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EFFECT OF URBAN STORMWATER RUNOFF TO A MAN-MADE LAKE ON GROUNDWATER QUALITY

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by

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Appreciation is extended to the property owners who allowed data collection on the land surrounding Loch Lomond. Fred Davis and Anthony Federico of SFWMD's Water Chemistry Division and Leslie Wedderburn of the SFWMD's Groundwater Division contributed helpful comments during the review of this paper. This report was prepared under the supervision of Abe Kreitman, Director, Groundwater Division, Resource Planning Department, South Florida Water Management District.

INTRODUCTION

Much of south Florida is dependent upon groundwater from shallow aquifers for domestic, agricultural, and industrial water supplies. These aquifers have high transmissivities and are generally prolific sources. It is therefore obvious that activities of man which have the potential for altering the natural hydrologic regime, or of affecting the quality of water obtainable from these aquifers, should be carefully monitored.

Urbanization is one such activity which, among other things, may reduce recharge to the aquifer and cause groundwater pollution through the recharge of urban polluted storm water runoff. It is felt, therefore, that this study will provide useful insight into the impact of one of the common practices associated with urbanization in this area - the use of excavated rockpit lakes for storm water disposal.

A similar study of somewhat broader scope was recently completed and submitted (March 1979) to the Big Cypress Basin Board (BCBB) of the South Florida Water Management District. This study considered four (4) types of lakes: (1) a natural lake in a rural setting, (2) an excavation in a rural setting, (3) a lake in an urban setting, and (4) a dormant rock pit. The objectives of this BCBB study were to document water quantity (in inflow-outflow terms), water quality, ecologic considerations and socio-economic conditions.

Both the BCBB study and the current investigation were designed to provide documentation on the effects and impacts of rockpit lakes on the surrounding areas and the impact of man's activities on such lakes. While generally similar in objective, the two studies were carried out in hydrogeologically distinct areas.

The results of these and subsequent follow-up studies are expected to assist local and regional interests in developing guidelines concerned with their construction and use.

PURPOSE AND SCOPE

The primary purpose of this reconnaissance study is to obtain a preliminary understanding of the impact of a rockpit lake, which has no surface water outlet and into which urban runoff is discharged, on the quality of the surrounding groundwater. A corrollary purpose is to gain a further understanding of the pattern of water flow between the lake and Biscayne water table aquifer.

This study was motivated by the continuing proliferation of urban developments in Dade and Broward Counties, of which rockpit lakes form an integral part. These lakes serve several functions. First, they are a source of fill for the surrounding urban developments (homesites). Second, they receive the storm runoff which drains from nearby roads, roofs, parking lots, lawns, and other surfaces. Third, they are a potential source of increased groundwater recharge, counterbalancing the loss of recharge due to increased surface water runoff resulting from urbanization and the creation of impervious surfaces. Fourth, if properly designed, they may serve as local scenic and recreational amenities. Thus, rockpit lakes can reduce development costs and have the potential for reducing some of the effects of urbanization on the groundwater flow system.

It is the combination of the second and third functions above which can readily result in an adverse impact on the quality of the water in the aquifer being recharged. Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) values are typically high for urban storm runoff. Nutrient loadings (from lawn and garden fertilizers), heavy metals and petroleum-based pollutant concentrations (from road and parking lot runoff) are also typically high. The recharge of such waters directly into the aquifer via rockpit lakes, without benefit of the renovating effects of percolation through overlying surficial soils, represents a potential threat to the quality of the aquifer waters. In Dade and Broward Counties, where the magnitude of this potential

hazard is increasing as urbanization continues, and where the population is highly dependent upon the Biscayne aquifer as the source of potable water, greater knowledge is needed regarding the extent to which this potential hazard actually constitutes a real danger. There has been no systematic investigation in south Florida to the authors' knowledge regarding the impact(s) that storm water pollutants have on the groundwater resource as a consequence of discharging urban runoff into rockpit lakes. This preliminary investigation is a first step toward quantifying the resulting impact(s). It is not a comprehensive study of the effects of rockpit lakes on groundwater quality, but rather must be considered as reconnaissance in nature.

SETTING

The site for this study is an urban rockpit lake known as Loch Lomond, in northern Broward County. The lake is located in the NE¼ of the NW¼ of Section 23, Township 48S, Range 42E, approximately one mile north of the Pompano Beach city limit, just southwest of the I-95/Sample Road Interchange (see Figure 1). The lake is bounded on the north by NW 35th Court, on the east by NW 3rd Avenue, on the south by NW 35th Street, and on the west by NW 5th Terrace.

This site was selected from among many potential sites in Dade and Broward Counties. It was chosen because of the simplicity of the lake's geometry, the relatively high ratio of land area drained to lake area, and its accessibility. In addition, the site was judged to be about average with regard to neighborhood cleanliness and degree of street litter.

Figure 2 is an aerial view showing the lake and the surrounding development. The dotted line represents the approximate boundaries of the lake's surface water drainage area, consisting of about 26 acres. The homes within

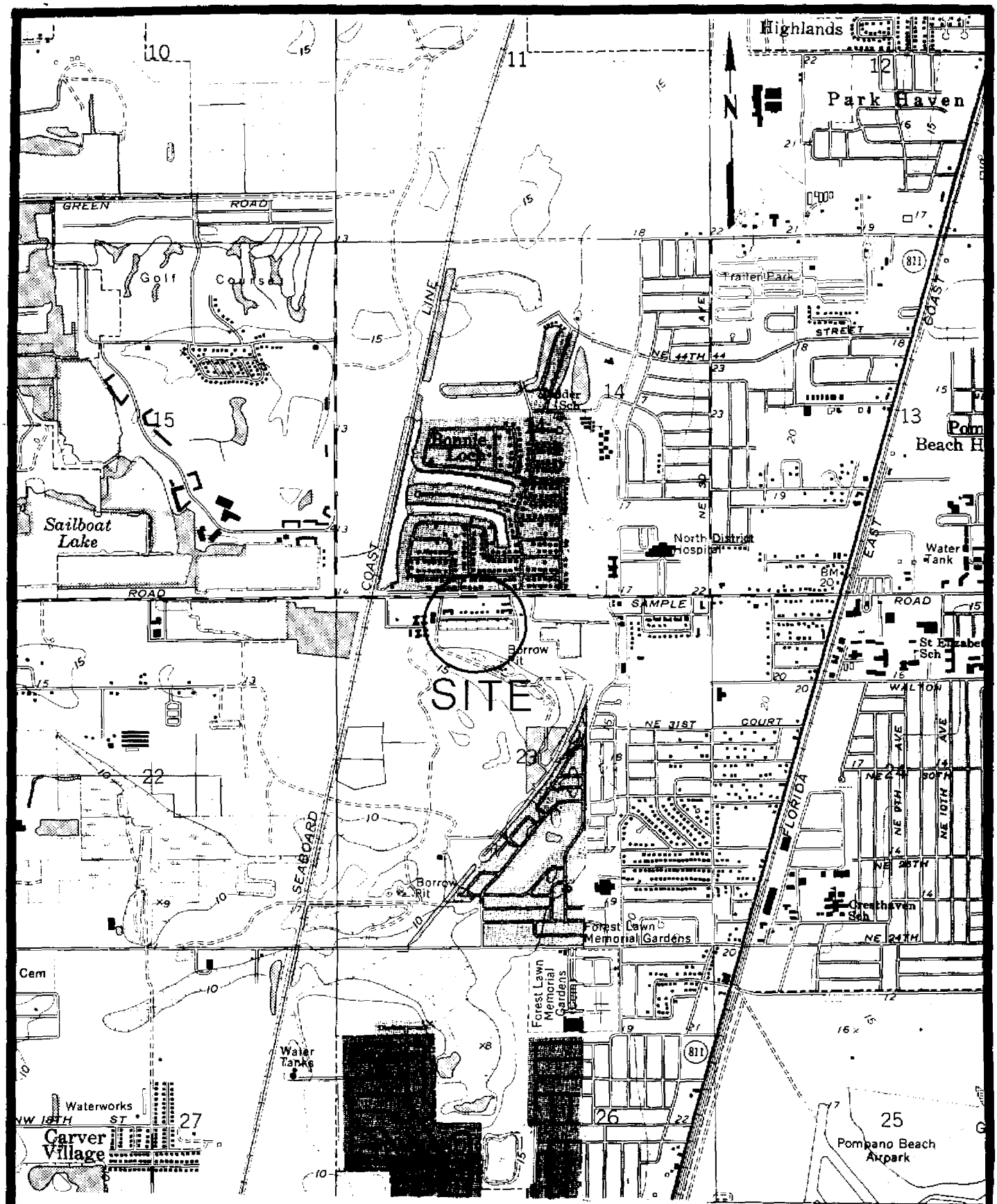
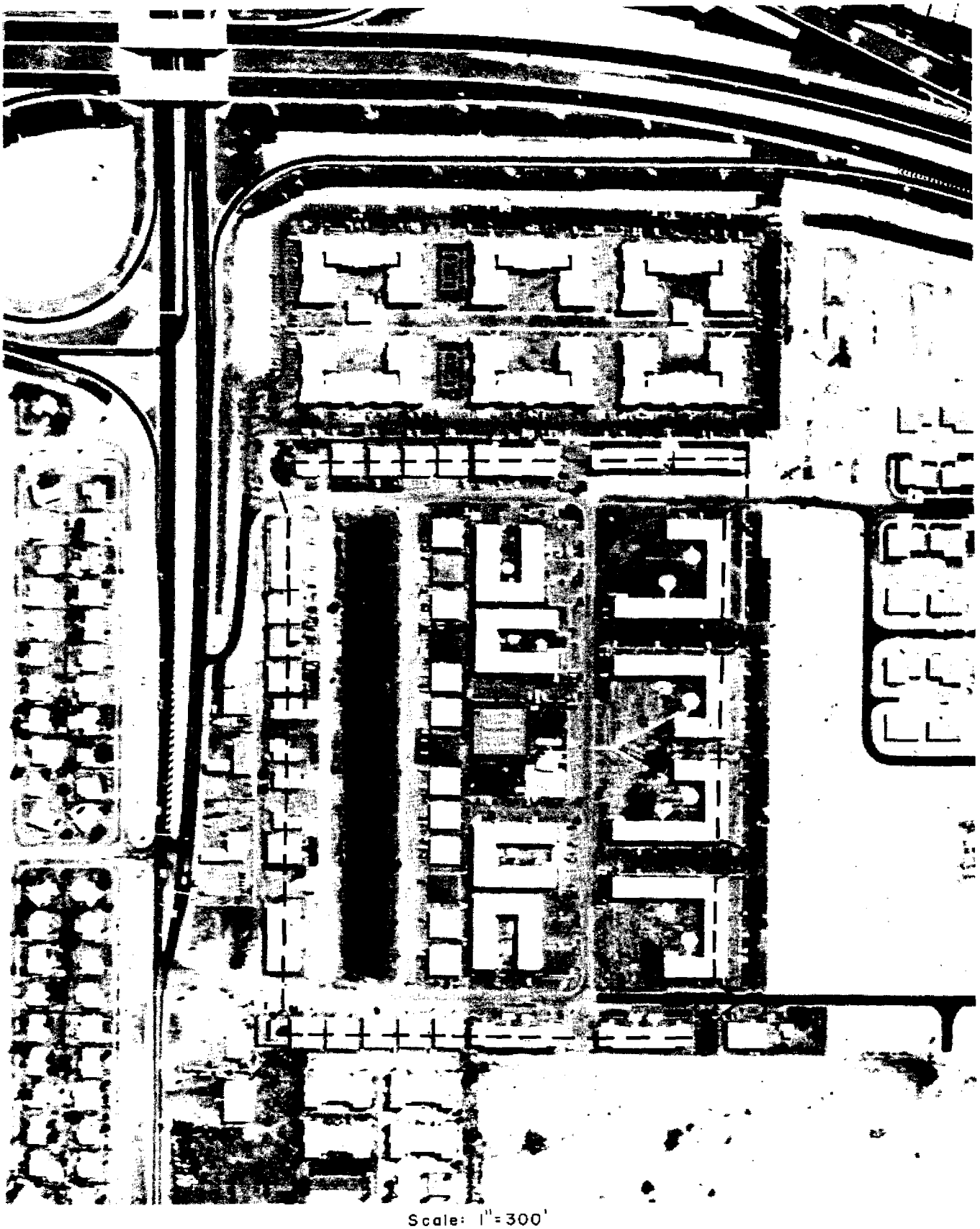


Figure 1 SITE LOCATION



Scale: 1"=300'

Dotted line shows approximate boundary of area which drains surface water into lake.

Figure 2 AERIAL VIEW OF SITE

this area are primarily duplexes, fourplexes, or one and two story apartment buildings. The drainage divide cuts across many of the buildings; however, if the area were expanded slightly to include these buildings in their entirety, it would contain 550 dwelling units in 30 acres, yielding a density of 18.3 units/acre.

The lake itself is rectangular in shape, with its major axis oriented in an east-west direction. It is approximately 980 ft. long and 95 ft. wide (these dimensions vary slightly with depth), with a surface area of 2.0 acres; lake stage varies between 3 ft. and 8 ft. NGVD (National Geodetic Vertical Datum). Lake stage is the surface expression of the local water table in the Biscayne aquifer. The lake is circumscribed first by a steep bank several feet wide and overgrown by a dense stand of high reeds, then by a berm and a flat strip 10 to 15 ft. in width with a sparse cover of grasses and weeds leading up to the road pavement. Road elevations are 14 to 15 ft. NGVD. The lowest point on the lake bottom is -13 ft. NGVD.

Figure 3 shows several cross sections of the lake. Side slopes are initially quite steep, as high as 1.4 to 1, becoming more gradual with depth until maximum depth is reached. Approximately 30 percent of the lake bottom is at maximum depth. The lake excavation penetrated two geologic formations; the overlying Pamlico Sand which is less than a few feet in thickness, and the underlying Miami Oolite consisting of oolitic limestone. The Miami Oolite extends to a depth of at least 28 ft. below groundwater level, the maximum penetration of adjacent wells installed for this study.

The area is drained by a system of grated drains and culverts. Outfall to the lake is direct via six culverts. The locations of these culverts and the grated drains to which they are connected are shown in Figure 4. The drainage boundary shown in Figure 2 encloses various local depressions in

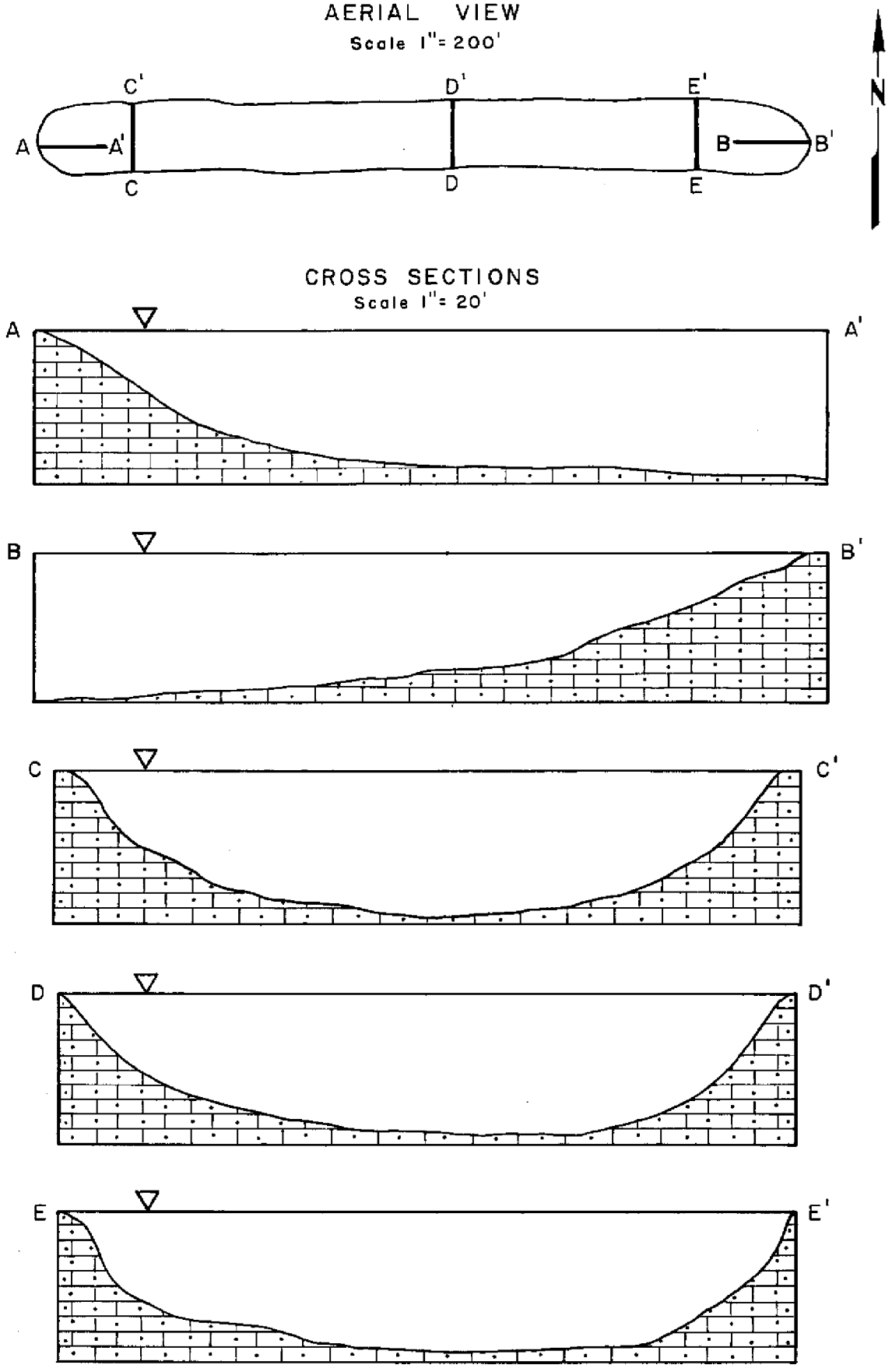


Figure 3 LOCH LOMOND CROSS SECTIONS

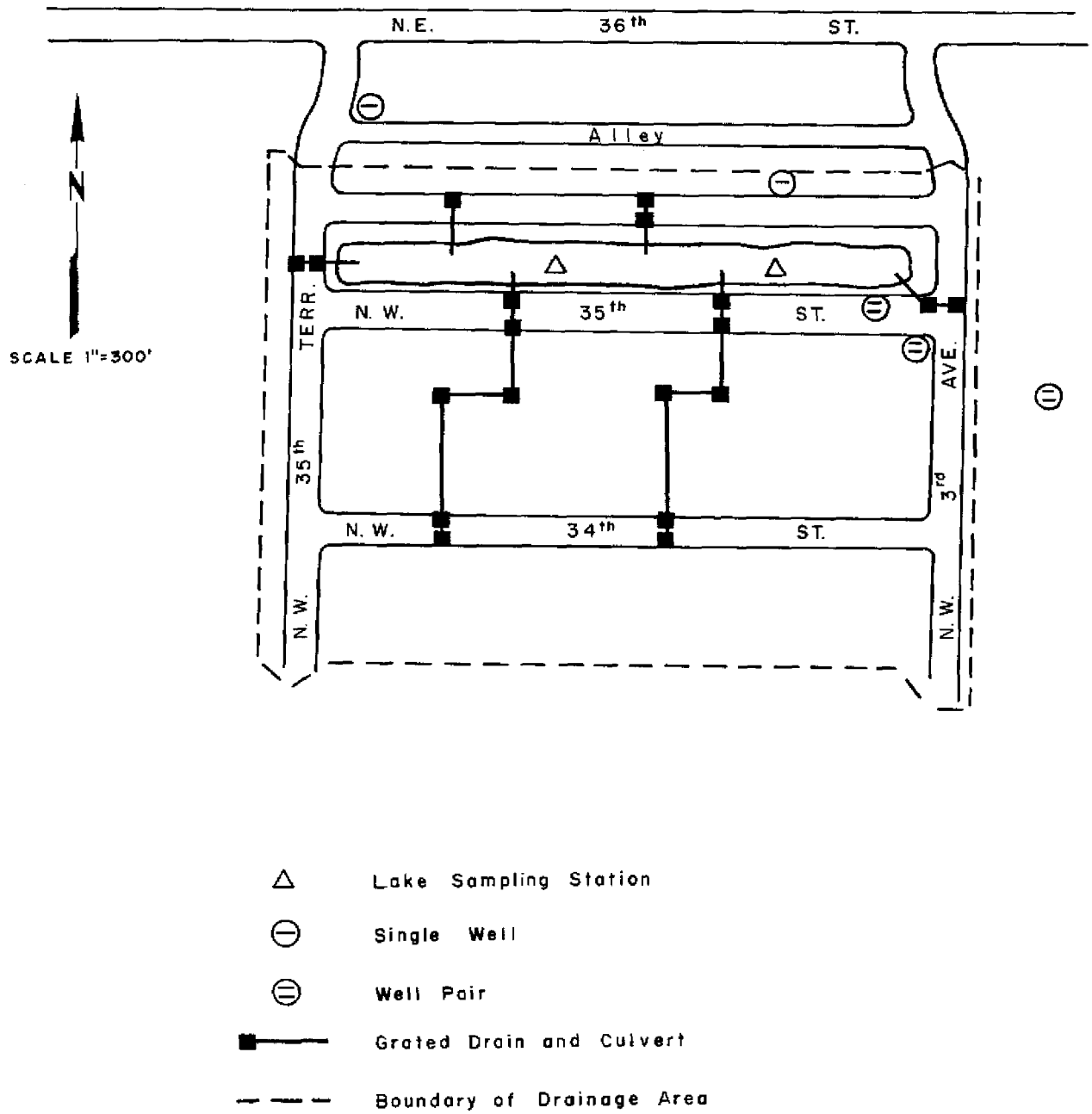


Figure 4 SAMPLING STATIONS, WELLS, DRAINS, AND CULVERT LOCATIONS

which storm runoff is subject to ponding and ordinarily does not reach the lake. The area is served by a sanitary sewer system.

