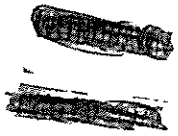
REPORT ON POLLUTION

IN

LAS VEGAS WASH AND LAS VEGAS BAY



DEPARTMENT OF THE INTERIOR
FEDERAL WATER POLLUTION CONTROL ADMINISTRATION

Division of Technical Services
Technical, Advisory, and Investigations Activities

Cincinnati, Ohio

and

Colorado River Basin Water Quality Control Project

Denver, Colorado

January 1967

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INTRODUCTION

In cooperation with the Colorado River Basin Water Quality Control Project of the Federal Water Pollution Control Administration, the Technical, Advisory, and Investigations Activity of the Administration conducted a survey in May 1966 to ascertain the effects of waste water discharges on the Las Vegas Wash, Las Vegas Bay, and the Boulder Beach area of Lake Mead. This survey could not have been accomplished without the generous assistance of the Bureau of Reclamation, the National Park Service, and the Geological Survey of the U.S. Department of the Interior; the Nevada State Health Department, and representatives of Clark County and the city of Las Vegas. Valuable data were also supplied by personnel of Basic Management Incorporated and the Nevada Power Company. The assistance of these agencies and private corporations is gratefully acknowledged.

STUDY AREA AND SAMPLING TECHNIQUE

The survey area is illustrated in Figure 1 and a description of the sampling stations is contained in Table I.

The study was conducted in three phases. The first phase was from May 19-23, 1966 and involved 14 sampling stations on waste discharges and in the Las Vegas Wash. The Clark County sewage treatment plant effluent and the city of Las Vegas sewage treatment plant effluent,as well as stations in the Wash itself (W-4, W-5, W-11),were sampled at 6-hour intervals during the 4-day period. All other stations were sampled daily except for the station at the entrance to Las Vegas Bay (LVB-12) which was sampled twice daily. The second phase of the survey was conducted from May 24 through 28, 1966 and involved eight stations in Las Vegas Bay. Sampling was also conducted on May 30 to ascertain the effects on water quality because of increased recreational use during the Memorial Day weekend. Samples were collected twice daily. The third phase of the study was performed on May 30-31, 1966 in the Boulder Beach area of Lake Mead. The purpose of this phase was to determine the bacteriological quality of the bathing water during a period of heavy usage on the Memorial Day weekend. A total of four samples was obtained from each station.

Analyses performed at selective stations in the field included total and fecal coliform determinations and biochemical oxygen demand (BOD). Samples were returned to the Robert A. Taft Sanitary Engineering Center in Cincinnati for nitrogen, phosphorus, and metals determinations.

WATER USE

The primary use of the study area that will be adversely affected by waste discharges is recreation. Lake Mead and particularly the Las Vegas Bay and Boulder Beach area provide a wide variety of direct contact water activity including fishing, boating, skiing and swimming. The National Park Service estimates that 1,316,000 people visited the Boulder Beach area and 846,000 people visited the Las Vegas Wash and Bay recreational

