Hydroxide		
			Nitrate	<0.22	0.00
			Nitrite		
			Orthophosphate		
			Sulfate	1920	39.98
Total Cations		231.32	Total Anions		221.89

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 656.0
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chlorine Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 22080
 Hardness, total 5300
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.35
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J. U.) _____
 Zinc (Zn) _____

Remarks: Odor - musty

* All values in mg/l unless otherwise noted.

Submitted by Raymond G. Schnepf
 Raymond G. Schnepf, Inc.

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
RESEARCH LABORATORY
555 E. WALNUT ST. PASADENA, CA. 91101 213-796-9141

CLIENT: CITY OF NEWPORT BEACH

LAB NUMBER 760652.

JOB NUMBER 40.0550

DESCRIPTION: TURBID WATER BROADMOOR UNDERDRAIN

SAMPLE VOLUME = 4.00 LITERS

SAMPLE TAKEN ON 4/29/76 BY R. PHRANER

SAMPLE RECEIVED: 5/4/76

COMPLETED ON 5/5/76 BY R. ZEHNFFENNIG

SPECIAL ANALYSES		
PARAMETERS	VALUE	UNITS
SPECIFIC COND	12900.000	MICROMHOS-CM
NO3-N	4.100	MG/L AS N
FLUORESCCEIN	< 0.100	PPB

SUBMITTED BY:

Raymond Zehnffennig
R. ZEHNFFENNIG, PH.D

REPORT OF
WATER ANALYSIS

Client: City of Newport Beach

Lab No. 770209
Job No. 40.0552

Description and amount of sample: 4 l clear water

Eastwall drain - Big Canyon Reservoir

Date sample taken: 5/3/77

Sampled by: Ralph Phraner

Date received: 5/6/77

Sample analyzed by: R. Zehnpfennig

Date of analysis: 5/9 - 12/77

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	168.8	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	120.0	
Sodium			Fluoride		
			Hydroxide		
			Nitrate (as N)	0.05	
			Nitrite (as N)		
			O-phosphate (as P)		
			Sulfate	260.0	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 138.4
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chloride Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 1140
 Hardness, total _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J.U.) _____
 Zinc (Zn) _____

Remarks:

*All values in mg/l unless otherwise noted.

Submitted by Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig
 Chief Chemist

REPORT OF
 WATER ANALYSIS

Lab No. 770208
 Job No. 40.0552

Client: City of Newport Beach

Description and amount of sample: 4 l clear water

Broadmoor Drain - Big Canyon Reservoir

Date sample taken: 5/3/77 Sampled by: Ralph Phraner

Date received: 5/6/77 Sample analyzed by: R. Zehnpfennig

Date of analysis: 5/9-12/77 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	348.8	5.72
Calcium	395.2	19.72	Borate (as B)		
Magnesium	469.9	38.64	Carbonate		
Potassium	20.0	0.51	Chloride	3558	100.37
Sodium	1960	85.25	Fluoride	0.71	0.04
			Hydroxide		
			Nitrate (as N)	4.1	0.29
			Nitrite (as N)		
			O-phosphate (as P)		
			Sulfate	1660	34.56
Total Cations	2845.1	144.12	Total Anions	5393.7	140.98

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 285.9
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chloride Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) 7
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 10940
 Hardness, total 2920
 Iron (Fe) 0.04

Lead (Pb) _____
 Manganese (Mn) 0.12
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) 7.40
 Phenols _____
 Phosphorus, total (P) _____
 Residue _____
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J.U.) 1.3
 Zinc (Zn) _____

Remarks:

*All values in mg/l unless otherwise noted.

Submitted by: Raymond Zehnpfennig
 Raymond G. Zehnpfennig
 Chief Chemist

JAMES M. MONTGOMERY, CONSULTING ENGINEERS, INC.

555 East Walnut Street, Pasadena, California 91101

Telephone: (213) 796-9141 or (213) 681-4255

REPORT OF
WATER ANALYSIS

Lab No. 770211

Job No. 40.0552

Client: City of Newport Beach

Description and amount of sample: 4 l clear water
Bren Drain - Big Canyon Reservoir

Date sample taken: 5/3/77

Sampled by: Ralph Phraner

Date received: 5/6/77

Sample analyzed by: R. Zehnpfennig

Date of analysis: 5/9-12/77

Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	370.3	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	4589	
Sodium			Fluoride		
			Hydroxide		
			Nitrate(as N)	5.1	
			Nitrite (as N)		
			O-phosphate (as P)		
			Sulfate	2400	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____

Alkalinity _____

Hydroxide _____

Carbonate _____

Bicarbonate 303.6

Arsenic (As) _____

Barium (Ba) _____

Biochemical Oxygen Demand

(BOD₅) _____

Cadmium (Cd) _____

Carbon Dioxide (CO₂) _____

Chemical Oxygen Demand (COD) _____

Chlorine Demand _____

Chloride Residual _____

Chromium, hexavalent (Cr^{VI}) _____

Chromium, total (Cr) _____

Color (units) _____

Copper (Cu) _____

Cyanide (CN) _____

Dissolved oxygen (DO) _____

Specific conductance (EC) 14400

Hardness, total _____

Iron (Fe) _____

Lead (Pb) _____

Manganese (Mn) _____

Mercury (Hg) _____

Moisture in sludge _____

Organic nitrogen _____

Oil and Grease _____

pH (units) _____

Phenols _____

Phosphorus, total (P) _____

Residue _____

Total solids (TS) _____

Total suspended solids (TSS) _____

Total dissolved solids (TDS) _____

Total fixed solids (TFS) _____

Total volatile solids (TVS) _____

Fixed dissolved solids (FDS) _____

Fixed suspended solids (FSS) _____

Volatile dissolved solids (VDS) _____

Volatile suspended solids (VSS) _____

Settleable solids () _____

Selenium (Se) _____

Silica (SiO₂) _____

Silver (Ag) _____

Strontium (Sr) _____

Sulfide (S) _____

Sulfite (SO₃) _____

Surfactants _____

Sulfur dioxide (SO₂) _____

Threshold odor No. _____

Turbidity (J.U.) _____

Zinc (Zn) _____

Remarks:

*All values in mg/l unless otherwise noted.

Submitted by

Raymond G. Zehnpfennig
Raymond G. Zehnpfennig

REPORT OF
 WATER ANALYSIS

Client: City of Newport Beach Lab No. 770210
 Job No. 40.0552
 Description and amount of sample: 4 l clear water
Main Underdrain - Big Canyon Reservoir
 Date sample taken: 5/3/77 Sampled by: Ralph Phraner
 Date received: 5/6/77 Sample analyzed by: R. Zehnpfennig
 Date of analysis: 5/9-12/77 Report No.: _____

Cations	mg/l	meq/l	Anions	mg/l	meq/l
Ammonium			Bicarbonate	460.4	
Calcium			Borate (as B)		
Magnesium			Carbonate		
Potassium			Chloride	2098	
Sodium			Fluoride		
			Hydroxide		
			Nitrate (as N)	1.05	
			Nitrite (as N)		
			O-phosphate (as P)		
			Sulfate	1580	
Total Cations			Total Anions		

Acidity (as CaCO₃) _____
 Alkalinity _____
 Hydroxide _____
 Carbonate _____
 Bicarbonate 377.4
 Arsenic (As) _____
 Barium (Ba) _____
 Biochemical Oxygen Demand (BOD₅) _____
 Cadmium (Cd) _____
 Carbon Dioxide (CO₂) _____
 Chemical Oxygen Demand (COD) _____
 Chlorine Demand _____
 Chloride Residual _____
 Chromium, hexavalent (Cr^{VI}) _____
 Chromium, total (Cr) _____
 Color (units) _____
 Copper (Cu) _____
 Cyanide (CN) _____
 Dissolved oxygen (DO) _____
 Specific conductance (EC) 7840
 Hardness, total _____
 Iron (Fe) _____

Lead (Pb) _____
 Manganese (Mn) _____
 Mercury (Hg) _____
 Moisture in sludge _____
 Organic nitrogen _____
 Oil and Grease _____
 pH (units) _____
 Phenols _____
 Phosphorus, total (P) _____
 Residue
 Total solids (TS) _____
 Total suspended solids (TSS) _____
 Total dissolved solids (TDS) _____
 Total fixed solids (TFS) _____
 Total volatile solids (TVS) _____
 Fixed dissolved solids (FDS) _____
 Fixed suspended solids (FSS) _____
 Volatile dissolved solids (VDS) _____
 Volatile suspended solids (VSS) _____
 Settleable solids () _____
 Selenium (Se) _____
 Silica (SiO₂) _____
 Silver (Ag) _____

Strontium (Sr) _____
 Sulfide (S) _____
 Sulfite (SO₃) _____
 Surfactants _____
 Sulfur dioxide (SO₂) _____
 Threshold odor No. _____
 Turbidity (J.U.) _____
 Zinc (Zn) _____

Remarks:

*All values in mg/l unless otherwise noted.

Submitted by: Raymond G. Zehnpfennig
 Raymond G. Zehnpfennig

APPENDIX D

UNDERDRAIN DISCHARGE DATA

APPENDIX D-1

MAIN RESERVOIR UNDERDRAIN
DISCHARGE DATA

Period (Date)	Duration (Minutes)	Instantaneous Discharge (Gal. per Min.)	Total Discharge (Gallons)	Average Discharge (Gal. per Min.)
1/22 - 2/7	23,040	7.2	86,425	3.75
2/7 - 2/20	18,780	7.87	105,875	5.64
2/20 - 3/6	19,980	7.9	99,025	4.96
3/6 - 3/21	20,460	7.64	114,875	5.60
3/21 - 4/7	24,550	7.8	136,800	5.57
4/7 - 4/18	14,820	7.7	83,425	5.63
4/18 - 5/5	22,260	7.65	127,575	5.73
5/5 - 5/16	-	-	-	(a)
5/16 - 5/30	10,655	7.2	55,625	5.22
5/30 - 6/13	18,955	8.5	116,700	6.16
6/13 - 6/23	14,530	8.5	71,950	4.95
6/23 - 6/30	9,105	6.5	45,375	4.98
6/30 - 7/7	8,445	6.7	42,825	5.07
7/7 - 7/18	15,705	7.0	67,900	4.32
7/18 - 7/25	9,915	8.5	45,400	4.58
7/25 - 8/1	9,535	8.2	43,500	4.56
8/1 - 8/8	9,782	8.25	43,675	4.47
8/8 - 8/12	5,367	(b)	24,600	4.58
8/12 - 8/29	-	-	-	(a)
8/29 - 9/5	9,815	11.0	60,400	6.15
9/5 - 9/12	9,890	11.0	61,550	6.22
9/12 - 9/9	11,000	11.2	63,300	5.75
9/19 - 9/29	14,410	11.0	90,475	6.27
3/21 - 4/2	16,920	13.2	57,156	3.38
4/2 - 4/3	1,412	11.9	4,209	2.98
4/7 - 4/18	15,975	13.2	64,455	4.03
4/18 - 5/5	24,480	13.2	62,540	2.55
5/5 - 5/16	15,845	13.2	45,800	2.89
5/16 - 5/30	20,050	13.2	16,583	.83
5/30 - 6/13	20,110	13.2	57,910	2.88
6/13 - 6/23	14,530	13.2	42,120	2.90
6/23 - 6/27	5,710	13.2	17,451	3.06
6/27 - 6/30	4,315	13.6	14,362	3.33
6/30 - 7/3	4,315	13.2	14,092	3.27
7/3 - 7/7	5,760	13.2	19,059	3.31
7/7 - 7/11	5,700	13.2	19,889	3.49
7/11 - 7/18	10,150	13.2	35,837	3.53
7/18 - 7/25	10,070	13.2	37,520	3.73
7/25 - 8/1	10,025	13.2	36,585	3.65
8/1 - 8/4	4,390	13.2	16,426	3.74
8/4 - 8/8	5,790	13.2	23,562	4.07
8/8 - 8/12	5,696	12.5	21,557	3.79
8/12 - 8/15	4,444	12.5	16,987	3.82
8/15 - 8/21	8,820	12.8	36,323	4.12
8/21 - 8/25	5,670	12.8	22,275	3.92
8/25 - 8/29	5,725	12.8	23,936	4.18
8/29 - 9/2	5,725	(b)	24,041	4.20
9/2 - 9/5	4,330	14.1	18,289	4.23
9/5 - 9/12	10,040	11.7	41,305	4.11
9/12 - 9/19	9,980	12.7	42,651	4.21
9/19 - 9/29	14,525	12.7	56,048	3.86

(a) Delete - Drain out of operation for most of period.