From USGS prepared water table contour maps of the area, groundwater flow is NW/WNW to SE/ESE. At the Pompano Beach municipal wellfield, approximately 2 miles south/southwest of the site, USGS reports a transmissiviity of 1.4 million gallons per day per foot, and a storage coefficient of 0.34 (Sherwood, et al, 1973).

PROCEDURE

The basic plan of this reconnaissance investigation was to: (1) collect and analyze water samples from both the lake and the adjacent groundwater on a regular basis for at least one full year, (2) collect lake stage and water table elevation data regularly for at least one full year, and (3) for at least two separate storm events, collect and analyze runoff samples from selected culverts.

The locations of two lake sampling stations are shown on Figure 4. At each station, samples were taken within 3 ft. of the surface, at mid-depth, and within 3 ft. of the bottom.

To accomplish objectives (1) and (2), a series of wells were installed in May and June of 1975. Eight wells were installed; 3 pairs of wells along a transect leading downgradient from the lake, one well near the lake on the groundwater contour passing through the lake (hereafter referred to as "offset"), and one well upgradient from the lake. Table 1 gives individual data for each well; all wells are 2 inches in diameter and are cased with galvanized steel casing for their entire length except for the bottom 2 ft. which is screened. Their locations are shown on Figure 4. Descriptions of the locations of all wells, lake stations, and culverts from which samples were taken, are presented in Table 2.

TABLE 1 - Well Descriptions

WELL NO.	WELL DEPTH (F.T.) BELOW GROUND LEVEL	ELEVATION OF SCREEN BOTTOM (FT. NGVD)	HYDROLOGIC POSITION RELATIVE TO LAKE	DISTANCE FROM LAKE (FT.)	SURVEYED ELEVATION UPPER EDGE OF UNCAPPED WELL (FT. ABOVE NGVD)
W-1S	18	-4	Downgradient	320	13.81
W-1D	28	-14	Downgradient	320	13.96
W-2S	18	-4	Downgradient	70	14.33
W-2D	28	-14	Downgradient	70	14.34
W-3S	18	-4	Downgradient	20	14.39
W-3D	28	-14	Downgradient	20	14.34
W-O	23	-8	Offset	70	15.16
W-U	23	-8	Upgradient	210	15.15

TABLE 2. SAMPLING STATION LOCATION DESCRIPTIONS

Station	Description
Lake Stations:	
L-1	260 ft. east of lake center, midway between north and south shore. Roughly midway between east culvert on south shore and staircase on north shore. Sampling depth: just below surface, less than 3 ft.
L-2	Same as L-1. Sampling depth: mid-depth, 7 - 9 ft.
L-3	Same as L-1. Sampling depth: just off bottom, 13 - 16 ft.
L-4	120 ft. west of lake center, midway between north and south shore. Roughly 70 ft. east of west culvert on south shore. Sampling depth: just below surface, less than 3 ft.
L-5	Same as L-4. Sampling depth: mid-depth, 7 - 9 ft.
L-6	Same as L-4. Sampling depth: just off bottom, 13 - 16 ft.
Wells:	
W-1S	10.5 ft. west, and 18 ft. south of the northwest corner of Building D, Pompano Club Apartments, 250 W. Sample Road, 18 ft. deep.
W-1D	5 ft. north, 1 ft. east, of W-1S, 28 ft. deep.
W-2S	4.5 ft. west/northwest of W-2D, 18 ft. deep.
W-2D	5 ft. south of the south corner of the storm drain located at the southwest corner of the intersection of NW 35 St. and NW 3 Ave., 28 ft. deep.
W-3S	3 ft. east of W-3D, 18 ft. deep.
W-3D	71 ft. north of the northwest corner of building 300 NW 35th St. 9.5 ft. north of north edge of NW 35th St. roadway. 28 ft. deep.
W-0	14.5 ft. south of the southwest corner of building, 341 NW 35th Ct. Just north of edge of parking lot pavement. 23 ft. deep.
W-U	Approximately 50 ft. north of northwest corner of building 521 NW 35th Court. Well has been buried under fill since April 1976. 23 ft. deep.
Culverts:	
C-1	East culvert on south shore of lake, approximately 300 ft. from east end of lake.
C-3	Culvert on west shore of lake.

Groundwater samples were collected from the installed wells by means of a pitcher pump. After the pump was attached to the well casing, water was poured into the pump to prime it. The priming water and approximately 10 volumes of water standing in the well were then pumped out, and the sample collected.

The water quality parameters to be monitored were chosen on the basis of overall study objectives and limitations. The following parameters were monitored: (1) field parameters: temperature (T), pH, specific conductance (SpC), dissolved oxygen (DO), Secchi disc depth; (2) Lab analyses: chloride (Cl), sulfate (SO_4), alkalinity (Alk), calcium (Ca), copper (Cu), dissolved lead (Pb), total lead (TPb), nitrate (NO_3), nitrite (NO_2), ammonium (NH_4), total kjeldahl nitrogen (TKN), orthophosphate (OPO_4), total dissolved phosphate ($TDPO_4$), total phosphate (TPO_4) chemical oxygen demand (COD). All field parameters were evaluated using a Hydrolab unit where appropriate. All laboratory analyses were performed by the Water Chemistry Division, SFWMD, with the exception of COD which was done by McGinnes Laboratories, Lake Park, Florida.

In March 1975, a staff gage, stilling wells, and continuous stage recorder were installed in the lake just west of the more easterly of the south shore culverts. The staff gage was leveled to NGVD and all other elevations were taken using this gage as a reference point.*

Rainfall data were obtained from a USGS rain gage at the I-95/Sample Road interchange approximately one quarter mile east of the site. The USGS

*A staff gage was installed in the lake by the District for this project. The staff gage was surveyed as closely as possible to NGVD using an existing, deteriorated staff gage, and information from the Office of Water Resources of the Broward County Engineering Department. All elevations in this report were taken using this staff gage as the reference point, with the assumption that this gage gave readings to NGVD. Elevations are therefore given to NGVD in this report, but it should be noted that some small differential may exist between reported elevations and actual NGVD. Since all elevations were taken from the same point, all reported elevations are internally consistent relative to each other.

discontinued data collection from this site on December 8, 1975.

Runoff water samples were collected from culverts C-1 and C-3 during a small storm on August 20, 1975. One sample per minute was taken from each culvert during the first 10 minutes with a final sample collected after 15 minutes. A single grab sample was collected at culvert C-1 on June 23, 1975.

Samples of sediment from the lake bottom were collected on August 28 and September 18, 1975. On each date, samples were taken from the westerly lake sampling station and from 70 feet further west directly opposite the west culvert on the south shore.

Sample collection runs were made approximately once a month. Except for the preliminary run in December 1974, routine sampling began on March 10, 1975 and ended on June 24, 1976. Twenty-one (21) sampling runs were made during this period. The well network was not fully installed until the June 23, 1975 run. Table 3 lists the collection runs along with corresponding sample numbers, dates and analyses performed.

Since the data could be expected to follow an annual cycle, the data used for statistical purposes were selected to fall within a one year period. Abbreviated sampling was initiated at the outset of the program. Complete data collection did not begin until June 23, 1975. Thus, this date was selected as the beginning of the series of data that was used for statistical purposes. Systematic sampling on approximately a 40-day sampling interval was used to distribute the sampling more evenly over the annual cycle than would be the case if all data were used.

Well W-U is located 780 ft. southeast of another rockpit lake (Figure 2). Since groundwater flow is towards the southeast, the quality of the water in this well may be affected by this lake water. This well has only a partial data record since it was destroyed by construction work in April 1976. Thus, means and standard deviations for data obtained for this site may be biased because of the partial record.

TABLE 3. SUMMARY OF SAMPLE COLLECTION RUNS

Date	Sample Numbers	From	Field Parameters	Analyses: Major ions	Trace Metals	N & P* Series	COD
2/13/74	C001-009	Lake	No Secchi	X	X	No NO_3	No
3/10/75	C021-026	Lake	X	X	X	X	No
3/26/75	C041-046	Lake	X	X	X	NH_4	No
4/09/75	C061-066	Lake	No Secchi	X	X	None	No
4/23/75	C081-086	Lake	No Secchi, pH	X	None	None	No
5/14/75	C101-106	Lake	X	X	X	X	X
	C112	Well	No DO	X	X	X	X
6/02/75	C121-126	Lake	X	X	X	None	X
	C131-132	Wells	No DO	X	X	None	X
6/23/75	C141-146	Lake	X	X	X	X	X
	C151-158	Wells	X	X	X	X	X
	C450	Culvert	None	X	X	X	X
7/16/75	C161-166	Lake	X	No Cl	X	NO_x	X
	C171-178	Wells	X	No Cl	X	NO_x	X
8/06/75	C181-186	Lake	No Secchi	X	X	NO_x	X
	C191-198	Wells	DO or SpCon	X	X	NO_x	X
8/20/75	C401-416	Culvert	None	X	X	X	X
	C425-441	Culvert	None	X	X	X	X
8/28/75	C201-206	Lake	X	X	X	X	X
	C211-218	Wells	X	X	X	X	X
9/18/75	C221-226	Lake	No Secchi	No SO_4	X	NO_x/NH_4	X
	C231-238	Wells	X	No SO_4	X	NO_x/NH_4	X
10/13/75	C241-246	Lake	X	X	X	NO_x	X
	C251-258	Wells	X	X	X	NO_x	X
11/06/75	C261-266	Lake	X	X	X	X	X
	C271-278	Wells	X	X	X	X	X
11/24/75	C281-286	Lake	X	X	X	NO_x	X
	C291-298	Wells	X	X	X	NO_x	X
12/17/75	C301-306	Lake	X	X	X	X	X
	C311-318	Wells	X	X	X	X	X
1/28/76	C321-326	Lake	X	X	X	NO_x	X
	C331-338	Wells	X	X	X	NO_x	X
3/04/76	C341-346	Lake	X	X	X	X	X
	C351-358	Wells	X	X	X	X	X
4/08/76	C361-366	Lake	X	X	X	No $TDPO_4$	X
	C371-377	Wells	X	X	X	No $TDPO_4$	X
6/24/76	C381-386	Lake	No DO	X	X	X	X
	C391-397	Wells	No DO	X	X	X	X

*NO_x = NO_2 and NO_3

RESULTS AND DISCUSSION

Lakewater/Groundwater Flow Patterns

Table 4 shows measured lake stage and water table elevation data. As can be seen, the water level relationships between the wells and the lake remained consistent throughout the period of study. All the water level elevations in wells W-1 - W-3 were below those of the lake, whereas the water level elevations in well W-U were above this depth. Water levels in well W-U were generally 0.2 - 0.5 ft. above lake stage; in well W-0, 0.1 - 0.2 ft. below; in wells W-3S and W-3D, 0.1 - 0.3 ft. below; in wells W-2S and W-2D, 0.2 - 0.4 ft. below; and in wells W-1S and W-1D, 0.4 - 0.7 ft. below.

These results are consistent with USGS water table contour maps for the area which show a water table gradient from the west-northwest to east-southeast. They imply that groundwater generally flows into the lake from the WNW and that the aquifer ESE of the lake receives water seeping from the lake. Figures 5a and 5b are water table contour maps for the dates of lowest and highest measured water levels, respectively.

The lake stage hydrographs exhibit characteristic stage responses that indicate a changing groundwater inflow-outflow regime. In general, the hydrograph exhibits three distinct patterns: 1) The most predominant (Figure 6a) consists of long periods of a very slow, near uniform rate of recession in the lake stage. 2) Some groundwater recharge events (Figure 6b) are manifested by very rapid, short duration increases in stage which tend to end abruptly, after which the initial, relatively rapid stage recession rate declines to a very slow near uniform rate. 3) Some groundwater recharge events (Figure 6c) are followed by a relatively rapid stage recession which gradually levels off, then the stage very slowly increases for several days, after which the first pattern predominates.

TABLE 4

LAKE STAGES AND WATER TABLE ELEVATIONS
(in feet above NGVD)

DATE	LAKE	WELL NUMBER							
		W-1S	W-1D	W-2S	W-2D	W-3S	W-3D	W-O	W-U
3/10/75	5.04								
3/26/75	4.54								
4/9/75	4.20								
4/23/75	3.66								
5/14/75	3.66								
6/2/75	3.80	3.39	3.38						
6/23/75	4.60	4.09	4.10	4.32	4.32	4.41	4.47	4.51	5.07
7/16/75	5.19	4.74	4.75	4.94	4.95	5.05	5.12	5.10	5.43
8/6/75	5.38	4.93	4.93	5.15	5.16	5.25	-	5.29	-
8/28/75	5.05	4.54	4.55	4.78	4.79	4.90	4.95	4.91	5.30
9/18/75	4.82	4.28	4.29	4.57	4.54	4.67	4.64	4.73	5.08
10/13/75	5.69	5.18	5.18	5.45	5.41	5.51	5.54	5.55	5.89
11/6/75	6.49	6.08	6.06	6.28	6.28	6.38	6.40	6.42	6.79
11/24/75	6.36	5.89	5.90	6.13	6.12	6.22	6.27	6.27	6.60
12/17/75	5.98	5.38	5.37	5.62	5.61	5.76	5.69	5.76	6.09
1/28/76	5.21	-	-	4.82	4.80	4.90	5.29	4.97	5.33
3/4/76	5.89	5.17	5.23	5.50	5.48	5.58	5.62	5.72	6.12
4/8/76	5.31	4.64	4.63	4.87	4.92	4.99	5.06	5.28	-
6/24/76	7.19	6.48	6.45	6.73	6.72	6.90	6.83	6.83	-