FIGURE 1

STUDY AREA

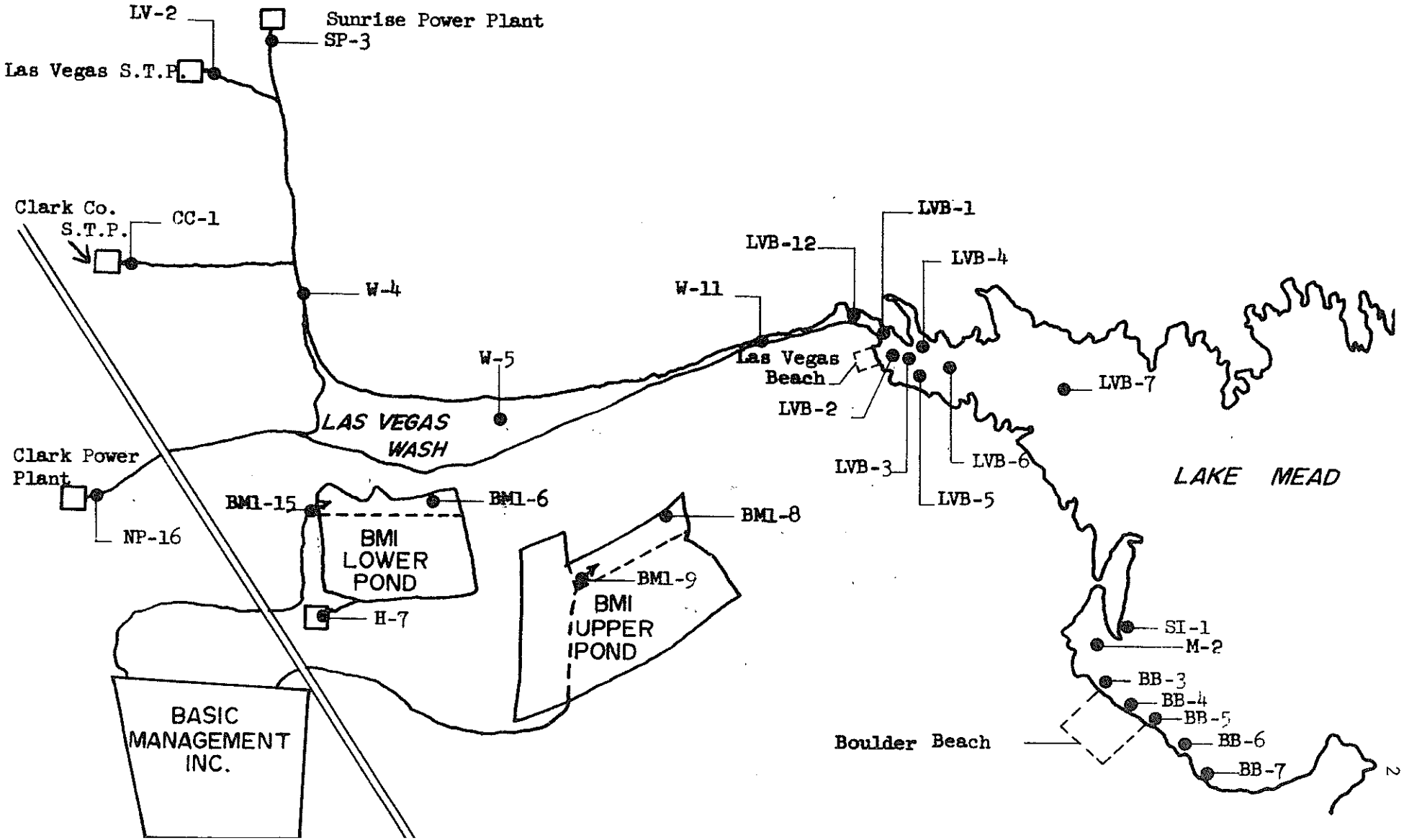

TABLE I

DESCRIPTION OF SAMPLING STATIONS

LAS VEGAS WASH

STATION	DESCRIPTION
CC-1	Effluent channel of Clark County Sewage Treatment Plant.
LV-2	Effluent channel of City of Las Vegas Sewage Treatment Plant.
SP-3	Effluent channel of Sunrise Station - Nevada Power Company.
W-4	Below confluence of sewage treatment plant effluents.
W-5	USGS gaging station in Las Vegas Wash.
BMI-6	Farthest end of the BMI lower pond from the influent channel at the approximate location of an effluent if an effluent were to take place. The water at this station should be in the ponds for the longest period of time.
H-7	Effluent of the oxidation pond for the Henderson sewage treatment plant.
BMI-8	Same as BMI-6 but in the upper ponds.
BMI-9	Influent to BMI upper ponds.
W-11	Las Vegas Wash at the North Shore Highway culvert.
LVB-12	Mouth of Las Vegas Wash at entrance to Las Vegas Bay.
BMI-15	Influent to BMI lower ponds.
NP-16	Effluent channel of Clark station - Nevada Power Company.

LAS VEGAS BAY

STATION	DESCRIPTION
LVB-12	Mouth of Las Vegas Wash at entrance to Las Vegas Bay.
LVB-1	Just above bathing area in Las Vegas Bay - 50 feet from shoreline.
LVB-2	Just below bathing area in Las Vegas Bay - 50 feet from shoreline

TABLE I
(Contd.)

DESCRIPTION OF SAMPLING STATIONS

LAS VEGAS BAY (contd.)

STATION	DESCRIPTION
LVB-3	Las Vegas boat marina.
LVB-4	Center of northern boat mooring area - Las Vegas Bay.
LVB-5	Center of southern boat mooring area - Las Vegas Bay.
LVB-6	Approximately one-half mile below all National Park Service improvement and development in Las Vegas Bay.
LVB-7	Beyond the mouth of Las Vegas Bay in Lake Mead proper.

BOULDER BEACH AREA

STATION	DESCRIPTION
SI-1	Saddle Island water intake.
M-2	Mouth of Las Vegas marina.
BB-3	Just above Boulder Beach bathing area - shoreline sample.
BB-4	At center of Boulder Beach bathing area - shoreline sample.
BB-5	Just below Boulder Beach bathing area - shoreline sample.
BB-6	Campground in Boulder Beach area - 50 feet from shoreline.
BB-7	Center of Hemingway boat harbor and marina.

area during 1965. There are two marinas in the Boulder Beach area and it is estimated that 300 boats were moored at these marinas during the period of the survey. There is a marina in Las Vegas Bay and approximately 325 boats were moored at this marina during the survey. Little use is made of the bathing beaches in the area during the week. However, these beaches are heavily populated with swimmers during the weekends and were particularly crowded during the Memorial Day weekend. From National Park Service figures it is estimated that recreational activity is increasing at the rate of about 13 percent per year.

Lake Mead is used as a source of water supply for the Las Vegas and Henderson areas with the intake located at Saddle Island near Boulder Beach. It is anticipated that future use of Lake Mead as a source of water supply will increase because of the phenomenal growth in the area.

Water in the Las Vegas Wash itself is not used for any purposes at the present time.

Part of the effluent from the two sewage treatment plants whose discharges provide the principal flow in the Wash is used for irrigation of about 860 acres and for cooling water at both the Sunrise station and Clark station of the Nevada Power Company. During the period of survey, the Clark County sewage treatment plant diverted approximately 1.6 MGD of effluent to the Sunrise power station; approximately 0.7 MGD to the Winterwood Golf Course for irrigation; and 2.2 MGD to the Clark Power Station and to the Paradise Valley subdivision. About 4 MGD is discharged to the Las Vegas Wash. The Las Vegas sewage treatment plant diverts effluent to three farms for irrigation purposes. About 11.5 MGD is discharged directly to Las Vegas Wash.

WASTE DISCHARGES

The principal sources of waste in the study area are the effluents from the Clark County sewage treatment plant and the Las Vegas city sewage treatment plant. The Las Vegas Wash is not a natural stream and flow in the Wash is principally the discharge from the two treatment plants. Lesser sources of waste are the Clark and Sunrise power stations of the Nevada Power Company. It is possible that a contribution is made from the Basic Management Incorporated holding ponds by seepage through ground water into the Las Vegas Wash. The concentration of pollutants from each source and their relative percentage of the total quantity of waste discharged are listed in Table II.