(b) No measurement

APPENDIX D-2

EAST WALL DRAIN
DISCHARGE DATA

Dates	Discharge gpm	Dates	Discharge gpm	Dates	Discharge gpm	Dates	Discharge gpm
1/22 - 2/7	15.3	Apr 26	14.9	June 18	16.4	Aug 10	
2/7 - 2/20	15.4	27	14.9	19	16.4	11	
2/20 - 3/6	15.0	28	14.9	20	16.5	12	
Mar 7	15.0	29	14.8	21	16.5	13	
8	15.0	30	14.8	22	16.6	14	
9	15.1	May 1	14.8	23	16.5	15	
10	15.1	2	14.9	24	Closed	16	
11	15.1	3	14.9	25		17	
12	15.1	4	14.9	26		18	
13	15.1	5	15.0	27		19	
14	15.2	6	15.0	28		20	
15	15.2	7	15.1	29		21	
16	15.2	8	15.2	30		22	16.2
17	15.2	9	15.2	July 1		23	16.2
18	15.1	10	15.2	2		24	16.1
19	15.4	11	15.3	3		25	16.1
20	15.1	12	15.4	4		26	16.1
21	15.2	13	15.3	5		27	16.0
22	15.2	14	15.5	6		28	16.0
23	15.4	15	15.4	7		29	15.9
24	15.4	16	15.6	8	16.7	30	16.0
25	15.7	17	16.1	9	16.4	31	15.9
26	15.2	18	15.2	10	16.3	Sept 1	16.0
27	15.1	19	15.5	11	16.2	2	15.4
28	15.1	20	15.7	12	16.1	3	15.9
29	15.5	21	15.7	13	16.2	4	15.9
30	14.4	22	15.7	14	16.0	5	15.9
31	14.9	23	15.7	15	16.1	6	15.9
Apr 1	14.9	24	15.7	16	16.1	7	15.9
2	14.5	25	15.8	17	16.1	8	15.8
3	15.7	26	15.7	18	16.0	9	15.8
4	14.6	27	15.8	19	16.1	10	15.8
5	14.7	28	15.8	20	16.0	11	15.8
6	14.6	29	15.8	21	16.1	12	15.8
7	14.6	30	15.9	22	16.0	13	15.9
8	14.7	31	15.9	23	16.0	14	15.9
9	14.7	1	15.9	24	16.0	15	15.9
10	14.8	2	16.0	25	16.0	16	15.8
11	14.8	3	16.0	26	16.0	17	15.8
12	14.8	4	16.0	27	16.0	18	15.7
13	14.9	5	16.1	28	16.0	19	15.7
14	14.8	6	16.1	29	15.9	20	15.7
15	14.9	7	16.1	30	15.9	21	15.7
16	14.9	8	16.2	31	15.9	22	15.7
17	14.9	9	16.1	Aug 1	15.8	23	15.6
18	15.0	10	16.2	2	15.8	24	15.6
19	15.0	11	16.3	3	15.8	25	15.5
20	15.1	12	16.3	4	Closed	26	15.5
21	15.1	13	16.3	5		27	15.5
22	14.9	14	16.3	6		28	15.6
23	14.9	15	16.4	7		29	15.6
24	15.0	16	16.4	8			
25	15.0	17	16.4	9			

APPENDIX D-3

BREN TRACT DRAIN
DISCHARGE DATA

Date	Discharge (gpm)	Date	Discharge (gpm)
3/21 - 4/2/75	3.38	8/15 - 8/21/75	4.12
4/2 - 4/3/75	2.98	8/21 - 8/25	3.92
4/7 - 4/18/75	4.03	8/25 - 8/29/75	4.18
4/18 - 5/5/75	2.55	8/29 - 9/2/75	4.20
5/5 - 5/16/75	2.89	9/2 - 9/5	4.23
5/16 - 5/30/75	.83	9/5 - 9/12/75	4.11
5/30 - 6/13/75	2.88	9/12 - 9/19/75	4.27
6/13 - 6/23/75	2.90	9/19 - 9/29/75(a)	3.86
6/23 - 6/27/75	3.06		
6/27 - 6/30/75	3.33	7/26/76	0.02
6/30 - 7/3/75	3.27	9/20/76	0.30
7/3 - 7/7/75	3.31	10/8/76	1.10
7/7 - 7/11/75	3.49	10/22/76	0.40
7/11 - 7/18/75	3.53	11/12/76	0.40
7/18 - 7/25/75	3.73	11/29/76	1.80
7/25 - 8/1/75	3.65	12/13/76	1.80
8/1 - 8/4/75	3.74	12/27/76	1.70
8/4 - 8/8/75	4.07	1/13/77	3.00
8/8 - 8/12/75	3.79	1/31/77	2.40
8/12 - 8/15/75	3.82	2/7/77	2.00
		2/25/77	2.10
		3/13/77	1.60
		2/21/77	-

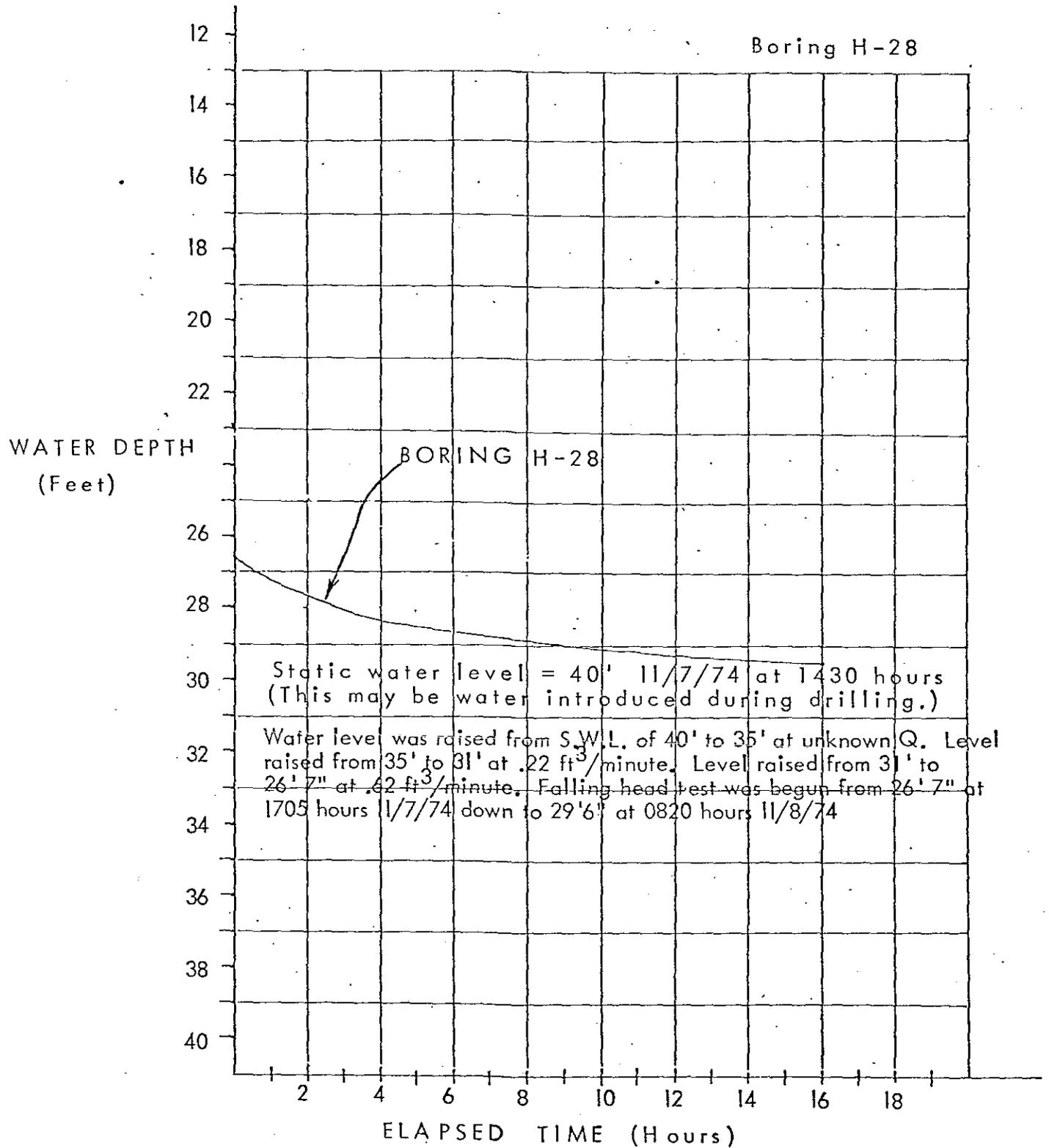
(a) After 9/29/75, all drain measurements taken by City personnel.

APPENDIX E

FIELD PERMEABILITY

TEST DATA

FALLING HEAD PERMEABILITY TESTS (Slug tests)

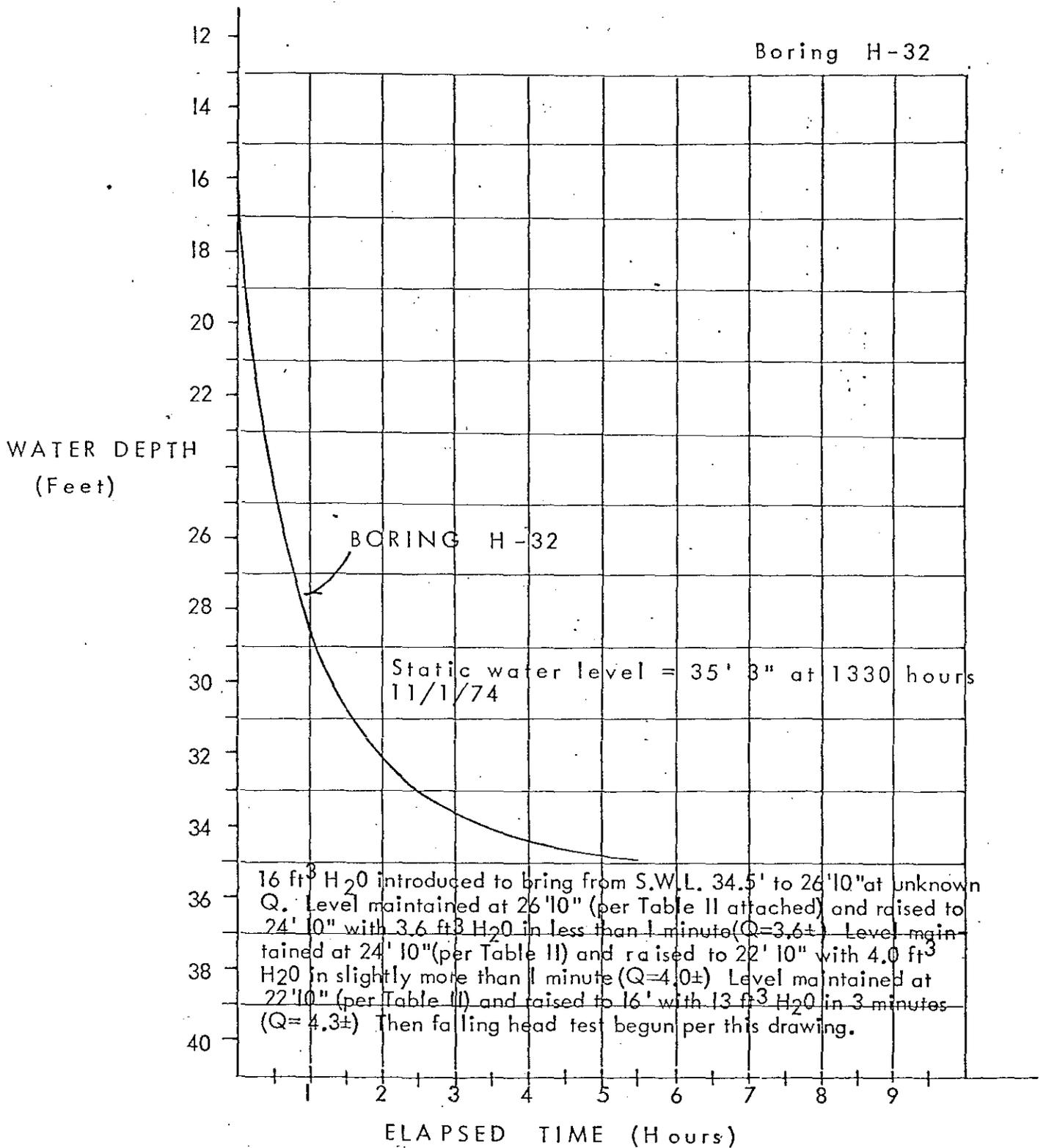


Field permeability tests were run using off-site water introduced into the boring to bring water levels to desired depth. Decay in elevation was measured with a Stevens Recorder.

BIG CANYON GROUND WATER STUDY
FOR JAMES M. MONTGOMERY, CONSULTING ENGINEERS.

Drawing
32a

FALLING HEAD PERMEABILITY TESTS (Slug tests)



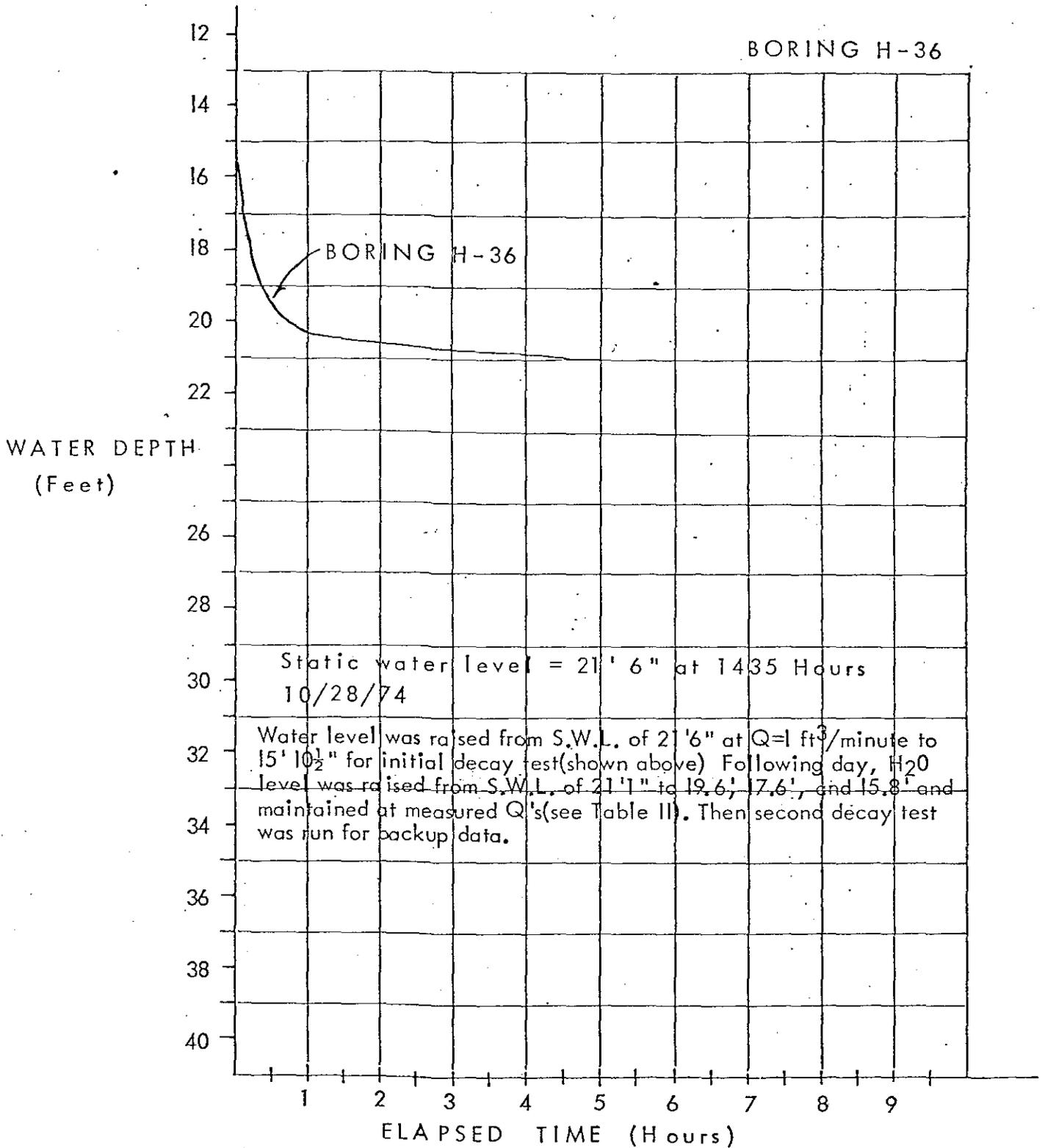
Field permeability tests were run using off-site water introduced into the boring to bring water levels to desired depth. Decay in elevation was measured with a Stevens Recorder.