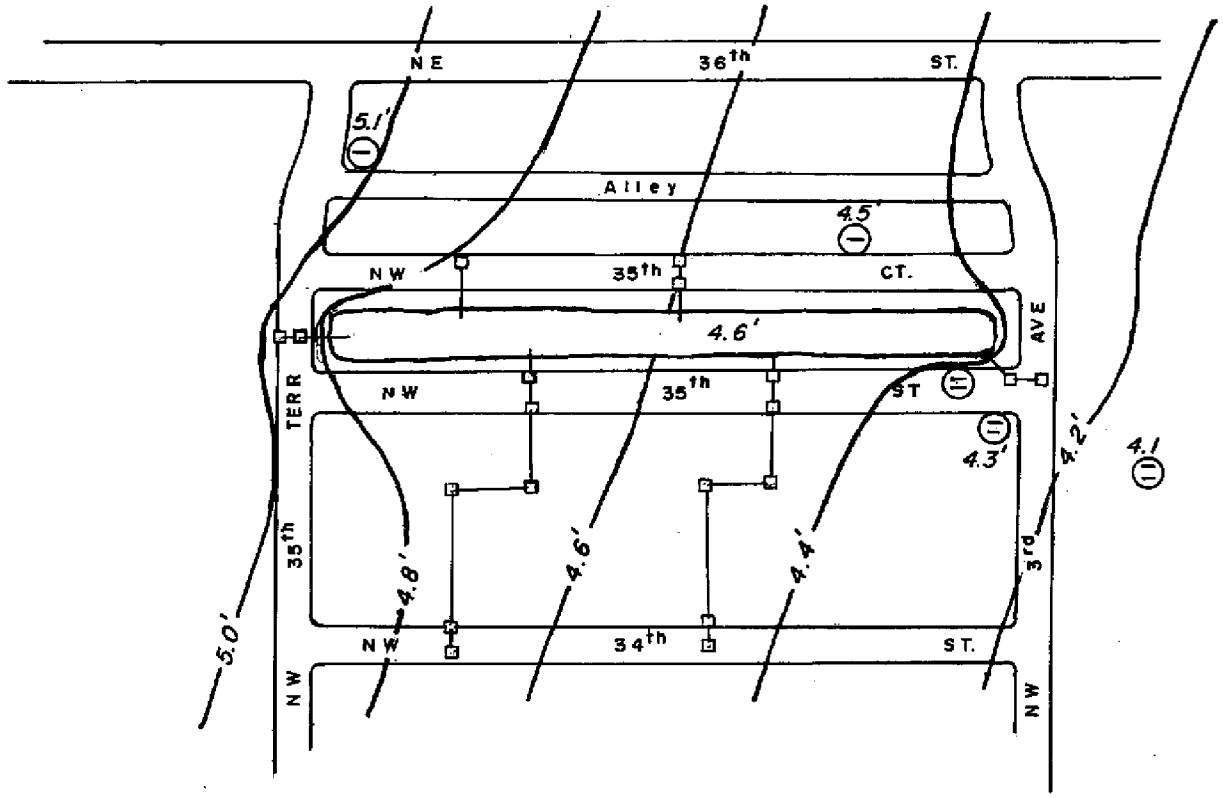


Figure 5a WATER TABLE CONTOURS, JUNE 23, 1975

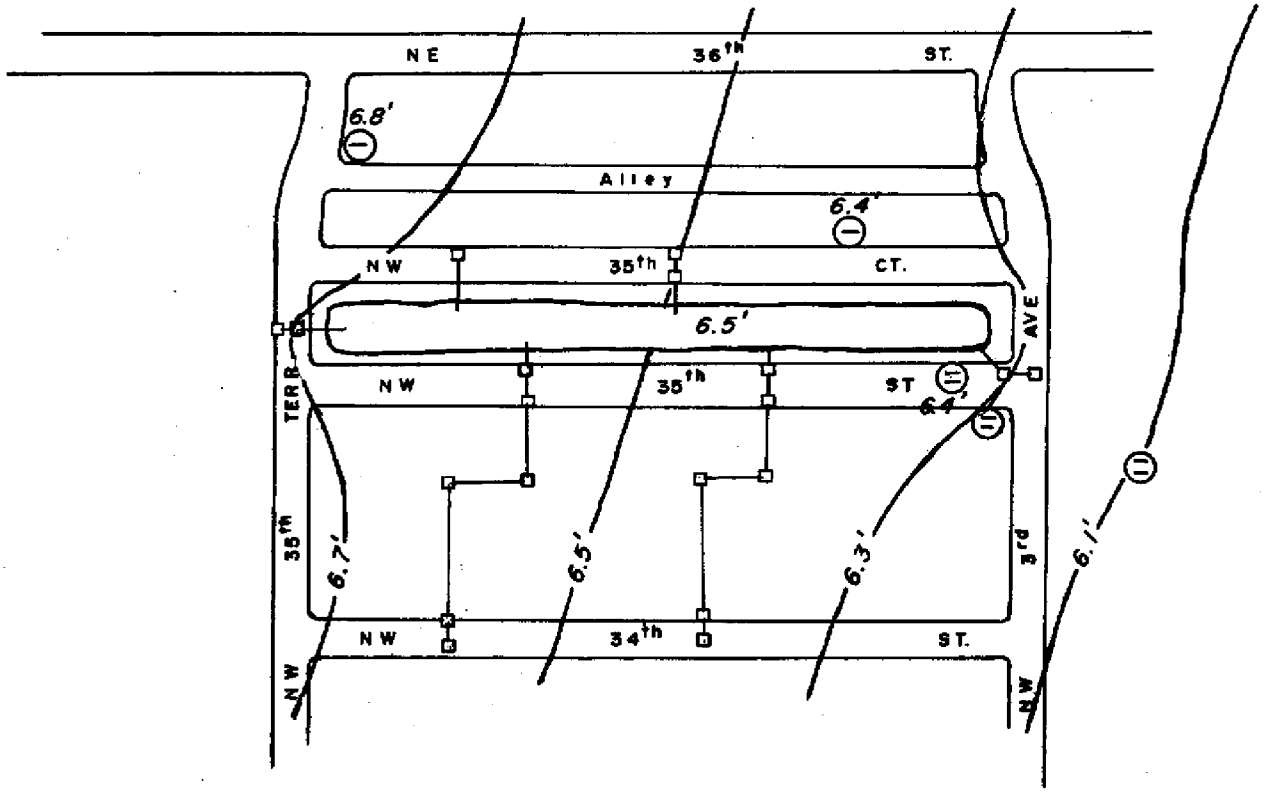


Figure 5b WATER TABLE CONTOURS, NOVEMBER 6, 1975

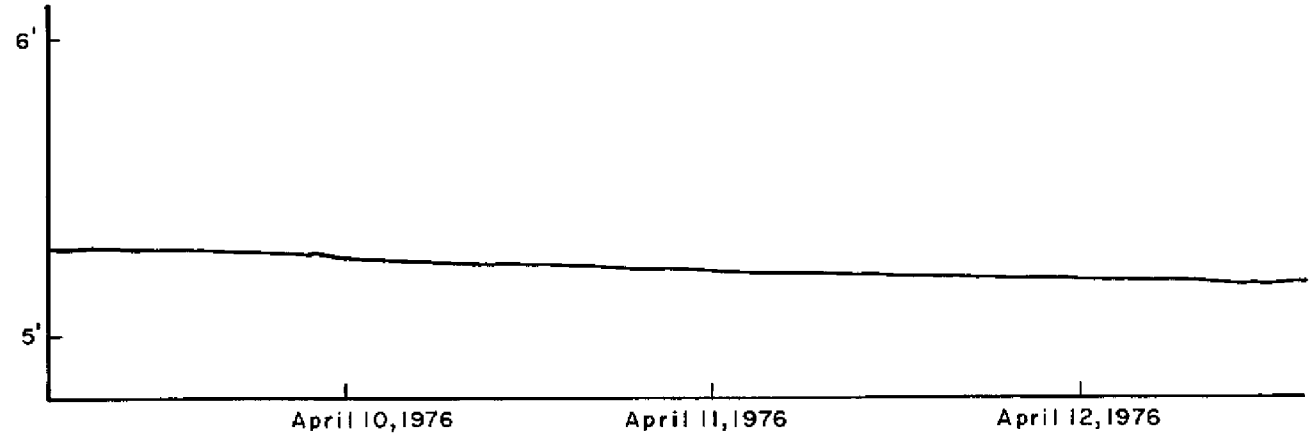


Figure 6a. STAGE HYDROGRAPH PATTERN 1: SLOW, STEADY RECESSION

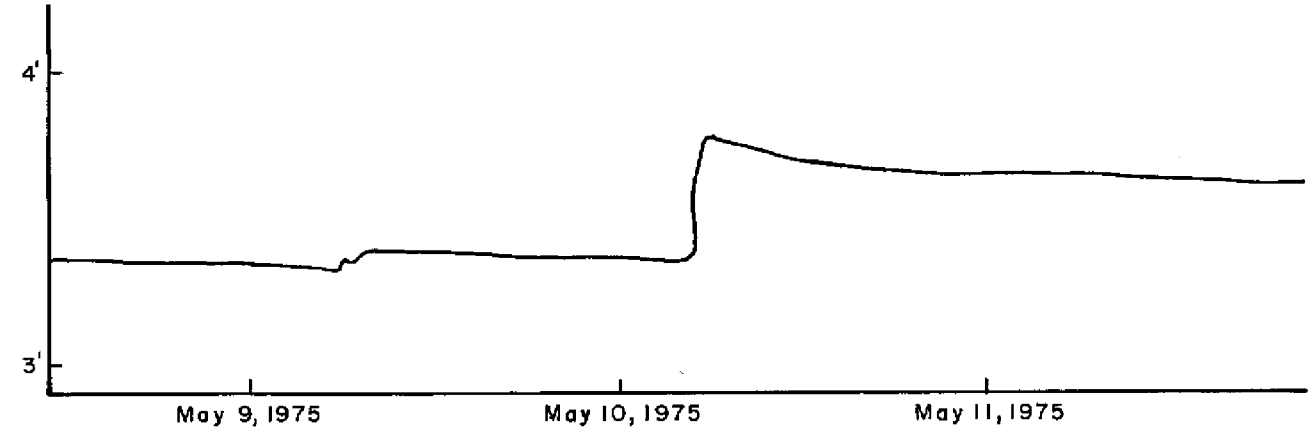


Figure 6b. STAGE HYDROGRAPH PATTERN 2: CLASSIC PEAK, ABRUPT RECESSION

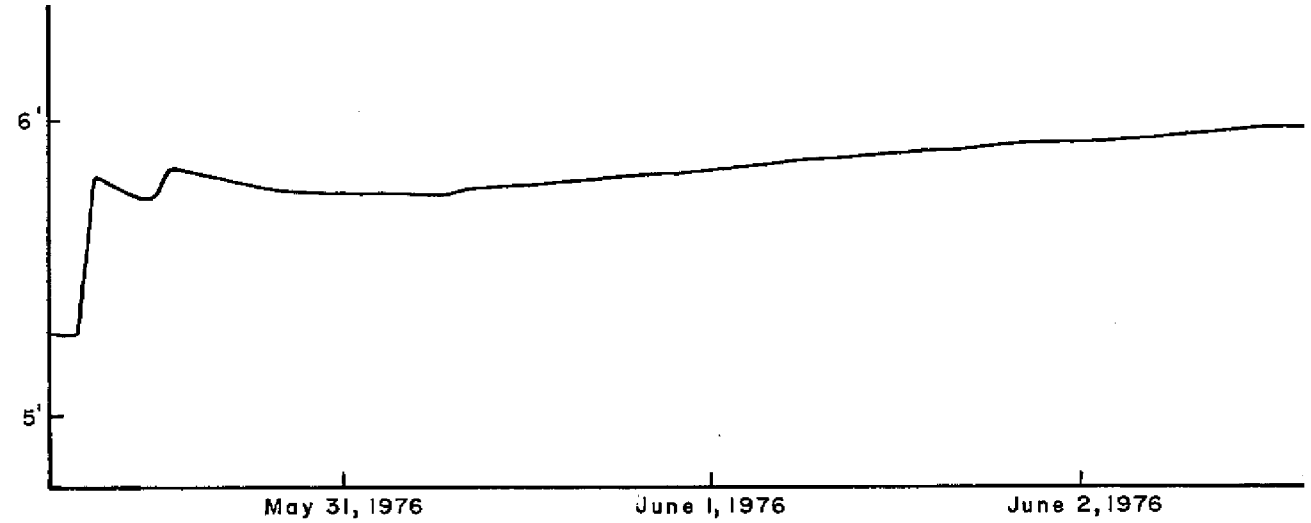


Figure 6c. STAGE HYDROGRAPH PATTERN 3: SLOW RISE AFTER HEAVY RAINFALL

The very slow, near uniform recession rate occurs during periods of no rainfall. The recession rate is from 0.02 to 0.04 ft. per day. The expected lake evaporation rate at this location is approximately 52 inches per year, or 0.012 ft. per day. The recession rate, therefore, exceeds that which can be attributed to lake evaporation losses. A regional recession in the water table, and thus the lake stage, is the probable cause for the lake stage decline in excess of that which can be attributed to evaporation losses. The water table recession results primarily because of discharge to canals and ditches, evapotranspirative water losses, and groundwater withdrawals by wells. The net outflow from the lake is estimated to be between 5500 and 19,000 gallons per day, or between 3.8 and 13.3 gallons per minute, respectively.

The second pattern occurs during significant stormwater runoff events. All sudden increases in lake stage during the entire period of operation of the stage recorder (3/27/75-6/11/76) are listed in Appendix F. For those periods during which the USGS rain gage was in operation, the rainfall corresponding to the stage rises are also listed. All rainfall events of at least 0.10 inch are listed; many events of less than 0.10 inch occurred but did not result in an increase in lake stage. During the periods when both the rain gage and the stage recorder were operational, a typical time lag of approximately a half-hour occurred between rainfall onset and stage rise onset for rainfall events in excess of 0.10 inch.

It is apparent therefore, that the observed increases in lake stage are due primarily to the drainage of stormwater runoff into the lake, in addition to rainfall occurring on the lake.

The hydrographs indicate that the gradient from the lake to the aquifer is greater during storms than that which occurs either before or after the stormwater runoff event. A net outflow from the lake to the aquifer can occur during the peak of a stormwater runoff event.

There are periods when there is a net inflow from the aquifer to the lake. These inflow periods are represented in Figure 6c by the slowly rising lake stage following the runoff event. These periods are characterized by a very slowly rising hydrograph which does not coincide with individual local rainfall events. Table 5 lists nine periods of slowly rising lake stages, each lasting 2 to 7 days. While these nine periods do not coincide with rainfall events, each one began 1 to 3 days after a particularly large runoff event or a series of runoff events. Several phenomena could cause a delayed water table rise. The time required for infiltration of rainwater into the soil and continued downward percolation to the water table will vary from site to site with differences in soil infiltration rates and vertical permeability of the material overlying the water table. It is unlikely, however, that this period could be 2 or 3 days at this site. A delayed water table response could also result from decreased groundwater withdrawals from the municipal wellfields in the area. A decrease in the drawdown due to the wellfield groundwater withdrawals would result in rising water table stages which would generate an inflow of groundwater into the lake. Delayed increases in the regional canal stages following an areally extensive and intensive rainfall event could also result in a rising water table several days after a rainfall event. Regional differences in the amount of rainfall and thus, the magnitude of the groundwater recharge, could result in a delayed water table stage response. Heterogeneous hydraulic characteristics of the aquifer, primarily the specific yield and the coefficient of transmissivity, could also lead to an apparent delayed water table response to a rainfall event. Since evaporation from the lake is occurring continuously, net in-seepage is taking place not only during periods of slow stage rise, but also when stage is stable or falling at a rate of less than 0.012 ft. per day. During the period of record, net inflow from the aquifer to the lake

TABLE 5 - PERIODS OF SLOW LAKE STAGE RISE

From			To		
Date	Time	Ft. Stage	Date	Time	Ft. Stage
5/31/75	1800	3.79	6/3/75	1500	3.81
6/6/75	2000	4.39	6/8/75	1000	4.42
6/26/75	1400	4.95	6/28/75	1700	4.98
9/19/75	1400	6.01	9/22/76	0500	6.07
10/23/75	0800	6.11	10/29/75	1700	6.15
11/2/75	0600	6.36	11/4/75	0500	6.38
11/7/75	0600	6.53	11/12/75	1600	6.58
2/29/76	1900	5.78	3/5/76	0200	5.90
5/31/76	1400	5.75	6/6/76	0100	6.02

occurred approximately 10-20% of the time and almost exclusively during the wet season.

There is one instance of a stage increase without significant rainfall and several occurrences of significant rainfall without an associated stage increase. These are probably due to the local nature of many south Florida storms and the quarter mile distance separating the lake and the rain gage.

For the 60 abrupt stage increases, for which there are corresponding rainfall data, a mean rainfall of 0.44 in. resulted in a mean increase in stage of 0.11 ft. (1.3 in.). For the entire 119 abrupt stage increases which occurred during the entire period of stage recorder operation, the mean rise in stage was 0.11 ft. with a mean duration of 1.2 hours for the period during which the stage was continually increasing. An increase in stage of 0.01 ft. represents an increase in the lake capacity of 915 cubic feet, or 6,840 gallons of water. The mean rate of stage rise was 0.094 ft. per hour which is equivalent to an inflow rate of 1,070 gallons per minute, or 2.39 cubic feet per second, from stormwater runoff plus direct rainfall assuming no exchange of water with the Biscayne aquifer.

Water Quality

The results of all water quality analyses performed are presented in Appendices A, B, and C. Summary tables which present various statistical analyses of the data are presented in the body of this report.

Some of the water quality data are censored in that values fall below the detection limits for the analytical methods used. The constituents that are severely censored are dissolved lead, orthophosphate, nitrate, and nitrite. To a lesser extent total lead, NO_x, and ammonia data are also censored. No statistical treatment of dissolved lead, orthophosphate, nitrate or nitrite was attempted because of the censoring of data.

The first four moments (mean, standard deviation, skewness, and kurtosis) were determined for each parameter at each station assuming normal and lognormal population frequency distributions. The skewness was used to determine which parameters at each sampling site best fit a particular frequency distribution. For the lake samples temperature, DO, specific conductivity, alkalinity, and pH approximate a normal frequency distribution. All other parameters more closely follow a lognormal frequency distribution for the lake sites. For the well samples only temperature, pH, and alkalinity follow a normal frequency distribution. All other parameters can be described by a lognormal frequency distribution. The assumed frequency distributions for each parameter of each type (lake or well) are given in Appendix D. All statistical treatments of water quality data in this report utilize the assumed frequency distributions.

First order serial correlation coefficients were calculated for all parameters at each sampling station. Confidence limits of 0.95 for the correlation coefficients were calculated in order to determine if the serial correlation coefficients are significantly different than zero. The computed serial correlation coefficients and their confidence limits indicate that the data are, with the exception of lake temperature, serially uncorrelated. Serially independent values are necessary for ordinary regression or correlelation analysis.

Table 6 lists the mean and standard deviation for each parameter at each sampling station. In those cases in which a log frequency distribution was used, the unbiased maximum-likelihood method of Sichel and Krige (Miesch, 1967) was used to estimate standard deviations and population means. For those cases in which no transformation was used, the arithmetic mean is considered the best estimate of abundance.

Estimates of the population means of the various lake parameters suggest certain trends with depth. The following parameters appear to increase with increasing depth within the lake as indicated by the means listed in Table 7:

TABLE 6 - MEANS AND STANDARD DEVIATIONS OF THE CHEMICAL PARAMETERS FOR EACH SAMPLING STATION

STATION		T	DO	SpC	pH	Ca*	Cl*	SO_4*	Alk	COD*	Cu*	NOx*	NH_4*	TKN*	TN*	TPb*
LAKE 1	μ	25.8	7.7	370.	7.7	1.9	1.21	1.58	3.15	1.20	.56	-1.61	-1.54	-.28	-.25	.61
	σ	3.2	0.7	65.	0.3	.06	.07	.14	.39	.22	.25	.57	.50	.12	.13	.33
LAKE 2	μ	25.5	7.4	383.	7.7	1.9	1.23	1.59	3.15	1.24	.58	-1.40	-1.55	-.26	-.21	.58
	σ	3.4	0.7	56.	0.3	.05	.10	.13	.36	.22	.26	.48	.42	.10	.08	.25
LAKE 3	μ	25.2	6.3	400.	7.5	1.9	1.21	1.53	3.20	1.25	.57	-1.30	-1.32	-.20	-.15	.91
	σ	3.5	1.3	54.	0.3	.05	.08	.25	.38	.15	.21	.63	.24	.04	.06	.44
LAKE 4	μ	25.9	7.7	385.	7.6	1.9	1.21	1.58	3.18	1.15	.57	-1.56	-1.77	-.27	-.22	.57
	σ	3.2	0.6	59.	0.4	.05	.07	.13	.38	.17	.27	.63	.30	.07	.08	.25
LAKE 5	μ	25.5	7.5	398.	7.6	1.9	1.20	1.58	3.20	1.16	.59	-1.61	-1.77	-.25	-.20	.62
	σ	3.5	0.6	48.	0.4	.06	.06	.13	.37	.23	.29	.59	.34	.07	.08	.23
LAKE 6	μ	25.2	6.1	413.	7.5	1.9	1.17	1.59	3.27	1.30	.52	-1.39	-1.44	-.17	-.10	.86
	σ	3.5	1.8	48.	0.3	.05	.15	.13	.41	.29	.33	.68	.38	.10	.08	.43

*Logrithmic means and standard deviations.
Alkalinity values in millequivalents/liter.
Cu and TPb values in micrograms/liter.
All other values in milligrams/liter.

....TABLE 6 (Continued)

STATION		T	DO*	SpC*	pH	Ca*	Cl*	SO_4*
WELL-IS	μ	26.3	.22	2.65	6.5	2.14	1.04	1.72
	σ	1.2	.23	.17	0.3	.04	.15	.28
WELL-ID	μ	26.1	.20	2.60	6.7	2.03	1.24	2.08
	σ	0.9	.20	.17	0.3	.08	.23	.18
WELL-25	μ	25.2	.41	2.58	6.9	2.06	1.22	1.58
	σ	1.4	.17	.21	0.3	.04	.22	.25
WELL-2D	μ	25.0	.37	2.63	7.0	2.08	1.17	1.83
	σ	1.1	.13	.17	0.3	.07	.10	.20
WELL-3S	μ	25.8	.49	2.52	7.4	1.92	1.26	1.48
	σ	2.3	.21	.17	0.4	.05	.08	.21
WELL-3D	μ	25.3	.44	2.43	7.3	1.89	1.25	1.50
	σ	2.2	.21	.19	0.4	.05	.06	.17
WELL-0	μ	26.7	.68	2.66	7.5	2.11	1.16	1.92
	σ	1.0	.11	.18	0.3	.05	.13	.21
WELL-U	μ	26.4	.46	2.46	7.3	1.90	0.77	1.78
	σ	0.9	.18	.17	0.2	.06	.17	.19

*Logrithmic means and standard deviations.
Alkalinity values in millequivalents/liter.
Cu and TPh values in micrograms/liter

Alk	COD*	Cu*	NOx*	NH_4*	TKN*	TN*	TPb*
6.04	1.34	.70	-1.85	-0.39	.04	-.001	.92
1.10	.21	.30	.36	.40	.20	.14	.53
3.45	1.34	.56	-1.86	-0.58	.01	.01	.63
.68	.21	.22	.54	.10	.07	.08	.39
5.02	.94	.55	-1.50	-1.44	-.39	-.28	.92
1.00	.53	.29	.74	.31	.13	.31	.29
4.87	.97	.58	1.99	-0.92	-.24	-.24	.70
1.21	.49	.31	.38	.13	.12	.13	.45
3.55	1.01	.72	-1.86	-1.36	-.30	-.26	.56
.34	.28	.48	.31	.28	.13	.11	.60
3.59	.92	.75	-1.61	-0.99	-.28	-.21	.74
.35	.28	.19	.58	.19	.10	.11	.54
4.78	1.06	1.05	-1.63	-0.86	-.17	-.13	1.08
1.13	.26	.47	.60	.15	.24	.26	.75
3.42	.42	.84	-1.34	-0.94	-.47	-.39	.76
.50	.72	.33	.39	.20	.16	.16	.62

All other values in milligrams/liter.

TABLE 7 - AVERAGE VALUE OF EACH LAKE PARAMETER FOR EACH SAMPLING DATE EVALUATED (in mg/l)

DATE	T[1]	DO	SpC[2]	pH	Ca	Cl	SO_4	Alk[3]	COD	Cu	TPb	NO_x	NH_4	TKN	TN
6/23/75	27.0	7.8	406.	7.0	63.0	14.9	36.1	2.84	15.6	4.4	5.6	X	.02	.65	X
7/16/75	27.2	7.9	363.	8.2	64.5	X	30.9	2.76	15.6	3.1	5.2	.047	X	X	X
8/28/75	29.8	7.0	381.	7.6	64.8	17.3	109.1	2.58	18.8	11.2	6.2	.062	.06	.61	.68
10/13/75	27.7	7.5	282.	7.9	66.4	20.5	32.7	3.30	16.8	2.6	4.1	.014	X	X	X
11/24/75	21.7	6.0	347.	7.5	X	16.0	32.7	3.05	6.5	2.4	6.4	.098	X	X	X
12/17/75	20.6	7.5	385.	7.4	73.8	19.8	38.2	3.35	8.4	3.7	5.3	.131	.07	.65	.77
1/28/76	19.4	8.3	408.	7.8	87.0	19.2	44.1	3.58	22.0	5.4	2.0	.334	X	X	X
3/4/76	22.9	7.3	385.	7.7	84.3	17.9	41.6	3.51	23.2	4.2	9.2	.094	.06	.63	.72
4/8/76	24.4	6.3	457.	7.7	84.1	16.9	39.5	3.68	24.5	3.1	6.3	.011	.05	.63	.63
6/24/76	27.7	6.6	430.	7.4	67.7	16.7	29.5	4.41	23.6	1.3	7.4	.020	.03	.63	.65

(1) in degrees celsius

(2) in micromhos-cm at $25^{o}C$

(3) in milliequivalents /ml

SpC, COD, NH_4, TKN and TPb. Temperature and DO appear to decrease with increasing depth. However, analysis of variance with F-tests, using a randomized block design, indicate that the differences in concentration are significant at the 0.95 confidence level only for temperature.