During the period of survey the influent flow to the Clark County sewage treatment plant averaged 8.47 MGD. This is a secondary high rate trickling filter plant designed for a capacity of 12 MGD. A small holding pond is also located at this treatment plant and is filled with treated effluent as required, depending on water uses of the effluent described in the following material. Approximately 54 percent of the treated effluent is diverted from the holding pond for irrigation purposes and for cooling purposes at power stations. Approximately 220 acres are irrigated with this plant effluent. The waste is chlorinated and an average of 3.9 MGD was discharged to the Wash. Coliform densities in the effluent

TABLE II

SOURCES OF WASTE

SOURCE	STATION	COLIFORM DISCHARGES Total No./100ml	% *	Fecal No./100 ml.	% *	NH_3 + N mg/l	% *	Total Phosphorus mg/l	% *	5-Day B.O.D. mg/l	% *	Flow To Wash MGD
Clark Co. S.T.P.	CC-1	6860	77	1280	74.2	18.4	19.5	12.2	21.9	5.8	6.3	3.9
Las Vegas S.T.P.	LV-2	682	22.6	150	25.8	25.1	78.6	14.6	77.4	28.6	91.9	11.5
Sunrise Power Sta.	SP-3	223	0.3	20	0.2	13.7	1.4	3.4	0.6	13.5	1.4	.378
Clark Power Sta.	NP-16	41	0.1	20	Neg.	7.1	0.5	1.3	0.1	5.2	0.4	.221
BMI - Lower Ponds	BMI-15					0.8		.36				
	BMI-6					2.0		.06				
Henderson Pond	H-7	100,000		18,000		15.4		10.6				
BMI - Upper Ponds	BMI-9					7.5		.59				
	BMI-8					2.8		.51				

* Percent of Total Quantity Discharged

averaged 6,860/100 ml and 1,280/100 ml for total and fecal coliform respectively. This represented 77 percent and 74.2 percent of the total coliform density discharged to the Wash on a quantitative basis. Ammonia and organic nitrogen discharged in the effluent averaged 18.4 mg/l, or about 19.5 percent of the total unoxidized nitrogen discharged from all sources. Total phosphorus averaged 12.2 mg/l, or 21.9 percent of the total discharged. The 5-day BOD amounted to 5.8 mg/l, or 6.3 percent of the total. However, this concentration of BOD was influenced by the presence of chlorine in the sample and it is probable that the true 5-day BOD in the sample may have been higher. It is recommended in the future that samples for 5-day BOD be collected well above the chlorine contact tank.

The city of Las Vegas sewage treatment plant is a high rate trickling filter type designed for 15 MGD and does not have a holding pond. The plant is overloaded at present but the construction of additional facilities which should be completed in March 1967, will double existing plant capacity. During the period of survey the influent flow averaged 15.6 MGD and the effluent 11.5 MGD. The effluent is chlorinated before final discharge. Part of the effluent is diverted for the irrigation of approximately 640 acres. Coliform densities in the effluent averaged 682/100 ml for total coliform and 150/100 ml for fecal coliform. These represented 22.6 percent and 25.8 percent of the total coliform densities discharged to the Wash. Ammonia and organic nitrogen discharged to the Wash averaged 25.1 mg/l, or 78.6 percent of the total. Phosphorus concentration in the effluent was 14.6 mg/l or 77.4 percent of the total. Five-day BOD discharged from this plant amounted to 91.9 percent of the total BOD discharged with a concentration of 28.6 mg/l.

Sunrise and Clark power stations were discharging an average of 378,000 gal/day and 221,000 gal/day respectively during the survey. These plants receive water principally from the effluent of the Clark County sewage treatment plant. The sewage effluent is treated with lime and clarified to remove the high concentrations of phosphorus and is superchlorinated to reduce the ammonia concentration. The water is then used for cooling purposes where about two-thirds is evaporated. The remainder is discharged back to the Las Vegas Wash. Pollution contribution from these sources were negligible, amounting to .4 percent and .2 percent of the total for coliform discharges; 1.9 percent of the total ammonia and organic nitrogen; .7 percent of the total phosphorus discharged; and 1.8 percent of the total BOD discharged.

Basic Management Incorporated, an industrial complex of five companies located at Henderson, Nevada, discharges wastes to two large holding ponds adjacent to the Las Vegas Wash. There is no designed effluent from these ponds; water being removed by evaporation. During the period of survey the waste discharged to the lower ponds amounted to 3.9 MGD. This waste is primarily from the Stauffer Chemical Company, a manufacturer of organic pesticides. Samples were taken at the influent to this pond (BMI-15) and at a point in the pond nearest Las Vegas Wash (BMI-6). If water from this pond is reaching the Wash, samples taken from the latter point would be representative of the quality. The influent to the lower ponds showed

concentrations of 0.8 mg/l of organic nitrogen and ammonia and 0.36 mg/l of phosphorus. Unoxidized nitrogen within the ponds amounted to 2 mg/l, but phosphorus had been reduced to .06 mg/l. DDT concentration in the influent to the pond was indeterminate. Within the pond the concentration of DDT was .0005 mg/l. The city of Henderson has a sewage treatment plant adjacent to this lower pond and its effluent is discharged to a small lagoon from which it flows into the B.M.I. lower ponds. The effluent from the Henderson lagoon averaged 100,000/100 ml and 18,000/100 ml for total and fecal coliform respectively. Organic nitrogen and ammonia averaged 15.4 mg/l and phosphorus amounted to 10.6 mg/l. The B.M.I. upper ponds receive principally the wastes from the Titanium Corporation of America. During the survey the influent to these ponds was 3.1 MGD. As in the lower ponds, a station was established adjacent to the Wash (BMI-8) as well as at the influent (BMI-9). Concentrations of organic nitrogen and ammonia in the influent totaled 7.5 mg/l. Within the ponds these concentrations had been reduced to 2.8 mg/l. Phosphorus in the influent averaged 0.59 mg/l, and within the pond was 0.51 mg/l. Analyses for several metals were also made on these samples. At the influent to the upper ponds, concentration of aluminum averaged 9.5 mg/l, and within the ponds was 5.7 mg/l. Chromium was 1.4 mg/l in the influent, and 1 mg/l in the ponds. Iron and manganese in the influent to the ponds totaled 29.3 mg/l, and within the ponds the concentration was 32.7 mg/l.