BIG CANYON GROUND WATER STUDY
FOR JAMES M. MONTGOMERY, CONSULTING ENGINEERS

Drawn
33c

FALLING HEAD PERMEABILITY TESTS
(Slug tests)

BORING H-36



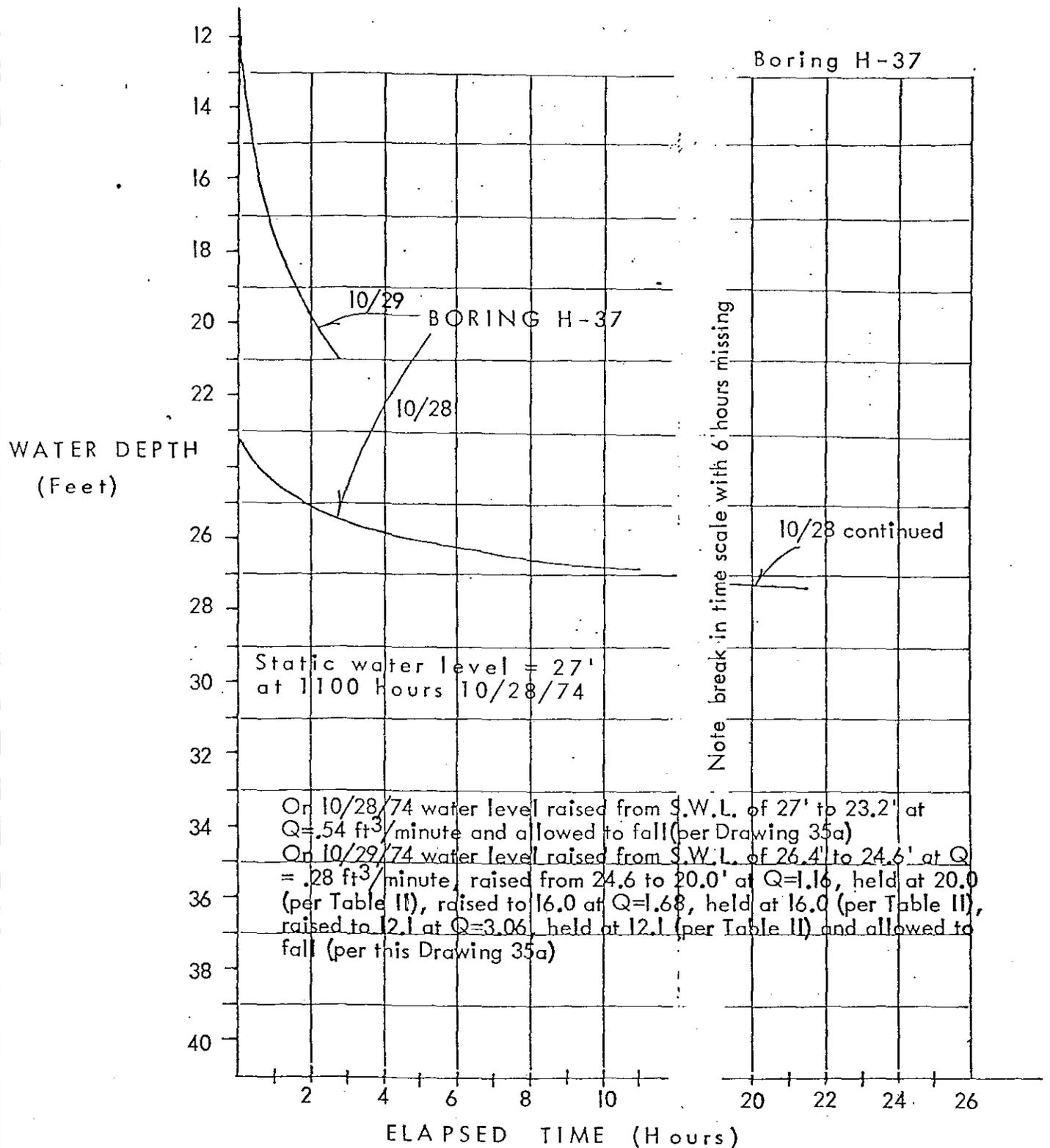
Field permeability tests were run using off-site water introduced into the boring to bring water levels to desired depth. Decay in elevation was measured with a Stevens Recorder.

BIG CANYON GROUND WATER STUDY
FOR JAMES M. MONTGOMERY, CONSULTING ENGINEERS

Drawn

34a

FALLING HEAD PERMEABILITY TESTS (Slug tests)



Field permeability tests were run using off-site water introduced into the boring to bring water levels to desired depth. Decay in elevation was measured with a Stevens Recorder.

BIG CANYON GROUND WATER STUDY
FOR JAMES M. MONTGOMERY, CONSULTING ENGINEERS

Drawn

35a

APPENDIX F

UNDERWATER INSPECTIONS
OF
RESERVOIR SURFACES

November 9, 1976

City of Newport Beach
City Hall
3300 Newport Boulevard
Newport Beach, California 92660

Attention: Mr. Benjamin B. Nolan
Assistant Public Works Director

Subject: Big Canyon Reservoir Ground Water Study-Phase III
Underwater Inspection (B-241)

Gentlemen:

In accordance with your authorization of July 27, 1976, we have conducted the subject underwater inspection of the lining and appurtenant facilities of Big Canyon Reservoir. The purpose of this inspection was to observe the reservoir performance under normal operating conditions. This letter report describes the results of the investigation.

The underwater inspection was performed, under our supervision, by Mr. Richard Easley on July 29 and July 30, 1976. A total of ten hours of bottom time was logged by Mr. Easley during the two days. Plate I, attached, shows the areas investigated.

Particular attention was given to the underwater inspection of the interior walls including toe of wall slopes, and the well point collector and disposal system along the east slope of the reservoir.

Visibility was poor because of large amounts of floating algae. A mat-like growth of algae covered the slopes and bottom of the reservoir up to 1/2-inch thick. Flat worms were found at several places clinging to the lining. The asphalt beneath the algae was rough and pitted and appeared to be dead in those areas where the flat worms were noted.

Because of the initial poor visibility conditions encountered, the following inspection procedure was utilized:

- (1) Clear away algae mat.
- (2) Leave area to allow sufficient time for suspended algae and sediment material to settle.
- (3) Return to previously cleared area to perform detailed inspection, looking for and noting any cracks or other physical features.
- (4) Apply fluorescein dye to check for leakage as evidenced by dye "take".
- (5) Photograph areas of special interest.

SUMMARY OF UNDERWATER INSPECTION

During the dives, a number of observations were made. The toe of the reservoir side walls and the bottom extending out from the toe, a distance of about ten feet, appear to be in good condition around the entire perimeter of the reservoir. Although extensive dye application was made, no take was observed.

The entire 48-inch inlet main, running from the west wall easterly past the center of the reservoir, appears to be in good condition. A small quantity of sand and sediment was found deposited in the mouth of the pipe. The 4-inch chlorinator line running along the inlet main appears to be in good condition, although the holding brackets appear to be from moderately to severely corroded.

Considerable attention was given to the east and south sidewalls of the reservoir. These areas have generally been suspected as being areas contributing to reservoir leakage. The asphalt patches of the 24-inch collector wells were individually inspected. They were visually checked for cracks and dye checked for leakage. No dye take was observed.

A large crack up to 3-1/2 inches wide and about 7 feet long was located about midway along the east wall between elevations 280 and 290. The crack is located at approximately the extension of the collector line up the east wall. There appeared to be a sandy material in the crack. No dye take was observed.

The concrete patch over the drain line for the collector wells was cleared of algae growth across the entire width of the reservoir. Visibility was very poor even after allowing several hours for suspended material to settle. No dye take was observed along any portion of the cover.

Along the south wall, between bench marks 2 and 4, many small cracks were observed. Some of these ranged up to 1/4-inch in width and up to about 30 feet in length. Most of the cracks appeared to have been filled with tar. Although extensive dye application was made, no dye take was observed.

The north wall was also systematically checked. Large areas of the algae mat were removed revealing a lace work of small cracks. For the most part, the cracks had been filled with tar. No dye take was observed in any of the areas.

Spot checks along the west wall of the reservoir and several additional passes along the reservoir bottom were made. Although many areas were dye checked, no take was observed.

CONCLUSIONS AND HYDROLOGIC IMPLICATIONS

Although the asphalt liner is weathered and cracked along many surfaces of the reservoir, no leakage was apparent, as evidenced by fluorescein dye take, at any location where the dye was applied. However, the hydrographs for piezometers measured April 5 and August 10, 1976, continue to indicate hydraulic connection and response to changes in the reservoir stage. As discussed in the draft report to the City "Big Canyon Reservoir Groundwater Study" dated December, 1975, the data suggests that the reservoir leakage, which approximates 15 gpm, may be attributed to one or more of the following conditions:

- (1) The leakage rate may be so small along any portion of a single crack, and the visibility so poor that dye take can not be observed.
- (2) Leakage may be occurring through cracks in the clay liner away from the cracks in the asphalt liner.
- (3) A more dispersed type of leakage may be occurring through the liner over large areas rather than through specific cracks.

Mr. Benjamin B. Nolan
City of Newport Beach

-5-

November 9, 1976

RECOMMENDATIONS

In consideration of the underwater conditions observed, the following actions are recommended:

- (1) During the next drawdown for cleaning, the reservoir walls and floor should be thoroughly cleaned of algae and other debris. High pressure hose water streams should be adequate for this operation.
- (2) Careful and detailed inspection of the asphalt liner should be made during the cleaning operation.
- (3) The large crack in the east wall, as well as any other open cracks found during cleaning should be repaired. It appears that all cracks observed during the underwater inspection can readily be repaired by hand labor with portable equipment.
- (4) Subsequent reservoir filling should be accompanied by detailed measurement of piezometer levels.

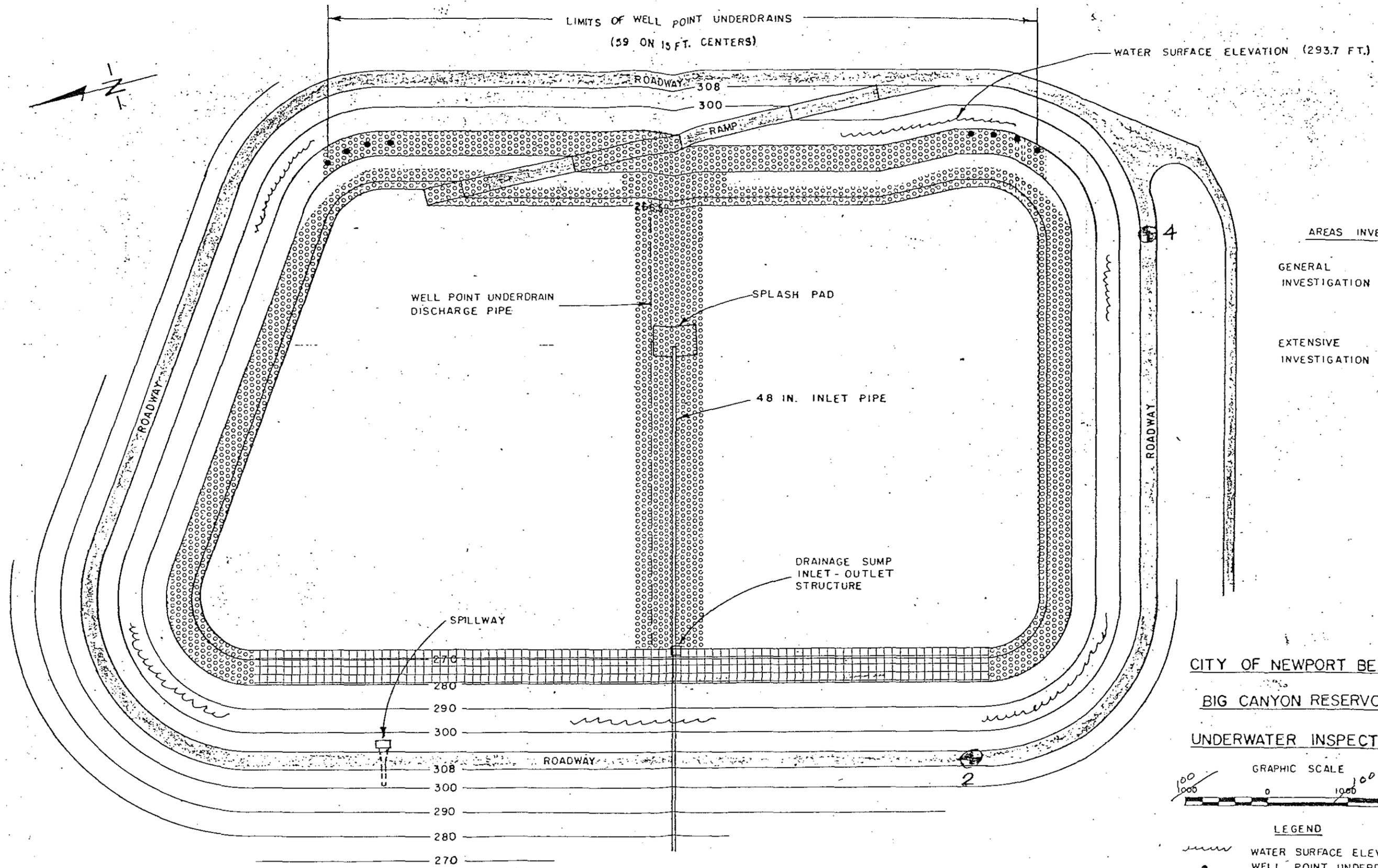
We are available to discuss this report at your convenience.