Linear correlation coefficients were calculated for selected pairs of sampling stations. Table 8 lists the correlation coefficients which are significantly greater than zero at the 0.95 confidence level.

Samples of bottom sediments taken from directly beneath lake station 6 on August 28, 1975 and on September 18, 1975 contained an average of 42 ppm lead; while bottom sediment samples taken directly opposite an outfall culvert on the same dates contained 115 ppm lead. The larger values of total lead compared to dissolved lead in the storm runoff water quality analyses in Appendix C suggest that most of the lead in the storm runoff is associated with particulates. The bottom sediments of the lake appear to be acting as a sink for lead from storm runoff.

The analyses of the storm runoff samples are presented in Appendix C. The quality of the runoff is quite variable; however, COD, chloride, lead, copper, total lead, orthophosphate, nitrate, nitrite, ammonia, TKN, and total nitrogen values of the runoff samples are generally far above the background groundwater values. Calcium and sulfate concentrations of the runoff water samples are lower than the background concentrations.

In Figures 7-9, average values of selected water quality parameters for the wells are plotted versus distance along a hypothesized flow line passing through the wells and the lake. The lake values of chloride, COD, specific conductance, and DO are far above those of the background groundwater. Furthermore, the wells downgradient from the lake contain water of higher chloride, COD, specific conductance, calcium, alkalinity, and sulfate than the

TABLE 8 - LINEAR CORRELATION COEFFICIENTS BETWEEN STATION PAIRS WHICH ARE SIGNIFICANT AT THE 0.95 LEVEL*

STATION PAIR	DO	SpC	pH	Ca	Cl	SO_4	Alk	COD	Cu	TPb
W-3S, W-3D		.78	.90	.73		.85	.88			
W-3S, L-avg.**						.73	.83	.85	.67	
W-3D, L-avg.						.84				
W-U, L-avg.			.73	-.95		.83	-.75		.71	
W-3S, W-U								.81		
W-3D, W-U	-.72					.84				
W-3S, W-2S		.71	.66					.90	.84	.66
W-1S, W-2S		.93						.63		
W-1S, W-1D		.89	.91					.91		

* Only those linear correlation coefficients which are significant at the 0.95 confidence level are listed.

**L-avg. indicates that the average of all lake stations was used.

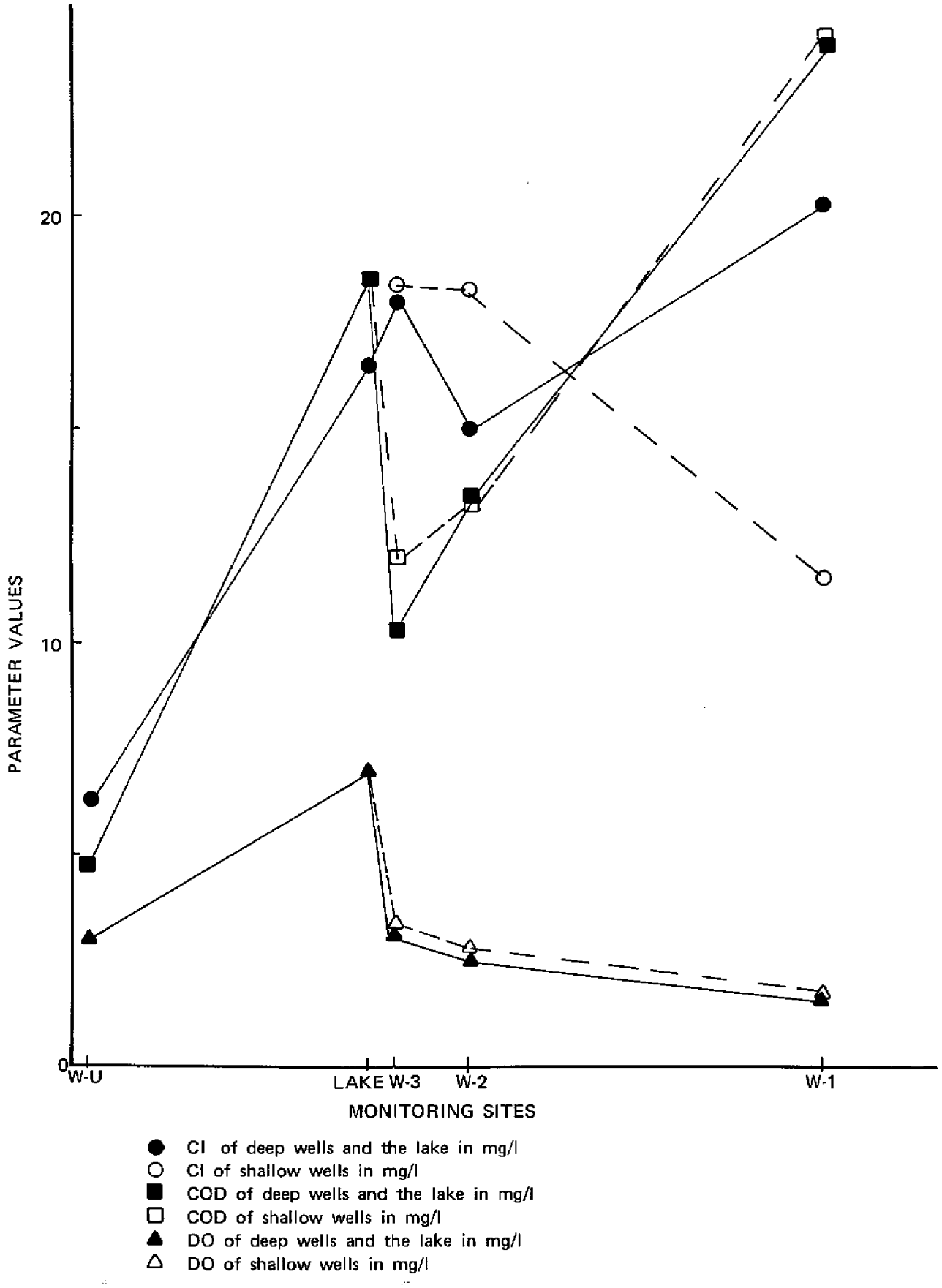


FIGURE 7 MEAN Cl, COD, AND DO AT MONITORING SITES AS A FUNCTION OF DISTANCE FROM THE LAKE

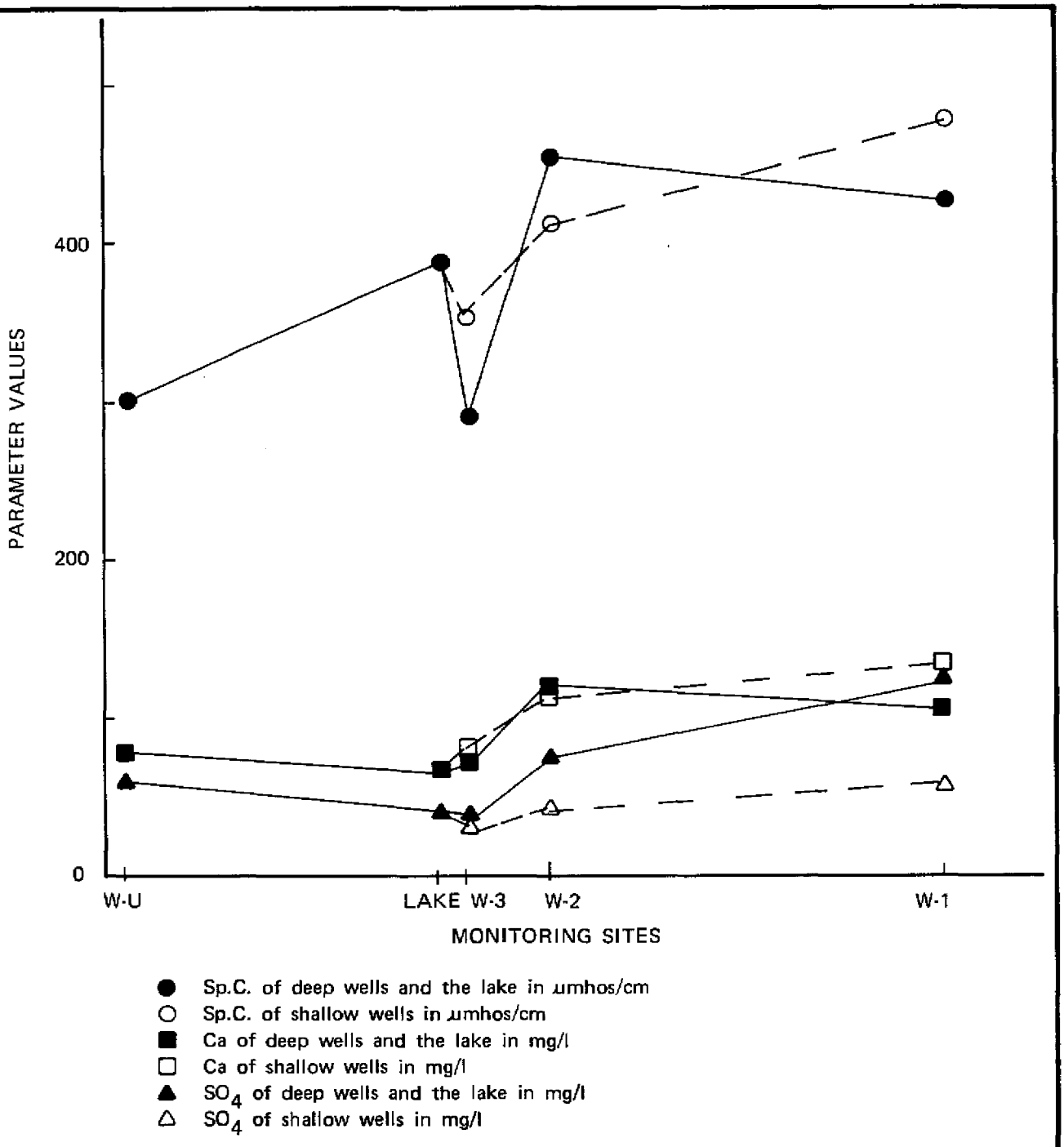


FIGURE 8 MEAN Sp.C., Ca, and SO_4 AT MONITORING SITES AS A FUNCTION OF DISTANCE FROM THE LAKE

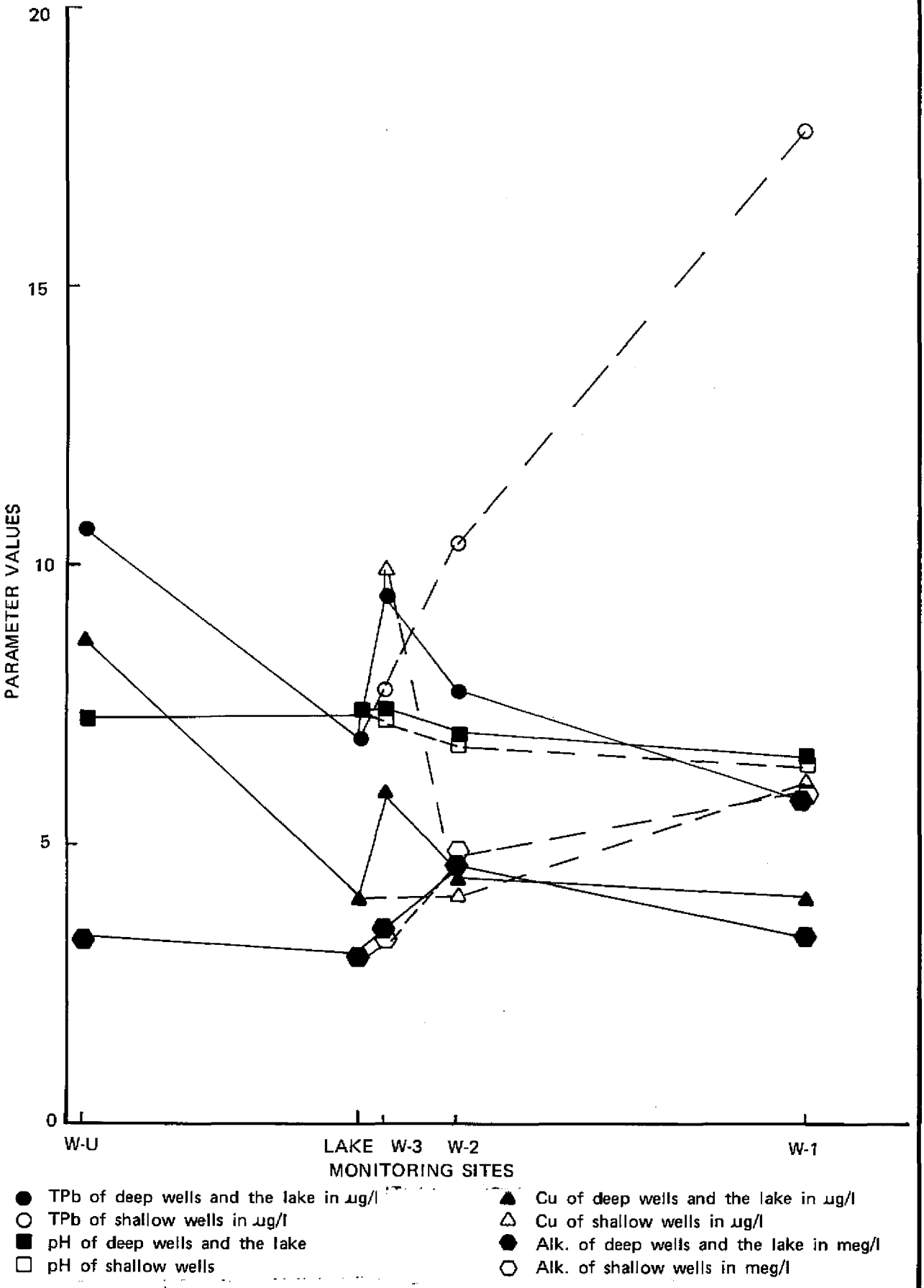


FIGURE 9 MEAN pH, TPb, Cu, AND ALK. AT MONITORING SITES AS A FUNCTION OF DISTANCE FROM THE LAKE

groundwater upgradient from the lake. In addition, pH decreases with distance downgradient from the lake, while specific conductance, alkalinity, sulfate, and calcium generally increase downgradient from the lake. The increase in sulfate may be due to either dissolution of sulfate minerals or biodegradation of organic matter containing sulfur. The increase in specific conductance, alkalinity, and calcium may be due to dissolution of minerals, especially carbonates, by carbon dioxide. The decrease in pH may be due to carbon dioxide. Biodegradation of organic matter produces carbon dioxide. Organic material, as measured by COD, is added to the water in the lake.

Paired comparison t-tests were conducted to test for significant concentration differences between various pairs of sampling stations. A significance level of .95 was used to test for difference. Table 9 summarizes the results of selected paired comparison tests. Data obtained from well W-U, which is assumed to monitor the background groundwater quality, was compared to the mean values for lake water. Values of DO, specific conductance, pH, COD, chloride, and TKN of the lake water are significantly above background while sulfate is below background. The lake appears to be a source for increasing DO, chloride, COD, TDS (as indicated by specific conductance), and nitrogen in the groundwater flow system draining the lake.

Data obtained from well W-U were also compared with the data from wells W-3S and W-3D, immediately downgradient from the lake. The groundwater immediately downgradient from the lake had significantly higher levels of COD, chloride, and TKN, whereas the sulfate concentration was lower. The data suggest an influence of the lake water on groundwater quality.

The data obtained from wells W-3S and W-3D were compared with that for average lake water. The water quality of the shallow well W-3S is more similar to that of the lake than the water quality of the deeper well W-3D. Well W-3D is probably sampling the transition zone between groundwater originating from

TABLE 9 - RESULTS OF SELECTED PAIRED COMPARISON TESTS FOR LAKE AND WELL PARAMETERS

STATION PAIR	T	DO	SpC	pH	Ca	Cl	SO_4	Alk	COD	Cu	NH_3	TKN	TN	TPb
W-3S, W-3D			D								D			
W-2S, W-2D			D			D	D				D	D		D
W-1S, W-1D			D	D	D		D	D						
W-U, W-3S						D	D							
W-U, W-3D						D	D					D		
W-U, L-avg*		D	D	D		D	D		D			D		
W-3S, L-avg.		D			D		D	D	D					
W-3D, L-avg.		D	D				D	D	D		D	D		
L-2S, W-3S				D	D			D		D				D
W-1S, W-2S	D	D	D	D	D	D			D		D	D		
W-2D, W-3D			D	D	D	D	D	D						
W-1D, W-2D	D	D		D			D	D	D		D	D	D	

D - indicates that there is a significant difference between sampling stations at the 0.95 confidence level.

*L-avg indicates the average of all lake sampling stations was used.

the lake and that unaffected by the lake. This transition zone would probably migrate vertically throughout the year depending on the storm water discharge received by the lake and regional groundwater gradients.

In order to compare the variation of water quality with depth, wells W-3S and W-3D, wells W-2S and W-2D, and wells W-1S and W-1D were compared. Differences in groundwater quality and depth appear to increase downgradient from the lake. This suggests that some other source such as infiltration of water from the surface is affecting the groundwater quality downgradient from the lake.

Wells W-3S and W-2S, wells W-2S and W-1S, wells W-3D and W-2D, and wells W-2D and W-1D were compared to check for changes in water quality downgradient from wells W-3S and W-3D. DO and pH decrease downgradient for both the shallow and deep wells whereas specific conductance and calcium increase. In the deep wells, sulfate increases downgradient. COD, ammonia, TKN, and total nitrogen increase from wells W-2S and W-2D to wells W-1S and W-1D. These comparisons suggest that the groundwater quality is altered as it flows downgradient from the lake either by chemical reactions of the groundwater constituents or by infiltration of water from the surface.

The water quality of the shallow well nearest the lake, W-3S, correlates better with the lake water than that of the deep well, W-3D. The water quality of W-3S correlates more positively with the lake water quality than with W-U, the background groundwater quality. The closer association of the well water quality with the lake than with the background water quality suggests that the lake is influencing the quality of water immediately downgradient from the lake.

The shallow and deep wells nearest the lake, W-3S and W-3D, correlate more positively with each other than do the shallow and deep wells farthest from the lake, W-1S and W-1D. The lower association of the data for wells

W-1S and W-1D and the values in Table 6 suggest that water pumped from well W-1S is being affected by local recharge to a much greater extent than at the W-3S and W-3D sites. Since W-1S and W-1D are located in a slight depression in a lawn adjacent to a parking lot 325 ft. from the lake, local recharge would be expected to have a more significant impact on the water quality than at W-3S and W-3D which have better surface drainage and are only 20 ft. from the lake.

Significant correlations for pH, specific conductance, COD, copper, and total lead between wells W-3S and W-2S suggest that the quality of water at well W-3S affects the water quality downgradient at well W-2S. Thus, the lake water appears to affect water quality at least as far downgradient as well W-2S, a distance of approximately 70 ft.

SUMMARY AND CONCLUSIONS

Water quality data covering a one year period for a rockpit lake receiving urban stormwater runoff, the groundwater around the lake, and three stormwater runoff samples, are presented in this report. Water level, temperature, DO, specific conductance, pH, calcium, chloride, sulfate, alkalinity, COD, copper, total lead, phosphorus, and nitrogen are the parameters measured. Linear correlation and paired comparison tests were used to evaluate the impact of the lake on groundwater quality. Lake sediments were also analyzed for lead content. Rainfall, groundwater levels, and lake stage were monitored at the site to provide an understanding of the pattern of flow between the lake and the groundwater.

The data presented in this report results in the following conclusions:

(1) Groundwater generally discharges into the western end of the lake and is recharged by the lake water flowing into the aquifer at the eastern end of the lake.

(2) Net seepage flow is predominately from the lake to the aquifer. This condition occurs during extended dry periods, and during and immediately after most stormwater runoff events. One to three days after some heavy rainfall events, however, the gradient reverses and net seepage flow from the aquifer to the lake results. Periods of this reverse net flow accounted for approximately 10-20 percent of the total period of record.

(3) Storm runoff to the lake can contain relatively high concentrations of chloride, copper, total lead, and nutrients as well as high values of chemical oxygen demand and alkalinity.

(4) It appears that accumulation of lead in the bottom sediments of the lake is occurring. This study did not attempt to determine if other heavy metals or nutrients are accumulating in the bottom sediments.

(5) The lake water is enriched in chloride, chemical oxygen demand, TKN, DO, and total dissolved solids (as indicated by specific conductivity), relative to background groundwater upgradient from the lake. The lake water is relatively low in sulfate concentration.

(6) There is a general increase in concentration of constituents in the groundwater downgradient from the lake as compared to the groundwater upgradient from the lake.