The question of whether wastes from these ponds seep into the Las Vegas Wash through the ground water cannot be categorically answered from the data gathered in this survey. From inspection of ground water levels and evaluation of flow at all sampling stations and sources of waste, it is believed reasonable to ascribe certain observed increase in flow and TDS concentration to seepage from the B.M.I. ponds.

During the survey, the total flow at the confluence of the effluents from the Clark County and Las Vegas sewage treatment plants and the Sunrise power station averaged 23.4 cfs at a TDS concentration of 1,135 mg/l. The flow at the USGS Gage (W-5) was 24.3 cfs at a TDS concentration of 2,400 mg/l. A part of the increase, 0.35 cfs, comes from the Clark power station at an average TDS concentration of 2,840 mg/l. Some ground water, at a TDS concentration of 4,930 mg/l, moves toward the Wash along Duck Creek. The bulk of the inflow appears to come from seepage from the B.M.I. lower ponds. A sample of ground water just north of the B.M.I. lower ponds had a TDS concentration of 8,140 mg/l. It therefore appears that the unaccounted gain of 0.5 cfs comes from ground water inflow, most of which could originate as seepage from the B.M.I. lower ponds.

Las Vegas Wash at the North Shore Highway Bridge (W-11) had an average flow of 26.1 cfs, an increase of 1.8 cfs over that at the USGS Gage (W-5) and a TDS concentration increase of 2,890 mg/l. Some of the inflow appears to result from seepage from the B.M.I. upper ponds.

The increased flow and TDS concentration in Las Vegas Wash below the effluent confluence could result from seepage from both B.M.I. pond areas. An intensive ground water survey of the area would be required to determine the seepage and TDS contribution from these ponds.

No wastes are discharged in the national park area. The National Park Service maintains mobile toilet facilities and removes wastes from the area. Pollution from moored boats was not determined but there is undoubtedly some contribution from this source.

EFFECTS OF POLLUTION ON WATER QUALITY

BACTERIA

Sewage effluents contain bacteria of the coliform group which typically occur in excreta or feces and can readily be detected. These bacteria, usually harmless in themselves, are always present in water which receives some form of sewage and have therefore been used as an indication of the probable presence of pathogenic organisms. The possibility of pathogenic organisms being present in the absence of coliform organisms is extremely remote. The coliform group has been used by numerous state and interstate water pollution control agencies as a basis for water quality objectives for various water uses. These standards are based on total coliform densities and objections to their use arise primarily because of the fact that certain coliform species may be derived from sources other than excreta. Recently a method for specific detection of fecal coliform bacteria has been developed. Both total and fecal coliform densities were determined on all samples during this survey. The results of both determinations are expressed in numbers of coliform per 100 ml of water. The commonly recommended total coliform density for direct contact water use, such as swimming and water skiing, is 1,000/100 ml. It is this coliform density upon which the level of water quality in the study area was judged.

Salmonella, a genus with more than 900 species, most of which have been shown to be pathogenic to man and warm-blooded animals, commonly produces serious disease in man. In the past, the isolation of Salmonella from streams or natural waters was deemed impractical because of the relatively low concentrations compared to coliform densities. Now, however, because of the availability of new techniques as well as selective media, the isolation of these pathogens is possible even at relatively low coliform densities. Although the principal determination of bacterial pollution in the Las Vegas study area was based on examination for coliform, additional sampling was conducted at certain stations for the detection of Salmonella. Coliform bacteria data collected are shown in Table III.

Total and fecal coliform densities measured at the confluence of the effluent from the Clark County sewage treatment plant and Las Vegas city sewage treatment plant (W-4) averaged 1,520/100 ml and 222/100 ml respectively. This represents a reduction in initial concentration from the sewage plants to the confluence point of 33 percent for total coliform and 50 percent for fecal coliform. Total coliform densities averaged 1,650/100 ml at the USGS gaging station (W-5) and were reduced to 862/100 ml at the North Shore Highway Bridge (Station W-11). Fecal coliform densities were reduced to 80/100 ml at the USGS gaging station and 35/100 ml at the North Shore Highway Bridge. At the mouth of the Las Vegas

TABLE III

COLIFORM BACTERIA

GEOMETRIC MEANS

May 1966

STATION	TOTAL COLIFORM MPN/100 ml.	FECAL COLIFORM MPN/100 ml.
LAS VEGAS WASH		
W-4	1520	222
W-5	1650	80
W-11	862	35
LAS VEGAS BAY		
LVB-12	38	< 20
LVB-1	44	< 7
LVB-2	22	< 3
LVB-3	14	< 4
LVB-4	7	< 3
LVB-5	< 10	< 2
LVB-6	4	< 2
LVB-7	2	< 2
BOULDER BEACH		
SI-1	< 4	< 2
M-2	11	< 2
BB-3	37	9
BB-4	101	38
BB-5	69	8
BB-6	8	< 2
BB-7	9	< 2

Wash and entrance to Las Vegas Bay (LVB-12) total coliform densities averaged 38/100 ml and fecal coliform densities averaged less than 20/100 ml. The reduction in total coliform densities in the Las Vegas Wash was approximately 98.3 percent from the initial concentration in the effluents. Coliform densities at the entrance to Las Vegas Bay were well below the 1,000/100 ml level of concern for direct contact water activity. Above and below the swimming area in Las Vegas Bay, total coliform densities averaged 22/100 ml and 14/100 ml and fecal coliform densities were less than 4/100 ml. There is no evidence from the data collected during this survey that bacterial pollution resulting from sewage effluents to the Las Vegas Wash is causing any damage to water quality in Las Vegas Bay.