Respectfully submitted,

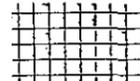
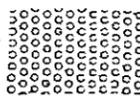


DuWayne R. Lidke

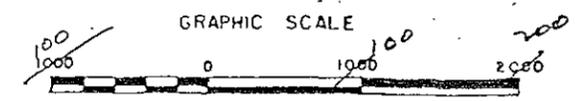
/da



AREAS INVESTIGATED

- GENERAL INVESTIGATION 
- EXTENSIVE INVESTIGATION 

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR
 UNDERWATER INSPECTION



LEGEND

-  WATER SURFACE ELEVATION
-  WELL POINT UNDERDRAIN
-  WELL POINT COLLECTOR

JULY 29-30, 1976

May 27, 1977

City of Newport Beach
City Hall
3300 Newport Boulevard
Newport Beach, California 92660

Attention: Mr. Benjamin B. Nolan
Assistant Public Works Director

Subject: Big Canyon Reservoir Ground Water Study-
Phase III Underwater Inspection (B-241)

Gentlemen:

In accordance with your authorization, by amended agreement of March 4, 1977, for the subject engineering services, we have conducted the underwater investigation of the lining of Big Canyon Reservoir.

The underwater inspection was performed April 13, 1977, under our supervision by Dive Masters Enterprises of Santa Ana, California. A total of approximately 9 man-hours of bottom time was spent by two divers. One diver was employed for 6 man-hours of investigative underwater time. The other, a diver-photographer, was utilized for 3 man-hours underwater.

Plate I, attached, shows the areas investigated. These areas were selected for intensive investigation as a result of visual observation of these areas during draining and cleaning operations of November-December, 1976. It was determined to be desirable to observe and obtain additional information on these areas, subsequent to refilling of reservoir, with the reservoir operating under normal conditions.

Mr. Benjamin B. Nolan
City of Newport Beach

-2-

May 27, 1977

General investigative procedures to be followed were outlined to the divers by Mr. Daniel Haggerty of James M. Montgomery, Consulting Engineers, Inc. and included the following:

1. The areas to be investigated and the location of the anchorage of the operating craft were to be selected by Mr. Haggerty. The city's 14-foot boat was utilized along with Dive Master Enterprise's 14-foot swamp craft.
2. The divers were instructed to observe physical features of the lining, looking for cracks, both old and recently repaired, patches, sink holes, dished or subsided areas, or any unusual lining areas for possible leakage.
3. When any suspect area is encountered, apply fluorescein dye to check for leakage as evidenced by dye "take".
4. Photograph areas of special interest.
5. Downstream underdrain discharges to be observed intermittently by City of Newport Beach personnel employed at reservoir for evidence of dye being discharged in underdrain system.

The following is a summary of the results of the underwater investigation of the reservoir lining.

I SUMMARY OF UNDERWATER INSPECTION

A. GENERAL

The underwater inspection commenced at the north area of the reservoir midway between reference points 7 and 8 located along the north wall as shown on City of Newport Beach drawing W-5057-S Big Canyon Reservoir Horizontal and Vertical Control Sheet. City reference points are similarly shown on Plate I. The water surface elevation was 293.8 feet at 7:30 A. M.

B. NORTH AREA

Visibility was reported by diver here to be excellent, estimated at approximately 10 feet. The inspection was concentrated on the lining from the toe of the slope of the north wall outward, encompassing an area of approximately 200 feet along the wall out to 100 feet from the toe. Extensive dye application was made but no take was observed. It was in this area out from the toe that the diver reported one eighth to one quarter of an inch of algae and sediment on the bottom of the reservoir. Diver stated it did not delay his inspection since it did not require time for algae and sediment to clear for dye application. A total underwater investigation time of 50 minutes was spent in this north area without any evidence of any dye take or leakage. Diver reported that there were no areas of any special interest which required photography.

C. NORTHEAST AREA

The craft was then moved to the northeast area of the reservoir. Both divers were employed to inspect this area. The area as indicated on Plate I extended out approximately 100 feet from the toe in an area from the end of the access ramp along the east wall to approximately 100 feet west of reference point 7.

Mr. Benjamin B. Nolan
City of Newport Beach

-4-

May 27, 1977

Two suspected areas were investigated thoroughly and dye-tested in the northeast area. Photograph was taken at Area #1, located 20 feet off the toe 50 feet westerly of reference point 7. Area #2 is described as "heaped up" on east side and 35-50 feet long with approximately 1 inch of subsidence discernible. The area runs parallel to, and 20 feet off the east toe along bottom of reservoir approximately midway between reference points 6 and 7. This irregular surface varies from a width of 6 to 18 inches. Dye was applied here with no take. Approximately 1 hour underwater time was spent here with two divers employed extensively throughout the northeast area. Photographs 2 through 4 were taken here. Also one polaroid picture of suspect area #2 was taken. The quality of the polaroid photo was poor due to malfunction in camera operation.

D. EAST AREA

Craft was moved to a new location along east reservoir wall approximately 275 feet north of access ramp gate and approximately 50 feet out from toe of slope. One diver was employed in this area. Commencing at a point 150 feet south of reference point 6, diver investigated the toe and to 50 feet out from toe working southerly. Some areas of both old and new lining patching were dye-tested with negative results.

Approximately 45 minutes of underwater investigation time was spent along east wall and reservoir bottom from the northeast area to north of access ramp gate.

Moved craft to point opposite launch point of access ramp at water surface (150 feet north of ramp gate). One diver working this area. Several patches were checked with dye, with no take. Extensive inspection made at toe and

out 50 feet from toe, working southerly to craft to provide full coverage along east wall and reservoir bottom. No areas of special interest were encountered here that warranted photography. One half hour underwater time was spent in this area.

The craft was then moved to the vicinity of access ramp gate. One diver investigating the east wall and reservoir bottom in this area. Attempt was made to locate two predetermined suspect seepage areas north of the access ramp gate approximately 3 feet in elevation above toe. The diver did not locate the two suspected seepage areas described in JMM's letter of January 3, 1977, as "50 to 75 feet north of the ramp entrance (in north-south orientation) and approximately 3 feet above the reservoir floor." Several areas described as "soft areas" on the slope in this vicinity were checked for dye take. Negative results were observed.

E. SOUTHEAST AREA

The southeast area of the reservoir was investigated extensively out to 100 feet from the east toe. This area was observed during reservoir dewatering operation in November-December 1976, as area where "seepage through the bottom of the lines was indicated by shallow ponds in the southeast corner of the reservoir." Both divers inspected this area. Visibility had decreased to 5-6 feet. Several patches were checked with dye with no take. One patch approximately 4 square feet located just off south toe near reference point 4, was tested with negative results. Diver reported this area bottom consistent with remainder of reservoir bottom with combination of algae and silt sediment. Full coverage of the southeast area in a zigzag pattern was completed. Some photos were taken in suspect areas but all dye tests were negative.

F. SOUTH AREA.

One diver worked the south wall and floor from the toe out to 50 feet making a zigzag pattern between the previously investigated southeast area working westerly to the southwest area. Diver described a raised up area east of reference point 3, 25 feet out from toe. Several dye checks taken on patches and repaired cracks in this general vicinity, however, no dye takes along south area of reservoir were observed.

G. SOUTHWEST AREA

Both divers inspected the southwest area. Divers performed extensive inspection coverage here, with several photographs taken. No dye takes were observed. Diver reported rust color to asphalt lining in this area. No patches, sink holes, or other unusual physical features were observed. An oily film covers bottom and appears mixed with algae. May be oil film from bitumastic sealer material, mixed with algae.

Completed underwater investigation after 45 minutes of underwater inspection in the southwest area between approximately 100 feet east of reference point 3 and 100 feet north of reference point 2.

H. FOLLOW-UP

Checked with City of Newport Beach personnel, Ron McClure in A. M. of April 14, 1977. He reported no dye observed at drain discharge outlets during day of April 13, 1977. He further advised in P. M., April 14, no dye observed at both discharge outlets of underdrain system during day.

II CONCLUSIONS

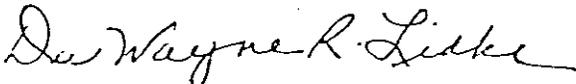
1. Within the areas investigated, intensive dye checks of all cracks, patches, and other suspect areas proved negative.
2. Algae is becoming a problem again.
3. The amount of underwater inspection time and the extensive areas covered, indicate that if there is any leakage it is in such small quantities that it is insignificant.
4. The conclusions drawn in our report of November 9, 1976 remain valid.

III RECOMMENDATIONS

1. Algae removal operation should be undertaken (John Macdonald, City of Newport Beach personnel, confirms that is to be done shortly). Copper sulfate will be used for algae control.
2. Perform underwater inspection at regularly scheduled intervals of about two-years following scheduled biennial draining and cleaning operation.
3. Should leakage rate increase significantly, underwater investigation should be undertaken to determine if lining problems are responsible.
4. Measurements of piezometer levels should continue.

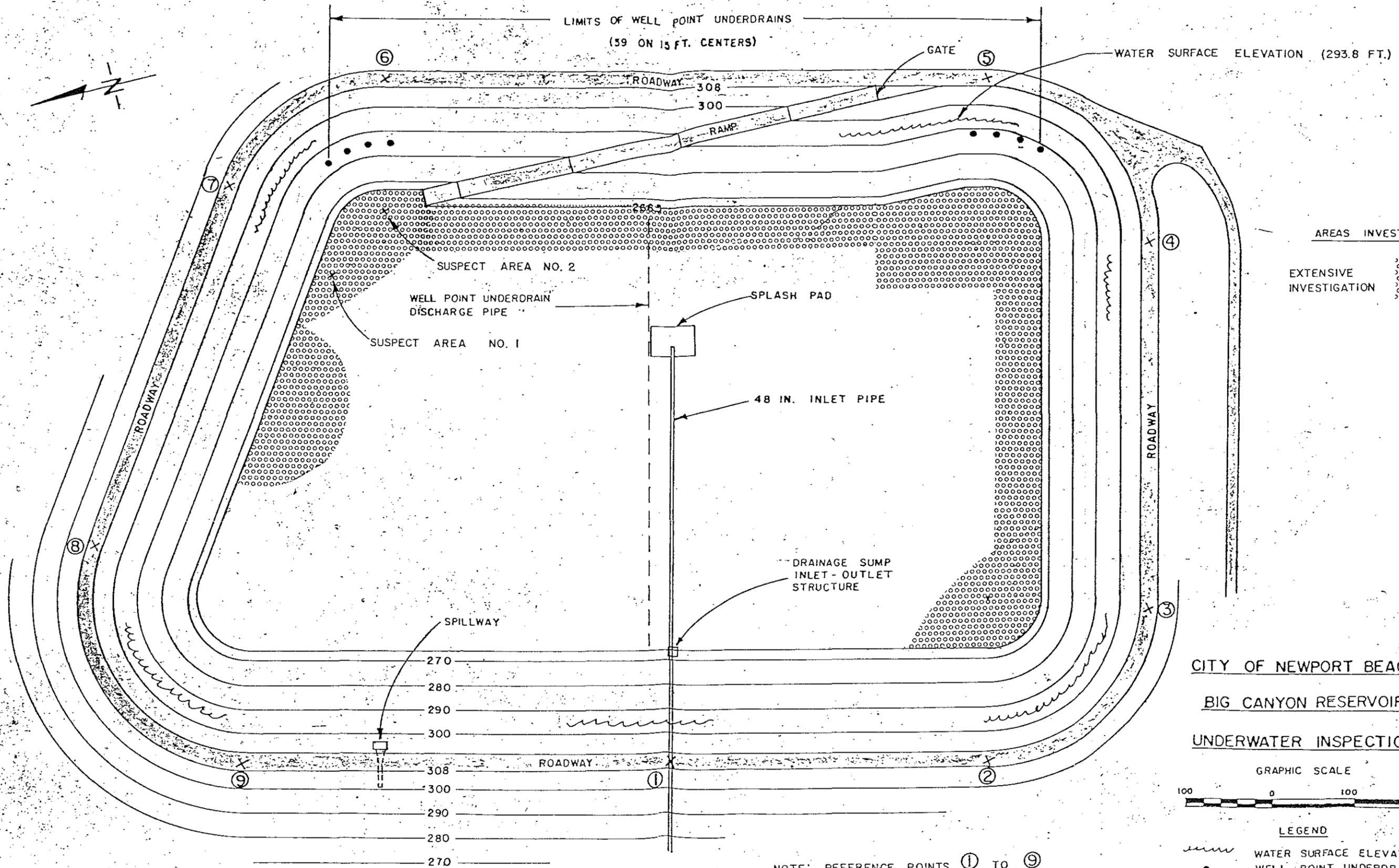
We are available to discuss this report at your convenience.