(7) Some of the groundwater parameters such as specific conductance, calcium, alkalinity, and hydrogen ion (as measured by pH) increase downgradient from the lake beyond the values found in the lake. These increases may result due to production of carbon dioxide from decomposition of organic matter contained in the lake water. They may also result from direct infiltration of surface runoff through unpaved surfaces in the area. The monitoring program reported in this study does not permit evaluation of the relative importance of each of these factors.

(8) The lake influences groundwater quality in its immediate vicinity; however, changes in water quality downgradient from the lake may be due to factors other than interaction with water originating from the lake. These factors may be masking the effect of the lake on groundwater quality. For the parameters monitored there is no indisputable evidence that the lake is degrading the quality of the groundwater for a significant distance downgradient from the lake.

This investigation was reconnaissance oriented in nature. The results of this study should not be overgeneralized, and should not be used as indisputable evidence that rockpit lakes do or do not result in the significant degradation of groundwater quality. Variations in lake size, lake depth, runoff quality, areal extent of the drainage basin and nature of the land use, aquifer characteristics, and/or investigation and instrument sophistication

can result in modifications to the conclusions reached as a consequence of the subject study.

This study shows that gross contamination of the groundwater by the lake is not occurring, although there is a change in water quality in the immediate vicinity of the lake. The long term effects of possible accumulation of heavy metals, organics, and nutrients in lake bottom sediments were not evaluated by this study.

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ABBREVIATIONS USED IN THE APPENDICES

ALK	Alkalinity
ALKCACO3	Alkalinity expressed as calcium carbonate
CA	Calcium
CL	Chloride
COD	Chemical Oxygen Demand
CU	Copper
D.O.	Dissolved Oxygen
MEQ/L	Milliequivalents per liter
MG/L	Milligrams per liter
MIN	Minutes
MO/DA/YR	Date in month/day/year
NH4	Ammonia
NO2	Nitrite
NO3	Nitrate
NOX	Sum of nitrite and nitrate
O-PO4	Orthophosphate
Pb	Lead
SECCHI M	Secchi disk depth in meters
SO4	Sulfate
SP COND UMHOS/CM	Specific conductance in micromhos per centimeter
TDISS	Total dissolved
TEMP CENT	Temperature in degrees centigrade
TKN	Total Kjeldahl nitrogen
TN	Total nitrogen
T-PO4	Total phosphate

APPENDIX

A

LAKE DATA BY STATION

STATION - L-1

DATE MO/DA/YR	DEPTH METERS	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
3/10/75	1.0	21.1	7.8	380.	7.80	2.45
3/26/75	1.0	24.3	7.3	250.	7.80	3.60
4/ 9/75	1.0	26.0	8.4	485.	7.70	
4/23/75	1.0	24.0	6.8	460.		
5/14/75	1.0	28.8	7.5	380.	7.70	2.05
6/ 2/75	1.0	29.4	8.0	410.	7.90	2.65
6/23/75	1.0	26.6	8.2	320.	7.30	3.10
7/16/75	1.0	27.4	7.9	320.	8.40	3.35
8/ 6/75	1.0	30.6			8.00	
8/28/75	1.0	30.1	7.4	385.	7.60	2.25
9/18/75	1.0	29.8	7.9	420.	7.30	
10/13/75	1.0	27.8	7.7	275.	7.90	1.85
11/ 6/75	1.0	25.4	7.9	370.	7.90	1.90
11/24/75	1.0	22.0	5.9	270.	7.50	3.10
12/17/75	1.0	20.9	7.6	355.	7.40	4.60
1/28/76	1.0	20.9	8.5	350.	7.90	2.70
3/ 4/76	1.0	23.8	8.6	375.	7.90	3.25
4/ 8/76	1.0	24.5	8.5	435.	7.80	2.30
6/24/76	1.0	27.6	7.2	425.	7.30	2.40

STATION - L-1

DATE MO/DA/YR	DEPTH METERS	CA MG/L	CL MG/L	SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
3/10/75	1.0	80.P0	13.2	44.9	3.32	166.0	
3/26/75	1.0	80.20	10.7	37.4	3.87	193.5	
4/ 9/75	1.0	86.20	18.2	34.8	3.58	179.0	
4/23/75	1.0	83.60	16.4	43.9	3.45	172.5	
5/14/75	1.0	68.40	15.5	40.3	3.12	156.0	16.0
6/ 2/75	1.0	69.60	15.3	39.5	3.10	155.0	12.0
6/23/75	1.0	62.70	14.8	34.2	2.79	139.5	14.9
7/16/75	1.0	65.11		29.0	2.73	136.5	9.6
8/ 6/75	1.0	61.18	13.9	24.2	2.69	134.5	18.2
8/28/75	1.0	65.24	20.0	108.3	2.49	124.5	21.6
9/18/75	1.0	59.20	19.5		2.77	138.5	38.0
10/13/75	1.0	66.24	20.9	35.8	3.25	162.5	16.6
11/ 6/75	1.0	63.88	16.0	28.2	2.73	136.5	13.0
11/24/75	1.0	72.16	16.9	31.6	3.01	150.5	5.0
12/17/75	1.0	72.11	17.8	37.5	3.28	164.0	9.5
1/28/76	1.0	86.00	18.4	43.2	3.68	184.0	17.5
3/ 4/76	1.0	84.32	18.7	41.2	3.47	173.5	31.0
4/ 8/76	1.0	82.94	16.7	40.5	3.59	179.5	23.5
6/24/76	1.0	65.22	15.6	29.2	2.95	147.5	18.0

STATION - L-1

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L		TDISS PB MG/L	TOTAL PB MG/L		O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
3/10/75	1.0	0.002		0.004	0.007		0.003	0.006	0.010
3/26/75	1.0	0.001		0.001	0.007	<	0.002		
4/ 9/75	1.0	0.002		0.001	0.004				
4/23/75	1.0								
5/14/75	1.0	0.003		0.003	0.009	<	0.002	0.013	0.021
6/ 2/75	1.0	0.003		0.003	0.007				
6/23/75	1.0	0.003		0.001	0.005	<	0.002	0.009	0.012
7/16/75	1.0	0.003		0.002	0.005				
8/ 6/75	1.0	0.005		0.004	0.007				
8/28/75	1.0	0.011		0.002	0.007		0.002	0.007	0.017
9/18/75	1.0	0.007	<	0.001	0.003				
10/13/75	1.0	0.002	<	0.001	0.003				
11/ 6/75	1.0	0.005	<	0.001	0.002	<	0.002	0.006	0.013
11/24/75	1.0	0.003	<	0.001	0.002				
12/17/75	1.0	0.005		0.001	0.002	<	0.002	0.012	0.012
1/28/76	1.0	0.005	<	0.001	0.001				
3/ 4/76	1.0	0.003		0.003	0.023	<	0.002	0.008	0.022
4/ 8/76	1.0	0.002	<	0.001	0.001	<	0.002		0.017
6/24/76	1.0	0.001	<	0.001	0.002	<	0.002	0.005	0.020

STATION - L-1

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L		NOX MG/L		NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	1.0		2.212	<	0.004				0.03	0.47	
3/26/75	1.0								0.40		
4/ 9/75	1.0										
4/23/75	1.0										
5/14/75	1.0		0.010	<	0.004			<	0.01	0.55	
6/ 2/75	1.0										
6/23/75	1.0			<	0.004			<	0.01	0.59	
7/16/75	1.0		0.008	<	0.004		0.013				
8/ 6/75	1.0	<	0.004	<	0.004	<	0.004				
8/28/75	1.0		0.012	<	0.004		0.016		0.08	0.57	0.58
9/19/75	1.0	<	0.004	<	0.004		0.007		0.01		
10/13/75	1.0	<	0.004		0.008		0.010				
11/ 6/75	1.0		0.057		0.005		0.062	<	0.01	0.27	0.33
11/24/75	1.0		0.088		0.004		0.092				
12/17/75	1.0		0.115		0.005		0.120		0.06	0.63	0.74
1/28/76	1.0		0.117	<	0.004		0.122				
3/ 4/76	1.0		0.088	<	0.004		0.092		0.03	0.46	0.55
4/ 8/76	1.0	<	0.004	<	0.004	<	0.004		0.03	0.53	0.53
6/24/76	1.0		0.025	<	0.004		0.029		0.02	0.75	0.77

STATION - L-2

DATE MO/DA/YR	DEPTH METERS	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
3/10/75	3.0	20.9	7.3	400.	7.30	
3/26/75	3.0	23.6	6.9	290.	7.80	
4/ 9/75	3.0	25.6	8.2	485.	7.70	
4/23/75	3.0	24.0	6.7	450.		
5/14/75	3.0	28.1	6.8	400.	7.60	
6/ 2/75	3.0	28.6	7.6	410.	7.80	
6/23/75	3.0	27.1	8.2	370.	7.30	
7/16/75	3.0	27.1	7.3	320.	8.40	
8/ 6/75	3.0	30.4			7.90	
8/28/75	3.0	29.8	7.1	385.	7.60	
9/18/75	3.0	29.8	7.3	420.	7.30	
10/13/75	3.0	27.6	7.8	300.	7.80	
11/ 6/75	3.0	25.2	7.2	365.	7.80	
11/24/75	3.0	21.6	5.9	295.	7.50	
12/17/75	3.0	20.5	7.5	380.	7.40	
1/28/76	3.0	19.1	8.8	370.	7.90	
3/ 4/76	3.0	23.2	8.4	375.	7.80	
4/ 8/76	3.0	24.5	8.2	455.	7.80	
6/24/76	3.0	27.6	6.5	430.	7.30	

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	CA MG/L	CL MG/L
3/10/75	3.0	83.40	14.2
3/26/75	3.0	81.50	11.3
4/ 9/75	3.0	81.90	15.4
4/23/75	3.0	81.10	15.4
5/14/75	3.0	68.80	16.3
6/ 2/75	3.0	68.50	14.9
6/23/75	3.0	62.50	15.0
7/16/75	3.0	64.46	
8/ 6/75	3.0	61.82	13.5
8/28/75	3.0	64.74	16.6
9/18/75	3.0	59.44	17.7
10/13/75	3.0	67.06	20.7
11/ 6/75	3.0	65.39	21.8
11/24/75	3.0	72.16	16.1
12/17/75	3.0	72.76	24.4
1/28/76	3.0	87.63	31.5
3/ 4/76	3.0	84.70	17.7
4/ 8/76	3.0	82.63	18.5
6/24/76	3.0	67.30	15.1

L-2

SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
45.1	3.44	172.0	
35.1	3.89	194.5	
38.6	3.58	179.0	
42.6	3.43	171.5	
39.8	3.17	158.5	26.0
39.8	3.07	153.5	16.0
37.8	2.86	143.0	15.3
32.2	2.74	137.0	10.2
24.7	2.72	136.0	16.9
108.3	2.58	129.0	17.5
	2.82	141.0	37.0
37.3	3.29	164.5	19.6
29.2	2.68	134.0	23.0
32.3	3.03	151.5	6.0
38.7	3.23	161.5	7.5
43.7	3.25	162.5	16.0
40.5	3.45	172.5	25.0
39.2	3.60	180.0	19.0
28.7	3.03	151.5	35.0

STATION - L-2

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	D-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
3/10/75	3.0	0.002	0.004	0.008	< 0.002	0.004	0.014
3/26/75	3.0	0.001	< 0.001	< 0.001	< 0.002		
4/ 9/75	3.0	0.012	0.008	0.002			
4/23/75	3.0						
5/14/75	3.0	0.003	0.003	0.010	< 0.002	0.008	0.014
6/ 2/75	3.0	0.002	0.004	0.007			
6/23/75	3.0	0.002	0.001	0.004	< 0.002	0.006	0.019
7/16/75	3.0	0.003	0.004	0.007			
8/ 6/75	3.0	0.004	0.004	0.008			
8/28/75	3.0	0.010	0.003	0.003	0.002	0.007	0.015
9/18/75	3.0	0.010	< 0.001	0.003			
10/13/75	3.0	0.002	< 0.001	0.003			
11/ 6/75	3.0	0.004	< 0.001	0.002	< 0.002	0.006	0.009
11/24/75	3.0	0.002	< 0.001	0.004			
12/17/75	3.0	0.003	0.002	0.003	< 0.002	0.016	0.014
1/28/76	3.0	0.005	< 0.001	0.002			
3/ 4/76	3.0	0.005	0.003	0.006	< 0.002	0.011	0.016
4/ 8/76	3.0	0.003	< 0.001	0.003	< 0.002		0.014
6/24/76	3.0	0.001	0.001	0.003	< 0.002	0.005	0.014

STATION - L-2

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L	NOX MG/L		NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	3.0		0.025	<	0.004		<	0.01	0.38	
3/26/75	3.0							0.05		
4/ 9/75	3.0									
4/23/75	3.0									
5/14/75	3.0	<	0.004	<	0.004			0.05	0.55	
6/ 2/75	3.0									
6/23/75	3.0			<	0.004			0.01	0.78	
7/16/75	3.0		0.080	<	0.004	0.084				
8/ 6/75	3.0	<	0.004	<	0.004	0.008				
8/28/75	3.0		0.055	<	0.004	0.059		0.03	0.69	0.74
9/18/75	3.0		0.014	<	0.004	0.019		0.05		
10/13/75	3.0		0.006		0.006	0.013				
11/ 6/75	3.0		0.055		0.005	0.060	<	0.01	0.43	0.49
11/24/75	3.0		0.086	<	0.004	0.090				
12/17/75	3.0		0.116		0.005	0.121		0.07	0.63	0.75
1/28/76	3.0		0.115		0.004	0.119				
3/ 4/76	3.0		0.088	<	0.004	0.092		0.02	0.58	0.67
4/ 8/76	3.0		0.040	<	0.004	0.044		0.16	0.49	0.53
6/24/76	3.0	<	0.004	<	0.004	0.005		0.01	0.52	0.52

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	TEMP CENT
3/10/75	5.0	20.6
3/26/75	5.0	23.3
4/ 9/75	5.0	25.5
4/23/75	5.0	23.8
5/14/75	5.0	28.0
6/ 2/75	5.0	28.2
6/23/75	5.0	27.2
7/16/75	5.0	27.1
8/ 6/75	5.0	29.8
8/28/75	5.0	29.6
9/18/75	5.0	29.7
10/13/75	5.0	27.6
11/ 6/75	5.0	25.1
11/24/75	5.0	21.5
12/17/75	5.0	20.4
1/28/76	5.0	18.4
3/ 4/76	5.0	21.5
4/ 8/76	5.0	24.2
6/24/76	5.0	27.7

L-3

D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
7.0	410.	7.00	
5.3	310.	7.80	
8.1	485.	7.70	
6.7	450.		
4.3	410.	7.30	
5.7	410.	7.60	
7.4	380.	7.10	
7.4	370.	8.30	
		7.40	
6.6	380.	7.60	
6.9	420.	7.20	
7.7	315.	7.90	
6.1	365.	7.60	
5.6	320.	7.40	
7.1	400.	7.30	
7.7	480.	7.80	
4.8	390.	7.60	
3.2	480.	7.50	
6.2	430.	7.40	

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	CA MG/L	CL MG/L
3/10/75	5.0	81.20	13.6
3/26/75	5.0	79.80	11.1
4/ 9/75	5.0	83.20	15.4
4/23/75	5.0	81.40	15.4
5/14/75	5.0	70.10	16.3
6/ 2/75	5.0	71.00	14.9
6/23/75	5.0	62.30	14.8
7/16/75	5.0	65.59	
8/ 6/75	5.0	66.53	13.5
8/28/75	5.0	64.06	18.0
9/18/75	5.0	60.88	18.7
10/13/75	5.0	66.73	21.7
11/ 6/75	5.0	66.73	17.0
11/24/75	5.0	81.44	16.1
12/17/75	5.0	74.55	20.3
1/28/76	5.0	87.80	21.6
3/ 4/76	5.0	84.88	16.9
4/ 8/76	5.0	84.34	16.5
6/24/76	5.0	66.34	19.8

L-3

	SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
	39.2	3.44	172.0	
	34.8	3.87	193.5	
	35.2	3.60	180.0	
	43.4	3.43	171.5	
	39.8	3.28	164.0	16.0
	40.0	3.15	157.5	17.5
	36.3	2.85	142.5	14.8
	31.9	2.78	139.0	13.4
	25.0	2.81	140.5	27.6
	109.3	2.58	129.0	15.5
		2.85	142.5	33.5
<	5.0	3.30	165.0	17.7
	27.7	2.71	135.5	16.0
	34.1	3.05	152.5	11.0
	38.0	3.18	159.0	10.5
	45.2	3.65	182.5	33.5
	42.0	3.60	180.0	15.0
	38.5	3.74	187.0	20.5
	28.7	3.03	151.5	18.5

STATION - L-3

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
3/10/75	5.0	0.001	0.003	0.007	< 0.002	0.003	0.016
3/26/75	5.0	< 0.001	0.001	0.008	< 0.002		
4/ 9/75	5.0	0.007	0.001	0.004			
4/23/75	5.0						
5/14/75	5.0	0.003	0.004	0.008	< 0.002	0.010	0.015
6/ 2/75	5.0	0.003	0.002	0.058			
6/23/75	5.0	0.002	0.002	0.005	< 0.002	0.007	0.017
7/16/75	5.0	0.003	0.001	0.003			
8/ 6/75	5.0	0.005	0.003	0.040			
8/28/75	5.0	0.010	0.002	0.012	0.004	0.009	0.023
9/18/75	5.0	0.005	< 0.001	0.018			
10/13/75	5.0	0.002	< 0.001	0.009			
11/ 6/75	5.0	0.003	< 0.001	0.012	< 0.002	0.007	0.014
11/24/75	5.0	0.002	< 0.001	0.002			
12/17/75	5.0	0.005	0.002	0.002	< 0.002	0.009	0.020
1/28/76	5.0	0.005	0.001	0.002			
3/ 4/76	5.0	0.002	0.004	0.011	0.003	0.011	0.018
4/ 8/76	5.0	0.002	< 0.001	0.004	< 0.002		0.024
6/24/76	5.0	0.001	< 0.001	0.030	< 0.002	0.007	0.017

STATION - 1-3

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L		NOX MG/L	NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	5.0		0.242	<	0.004			0.02	0.72	
3/26/75	5.0							0.03		
4/ 9/75	5.0									
4/23/75	5.0									
5/14/75	5.0		0.009	<	0.004			0.04	0.56	
6/ 2/75	5.0									
6/23/75	5.0			<	0.004			0.06	0.63	
7/16/75	5.0		0.056	<	0.004		0.060			
8/ 6/75	5.0	<	0.004	<	0.004	<	0.004			
8/28/75	5.0		0.145	<	0.004		0.149	0.10	0.64	0.78
9/18/75	5.0		0.083	<	0.004		0.088	0.03		
10/13/75	5.0	<	0.004		0.008		0.012			
11/ 6/75	5.0		0.048		0.005		0.053	0.07	0.55	0.60
11/24/75	5.0		0.109	<	0.004		0.114			
12/17/75	5.0		0.138		0.006		0.144	0.10	0.65	0.79
1/28/76	5.0		0.420		0.007		0.427			
3/ 4/76	5.0		0.084		0.006		0.090	0.08	0.74	0.83
4/ 8/76	5.0	<	0.004	<	0.004		0.004	0.03	0.62	0.62
6/24/76	5.0		0.051	<	0.004		0.055	0.04	0.57	0.62

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	TEMP CENT
3/10/75	1.0	21.0
3/26/75	1.0	24.4
4/ 9/75	1.0	26.8
4/23/75	1.0	23.9
5/14/75	1.0	28.5
6/ 2/75	1.0	29.6
6/23/75	1.0	27.1
7/16/75	1.0	27.4
8/ 6/75	1.0	30.7
8/28/75	1.0	30.3
9/18/75	1.0	29.9
10/13/75	1.0	27.8
11/ 6/75	1.0	25.5
11/24/75	1.0	21.9
12/17/75	1.0	21.1
1/28/76	1.0	20.9
3/ 4/76	1.0	24.1
4/ 8/76	1.0	24.4
6/24/76	1.0	27.6

L-4

D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
6.8	310.	6.80	2.65
7.4	330.	7.80	4.10
7.9	490.	7.70	
7.2	425.		
7.9	310.	7.70	1.95
8.0	415.	8.00	2.95
7.8	440.	6.80	2.85
8.3	390.	8.10	3.45
		8.10	
7.3	380.	7.70	2.15
7.7	420.	7.40	
7.1	240.	8.00	1.80
8.0	375.	7.90	1.75
8.2	390.	7.50	3.05
7.8	370.	7.40	4.40
8.5	385.	7.90	2.45
8.6	385.	7.80	3.50
8.2	435.	7.80	2.30
	435.	7.30	2.40