Salmonella bacteria were isolated in the effluent from the Las Vegas city sewage treatment plant; from the sampling station at the confluence of the two effluents; and from the North Shore Highway Bridge. Salmonella were not isolated in the effluent from the Clark County sewage treatment plant or at any of the sampling stations in Las Vegas Bay. Although chlorination at both of the sewage treatment plants is generally effective in reducing bacterial densities, the isolation of Salmonella in the Wash and the Las Vegas city effluent, as well as excessive coliform densities in some individual samples of the effluents from both treatment plants indicates that the operation of the chlorination facilities at both plants can be improved to provide greater efficiencies.

There is no significant bacterial contamination in the Boulder Beach area. Background densities at the two marinas in the area and in the bathing section were less than 20/100 ml for total coliform and about 2/100 ml for fecal coliform. The densities in the marina did not increase significantly during the Memorial Day weekend period of heavy use. The densities in the bathing area, however, did increase to a maximum of 1,400/100 ml and 700/100 ml for total and fecal coliform respectively. These densities returned to the low background levels immediately after Memorial Day weekend. It is therefore presumed that the increased coliform densities resulted from the bathers themselves rather than any pollutional discharge outside the bathing area. The Saddle Island water intake showed total and fecal coliform densities of less than 2/100 ml. No Salmonella were recovered from either the beach area or the water intake.

NITROGEN AND PHOSPHORUS

For the past several years, Las Vegas Bay has experienced a build-up in concentrations of nitrogen and phosphorus. The result of this build-up has been an increasing algal concentration. The situation has reached the point within the Bay that a distinct green color is noticeable in the water. If this process continues, it is possible that large blooms of algae will grow in the waters of Las Vegas Bay, destroying its usefulness as a recreation area. Algae measured at the mouth of the Las Vegas Wash showed a density of 23,800/ml. Algal counts exceeded 9,000/ml for a distance of three miles out from the mouth of the Wash. Densities exceeded 2,000/ml for six miles out from the Wash. In Lake Mead itself, algae counts averaged 1,000/ml with a peak of 2,100/ml. At this point, objectionable color was no longer noticeable. This density of 2,000/ml

which is approximately the upper limit of algae densities in Lake Mead where no color or eutrophication is apparent, represents a reasonable value for algae throughout Las Vegas Bay so that objectionable color and eutrophication do not occur.

Las Vegas Bay was the only area that exhibited surface algal concentrations greater than five times the algal concentration observed in the main body of Lake Mead.

Correlations of unsatisfied nitrogen concentrations (NH_3 + N) in Las Vegas Bay showed no relationship between these constituents and algae counts. Nitrogen does not appear to be a limiting fertility factor for phytoplankton population in Lake Mead since concentrations exceeding 0.3 mg/l, the generally accepted threshold value, occurred in the center of the area exhibiting less than 2,000 algae per ml (LVB-7). Nitrogen is, therefore, not the limiting factor causing increases in algae concentrations in Las Vegas Bay. Nitrogen and phosphorus data collected are shown in Table IV.

There is a definable relationship between total phosphorus and algae count in Las Vegas Bay as shown by Figure 2 and Table V. Lake Mead, itself, is deficient in phosphorus concentrations related to threshold levels that may result in algae blooms (0.015 mg/l). The main body of Lake Mead contained a total phosphorus concentration of 0.005 mg/l with no soluble phosphorus. Las Vegas Bay contained an average concentration of .025 mg/l of total phosphorus. The algae concentrations in Las Vegas Bay result primarily from the discharge of phosphorus in the effluents from the Clark County and Las Vegas sewage treatment plants, which together represent 98.1 percent of the phosphorus discharged to Las Vegas Bay through Las Vegas Wash. These plants show effluent concentrations of 12.2 mg/l and 14.6 mg/l respectively for phosphorus. In order to limit algal densities to 2,000/ml or less throughout Las Vegas Bay, it is necessary that total phosphorus in the Bay not exceed .005 mg/l at any point. The concentration of phosphorus at the confluence station (W-4) was 12.9 mg/l. This is approximately a 10 percent reduction below the expected concentration from the mixing of the two sewage effluents. The concentration was 8.2 mg/l at the USGS gaging station (W-5) and continued to decline to 4.8 mg/l at the North Shore highway station (W-11). At the entrance to Las Vegas Bay (LVB-12) concentration of phosphorus averaged .06 mg/l. If the phosphorus concentration at this station is not to exceed .005 mg/l, the concentration in the sewage effluents must be reduced to 1.2 mg/l. Based on present waste effluent concentrations, this represents a 90 percent reduction in phosphorus from the Clark County sewage treatment plant and a 92 percent reduction from the Las Vegas city sewage treatment plant.

At the Saddle Island water intake, the algae density was 1,700/ml. Two miles upstream from the Boulder City water intake the algae count was 900/ml. These algae populations are characteristic of Lake Mead waters and were not influenced by nitrogen and phosphorus discharged through Las Vegas Wash.

TABLE IV

NUTRIENTS

STATION	No. of Samples	ORGANIC N* mg/l	NH_3 as N* mg/l	NO_3 as N* mg/l	TOTAL PHOSPHORUS*(P) mg/l
LAS VEGAS WASH					
W-4	16	5.2	16.7	1.5	12.9
W-5	16	1.2	0.2	1.4	8.2
W-11	16	1.0	0.6	8.0	4.8
LAS VEGAS BAY					
LVB-12	18	1.0	0.3	0.1	.06
LVB-1	10	0.9	0.2	< 0.1	.047
LVB-2	10	0.8	0.1	< 0.1	.031
LVB-3	10	1.0	0.1	< 0.1	.023
LVB-4	9	0.8	0.1	< 0.1	.024
LVB-5	9	0.8	0.1	< 0.1	.019
LVB-6	8	0.7	< 0.1	< 0.1	.015
LVB-7	9	0.4	< 0.1	0.4	< .005
SADDLE ISLAND WATER INTAKE					
SI-1	4	0.5	0.1	0.4	< .005