Respectfully submitted,



DuWayne R. Lidke
Vice President

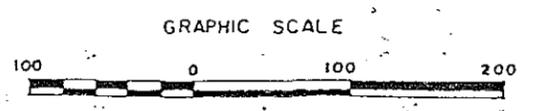
DJH/DRL/da



AREAS INVESTIGATED

EXTENSIVE INVESTIGATION	
-------------------------	--

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR
 UNDERWATER INSPECTION



LEGEND

	WATER SURFACE ELEVATION
	WELL POINT UNDERDRAIN
	WELL POINT COLLECTOR

NOTE: REFERENCE POINTS ① TO ⑨
 ARE FROM CITY DWG. W-5057-5,
 BIG CANYON RESERVOIR.

APRIL 13, 1977

APPENDIX G

LOCATIONS AND REFERENCE POINT
ELEVATIONS OF THE NEW BROADMOOR
TRACT PIEZOMETERS H-50 THROUGH
H-56; WATER LEVEL MEASUREMENTS

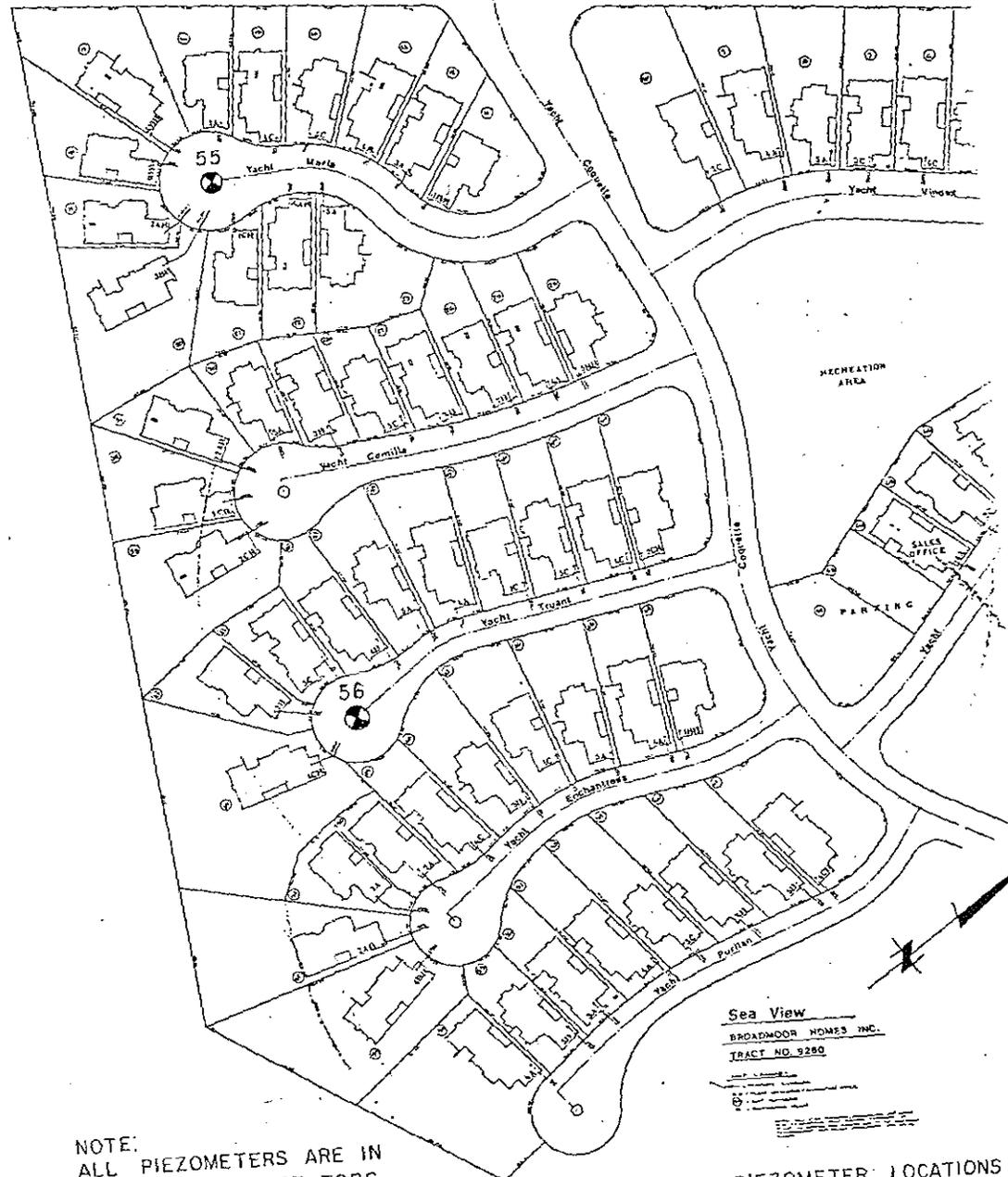
APPENDIX G

GROUND WATER LEVELS
BROADMOOR TRACT PIEZOMETERS

Piezometer No.	Elevation Reference Point (Ft)	Elevation Ref. Point to Water Depth (Ft)	Elevation Water Surface (Ft)
50	270.24	29.94	240.30
51	270.45	22.14	248.31
52	271.24	16.18	255.06
53	272.27	18.13	254.14
54	*274.41	17.33	257.08
55	285.68	16.56	269.12
56	332.63	37.47	295.16

* High point of broken piezometer pipe where reading was taken.

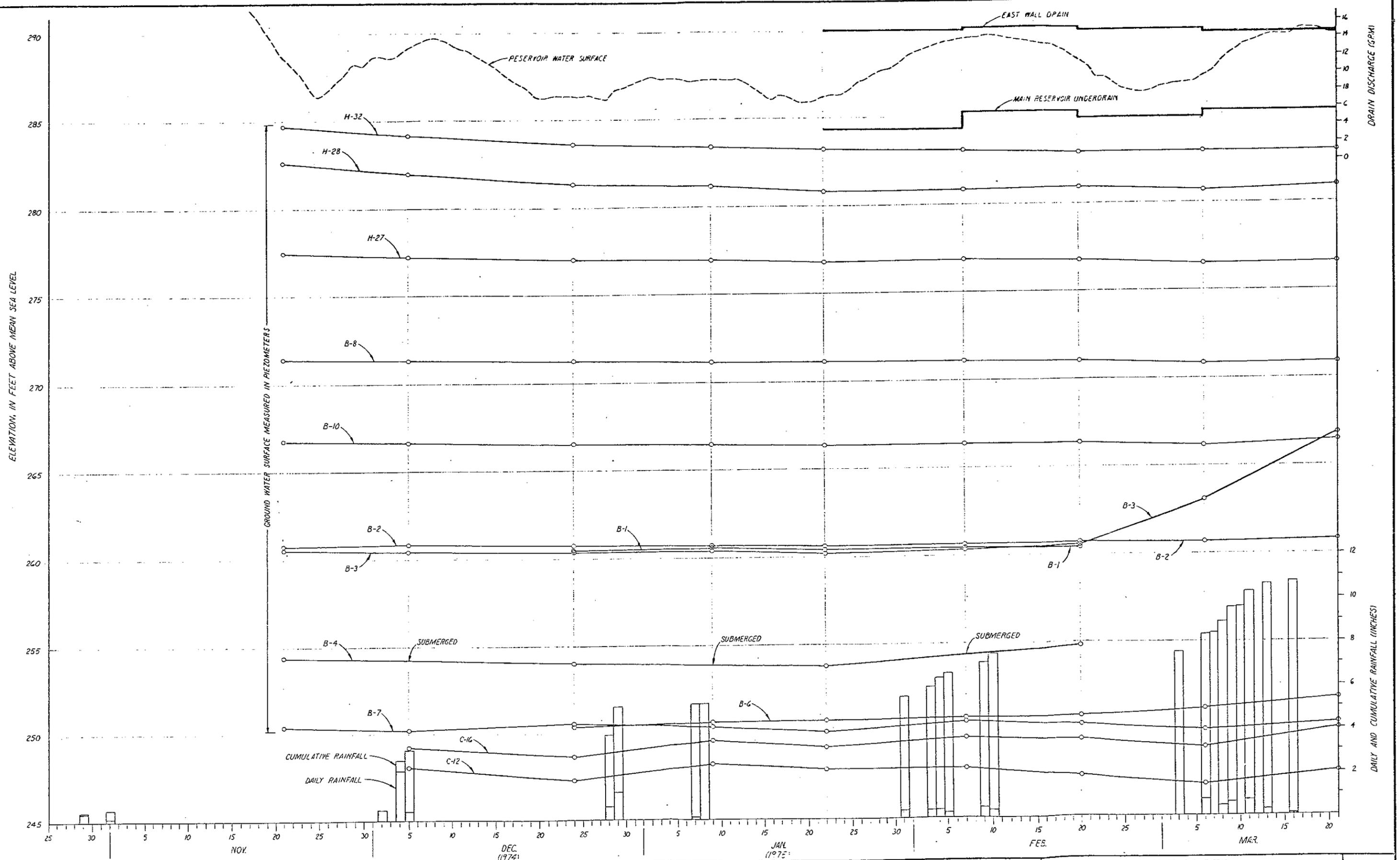
50 51 52 53 54
MacArthur Boulevard



NOTE:
ALL PIEZOMETERS ARE IN
VAULTS WITH CAST TOPS
MARKED WATER.

Sea View
BROADMOOR HOMES INC.
TRACT NO. 9280

PIEZOMETER LOCATIONS
BROADMOOR TRACT.



REV	DATE	BY	DESCRIPTION

SCALE:
AS SHOWN

DESIGNED *RWP*
DRAWN *CH*
CHECKED *K.H.N.*

SUBMITTED
PROJECT ENGINEER R.C.E. NO. DATE
RECOMMENDED
JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC. R.C.E. NO. DATE

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
17802 SKY PARK CIRCLE SUITE 201, IRVINE, CALIFORNIA 92707
PASADENA ROSE PORT LAUREL PALM BEACH LA JOLLA LAS VEGAS OAKLAND MILITARY GREEN

APPROVED _____ DATE _____
APPROVED _____ DATE _____

CITY OF NEWPORT BEACH
BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
1/25/74 - 3/20/75

PLATE
1B

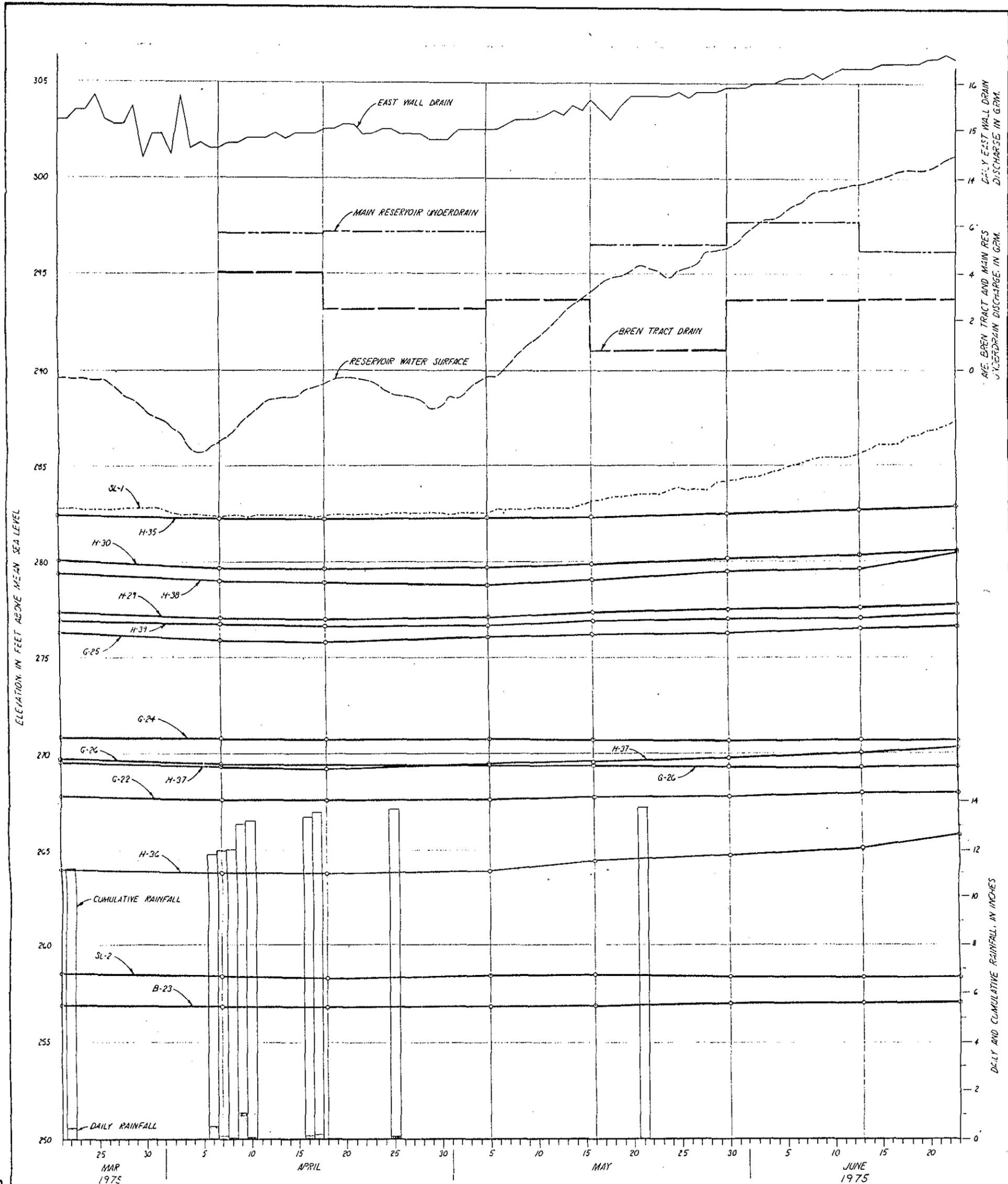


PLATE 2A

SCALE:
AS SHOWN

DESIGNED _____
DRAWN _____
CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
17802 SKY PARK CIRCLE SUITE 201, IRVINE, CALIFORNIA 92707
PASADENA BOISE FORT LAUDERDALE IRVINE LA JOLLA LAS VEGAS UPLAND WALNUT CREEK