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	CA MG/L	CL MG/L
3/10/75	1.0	82.60	12.6
3/26/75	1.0	80.20	12.0
4/ 9/75	1.0	84.90	15.4
4/23/75	1.0	80.50	16.8
5/14/75	1.0	70.10	15.5
6/ 2/75	1.0	67.50	15.7
6/23/75	1.0	62.20	15.2
7/16/75	1.0	64.14	
8/ 6/75	1.0	60.85	13.3
8/28/75	1.0	65.24	18.0
9/18/75	1.0	59.20	17.0
10/13/75	1.0	65.75	20.3
11/ 6/75	1.0	66.56	16.8
11/24/75	1.0	74.48	15.9
12/17/75	1.0	72.44	19.6
1/28/76	1.0	86.81	22.4
3/ 4/76	1.0	82.81	16.7
4/ 8/76	1.0	82.48	16.7
6/24/76	1.0	68.09	16.6

L-4

SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
37.2	3.47	173.5	
35.6	3.85	192.5	
35.1	3.59	179.5	
41.4	3.38	169.0	
37.9	3.20	160.0	19.0
39.8	3.07	153.5	14.0
36.3	2.83	141.5	15.7
31.3	2.78	139.0	11.2
25.2	2.69	134.5	17.3
107.7	2.58	129.0	17.6
	2.80	140.0	33.0
39.8	3.33	166.5	10.5
29.2	2.76	138.0	14.0
30.8	3.05	152.5	7.0
38.2	3.28	164.0	7.5
44.7	3.65	182.5	10.0
41.5	3.45	172.5	14.5
38.5	3.67	183.5	17.0
32.1	3.07	153.5	18.5

STATION - L-4

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L	TDISS PR MG/L	TOTAL PR MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
3/10/75	1.0	0.001	< 0.001	0.008	< 0.002	0.002	0.011
3/26/75	1.0	< 0.001	0.002	0.006	< 0.002		
4/ 9/75	1.0	0.004	0.001	0.002			
4/23/75	1.0						
5/14/75	1.0	0.004	0.005	0.008	< 0.002	0.009	0.016
6/ 2/75	1.0	0.009	0.002	0.006			
6/23/75	1.0	0.005	0.002	0.005	< 0.002	0.006	0.011
7/16/75	1.0	0.003	0.002	0.004			
8/ 6/75	1.0	0.003	0.002	0.007			
8/28/75	1.0	0.010	0.002	0.002	0.002	0.006	0.016
9/18/75	1.0	0.009	< 0.001	0.003			
10/13/75	1.0	0.003	< 0.001	0.003			
11/ 6/75	1.0	0.004	< 0.001	0.002	< 0.002	0.006	0.009
11/24/75	1.0	0.002	< 0.001	0.002			
12/17/75	1.0	0.002	0.002	0.003	< 0.002	0.006	0.013
1/28/76	1.0	0.005	0.001	0.002			
3/ 4/76	1.0	0.003	0.003	0.009	< 0.002	0.007	0.012
4/ 8/76	1.0	0.002	< 0.001	0.003	< 0.002		0.011
6/24/76	1.0	0.001	< 0.001	0.003	< 0.002	0.006	0.016

STATION - L-4

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L	NOX MG/L		NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	1.0		0.038	<	0.004			0.03	0.41	
3/26/75	1.0						<	0.01		
4/ 9/75	1.0									
4/23/75	1.0									
5/14/75	1.0	<	0.004	<	0.004		<	0.01	0.55	
6/ 2/75	1.0									
6/23/75	1.0			<	0.004		<	0.01	0.56	
7/16/75	1.0		0.054	<	0.004	0.058				
8/ 6/75	1.0	<	0.004	<	0.004	0.004				
8/28/75	1.0		0.006	<	0.004	0.011		0.04	0.60	0.61
9/18/75	1.0		0.024	<	0.004	0.028		0.01		
10/13/75	1.0	<	0.004		0.006	0.007				
11/ 6/75	1.0		0.061		0.005	0.066	<	0.01	0.42	0.48
11/24/75	1.0		0.096		0.005	0.101				
12/17/75	1.0		0.159		0.005	0.164		0.07	0.64	0.80
1/28/76	1.0		0.152	<	0.004	0.156				
3/ 4/76	1.0		0.092	<	0.004	0.097		0.02	0.61	0.70
4/ 8/76	1.0	<	0.004	<	0.004	0.004	<	0.01	0.53	0.53
6/24/76	1.0	<	0.004	<	0.004	0.006		0.02	0.55	0.55

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	TEMP CENT
3/10/75	3.0	20.6
3/26/75	3.0	23.9
4/ 9/75	3.0	26.1
4/23/75	3.0	23.9
5/14/75	3.0	28.1
6/ 2/75	3.0	28.7
6/23/75	3.0	27.1
7/16/75	3.0	27.0
8/ 6/75	3.0	30.4
8/28/75	3.0	29.8
9/18/75	3.0	29.8
10/13/75	3.0	27.8
11/ 6/75	3.0	25.3
11/24/75	3.0	21.6
12/17/75	3.0	20.5
1/28/76	3.0	18.6
3/ 4/76	3.0	23.1
4/ 8/76	3.0	24.4
6/24/76	3.0	27.7

L-5

D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
6.7	340.	6.70	
7.0	355.	7.80	
8.1	480.	7.70	
7.1	440.		
7.7	375.	7.70	
7.4	410.	7.90	
7.7	455.	6.80	
8.1	390.	8.00	
		8.00	
6.7	380.	7.60	
7.5	420.	7.30	
7.6	270.	8.00	
7.9	375.	7.90	
6.3	395.	7.50	
7.5	395.	7.40	
8.5	420.	7.80	
8.4	385.	7.70	
8.0	450.	7.80	
	430.	7.40	

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	CA MG/L	CL MG/L
3/10/75	3.0	83.70	13.8
3/26/75	3.0	81.50	10.9
4/ 9/75	3.0	90.00	15.4
4/23/75	3.0	82.00	15.4
5/14/75	3.0	71.50	15.7
6/ 2/75	3.0	68.20	15.5
6/23/75	3.0	65.50	15.0
7/16/75	3.0	64.46	
8/ 6/75	3.0	61.18	13.3
8/28/75	3.0	64.40	16.0
9/18/75	3.0	59.68	15.8
10/13/75	3.0	66.24	19.7
11/ 6/75	3.0	65.89	18.2
11/24/75	3.0	72.99	15.5
12/17/75	3.0	75.52	19.8
1/28/76	3.0	87.63	17.0
3/ 4/76	3.0	86.20	18.5
4/ 8/76	3.0	85.59	16.3
6/24/76	3.0	68.41	16.2

L-5

SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
36.5	3.44	172.0	
34.6	3.85	192.5	
39.9	3.63	181.5	
41.4	3.41	170.5	
38.6	3.25	162.5	7.5
39.8	3.10	155.0	17.0
35.8	2.85	142.5	16.0
31.7	2.80	140.0	13.9
26.0	2.71	135.5	19.2
110.3	2.61	130.5	16.4
	2.85	142.5	32.0
39.3	3.31	165.5	20.2
29.5	2.76	138.0	14.0
34.8	3.06	153.0	4.0
38.0	3.30	165.0	7.5
43.7	3.70	185.0	11.5
41.5	3.45	172.5	23.5
39.8	3.68	184.0	17.0
28.7	3.11	155.5	22.5

STATION - L-5

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L		TDISS PB MG/L	TOTAL PB MG/L		O-PO4 MG/L	TOPO4 MG/L	T-PO4 MG/L
3/10/75	3.0	0.001	<	0.001	0.007		0.003	0.006	0.011
3/26/75	3.0	0.001		0.001	0.011	<	0.002		
4/ 9/75	3.0	0.008	<	0.001	0.003				
4/23/75	3.0								
5/14/75	3.0	0.003		0.004	0.010		0.007	0.008	0.015
6/ 2/75	3.0	0.003		0.002	0.007				
6/23/75	3.0	0.005		0.004	0.006	<	0.002	0.006	0.012
7/16/75	3.0	0.002		0.002	0.005				
8/ 6/75	3.0	0.003		0.002	0.006				
8/28/75	3.0	0.014		0.003	0.002		0.002	0.014	0.017
9/18/75	3.0	0.011	<	0.001	0.003				
10/13/75	3.0	0.001	<	0.001	0.003				
11/ 6/75	3.0	0.003	<	0.001	0.002	<	0.002	0.005	0.011
11/24/75	3.0	0.002	<	0.001	0.002				
12/17/75	3.0	0.002		0.001	0.003	<	0.002	0.006	0.018
1/28/76	3.0	0.003	<	0.001	0.003				
3/ 4/76	3.0	0.005		0.003	0.005		0.159	0.133	0.014
4/ 8/76	3.0	0.005		0.002	0.003	<	0.002		0.015
6/24/76	3.0	0.002	<	0.001	0.003	<	0.002	0.005	0.014

STATION - L-5

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L		NOX MG/L		NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	3.0		0.020	<	0.004				0.01	0.45	
3/26/75	3.0							<	0.01		
4/ 9/75	3.0										
4/23/75	3.0										
5/14/75	3.0	<	0.004	<	0.004				0.01	0.57	
6/ 2/75	3.0										
6/23/75	3.0			<	0.004			<	0.01	0.64	
7/16/75	3.0		0.041	<	0.004		0.045				
8/ 6/75	3.0	<	0.004	<	0.004	<	0.004				
8/28/75	3.0		0.005	<	0.004		0.010		0.04	0.65	0.65
9/18/75	3.0		0.004	<	0.004		0.009	<	0.01		
10/13/75	3.0		0.011		0.007		0.018				
11/ 6/75	3.0		0.052	<	0.004		0.056	<	0.01	0.47	0.52
11/24/75	3.0		0.090	<	0.004		0.095				
12/17/75	3.0		0.116		0.005		0.121		0.06	0.65	0.77
1/28/76	3.0		0.117		0.004		0.122				
3/ 4/76	3.0		0.092	<	0.004		0.097		0.07	0.58	0.67
4/ 8/76	3.0	<	0.004	<	0.004	<	0.004	<	0.01	0.48	0.48
6/24/76	3.0	<	0.004	<	0.004		0.006		0.02	0.68	0.68

APPENDIX A

STATION - L

DATE MO/DA/YR	DEPTH METERS	TEMP CENT
3/10/75	5.0	20.5
3/26/75	5.0	23.4
4/ 9/75	5.0	25.5
4/23/75	5.0	23.8
5/14/75	5.0	27.8
6/ 2/75	5.0	28.1
6/23/75	5.0	27.0
7/16/75	5.0	26.9
8/ 6/75	5.0	29.6
8/28/75	5.0	29.4
9/18/75	5.0	29.6
10/13/75	5.0	27.6
11/ 6/75	5.0	25.2
11/24/75	5.0	21.4
12/17/75	5.0	20.3
1/28/76	5.0	18.4
3/ 4/76	5.0	21.6
4/ 8/76	5.0	24.2
6/24/76	5.0	27.7

-6

D.O. MG/L	SP COND UMHOS/CM	PH	SECCHI M
6.9	350.	6.90	
3.9	390.	7.80	
8.0	480.	7.70	
7.1	460.		
3.9	410.	7.30	
4.3	435.	7.50	
7.6	470.	6.80	
8.1	390.	8.10	
		7.20	
6.7	375.	7.60	
7.0	425.	7.20	
7.0	290.	7.90	
5.7	380.	7.50	
5.9	410.	7.40	
7.3	410.	7.40	
7.7	445.	7.70	
4.7	400.	7.40	
1.9	485.	7.40	
	430.	7.40	

APPENDIX A

STATION -

DATE MO/DA/YR	DEPTH METERS	CA MG/L		CL MG/L
3/10/75	5.0	81.60		13.2
3/26/75	5.0	81.90		11.3
4/ 9/75	5.0	87.50		15.4
4/23/75	5.0	82.00		16.4
5/14/75	5.0	76.20		16.3
6/ 2/75	5.0	71.00		16.9
6/23/75	5.0	62.90		14.8
7/16/75	5.0	63.17		
8/ 6/75	5.0	64.91		13.3
8/28/75	5.0	65.24		15.?
9/18/75	5.0	60.88		15.8
10/13/75	5.0	66.41		19.5
11/ 6/75	5.0	81.16		21.0
11/24/75	5.0			15.3
12/17/75	5.0	75.36		16.8
1/28/76	5.0	86.32	<	4.0
3/ 4/76	5.0	82.81		18.9
4/ 8/76	5.0	86.68		16.5
6/24/76	5.0	70.65		16.6

L-6

SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
36.7	3.44	172.0	
34.1	3.97	198.5	
42.6	3.60	180.0	
42.6	3.43	171.5	
38.6	3.46	173.0	7.0
40.0	3.30	165.0	26.0
36.3	2.86	143.0	16.8
29.0	2.70	135.0	35.3
27.5	2.85	142.5	16.4
110.6	2.62	131.0	24.4
	2.85	142.5	37.5
38.8	3.34	167.0	16.0
29.2	2.75	137.5	15.0
32.6	3.09	154.5	6.0
38.7	3.84	192.0	8.0
44.2	3.54	177.0	43.5
42.8	3.64	182.0	30.0
39.2	3.77	188.5	50.0
29.5	3.11	155.5	29.0

STATION - L-6

DATE MO/DA/YR	DEPTH METERS	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
3/10/75	5.0	0.001	< 0.001	0.006	< 0.002	0.002	0.013
3/26/75	5.0	< 0.001	0.001	0.007	< 0.002		
4/ 9/75	5.0	0.005	0.002	0.003			
4/23/75	5.0						
5/14/75	5.0	0.003	0.004	0.013	< 0.002	0.006	0.018
6/ 2/75	5.0	0.003	0.003	0.015			
6/23/75	5.0	0.006	0.004	0.008	< 0.002	0.006	0.178
7/16/75	5.0	0.002	0.002	0.006			
8/ 6/75	5.0	0.003	0.003	0.017			
8/28/75	5.0	0.010	0.003	0.010	0.002	0.005	0.018
9/18/75	5.0	0.011	< 0.001	< 0.001			
10/13/75	5.0	0.002	< 0.001	0.003			
11/ 6/75	5.0	0.004	0.012	0.013	< 0.002	0.005	0.013
11/24/75	5.0	0.001	< 0.001	0.027			
12/17/75	5.0	0.001	0.002	0.017	< 0.002	0.005	0.055
1/28/76	5.0	0.006	0.001	0.002			
3/ 4/76	5.0	0.005	0.003	0.001	0.011	0.020	0.020
4/ 8/76	5.0	0.002	< 0.001	0.024	< 0.002		0.090
6/24/76	5.0	< 0.001	< 0.001	0.003	0.002	0.005	0.021

STATION - L-6

DATE MO/DA/YR	DEPTH METERS		NO3 MG/L		NO2 MG/L		NOX MG/L		NH4 MG/L	TKN MG/L	TOTAL N MG/L
3/10/75	5.0		0.008	<	0.004			<	0.01	0.47	
3/26/75	5.0								0.01		
4/ 9/75	5.0										
4/23/75	5.0										
5/14/75	5.0		0.155	<	0.004				0.11	0.66	
6/ 2/75	5.0										
6/23/75	5.0			<	0.004				0.02	0.68	
7/16/75	5.0		0.017	<	0.004		0.021				
8/ 6/75	5.0	<	0.004		0.022	<	0.004				
8/28/75	5.0		0.125	<	0.004		0.129		0.04	0.53	0.65
9/18/75	5.0		0.014	<	0.004		0.018		0.02		
10/13/75	5.0		0.016		0.007		0.023				
11/ 6/75	5.0		0.050		0.004		0.054		0.04	0.66	0.71
11/24/75	5.0		0.089	<	0.004		0.093				
12/17/75	5.0		0.109		0.005		0.114		0.07	0.67	0.78
1/28/76	5.0		1.053		0.005		1.058				
3/ 4/76	5.0		0.090		0.004		0.095		0.13	0.80	0.89
4/ 8/76	5.0	<	0.004	<	0.004	<	0.004		0.04	1.10	1.10
6/24/76	5.0		0.016	<	0.004		0.020		0.05	0.69	0.71

A P P E N D I X

B

WELL DATA BY STATION

APPENDIX B

STATION -

DATE MO/DA/YR	TEMP CENT	D.O. MG/L
6/ 2/75	26.5	2.3
6/23/75	24.7	2.1
7/16/75	25.5	1.7
8/ 6/75	27.5	
8/28/75	27.6	3.1
9/18/75	25.0	2.2
10/13/75	27.7	2.1
11/ 6/75	28.2	3.4
11/24/75	27.0	0.6
12/17/75	26.0	0.9
1/28/76	25.2	1.6
3/ 4/76	25.5	1.6
4/ 8/76	24.8	0.8
6/24/76	26.5	

W-1S

SP COND UMHOS/CM	PH
675.	6.60
425.	7.20
630.	6.90
	6.10
665.	6.60
660.	6.00
280.	6.60
440.	6.50
315.	6.60
270.	6.50
425.	6.40
580.	6.50
240.	6.70
605.	6.40

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
6/ 2/75	135.80	17.1	40.0
6/23/75	130.50	13.2	44.5
7/16/75	137.76		37.6
8/ 6/75	128.02	13.5	35.0
8/28/75	137.25	17.8	165.6
9/18/75	124.27	14.8	
10/13/75	132.33	14.7	67.2
11/ 6/75	117.72	7.4	22.9
11/24/75		5.9	31.8
12/17/75	132.51	10.0	75.7
1/28/76	145.49	8.4	114.9
3/ 4/76	159.46	9.6	92.8
4/ 8/76	140.24	8.9	78.4
6/24/76	157.55	8.2	19.2

W-1S

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
7.16	358.0	21.5
6.19	309.5	21.8
6.69	334.5	15.6
6.71	335.5	43.1
2.61	130.5	16.8
6.89	344.5	47.5
5.89	294.5	19.4
5.86	293.0	11.0
6.73	336.5	10.0
5.99	299.5	17.0
5.47	273.5	23.5
6.58	329.0	40.0
6.05	302.5	20.0
5.79	289.5	36.5

STATION - W-1S

DATE MO/DA/YR	TDISS CU MG/L		TDISS PB MG/L		TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
6/ 2/75	0.004		0.002		0.011			
6/23/75	0.002	<	0.001		0.008	0.046	0.049	0.385
7/16/75	0.003	<	0.001		0.008			
8/ 6/75	0.014		0.007		0.131			
8/28/75	0.019		0.002		0.005	0.034	0.040	0.115
9/18/75	0.009	<	0.001		0.018			
10/13/75	0.003	<	0.001		0.014			
11/ 6/75	0.003	<	0.001	<	0.001	0.060	0.071	0.066
11/24/75	0.001	<	0.001		0.008			
12/17/75	0.004	<	0.001		0.019	0.010	0.033	0.189
1/28/76	0.004	<	0.001		0.002			
3/ 4/76	0.004	<	0.001		0.004	0.007	0.012	0.207
4/ 8/76	0.006	<	0.001		0.006	0.021		0.153
6/24/76	0.007	<	0.001		0.016	0.023	0.030	0.043

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L	NOX MG/L
6/ 2/75					
6/23/75			<	0.004	
7/16/75		0.004	<	0.004	0.009
8/ 6/75		0.016	<	0.004	0.020
8/28/75		0.008	<	0.004	0.013
9/18/75		0.048	<	0.004	0.052
10/13/75		0.039		0.008	0.047
11/ 6/75	<	0.004	<	0.004	0.007
11/24/75	<	0.004	<	0.004	0.007
12/17/75		0.040		0.006	0.047
1/28/76	<	0.004	<	0.004	0.006
3/ 4/76		0.006	<	0.004	0.011
4/ 8/76		0.008	<	0.004	0.013
6/24/76	<	0.004	<	0.004	0.005

W-1S

NH4 MG/L	TKN MG/L	TOTAL N MG/L
1.45	2.10	
1.15	1.88	1.89
0.86		
0.42	0.78	0.78
0.29	1.00	1.04
0.18	0.92	0.93
0.15	0.81	0.82
0.15	0.81	0.81

APPENDIX B

STATION -

DATE MO/DA/YR	TEMP CENT	D.O. MG/L
5/14/75	26.5	
6/ 2/75	26.1	3.0
6/23/75	24.9	1.9
7/16/75	24.8	3.5
8/ 6/75	26.9	
8/28/75	26.9	1.5
9/18/75	24.3	1.0
10/13/75	26.0	1.4
11/ 6/75	27.7	1.1
11/24/75	26.9	0.8
12/17/75	26.6	0.9
1/28/76	26.2	1.5
3/ 4/76	26.4	2.3
4/ 8/76	25.2	1.3
6/24/76	26.4	

W-1D

SP COND UMHOS/CM	PH
525.	6.70
625.	6.80
355.	7.50
530.	7.00
	6.50
450.	6.70
445.	6.10
230.	6.80
540.	6.50
300.	6.50
270.	6.50
300.	6.60
555.	6.60
195.	6.60
665.	6.60