* Mean value of total samples collected

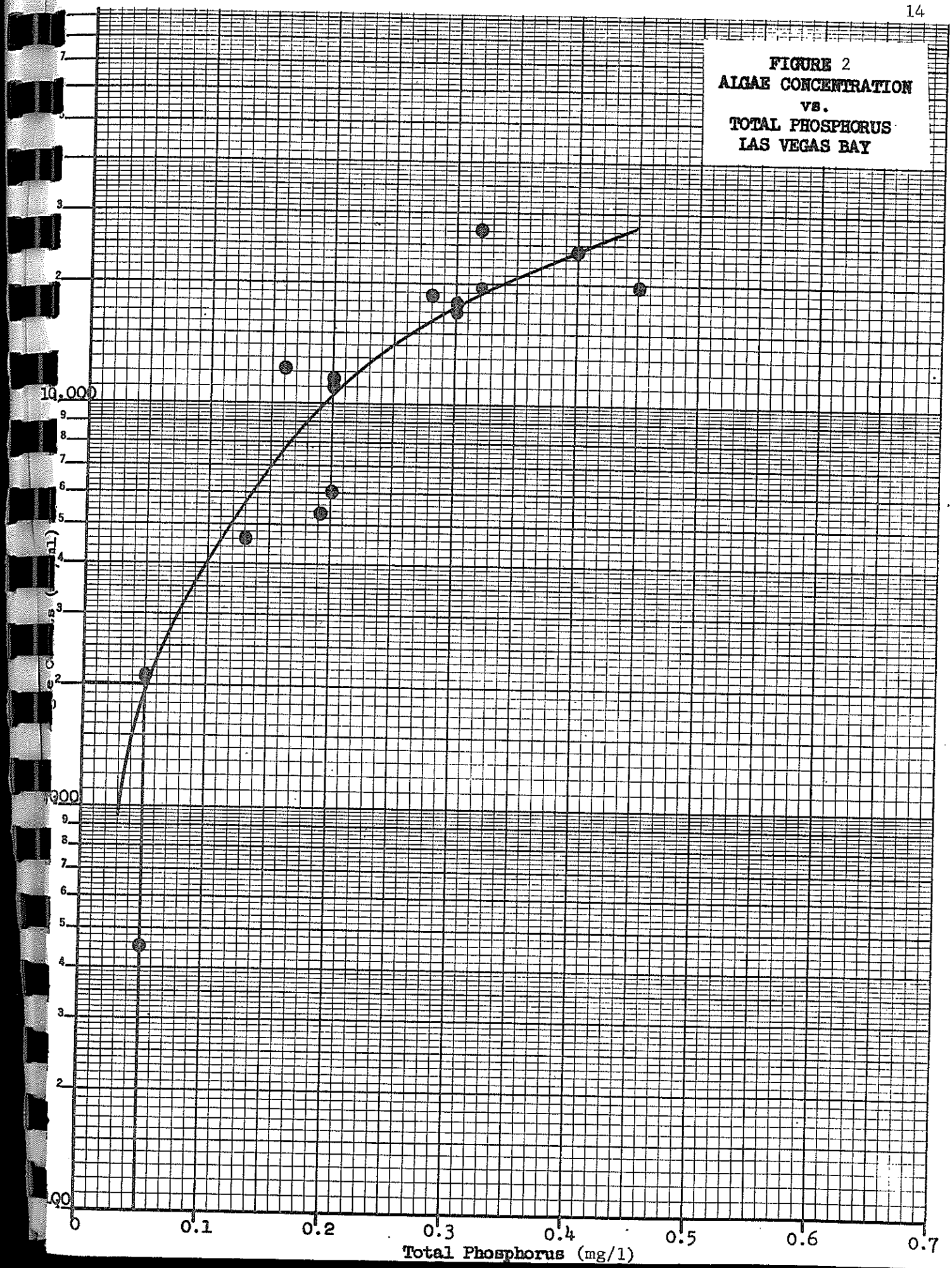
FIGURE 2
ALGAE CONCENTRATION
vs.
TOTAL PHOSPHORUS
LAS VEGAS BAY
10,000
9
8
7
6
5
4
3
2
1,000
9
8
7
6
5
4
3
2
100
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
Total Phosphorus (mg/l)

TABLE V

ALGAE AND TOTAL PHOSPHORUS CONCENTRATIONS

LAS VEGAS BAY

MAY 27, 1966

STATION	DEPTH Ft.	ALGAE COUNT No./ml.	TOTAL PHOSPHORUS mg/l
LVB-1	Surface	23,800	.040
LVB-2	Surface	17,700	.030
	5	19,500	.032
LVB-3	Surface	18,900	.028
	5	17,000	.030
	10	27,100	.032
LVB-4-A	Surface	12,100	.016
	5	11,600	.020
	10	11,200	.020
LVB-6	Surface	4,600	.013
	5	5,300	.019
	10	6,000	.020
LVB-7	Surface	450	.005
	5	2,100	.005
	10	450	.005

Las Vegas Wash supports a population of bottom organisms that is often associated with organic wastes. The effluent ditches from both the Las Vegas and Clark County sewage treatment plants contained abundant numbers of pollution tolerant physid snails and mosquito larvae. Downstream from the confluence of the outfall ditches, sludgeworms and midges were the only bottom organisms in the stream bed and these were few in numbers. Sphaerotilus, a sewage-associated bacterium, covered sticks and rocks along the Wash. Las Vegas Wash at the North Shore Road supported only a pollution tolerant population of midges and snails. A stringy green alga, Cladophora sp., was very abundant and covered the stream bed in the reach from North Shore Road downstream to the entrance to Las Vegas Bay. Some floating clumps of Cladophora were observed in Las Vegas Bay.