CITY OF NEWPORT BEACH
BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
3/21/75 - 6/23/75

PLATE
2A

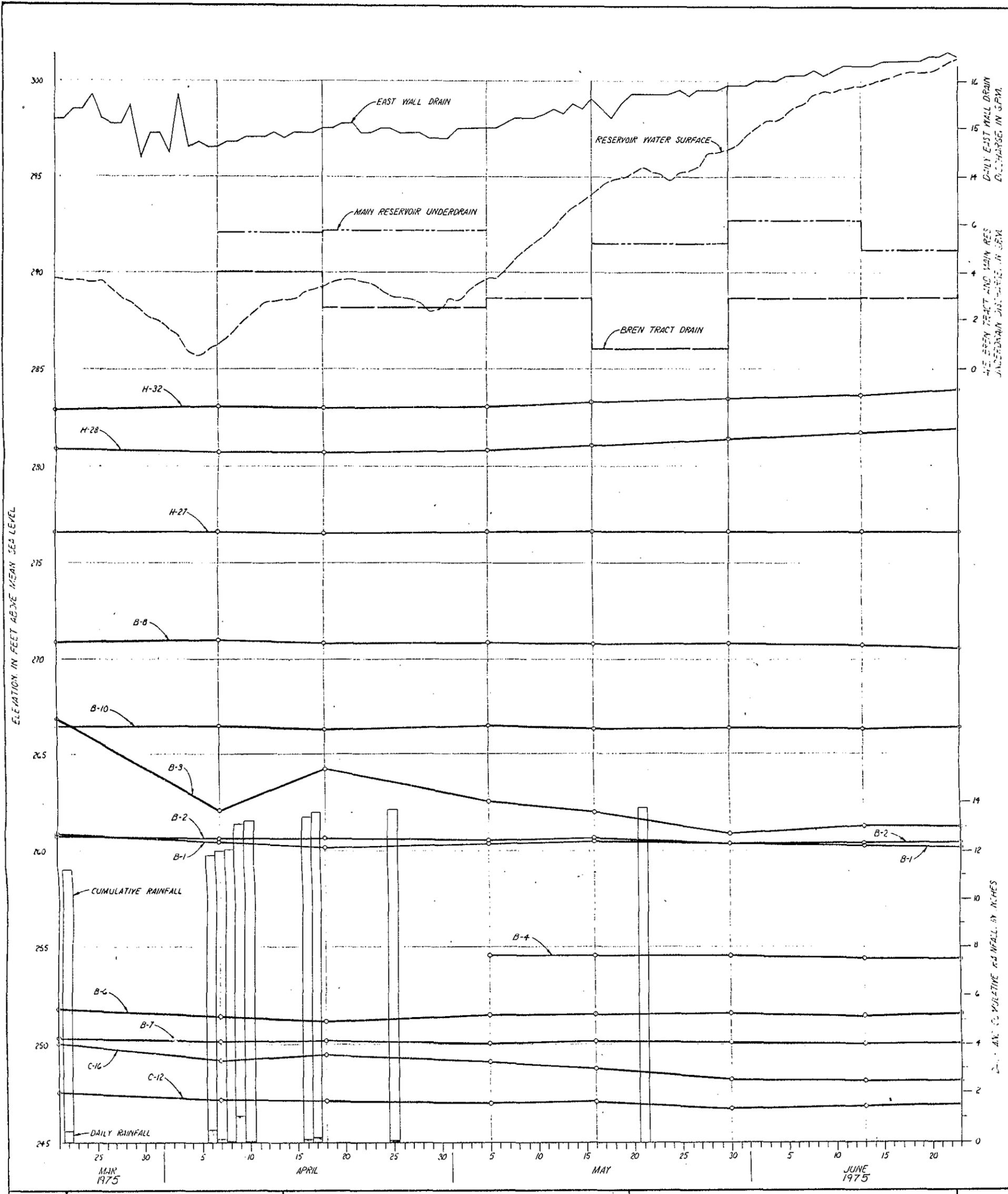


PLATE 2B

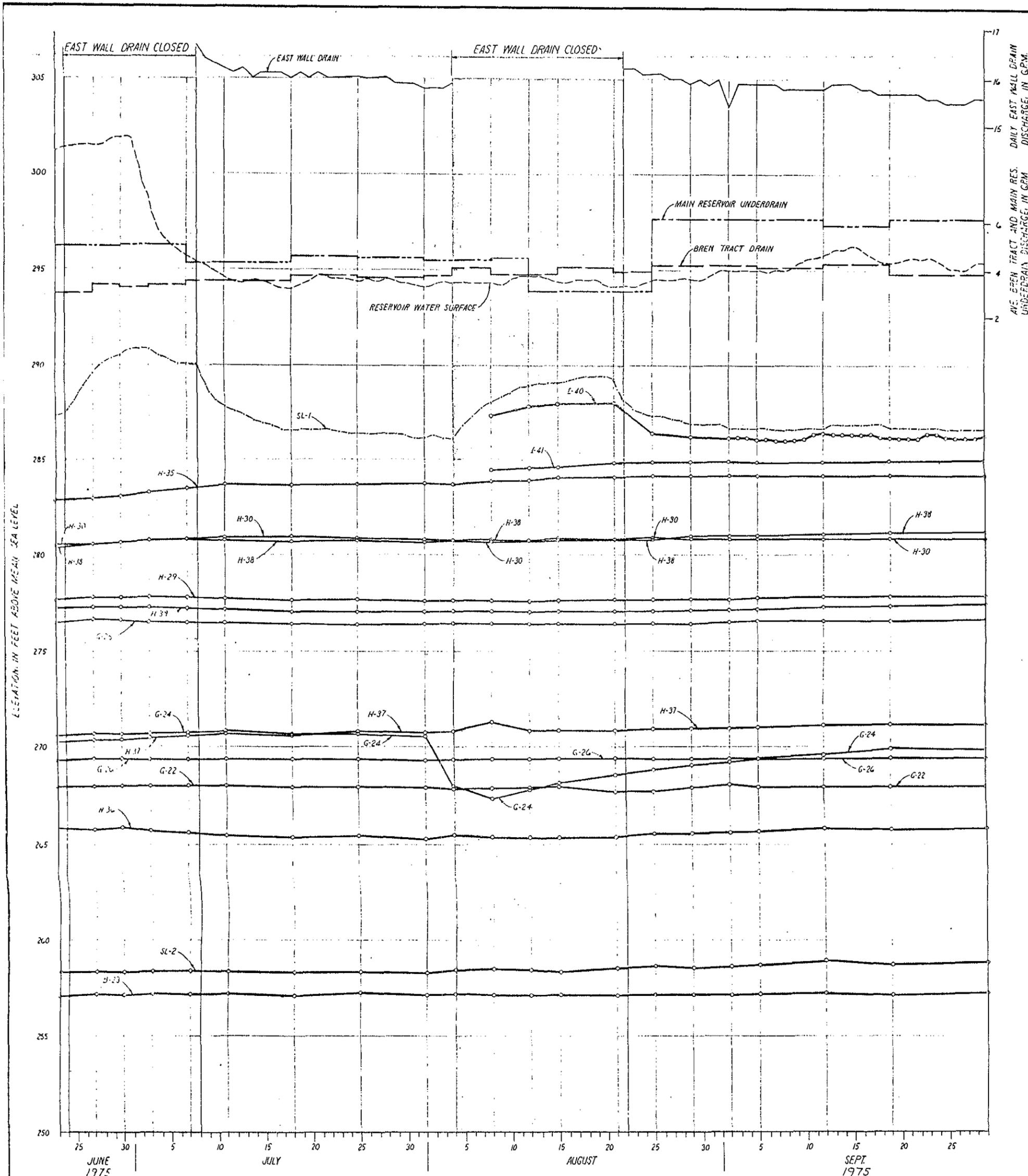
SCALE	DESIGNED _____
AS SHOWN	DRAWN _____
	CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
 17802 SKY PARK CIRCLE SUITE 201, IRVINE, CALIFORNIA 92707
 PASADENA BOISE FORT LAUDERDALE IRVINE LA JOLLA LAS VEGAS OPLAND WALNUT CREEK



CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 3/21/75 - 6/23/75

PLATE
2B



SCALE:
AS SHOWN

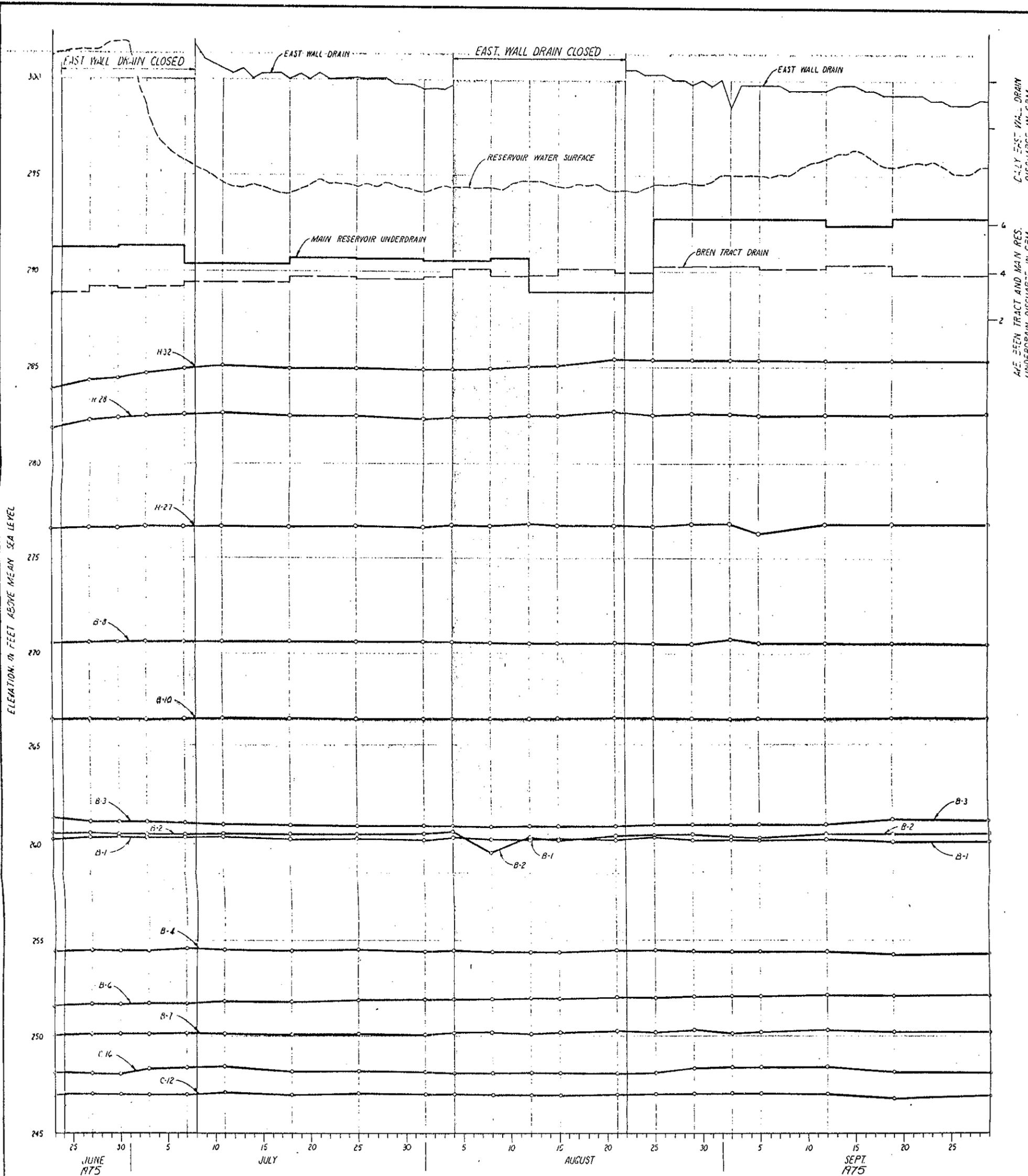
DESIGNED _____
DRAWN _____
CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
17802 SKY PARK CIRCLE SUITE 201, IRVINE, CALIFORNIA 92707
PASADENA BOISE FORT LAUDERDALE IRVINE LA JOLLA LAS VEGAS UPLAND WALNUT CREEK



CITY OF NEWPORT BEACH
BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS & DRAIN OUTFLOW
6/23/75 - 9/29/75

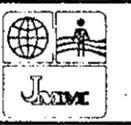
PLATE
3A



ALL EAST WALL DRAIN
 DISCHARGE IN GPM
 ARE BREN TRACT AND MAIN RES.
 UNDERDRAIN DISCHARGE IN GPM

SCALE: _____
 AS SHOWN
 DESIGNED _____
 DRAWN _____
 CHECKED _____

**JAMES M. MONTGOMERY
 CONSULTING ENGINEERS, INC.**
 17802 SKY PARK CIRCLE SUITE 201, IRVINE, CALIFORNIA 92707
 PASADENA BOSTON FORT LAUDERDALE IRVINE LA JOLLA LAS VEGAS UPLAND WALNUT CREEK



CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS & DRAIN OUTFLOW
 6/23/75 - 9/29/75