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
5/14/75	101.80	60.5	112.4
6/ 2/75	119.40	11.2	142.6
6/23/75	102.60	12.6	110.8
7/16/75	92.55		113.6
8/ 6/75	88.76	10.3	92.9
8/28/75	93.50	10.4	340.7
9/18/75	81.53	16.8	
10/13/75	96.59	20.5	104.6
11/ 6/75	141.54	13.8	
11/24/75		12.7	122.9
12/17/75	132.51	45.7	153.8
1/28/76	124.84	13.4	99.2
3/ 4/76	137.81	14.6	125.7
4/ 8/76	91.66	22.5	52.1
6/24/76	121.51	19.6	124.1

W-10

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
3.04	152.0	16.0
3.64	182.0	27.5
2.90	145.0	25.9
2.67	133.5	19.8
2.79	139.5	30.8
2.72	136.0	20.3
2.72	136.0	36.5
3.26	163.0	18.7
4.98	249.0	19.0
3.35	167.5	8.0
3.92	196.0	11.5
4.20	210.0	28.5
4.07	203.5	43.5
3.54	177.0	14.0
4.02	201.0	47.0

STATION - W-1D

DATE MO/DA/YR	TDISS CU MG/L		TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
5/14/75	0.002		0.002	0.015	0.040	0.041	0.052
6/ 2/75	0.002		0.002	0.010			
6/23/75	0.004	<	0.001	0.001	0.033	0.217	0.446
7/16/75	0.005	<	0.001	0.004			
8/ 6/75	0.002		0.002	0.004			
8/28/75	0.008		0.002	0.001	0.029	0.039	0.054
9/18/75	0.010		0.001	0.008			
10/13/75	0.002	<	0.001	0.005			
11/ 6/75	0.002	<	0.001	0.001	0.022	0.037	0.056
11/24/75	0.002	<	0.001	0.002			
12/17/75	0.002	<	0.001	0.003	0.023	0.062	0.189
1/28/76	0.004	<	0.001	0.006			
3/ 4/76	0.006	<	0.001	0.008	0.027	0.035	0.138
4/ 8/76	0.002		0.001	0.013	0.013		0.206
6/24/76	0.002	<	0.001	0.008	0.017	0.019	0.033

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L		NOX MG/L
5/14/75	<	0.004	<	0.004		
6/ 2/75						
6/23/75				0.016		
7/16/75		0.055	<	0.004		0.059
8/ 6/75	<	0.004	<	0.004		0.005
8/28/75		0.167	<	0.004		0.172
9/18/75		0.014	<	0.004		0.019
10/13/75	<	0.004		0.008		0.009
11/ 6/75		0.016	<	0.004		0.020
11/24/75	<	0.004	<	0.004	<	0.004
12/17/75				0.010		0.004
1/28/76		0.054	<	0.004		0.058
3/ 4/76	<	0.004	<	0.004		0.006
4/ 8/76		0.004	<	0.004		0.009
6/24/76	<	0.004	<	0.004		0.005

W-1D

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.20	1.04	
0.22	1.14	
0.19	0.94	1.11
0.17		
0.24	1.33	1.34
0.25	0.81	0.81
0.27	1.08	1.08
0.13	0.85	0.85
0.26	1.03	1.03

APPENDIX B

STATION -

DATE MO/DA/YR	TEMP CENT	D.O. MG/L
6/23/75	23.5	1.2
7/16/75	24.0	3.0
8/ 6/75	26.2	
8/28/75	26.6	4.0
9/18/75	24.0	3.4
10/13/75	26.4	1.6
11/ 6/75	27.1	2.9
11/24/75	26.1	1.6
12/17/75	26.4	3.1
1/28/76	24.6	2.5
3/ 4/76	23.9	2.7
4/ 8/76	23.1	4.1
6/24/76	25.2	

W-2S

SP COND UMHOS/CM	PH
215.	7.20
670.	7.10
	6.30
650.	6.80
645.	6.20
190.	6.90
500.	7.00
250.	6.90
255.	6.90
310.	7.10
490.	7.00
235.	7.20
615.	6.90

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L		CL MG/L	SO4 MG/L
6/23/75	110.60		24.0	56.2
7/16/75	125.16			47.5
8/ 6/75	126.73		11.5	35.7
8/28/75	134.05		13.6	133.3
9/18/75	130.27	<	4.0	
10/13/75	117.97		19.3	67.9
11/ 6/75	100.45		30.1	
11/24/75			20.9	27.1
12/17/75	101.18		18.6	29.1
1/28/76	107.47		13.6	21.2
3/ 4/76	116.52		19.7	22.6
4/ 8/76	111.12		26.2	29.1
6/24/76	112.90		18.8	23.5

W-2S

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
5.34	267.0	15.6
5.89	294.5	5.8
5.91	295.5	22.3
5.69	284.5	11.2
6.44	322.0	39.0
2.69	134.5	8.0
4.55	227.5	0.3
4.52	226.0	3.0
4.73	236.5	8.5
4.82	241.0	9.5
5.87	293.5	12.5
4.79	239.4	10.0
4.02	201.0	27.0

STATION - W-2S

DATE MO/DA/YR	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
6/23/75	0.005	0.001	0.012	0.007	0.011	0.142
7/16/75	< 0.003	< 0.001	0.009			
8/ 6/75	0.004	0.004	0.006			
8/28/75	0.008	0.003	0.031	0.003	0.009	0.015
9/18/75	< 0.006	< 0.001	0.008			
10/13/75	< 0.003	< 0.001	0.020			
11/ 6/75	< 0.003	< 0.001	< 0.007	0.002	0.007	0.008
11/24/75	< 0.002	< 0.001	0.004			
12/17/75	< 0.004	< 0.001	< 0.007	0.002	0.011	0.189
1/28/76	< 0.002	< 0.001	0.004			
3/ 4/76	< 0.004	< 0.001	0.003	0.002	0.004	0.062
4/ 8/76	< 0.002	< 0.001	< 0.011	0.002		0.151
6/24/76	< 0.001	< 0.001	0.013	0.006	0.011	0.010

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L	NOX MG/L
6/23/75			<	0.004	
7/16/75	<	0.004	<	0.004	0.006
8/ 6/75		0.004	<	0.004	0.009
8/28/75		0.020	<	0.004	0.024
9/18/75		0.019	<	0.004	0.023
10/13/75		0.107		0.007	0.114
11/ 6/75		0.004	<	0.004	0.009
11/24/75		0.019	<	0.004	0.023
12/17/75		0.014		0.010	0.025
1/28/76		0.312	<	0.004	0.316
3/ 4/76	<	0.004	<	0.004	0.006
4/ 8/76		1.582	<	0.004	1.586
6/24/76		0.013	<	0.004	0.017

W-2S

	NH4 MG/L	TKN MG/L	TOTAL N MG/L
	0.03	0.49	
	0.05	0.39	0.41
	0.05		
<	0.01	0.63	0.63
	0.11	0.24	0.26
	0.05	0.33	0.33
	0.04	0.46	2.04
	0.02	0.43	0.44

STATION - W-2D

DATE MO/DA/YR	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
6/23/75	23.4	3.6	340.	7.70
7/16/75	23.5	1.9	710.	7.00
8/ 6/75	26.1			6.40
8/28/75	25.8	3.1	670.	6.90
9/18/75	23.3	1.7	480.	6.40
10/13/75	25.8	3.2	240.	7.00
11/ 6/75	26.6	1.7	450.	7.00
11/24/75	25.9	1.7	235.	6.90
12/17/75	25.5	1.6	350.	6.80
1/28/76	25.4	3.0	350.	7.10
3/ 4/76	24.9	3.1	540.	7.00
4/ 8/76	24.0	2.5	400.	7.20
6/24/76	25.4		705.	7.00

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
6/23/75	118.80	14.6	69.2
7/16/75	141.95		88.2
8/ 6/75	136.30	16.9	61.3
8/28/75	129.68	11.2	200.8
9/18/75	99.07	15.2	
10/13/75	94.96	18.3	46.5
11/ 6/75	91.22	14.0	115.7
11/24/75		11.3	33.8
12/17/75	111.57	11.8	53.9
1/28/76	129.76	12.4	63.2
3/ 4/76	136.11	13.2	79.3
4/ 8/76	145.85	18.9	58.2
6/24/76	143.68	23.3	47.8

W-2D

ALK MEQ/L	ALKCACO3 MG/L	EOD MG/L
5.06	253.0	10.7
5.85	292.5	8.8
6.10	305.0	20.3
5.41	270.5	15.0
4.11	205.5	37.0
4.49	224.5	10.8
3.92	196.0	0.4
4.30	215.0	5.0
4.92	246.0	5.5
5.43	271.5	14.0
6.07	303.5	30.5
1.70	85.0	11.5
5.93	296.5	7.0

STATION - W-2D

DATE MO/DA/YR	TDISS CU MG/L		TDISS PB MG/L		TOTAL PB MG/L		O-PO4 MG/L		TDPO4 MG/L		T-PO4 MG/L
6/23/75	0.006		0.001		0.017	<	0.002		0.010		1.001
7/16/75	0.002	<	0.001		0.002						
8/ 6/75	0.002		0.002		0.011						
8/28/75	0.010		0.002		0.007		0.002		0.007		0.028
9/18/75	0.004	<	0.001		0.027						
10/13/75	0.002	<	0.001		0.014						
11/ 6/75	0.005	<	0.001	<	0.001	<	0.002		0.011		0.011
11/24/75	0.001	<	0.001		0.003						
12/17/75	0.001	<	0.001		0.003	<	0.002		0.092		0.189
1/28/76	0.003	<	0.001		0.002						
3/ 4/76	0.003	<	0.001		0.004	<	0.002		0.002		0.294
4/ 8/76	0.012		0.001		0.009	<	0.002				0.363
6/24/76	0.001	<	0.001		0.002	<	0.002	<	0.002		0.015

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L		NOX MG/L
6/23/75			<	0.004		
7/16/75		0.059	<	0.004		0.064
8/ 6/75		0.027	<	0.004		0.031
8/28/75	<	0.004	<	0.004		0.008
9/18/75	<	0.004	<	0.004		0.006
10/13/75		0.016		0.007		0.023
11/ 6/75		0.009	<	0.004		0.014
11/24/75	<	0.004	<	0.004	<	0.004
12/17/75				0.008		0.005
1/28/76	<	0.004	<	0.004		0.008
3/ 4/76		0.007	<	0.004		0.012
4/ 8/76	<	0.004	<	0.004	<	0.004
6/24/76	<	0.004	<	0.004		0.005

W-2D

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.08	0.61	
0.14	0.63	0.63
0.12		
0.09	0.42	0.43
0.18	0.46	0.46
0.18	0.88	0.89
0.11	0.71	0.71
0.10	0.44	0.44

APPENDIX B

STATION -

DATE MO/DA/YR	TEMP CENT	D.O. MG/L
6/23/75	25.0	5.2
7/16/75	24.6	7.4
8/ 6/75	27.4	
8/28/75	28.0	3.7
9/18/75	25.8	4.0
10/13/75	28.6	4.1
11/ 6/75	28.9	2.4
11/24/75	27.6	1.4
12/17/75	26.1	1.7
1/28/76	24.0	2.2
3/ 4/76	22.7	3.3
4/ 8/76	21.3	2.5
6/24/76	25.1	

W-3S

SP COND UMHOS/CM	PH
410.	8.30
425.	7.90
	7.20
425.	7.30
400.	7.00
180.	7.30
420.	7.20
240.	7.20
165.	7.20
230.	7.40
415.	7.40
375.	7.30
515.	7.10

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
6/23/75	83.30	15.8	22.2
7/16/75	70.27		32.2
8/ 6/75	73.35	15.1	22.7
8/28/75	75.50	25.8	95.0
9/18/75	93.54	15.8	
10/13/75	73.91	20.3	28.8
11/ 6/75	74.78	16.8	28.7
11/24/75		15.1	20.7
12/17/75	98.09	16.6	13.2
1/28/76	81.73	18.0	29.8
3/ 4/76	88.46	19.9	37.7
4/ 8/76	100.23	23.8	44.8
6/24/76	89.78	18.0	29.9

W-3S

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
3.62	181.0	9.7
3.22	161.0	6.1
3.06	153.0	9.5
3.33	166.5	13.6
3.63	181.5	11.0
3.63	181.5	10.9
3.26	163.0	4.0
3.26	163.0	3.0
3.69	184.5	8.0
3.48	174.0	16.5
3.65	182.5	22.0
4.14	207.0	12.5
4.24	212.0	30.5

STATION - W-3S

DATE MO/DA/YR	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
6/23/75	0.013	< 0.006	0.032	< 0.002	0.004	0.105
7/16/75	0.002	< 0.001	0.015			
8/ 6/75	0.002	0.001	0.009			
8/28/75	0.011	0.002	0.004	< 0.003	0.008	0.010
9/18/75	0.062	0.008	0.014			
10/13/75	0.003	< 0.001	0.017			
11/ 6/75	0.002	< 0.001	0.001	< 0.002	0.006	0.020
11/24/75	0.001	< 0.001	< 0.001			
12/17/75	0.007	0.005	0.004	< 0.002	0.010	< 0.002
1/28/76	0.005	< 0.001	< 0.001			
3/ 4/76	0.009	0.001	0.001	< 0.005	0.013	0.124
4/ 8/76	0.006	< 0.001	0.002	< 0.007		0.180
6/24/76	< 0.001	< 0.001	0.002	< 0.003	0.008	0.027

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L		NOX MG/L
6/23/75			<	0.004		
7/16/75		0.037	<	0.004		0.041
8/ 6/75		0.004	<	0.004		0.009
8/28/75		0.004	<	0.004		0.009
9/18/75	<	0.004	<	0.004		0.007
10/13/75	<	0.004		0.008		0.010
11/ 6/75		0.005	<	0.004		0.010
11/24/75		0.011	<	0.004		0.015
12/17/75		0.038		0.008		0.046
1/28/76		0.013	<	0.004		0.017
3/ 4/76		0.011	<	0.004		0.015
4/ 8/76		0.022	<	0.004		0.026
6/24/76	<	0.004	<	0.004	<	0.004

W-3S

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.12	0.37	
0.05	0.46	0.46
0.03		
0.02	0.59	0.60
0.11	0.32	0.36
0.04	0.52	0.53
0.03	0.80	0.82
0.03	0.55	0.55

STATION - W-3D

DATE MO/DA/YR	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
6/23/75	22.7	1.8	215.	8.30
7/16/75	23.5	5.4	440.	7.60
8/28/75	27.1	6.5	230.	7.10
9/18/75	25.0	1.8	395.	7.10
10/13/75	27.5	2.9	185.	7.30
11/ 6/75	28.5	1.4	370.	7.10
11/24/75	27.8	3.9	155.	7.00
12/17/75	26.7	3.4	170.	6.80
1/28/76	25.4	1.8	180.	7.30
3/ 4/76	23.6	2.3	410.	7.30
4/ 8/76	21.9	2.7	230.	7.50
6/24/76	24.1		515.	7.20

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
6/23/75	79.16	16.0	29.6
7/16/75	72.21		28.8
8/28/75	74.83	15.0	89.6
9/18/75	68.54	16.8	
10/13/75	67.71	19.7	24.8
11/ 6/75	68.91	16.2	23.9
11/24/75		16.5	34.3
12/17/75	75.36	18.6	23.8
1/28/76	74.52	17.6	21.8
3/ 4/76	90.16	20.1	36.4
4/ 8/76	96.02	23.8	34.4
6/24/76	89.14	17.0	28.0

W-3D

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
3.85	192.5	6.9
3.52	176.0	10.3
3.28	164.0	8.5
3.18	159.0	9.0
3.48	174.0	6.7
3.23	161.5	30.0
3.31	165.5	4.0
3.58	179.0	4.0
3.38	169.0	14.0
3.91	195.5	3.0
4.12	206.0	17.0
4.21	210.5	10.0

STATION - W-3D

DATE MO/DA/YR	TDISS CU MG/L		TDISS PB MG/L		TOTAL PB MG/L		O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
6/23/75	0.002		0.001		0.010		0.007	0.061	1.098
7/16/75	0.002		0.003		0.024				
8/28/75	0.006		0.003		0.025		0.006	0.014	0.256
9/18/75	0.010		0.001		0.016				
10/13/75	0.005	<	0.001	<	0.001				
11/ 6/75	0.007	<	0.001	<	0.001	<	0.002	0.025	0.127
11/24/75	0.006	<	0.001		0.002				
12/17/75	0.006		0.001		0.007		0.003	0.015	0.756
1/28/76	0.007	<	0.001		0.004				
3/ 4/76	0.008	<	0.001		0.014		0.009	0.021	0.046
4/ 8/76	0.007	<	0.001		0.002		0.010		0.085
6/24/76	0.003	<	0.001		0.008		0.013	0.019	0.035

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L		NOX MG/L
6/23/75			<	0.004		
7/16/75		0.014	<	0.004		0.018
8/28/75		0.005	<	0.004		0.010
9/18/75		0.022	<	0.004		0.026
10/13/75	<	0.004		0.007		0.009
11/ 6/75		0.047	<	0.004		0.051
11/24/75		0.033	<	0.004		0.037
12/17/75		0.334		0.009		0.343
1/28/76		0.012	<	0.004		0.016
3/ 4/76	<	0.004	<	0.004		0.007
4/ 8/76		0.150	<	0.004		0.155
6/24/76	<	0.004	<	0.004	<	0.004

W-3D

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.08	0.59	
0.14	0.48	0.49
0.15		
0.10	0.83	0.88
0.19	0.39	0.73
0.11	0.46	0.46
0.07	0.52	0.67
0.05	0.54	0.54

STATION - W-0

DATE MO/DA/YR	TEMP CENT	D.O. MG/L	SP COND UMHOS/CM	PH
6/23/75	25.4	4.8	330.	6.70
7/16/75	25.4	4.9	740.	7.90
8/ 6/75	28.1			7.70
8/28/75	27.9	4.4	740.	7.60
9/18/75	25.8	5.4	705.	7.20
10/13/75	27.7	4.7	400.	7.70
11/ 6/75	28.1	4.6	565.	7.70
11/24/75	27.0	4.7	420.	7.50
12/17/75	26.8	4.6	245.	7.40
1/28/76	25.3	9.0	290.	7.60
3/ 4/76	26.9	4.7	510.	7.30
4/ 8/76	26.0	2.9	260.	7.50
6/24/76	27.1		680.	7.50

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L	CL MG/L	SO4 MG/L
6/23/75	98.60	17.0	50.1
7/16/75	160.24		101.1
8/ 6/75	139.54	11.9	82.6
8/28/75	141.45	11.2	336.7
9/18/75	143.90	12.0	
10/13/75	133.30	16.1	92.9
11/ 6/75	118.40	14.0	75.3
11/24/75		11.3	70.8
12/17/75	121.30	14.1	69.3
1/28/76	125.66	11.2	71.0
3/ 4/76	118.97	13.8	66.2
4/ 8/76	122.96	34.5	65.8
6/24/76	125.02	14.5	69.2

W-0

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
4.27	213.5	8.7
5.39	269.5	20.7
5.70	285.0	13.5
5.16	258.0	15.9
5.86	293.0	16.5
5.09	254.5	9.3
4.81	240.5	7.0
4.76	238.0	5.0
4.92	246.0	3.0
4.97	248.5	17.0
4.72	236.0	24.0
1.29	64.5	18.5
5.20	260.0	15.0

STATION - W-0

DATE MO/DA/YR	TDISS CU MG/L		TDISS PB MG/L		TOTAL PB MG/L		O-PO4 MG/L		TDPO4 MG/L	T-PO4 MG/L
6/23/75	0.082		0.003		0.010	<	0.002		0.006	0.036
7/16/75	0.012	<	0.001		0.006					
8/ 6/75	0.029		0.005		0.035					
8/28/75	0.074		0.002		0.008	<	0.002	<	0.002	0.004
9/18/75	0.010		0.001		0.188					
10/13/75	0.003		0.001		0.228					
11/ 6/75	0.011	<	0.001	<	0.001	<	0.002		0.003	0.003
11/24/75	0.005	<	0.001		0.001					
12/17/75	0.009		0.001		0.007	<	0.002		0.004	0.028
1/28/76	0.007	<	0.001		0.009					
3/ 4/76	0.007	<	0.001		0.027	<	0.002		0.099	0.089
4/ 8/76	0.008		0.001		0.037		0.064			0.294
6/24/76	0.001	<	0.001		0.002		0.002		0.005	0.006