In summary, Las Vegas Wash supports a pollution tolerant population of bottom organisms and luxuriant mats of algae, which break loose and float into Lake Mead.

METALS AND PESTICIDES

As detailed earlier in this report, a consideration of discharge at stations in the Las Vegas Wash showed that at least some of the augmented flow in the Wash may be the result of infiltration from the B.M.I. waste holding ponds. Analysis for metals and organic pesticides in the ponds as well as the Wash and the Bay indicates that, if infiltration is occurring, there is no effect of this infiltration on water quality in the Wash or Bay. Although high concentrations of iron, manganese and aluminum were determined in the upper ponds, no increased concentrations of these metals could be noted in the Wash or Bay. In fact, from stations W-5 to W-11 the concentrations of iron and aluminum decreased. Concentrations of all metals in Las Vegas Bay, with the exception of three aluminum samples, were below the levels of detection for the chemical tests.

Analysis for DDT, dieldrin and endrin exhibited no excessive concentrations of any of these pesticides in either the B.M.I. ponds, the Las Vegas Wash, or the Bay. DDT increased from 0.5 µg/l at station W-5 to 4.3 µg/l at station W-11. However, at the entrance to Las Vegas Bay (LVB-12) the concentration had been reduced to 0.5 µg/l. DDT averaged 0.5 µg/l within the lower B.M.I. ponds and 0.2 µg/l in the upper B.M.I. ponds. Only trace amounts of dieldrin and endrin were found at all stations except the effluents from the Clark County plant and W-4, the confluence station. Concentration of dieldrin in the effluent from Clark County was 0.03 µg/l. At station W-4, dieldrin was 0.08 µg/l and the endrin level was 0.1 µg/l. The results of the metals and pesticides analyses are shown in Table VI.

SUMMARY AND CONCLUSIONS

Results of a water quality survey conducted in Las Vegas Wash, Las Vegas Bay and the Boulder Beach area of Lake Mead showed no deleterious

TABLE VI

METALS AND PESTICIDES

	STATION	Al mg/l	Cd mg/l	Mn mg/l	Zn mg/l	Cu mg/l	Fe mg/l	DDT µg/l	Dieldrin µg/l	Endrin µg/l
WASTE SOURCES										
	CC-1	<0.5	0	0	<0.04	<0.01	<0.10	0.31	.0265	Trace
	LV-2	1.0	0	0	<0.04	0.03	<0.10	0.49	Trace	Trace
	SP-3	<0.5	0	0	-	0.09	<0.10	N O T D O N E		
	NP-16	<0.5	0	0	-	0.29	0.19	N O T D O N E		
Lower Ponds	BMI-15	1.0	0.1	0	<0.04	<0.01	0.57	INDETERMINATE		
	BMI-6	<0.5	0	0.3	<0.04	<0.01	<0.10	0.49	Trace	Trace
	H-7	<0.5	0	0	<0.04	<0.01	<0.10	0.19	Trace	Trace
Upper Ponds	BMI-9	5.70	1.40	24.3	-	0.39	5.0	0.65	-	-
	BMI-8	9.5	1.0	29.8	-	0.34	2.86	0.15	-	-
LAS VEGAS WASH										
	W-4	1.5	0	0.03	-	0.05	0.57	0.39	.0793	.1073
	W-5	1.0	0	0.08	<0.04	<0.01	0.37	0.49	Trace	Trace
	W-11	<0.5	<0.1	0.12	0.10	0.02	0.10	4.33	Trace	Trace
LAS VEGAS BAY										
	LVB-12	<0.5	0	0	<0.04	<0.01	<0.10	0.54	Trace	Trace
	LVB-1	<0.5	0	0	<0.04	<0.01	<0.10	1.02	Trace	-
	LVB-2	<0.5	0	0	<0.04	<0.01	<0.10	0.50	Trace	-
	LVB-3	<0.5	0	0	<0.04	<0.01	<0.10	0.95	Trace	Trace
	LVB-4	0.80	0	0	<0.04	<0.01	<0.10	0.09	Trace	Trace
	LVB-5	<0.5	0	0	<0.04	<0.01	<0.10	N O T D O N E		
	LVB-6	<0.5	0	0	<0.04	<0.01	<0.10	0.32	-	Trace
	LVB-7	0.80	0	0	<0.04	<0.01	<0.10	0.41	Trace	-
SADDLE ISLAND WATER INTAKE										
	SI-1	0.8	0	0	<0.04	<0.01	<0.10	N O T D O N E		

effect on water use due to bacterial pollution discharged through the Las Vegas Wash. Coliform levels throughout Las Vegas Bay and in the Boulder Beach area were well below the levels of concern for direct contact water activities. At Boulder Beach, increased counts are the result of augmented bathing activity rather than pollutional discharges from outside the area. Although chlorination at the Clark County sewage treatment plant and the Las Vegas city sewage treatment plant is generally effective, the determination of excessive densities of coliform in several samples from the effluents of both plants and the isolation of Salmonella in the Las Vegas city effluent as well as in the Las Vegas Wash indicates that operation of chlorination facilities should be improved to provide greater disinfection efficiencies.

The growth of algae in Las Vegas Bay is presently producing an objectionable aesthetic condition and, if allowed to continue unabated, will eventually destroy the recreational use of the area. These algae growths result from the discharge of nutrients, particularly phosphorus, through the Las Vegas Wash from the Clark County sewage treatment plant and the Las Vegas city sewage treatment plant. In order to maintain algae counts throughout Las Vegas Bay of less than 2,000/ml, approximating the present background levels in Lake Mead, phosphorus concentrations in the Bay should not exceed 0.005 mg/l. To accomplish this objective, the sewage treatment plants may not discharge a concentration of more than 1.2 mg/l in their effluents. Based on present waste concentrations, this represents a 90 percent reduction in effluent phosphorus concentration for Clark County sewage treatment plant and a 92 percent reduction for the Las Vegas city sewage treatment plant.