PLATE
3B

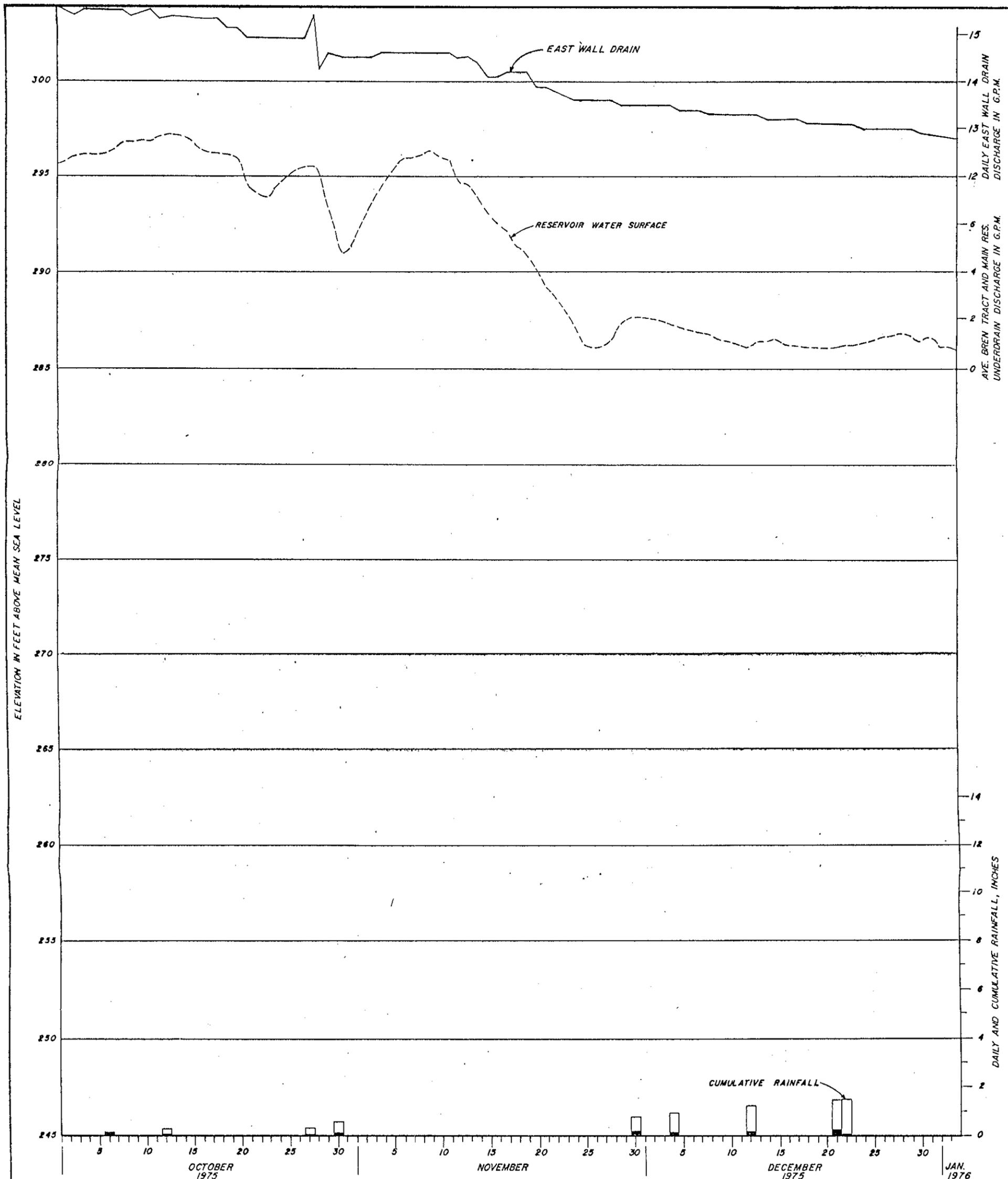


PLATE 4

SCALE:
AS SHOWN

DESIGNED _____
DRAWN _____
CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
17802 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714



CITY OF NEWPORT BEACH
BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
10/1/75 - 1/3/76

PLATE 4

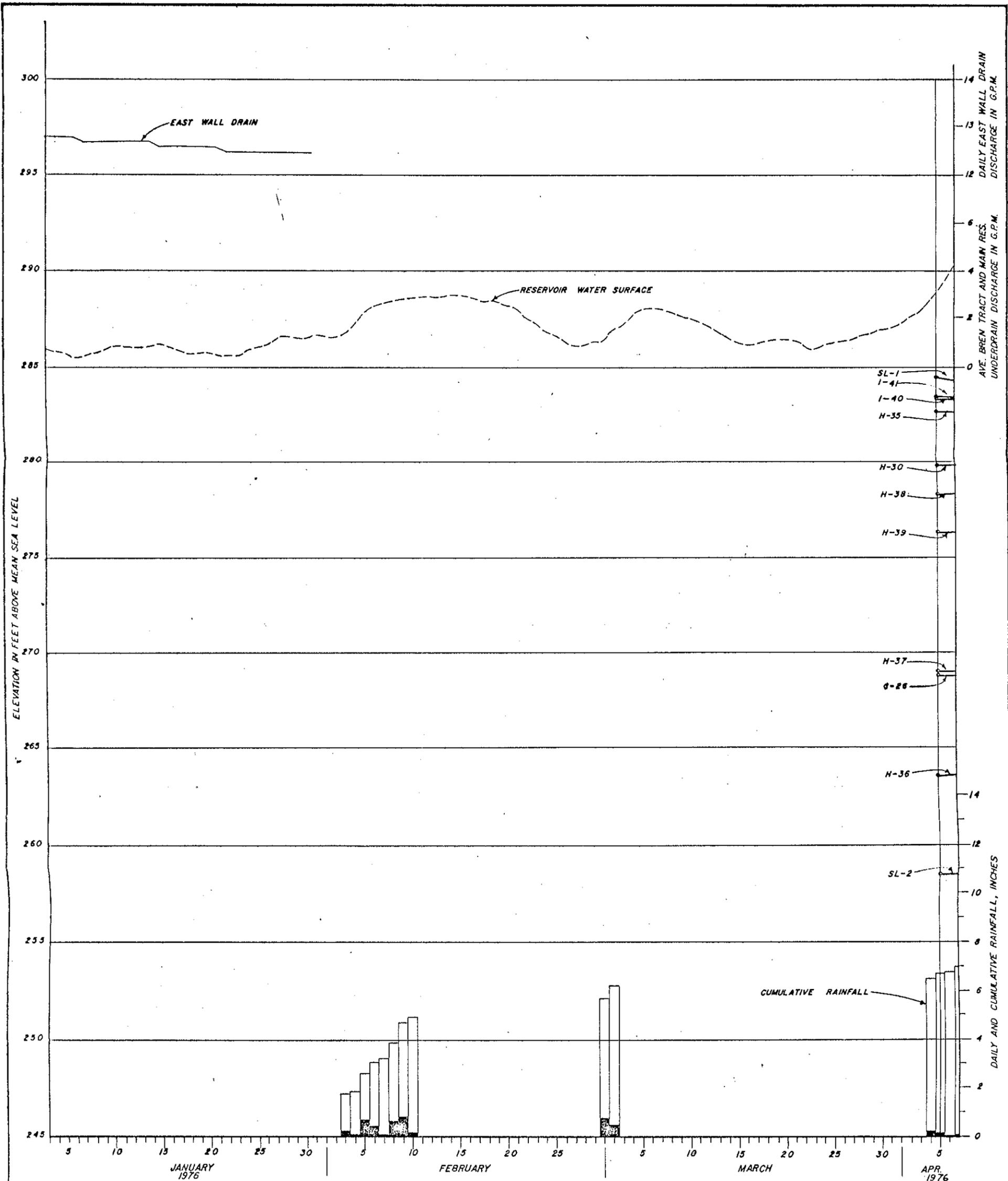


PLATE 5

SCALE: AS SHOWN
 DESIGNED _____
 DRAWN _____
 CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
 17807 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714



CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
 FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 1/3/76 - 4/7/76

PLATE 5

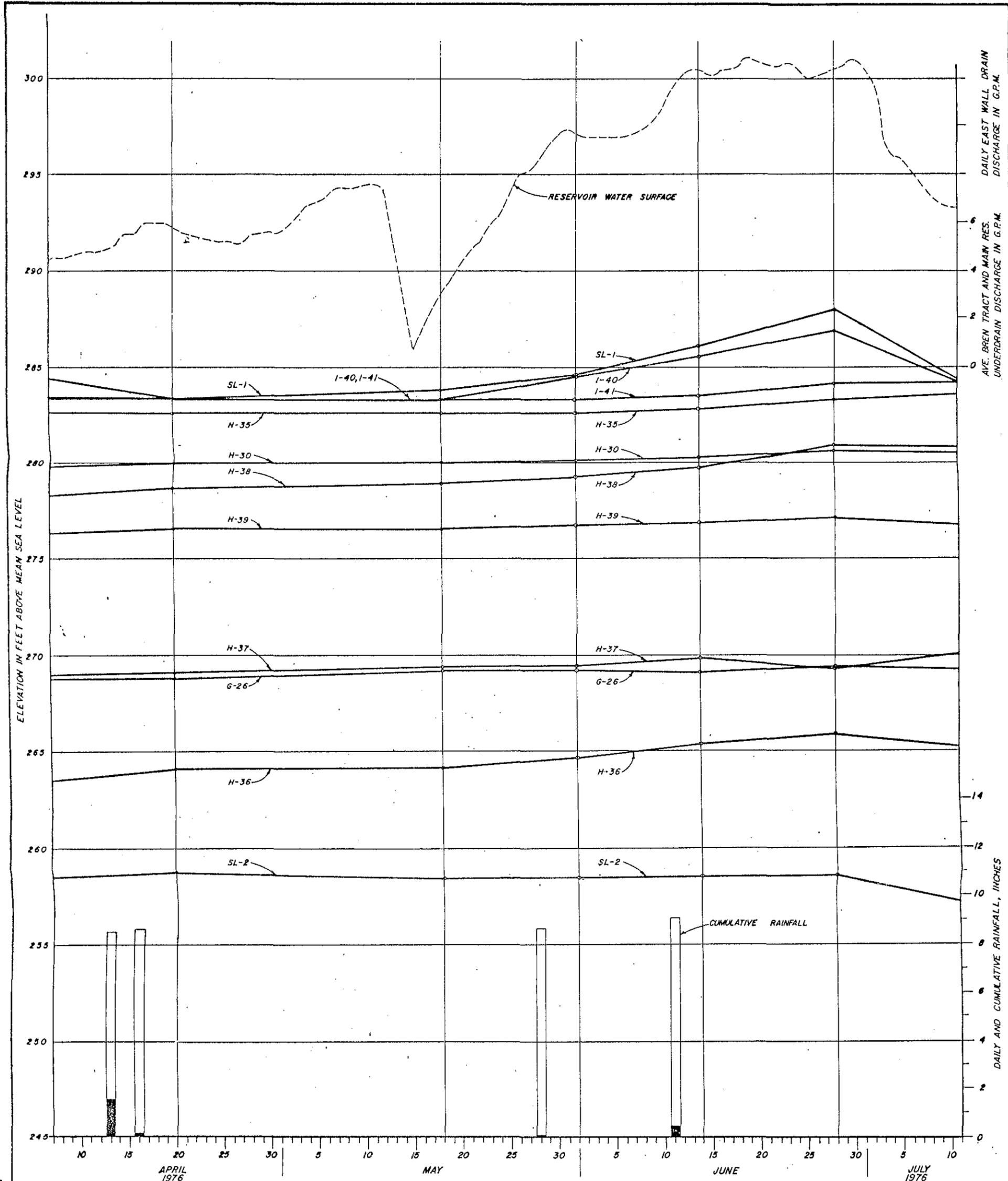


PLATE 6

SCALE:	DESIGNED _____
AS SHOWN	DRAWN _____
	CHECKED _____

JAMES M. MONTGOMERY
CONSULTING ENGINEERS, INC.
17802 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 4/7/76 - 7/11/76

PLATE
6

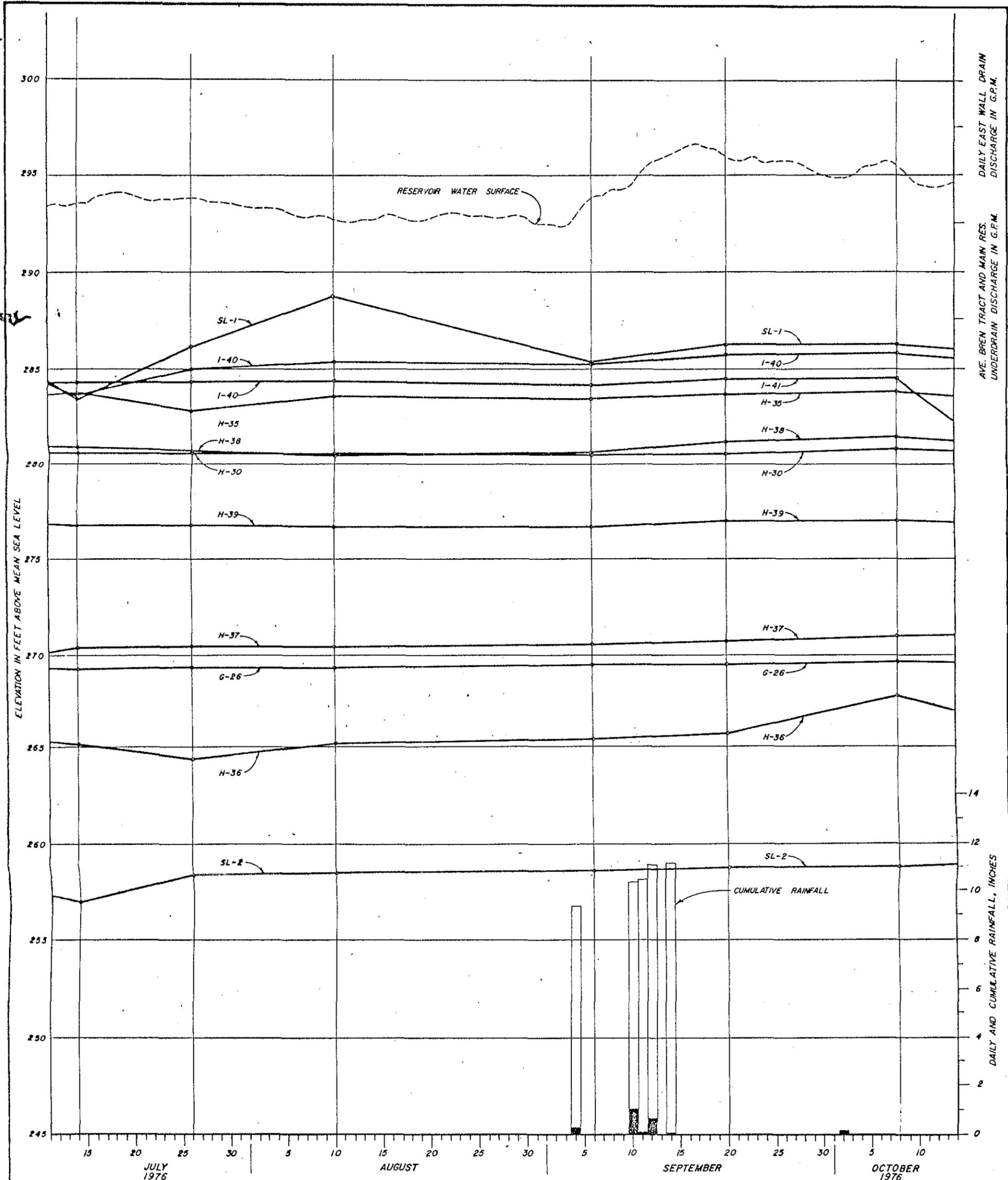


PLATE 7

SCALE	DESIGNED _____
AS SHOWN	DRAWN _____
	CHECKED _____

JAMES M. MONTGOMERY
CONSULTING ENGINEERS, INC.
17807 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 7/11/76 - 10/14/76