APPENDIX B

STATION -

DATE MO/DA/YR		NO3 MG/L		NO2 MG/L		NOX MG/L
6/23/75			<	0.004		
7/16/75	<	0.004	<	0.004		0.008
8/ 6/75		0.167	<	0.004		0.172
8/28/75	<	0.004	<	0.004		0.008
9/18/75		0.160	<	0.004		0.164
10/13/75		0.004		0.009		0.014
11/ 6/75		0.008	<	0.004		0.013
11/24/75						
12/17/75		0.039		0.009		0.048
1/28/76		0.005	<	0.004		0.010
3/ 4/76	<	0.004	<	0.004	<	0.004
4/ 8/76		0.134		0.010		0.144
6/24/76		0.007	<	0.004		0.012

W-0

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.08	0.54	
0.13	0.71	0.71
0.13		
0.12	0.50	0.51
0.13	0.41	0.45
0.19	0.64	0.64
0.27	2.25	2.39
0.13	0.61	0.62

APPENDIX B

STATION -

DATE MO/DA/YR	TEMP CENT	D.O. MG/L
6/23/75	25.0	4.1
7/16/75	24.8	2.1
8/ 6/75	27.1	
8/28/75	27.2	2.2
9/18/75	26.5	2.1
10/13/75	27.1	4.2
11/ 6/75	27.6	1.9
11/24/75	26.2	2.1
12/17/75	26.4	2.2
1/28/76	26.4	4.0
3/ 4/76	26.2	6.0
4/ 8/76		

W-U

SP COND UMHOS/CM	PH
245.	7.20
340.	7.60
	7.20
345.	7.20
450.	6.80
160.	7.50
400.	7.30
370.	7.30
140.	7.30
290.	7.50
315.	7.70

APPENDIX B

STATION -

DATE MO/DA/YR	CA MG/L		CL MG/L	SO4 MG/L
6/23/75			5.6	71.8
7/16/75	88.51			56.6
8/ 6/75	89.73		5.1	50.8
8/28/75	88.63		4.8	174.1
9/18/75	84.47		4.4	
10/13/75	84.68		9.0	
11/ 6/75	83.17		13.4	68.7
11/24/75			4.1	49.7
12/17/75	76.98		5.5	50.4
1/28/76	66.65	<	4.0	45.7
3/ 4/76	59.65		7.8	40.2
4/ 8/76				

W-U

ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
4.02	201.0	5.3
3.91	195.5	0.1
3.68	184.0	7.4
3.68	184.0	8.8
3.54	177.0	6.0
3.91	195.5	4.8
3.14	157.0	8.0
3.28	164.0	0.1
3.26	163.0	2.5
2.66	133.0	7.0
2.50	125.0	3.0

STATION - W-U

DATE MO/DA/YR		TDISS CU MG/L		TDISS PB MG/L		TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
6/23/75		0.011	<	0.001		0.009	0.028	0.158	0.329
7/16/75	<	0.002	<	0.001		0.007			
8/ 6/75		0.003		0.003		0.009			
8/28/75		0.016		0.003		0.015	0.011	0.040	0.013
9/18/75		0.016		0.001		0.014			
10/13/75		0.004	<	0.001		0.009			
11/ 6/75		0.018		0.001	<	0.001	0.017	0.040	0.018
11/24/75		0.005	<	0.001		0.033			
12/17/75		0.003	<	0.001		0.018	0.019	0.044	0.189
1/28/76		0.006	<	0.001	<	0.001			
3/ 4/76		0.009	<	0.001			0.055	0.036	0.145
4/ 8/76									

APPENDIX B

STATION -

DATE MO/DA/YR	NO3 MG/L		NO2 MG/L	NOX MG/L
6/23/75			0.018	
7/16/75	0.147	<	0.004	0.151
8/ 6/75	0.007	<	0.004	0.012
8/28/75	0.130	<	0.004	0.135
9/18/75	0.042	<	0.004	0.046
10/13/75	0.013		0.008	0.022
11/ 6/75	0.063	<	0.004	0.068
11/24/75				
12/17/75	0.078		0.010	0.088
1/28/76	0.013		0.007	0.020
3/ 4/76	0.020		0.010	0.031
4/ 8/76				

W-U

NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.16	0.37	
0.14	0.44	0.57
0.11		
0.08	0.18	0.24
0.20	0.33	0.41
0.06	0.44	0.47

APPENDIX

C

CULVERT DATA BY STATION

APPENDIX C CULVERT DATA BY

STATION - C-1

DATE MO/DA/YR	TIME HOUR,MIN	CA MG/L	CL MG/L
8/20/75		89.46	29.4
8/20/75		87.10	36.0
8/20/75		86.59	37.4
8/20/75		83.22	38.3
8/20/75		80.86	39.1
8/20/75		81.36	41.3
8/20/75		77.32	40.5
8/20/75		75.29	40.9
8/20/75		67.87	41.1
8/20/75		66.86	41.9
8/20/75		67.87	44.5
8/20/75		66.36	42.3
8/20/75		65.85	43.7
8/20/75		66.02	47.7
8/20/75		65.85	43.9
8/20/75		67.70	59.3
6/23/75		20.90	5.6

STATION PAGE 1

SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
30.2	3.73	186.5	59.0
34.4	3.30	165.0	203.0
35.4	3.03	151.5	243.0
36.2	3.02	151.0	250.0
36.4	2.95	147.5	263.0
38.8	2.74	137.0	268.0
39.0	2.71	135.5	236.0
39.0	2.60	130.0	238.0
39.3	2.54	127.0	236.0
41.1	2.47	123.5	232.0
42.4	2.38	119.0	231.0
43.4	2.26	113.0	234.0
43.7	2.33	116.4	231.0
45.3	2.28	114.0	245.0
45.8	2.31	115.5	239.0
48.4	1.77	88.5	238.0
8.2	0.84	42.0	35.1

STATION - C-1

DATE MO/DA/YR	TIME HOUR,MIN	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
8/20/75		0.014	0.002	0.041	0.116	0.157	0.172
8/20/75		0.016	0.010	0.064	0.020	0.099	0.224
8/20/75		0.017	0.008	0.072	0.004	0.116	0.201
8/20/75		0.018	0.007	0.046	0.003	0.120	0.190
8/20/75		0.018	0.010	0.069	0.003	0.123	0.202
8/20/75		0.020	0.010	0.055	0.013	0.159	0.168
8/20/75		0.020	0.010	0.057	0.009	0.113	0.198
8/20/75		0.021	0.009	0.054	0.005	0.168	0.185
8/20/75		0.019	0.013	0.051	0.008	0.130	0.182
8/20/75		0.020	0.012	0.058	0.002	0.138	0.193
8/20/75		0.019	0.012	0.053	0.004	0.173	0.207
8/20/75		0.031	0.012	0.068	0.008	0.128	0.226
8/20/75		0.034	0.011	0.052	0.006	0.132	0.206
8/20/75		0.040	0.011	0.065	0.003	0.143	0.204
8/20/75		0.035	0.014	0.062	0.005	0.126	0.213
8/20/75		0.034	0.013	0.051	0.007	0.109	0.162
6/23/75		0.007	0.013	0.009	0.144	0.170	0.196

STATION - C-1

DATE MO/DA/YR	TIME HOUR,MIN		NO3 MG/L		NO2 MG/L		NOX MG/L		NH4 MG/L		TKN MG/L		TOTAL N MG/L
8/20/75		<	0.004	<	0.004	<	0.004	<	0.01	<	0.06	<	0.10
8/20/75		<	0.004	<	0.004	<	0.004	<	0.01		1.41		1.41
8/20/75		<	0.004		0.004	<	0.004	<	0.01		2.03		2.03
8/20/75		<	0.004		0.004		0.005	<	0.01		2.21		2.21
8/20/75			0.013	<	0.004		0.017	<	0.01		2.32		2.33
8/20/75			0.005		0.010		0.015	<	0.01		2.25		2.26
8/20/75		<	0.004		0.006		0.010	<	0.01		2.48		2.49
8/20/75		<	0.004		0.005		0.008	<	0.01		2.60		2.60
8/20/75		<	0.004		0.007		0.010	<	0.01		2.60		2.61
8/20/75			0.005	<	0.004		0.010	<	0.01		2.41		2.42
8/20/75		<	0.004		0.005		0.008	<	0.01		2.00		2.00
8/20/75		<	0.004		0.007		0.010	<	0.01		2.16		2.17
8/20/75		<	0.004		0.007		0.009	<	0.01		1.94		1.94
8/20/75		<	0.004		0.005		0.007	<	0.01		2.42		2.42
8/20/75		<	0.004		0.006		0.009	<	0.01		2.08		2.08
8/20/75		<	0.004		0.007		0.009	<	0.01		2.17		2.17
6/23/75					0.014				0.03		0.56		

STATION - C-3

DATE MO/DA/YR	TIME HOUR,MIN	CA MG/L	CL MG/L	SO4 MG/L	ALK MEQ/L	ALKCACO3 MG/L	COD MG/L
8/20/75	1233.	37.18	86.2	16.1	7.63	381.5	528.0
8/20/75	1234.	36.84	89.9	22.2	8.71	435.5	574.0
8/20/75	1235.	44.26	89.7	22.2	8.52	426.0	594.0
8/20/75	1236.	48.14	89.9	23.7	8.73	436.5	611.0
8/20/75	1237.	45.95	91.5	24.2	8.52	426.0	616.0
8/20/75	1238.	45.95	90.1	24.5	8.26	413.0	542.0
8/20/75	1239.	47.47	90.9	25.8	8.13	406.5	550.0
8/20/75	1240.	49.49	91.1	26.5	7.94	397.0	546.0
8/20/75	1241.	53.03	90.1	39.8	7.85	392.5	564.0
8/20/75	1242.	50.17	89.7	40.8	7.48	374.0	563.0
8/20/75	1244.	50.34	89.1	41.6	7.83	391.5	580.0
8/20/75	1246.	52.86	87.4	43.2	7.63	381.5	704.0
8/20/75	1248.	52.70	87.8	43.2	6.49	324.5	695.0
8/20/75	1250.	52.86	86.2	44.2	6.21	310.5	693.0
8/20/75	1252.	51.85	86.2	44.5	6.19	309.5	696.0
8/20/75	1258.	54.38	84.6	43.7	5.93	296.5	690.0

STATION - C-3

DATE MO/DA/YR	TIME HOUR,MIN	TDISS CU MG/L	TDISS PB MG/L	TOTAL PB MG/L	O-PO4 MG/L	TDPO4 MG/L	T-PO4 MG/L
8/20/75	1233.	0.096	0.001	2.700	1.755	2.020	
8/20/75	1234.	0.105	0.001	2.900	1.193	1.522	1.956
8/20/75	1235.	0.097	0.001	2.800	0.994	1.323	1.676
8/20/75	1236.	0.087	0.002	2.900	0.865	1.196	1.513
8/20/75	1237.	0.080	0.001	2.800	0.780	1.131	1.474
8/20/75	1238.	0.097	0.001	2.700	0.681	1.094	1.403
8/20/75	1239.	0.113	0.001	2.600	0.627	1.006	1.371
8/20/75	1240.	0.106	0.001	2.600	0.619	0.962	1.313
8/20/75	1241.	0.109	0.002	2.700	0.612	0.981	1.305
8/20/75	1242.	0.094	0.001	2.300	0.594	0.975	1.342
8/20/75	1244.	0.112	0.001	2.300	0.491	0.989	1.229
8/20/75	1246.	0.072	0.001	2.200	0.476	0.964	1.207
8/20/75	1248.	0.102	0.001	2.000	0.457	0.925	1.127
8/20/75	1250.	0.060	0.001	2.000	0.463	0.873	1.115
8/20/75	1252.	0.103	0.001	1.900	0.449	0.850	1.100
8/20/75	1258.	0.086	< 0.001	2.000	0.417	0.814	1.040

APPENDIX C CULVERT DATA

STATION - C

DATE MO/DA/YR	TIME HOUR,MIN	NO3 MG/L	NO2 MG/L
8/20/75	1233.	0.014	0.059
8/20/75	1234.		0.300
8/20/75	1235.		0.388
8/20/75	1236.		0.482
8/20/75	1237.		0.555
8/20/75	1238.		0.608
8/20/75	1239.		0.669
8/20/75	1240.		0.711
8/20/75	1241.		0.756
8/20/75	1242.	0.378	0.467
8/20/75	1244.	0.495	0.512
8/20/75	1246.	0.442	0.525
8/20/75	1248.	0.463	0.566
8/20/75	1250.	0.486	0.562
8/20/75	1252.	0.499	0.566
8/20/75	1258.	0.500	0.579

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NOX MG/L	NH4 MG/L	TKN MG/L	TOTAL N MG/L
0.074	2.54		
0.271	1.34	1.70	1.97
0.352	0.96	1.55	1.90
0.463	0.70	1.51	1.97
0.545	0.51	1.54	2.08
0.582	0.41	0.94	1.52
0.646	0.34	1.36	2.00
0.698	0.36	1.13	1.82
0.740	0.33	1.41	2.15
0.845	0.33	1.28	2.12
1.008	0.20	1.44	2.44
0.967	0.25	1.03	1.99
1.030	0.30	1.06	2.09
1.048	0.23	1.06	2.10
1.066	0.23	0.52	1.58
1.080	0.15	1.53	2.61

A P P E N D I X

D

TIME PERIODS BETWEEN SUCCESSIVE SAMPLING DATES

APPENDIX D - TIME PERIODS BETWEEN SUCCESSIVE SAMPLING DATES

DATA COLLECTION DATE	ELAPSED DATE	LENGTH OF PERIOD BETWEEN SUCCESSIVE DATES USED FOR STATISTICAL ANALYSIS
12/13/74	1	
3/10/75	88	
3/26/75	104	
4/09/75	118	
4/23/75	132	
5/14/75	153	
6/02/75	172	
6/23/75*	193	0
7/16/75*	216	23
8/06/75	237	
8/28/75*	254	43
9/18/75	280	
10/13/75*	305	46
11/06/75	329	
11/24/75*	347	42
12/17/75*	370	23
1/28/76*	412	42
3/04/76*	447	35
4/08/76*	482	35
6/24/76*	559	77

*Dates for which the Data are Used for Statistical Analysis.

APPENDIX

E

ASSUMED FREQUENCY DISTRIBUTIONS FOR THE POPULATIONS SAMPLED

APPENDIX E - ASSUMED FREQUENCY DISTRIBUTIONS FOR THE POPULATIONS SAMPLED

CONSTITUENT	LAKE	WELLS
Temperature	A*	A
Dissolved Oxygen	A	L**
Specific Conductivity	A	L
pH	A	A
Calcium	L	L
Chloride	L	L
Sulfate	L	L
Alkalinity	A	A
Chemical Oxygen Demand	L	L
Copper	L	L
NO_x	L	L
Ammonia	L	L
Total Kjeldahl Nitrogen	L	L
Total Nitrogen	L	L
Total Lead	L	L

*A = arithmetic frequency distribution
**L = logarithmic frequency distribution

A P P E N D I X

F

RAINFALL/RUNOFF EVENTS

APPENDIX F - RAINFALL/RUNOFF EVENTS

DATE	RAINFALL (INCHES)	TIME (START/STOP)	LAKE STAGE RISE (FEET)	TIME (START/STOP)
5/5/75	.24	1921/2019	.05	2000/2100
5/7	.68	1720/1746	.12	2030/2100
5/9	.37	1710/1844	.07	1800/1915
5/10	1.36	1454/1634	.43	1645/1800
5/13	.66	1651/1829	.15	1800/1915
5/16	.37	1527/1640	.06	1715/1730
5/22	.11	0950/1025	.02	1100/1145
5/24	.18	0636/0757	.02	0800/0930
5/28	.06	0003/0012	.02	0130/0230
5/28	.40	1203/1220	.15	1330/1430
5/28	.25	1717/1853	.09	1845/1945
5/29	.88	1331/1354	.25	1500/1530
5/30	-	- -	.17	1600/1800
6/3			.80	1515/1700
6/5			.04	1230/1000
6/8			.05	1530/1630
6/10			.07	1415/1500
6/17			.05	1200/1300
6/19			.03	1400/1615
6/20			.05	1600/1815
6/21			.25	0930/1015
6/24			.48	1430/1645
6/25			.19	1115/1215
6/28			.02	1145/1215
7/2	.13	1223/1612	.02	1230/1530
7/4	.46	1435/1515	.07	1445/1600
7/6	.25	0003/0030	.04	0015/0100
7/10	.05	1103/1158	.01	1200/1215
7/11	.29	1444/1725	.04	1500/1900
7/14	.23	1234/1243	.04	1315/1345
7/14	.14	2200/2222	.04	2245/2315
7/15	-	- -	.02	1415/1430
7/16	.22	0133/0140	.05	0145/0215
7/16	.31	1242/1302	-	- -
7/17	.53	0512/0751	.05	0515/0815
7/19	1.03	0515/0900	.18	0645/0915
7/20	.18	0800/0824	.05	0815/0915
7/25	.01	1115/1120	.04	1145/1215
7/31	.89	1056/1421	.15	1145/1215
			.06	1400/1430
7/31	.08	2030/2056	.01	2115/2130

APPENDIX F - Continued

DATE	RAINFALL (INCHES)	TIME (START/STOP)	LAKE STAGE RISE (FEET)	TIME (START/STOP)
8/1/75	.26	0027/0035	.01	0115/0130
8/1	.08	0646/0700	.01	0730/0745
8/4	.74	0059/0258	.15	0130/0345
8/7	.19	0831/0837	.06	0830/0900
8/7	.18	2259/2340	.02	2300/2400
8/16	.26	0626/0636	.05	0700/0745
8/20	.01	1156/1158	-	- -
8/20	.27	2141/2206	.07	2230/2315
8/21	.14	0930/1004	.01	1000/1015
8/21	.40	1101/1120	.10	1145/1215
8/23	1.25	1547/1746	.30	1630/1730
			.02	1815/1830
8/26	.05	1451/1501	.01	1545/1615
8/29	.29	0434/0451	.04	0445/0515
9/4	.11	1347/1353	.03	1400/1445
9/7	.12	0837/0905	.05	0900/0945
9/7	.64	1645/1711	.18	1715/1800
9/9	.48	0908/1329	.05	0945/1015
			.14	1130/1200
9/16	.12	0705/0714	.02	0800/0830
9/17	.48	1413/1505	.10	1500/1600
9/18	4.39	1335/2129	.07	1430/1515
			.07	1600/1630
			1.18	1745/2200
			.03	2230/2300
10/3-10/4	.22	2253/0054	.06	0030/0145
10/13	.19	0521/0535	.03	0600/0615
10/14	.57	1315/1335	.12	1400/1430
10/16	.10	0618/0624	.01	0700/0715
10/18	.40	0842/0857	.05	0930/1000
10/18	-	- -	.02	1930/2000
10/19	.10	1343/1633	-	- -
	.23	1836/1923	-	- -
10/20	.14	0604/0819	-	- -
10/21	1.10	0256/0810	.13	0345/0545
			.06	0645/0715
			.03	0830/0915
10/22	.46	0915/0932	.09	1000/1045
			.14	1530/1615
10/29	.40	1446/1837	.06	1600/1645
10/30	.10	1650/1659	.02	1700/1715
10/30	.14	2113/2122	-	- -
10/31	.42	0613/0628	.08	0630/0700
10/31	.57	1050/1122	.15	1100/1130

APPENDIX F - Continued

DATE	RAINFALL (INCHES)	TIME (START/STOP)	LAKE STAGE RISE (FEET)	TIME (START/STOP)
11/4/75	.60	0509/0600	.12	0515/0600
11/4	.30	1206/1347	.04	1200/1345
11/4	.16	1556/1732	.02	1645/1700
11/6	.14	2245/2319	-	- -
11/20	.47	0412/0920	.10	0415/0930
1/5/76			.09	1815/2100
2/1			.01	0945/1000
			.05	1145/1215
			.02	1630/1700
2/24-2/25			.24	2015/1115
2/25			.01	1215/1245
2/25			.01	1215/1245
2/26			.02	0115/0200
2/26			.02	0845/1015
2/27			.08	0000/0045
2/28			.62	0815/1145
			.07	1600/1630
2/29			.05	0200/0215
			.11	0815/0900
3/10			.35	1645/1800
			.02	1945/2000
4/6			.16	1015/1115
5/2			.01	0745/0800
			.01	1100/1115
			.03	0230/0300
			.26	1815/1945
5/4			.06	1215/2150
5/12			.03	1315/1330
5/16			.01	1100/1115
			.12	2100/2400
5/18			.06	1430/1745
5/22			.14	1400/1430
5/23			.16	0500/0600
5/24			.09	1300/1500
			.12	1630/1745
5/29			.49	1745/1845
			.04	2130/2300
5/30			.53	1845/2015
5/30-5/31			.12	2345/0045
6/6			.11	0100/0215
6/9			.14	0015/0115
6/11/76			.04	1745/1945