PLATE
7

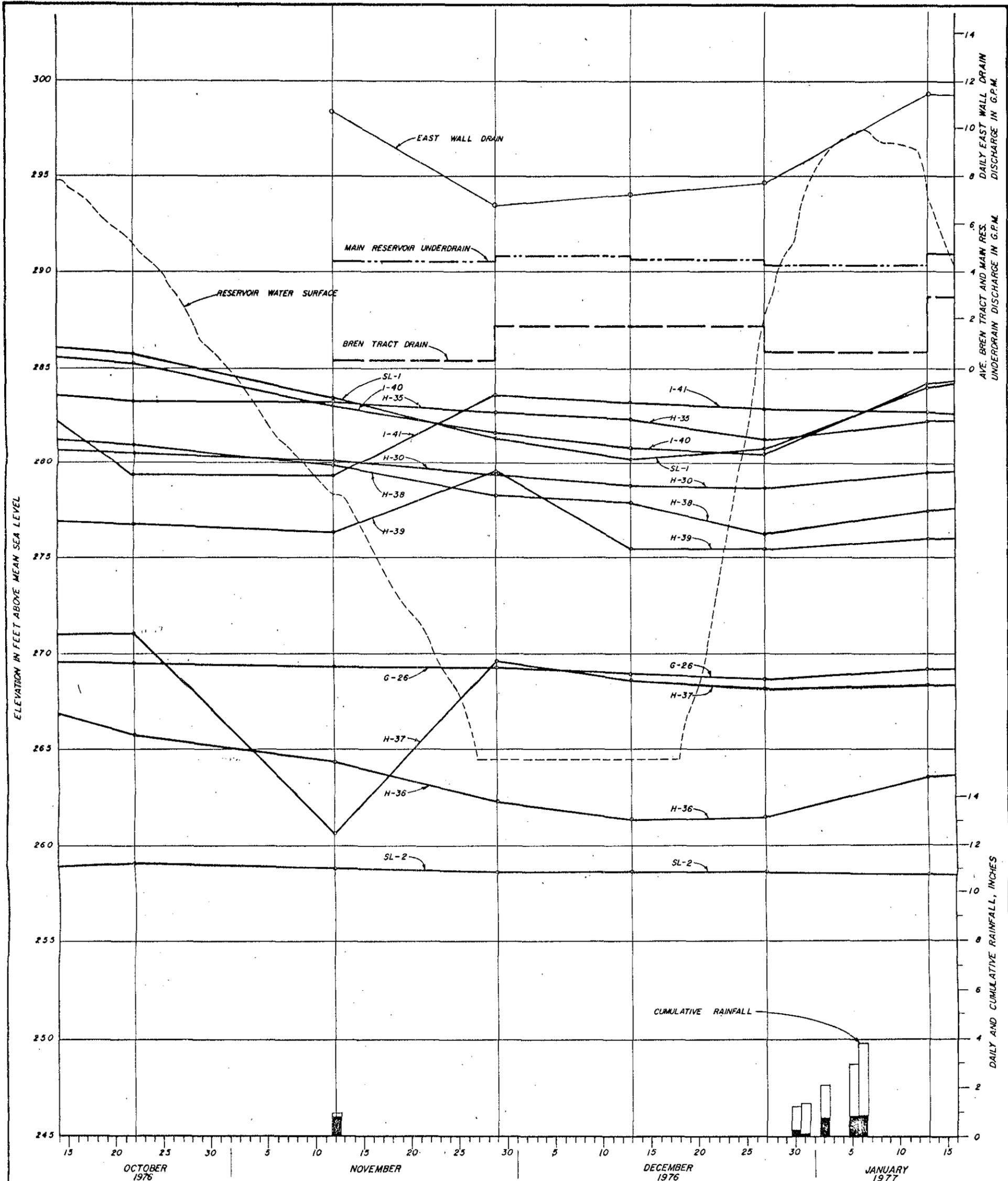


PLATE 8

SCALE: AS SHOWN

DESIGNED _____

DRAWN _____

CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.

17807 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714

CITY OF NEWPORT BEACH

BIG CANYON RESERVOIR GROUND WATER STUDY

FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW

10/14/76 - 1/16/77

PLATE 8

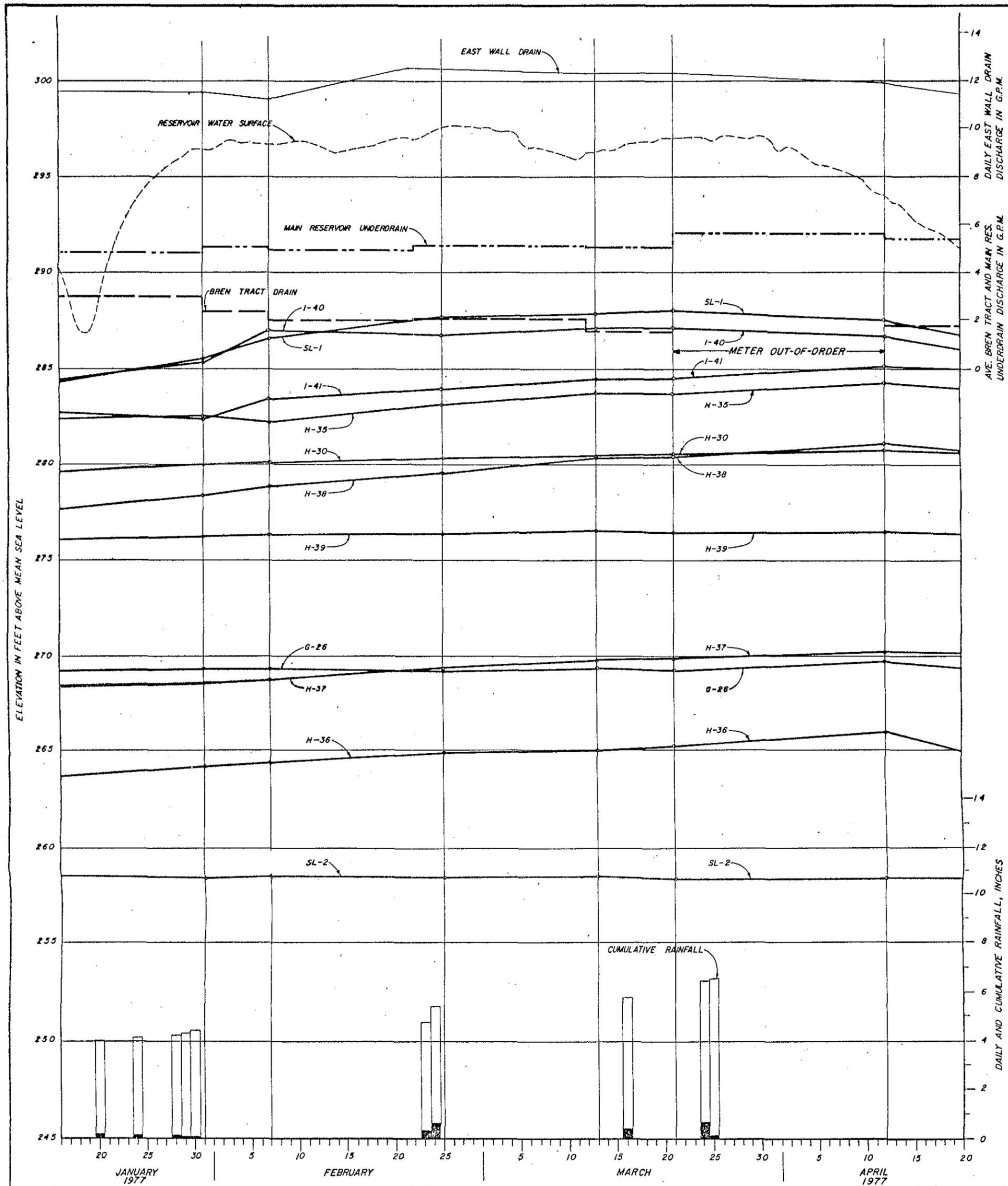


PLATE 9

SCALE: AS SHOWN
 DESIGNED _____
 DRAWN _____
 CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
 17802 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
 FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 1/16/77 - 4/20/77

PLATE 9

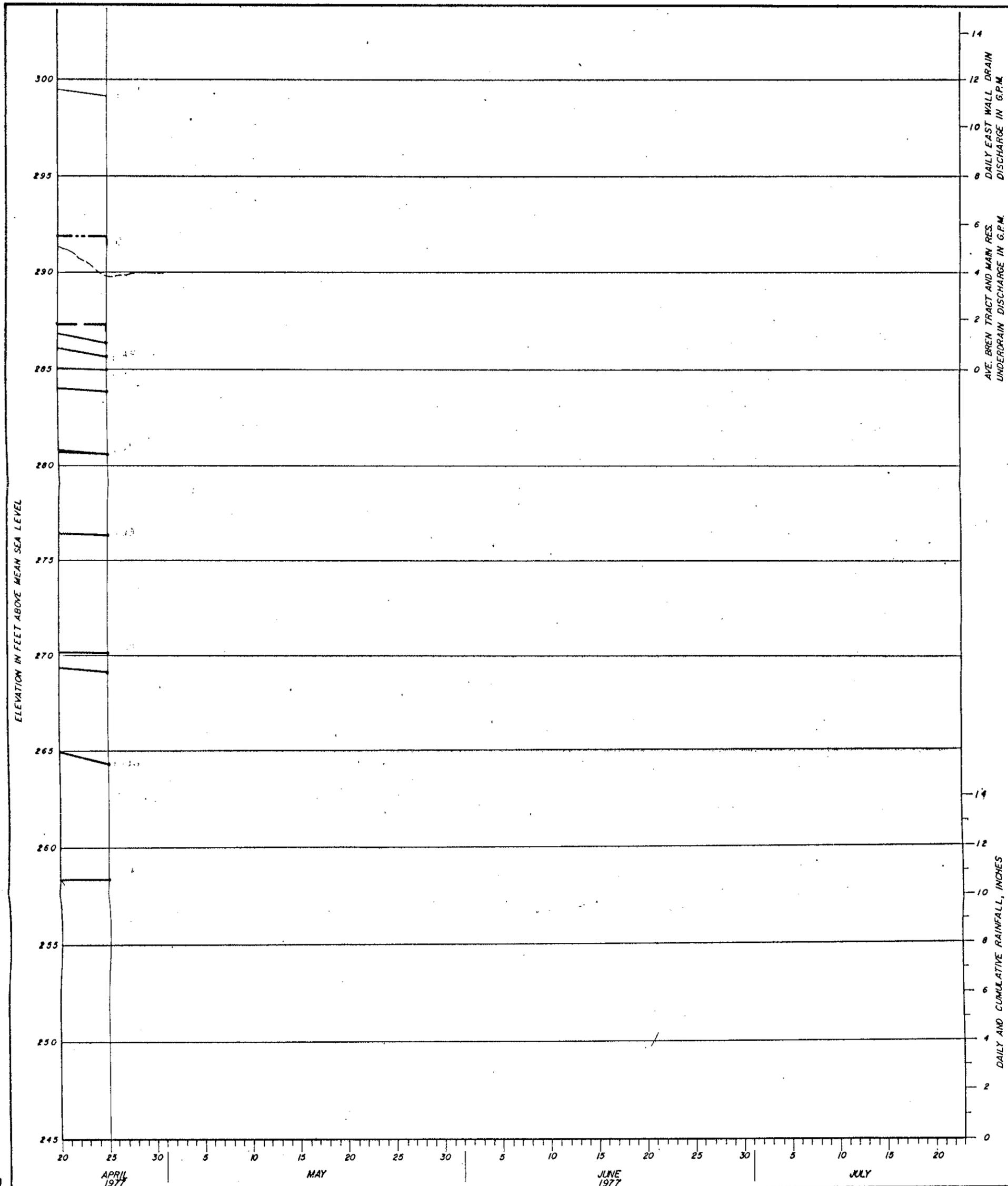


PLATE 10

SCALE AS SHOWN
 DESIGNED _____
 DRAWN _____
 CHECKED _____

JAMES M. MONTGOMERY CONSULTING ENGINEERS, INC.
 17602 SKY PARK CIRCLE, IRVINE, CALIFORNIA 92714

CITY OF NEWPORT BEACH
 BIG CANYON RESERVOIR GROUND WATER STUDY
FLUCTUATION OF WATER LEVELS, RAINFALL & DRAIN OUTFLOW
 4/20/77 - 4/30/77

PLATE 10