Although it is possible that infiltration from the B.M.I. waste holding ponds to the Las Vegas Wash may be occurring, the TDS contribution from this source was not demonstrated during this survey. An intensive ground water survey of the area would be required to determine the seepage and TDS contribution from these ponds.

The levels of metals in Las Vegas Bay were below the limits of chemical tests. Concentrations of organic pesticides were also well below levels of concern.

APPENDIX

TABLE A-I

SUMMARY OF FIELD DATA

Las Vegas Wash
May 1966

Station		Org N	NO_3 as N	NH_3 as N	Total P	Coliform Densities		B. O. D.	
						Total	Fecal	2-day	5-day
		mg/l	mg/l	mg/l	mg/l	MPN/100 ml	MPN/100 ml	mg/l	mg/l
CC-1	Avg.	3.9	2.1	14.5	12.2	6,860	1,280	2.1	5.8
	Max.	4.5	2.8	18.9	14.8	2,400,000	1,300,000	7.3	13.6
	Min.	2.8	1.3	10.2	8.5	< 20	< 20	-	0.4
LV-2	Avg.	5.0	0.2	20.1	14.6	682	150	14.0	28.6
	Max.	7.3	0.9	27.1	18.5	> 1,600,000	> 1,600,000	22.0	42.5
	Min.	3.7	< 0.1	15.1	9.3	< 20	< 20	3.0	13.6
SP-3	Avg.	5.6	6.1	8.1	3.4	223	20	6.2	13.5
	Max.	6.6	6.3	8.6	5.5	1,100	50	9.9	24.1
	Min.	4.8	5.6	7.4	0.4	< 20	< 20	4.1	9.6
W-4	Avg.	5.2	1.5	16.7	12.9	1,520	222	6.8	17.7
	Max.	6.8	3.6	24.4	18.5	630,000	70,000	10.6	25.7
	Min.	4.1	0.5	12.0	8.2	< 20	< 20	2.1	4.3
W-5	Avg.	1.2	1.4	0.2	8.2	1,650	80	1.3	2.3
	Max.	1.8	2.4	0.3	10.2	13,000	170	2.8	4.8
	Min.	0.9	0.4	0.1	7.0	220	20	0.6	1.2
BMI-6	Avg.	1.7	< 0.1	0.3	0.06				
	Max.	2.6	-	0.5	0.09				
	Min.	1.1	-	0.1	0.04				
H-7	Avg.	8.1	0.1	7.3	10.6	100,000	18,000		
	Max.	10.4	0.1	11.8	12.0	170,000	170,000		
	Min.	6.8	< 0.1	1.0	9.8	49,000	4,900		

TABLE A-I (Cont.)

SUMMARY OF FIELD DATA

Las Vegas Wash
May 1966

Station		Org N mg/l	NO_3 as N mg/l	NH_3 as N mg/l	Total P mg/l	Coliform Densities Total MPN/100 ml	Coliform Densities Fecal MPN/100 ml	B. O. D. 2-day mg/l	B. O. D. 5-day mg/l
BMI-8	Avg.	1.0	0.3	1.8	0.5				
	Max.	1.8	0.6	2.0	1.5				
	Min.	0.6	0.1	1.6	0.01				
BMI-9	Avg.	1.4	0.2	6.1	0.6				
	Max.	3.9	0.5	14.4	1.6				
	Min.	0.1	< 0.1	0.9	0.14				
W-11	Avg.	1.0	8.0	0.6	4.8	862	35	0.8	1.4
	Max.	1.7	9.1	4.0	6.5	3,300	170	1.6	2.9
	Min.	0.5	6.7	< 0.1	3.1	140	< 20	0.2	0.7
LVB-12	Avg.	1.0	0.1	0.3	0.06	38	< 20		
	Max.	1.6	0.1	1.9	0.08	790	< 20		
	Min.	0.8	< 0.1	< 0.1	0.03	4	< 2		
BMI-15	Avg.	0.6	1.5	0.2	0.36				
	Max.	0.7	2.3	0.4	0.80				
	Min.	0.5	0.1	< 0.1	0.17				
NP-16	Avg.	4.1	10.1	3.0	1.3	41	< 20		
	Max.	4.4	11.0	4.4	3.8	140	-		
	Min.	3.5	9.5	1.0	0.35	< 20	-		

TABLE A-II

SUMMARY OF FIELD DATA

Las Vegas Bay
May 1966

Station		Org N	NO_3 as N	NH_3 as N	Total P	Coliform Densities	
						Total	Fecal
		mg/l	mg/l	mg/l	mg/l	MPN/100 ml	MPN/100 ml
LVB-1	Avg.	0.9	<.0.1	0.2	.047	44	< 7
	Max.	1.3	0.1	0.6	.095	170	13
	Min.	0.6	< 0.1	< 0.1	.020	17	2
LVB-2	Avg.	0.8	< 0.1	0.1	.031	22	< 3
	Max.	0.9	-	0.2	.052	79	5
	Min.	0.6	-	< 0.1	.015	2	< 2
LVB-3	Avg.	1.0	< 0.1	0.1	.023	14	< 4
	Max.	3.4	-	0.4	.010	33	8
	Min.	0.6	-	0.1	.048	2	< 2
LVB-4	Avg.	0.3	< 0.1	0.1	.024	7	< 3
	Max.	1.2	-	0.3	.030	17	5
	Min.	0.6	-	< 0.1	.010	2	< 2
LVB-5	Avg.	0.8	< 0.1	0.1	.019	< 10	< 2
	Max.	1.8	-	0.6	.040	33	2
	Min.	0.6	-	< 0.1	.010	< 2	< 2
LVB-6	Avg.	0.7	< 0.1	< 0.1	.015	4	< 2
	Max.	1.5	-	-	.020	8	-
	Min.	0.4	-	-	< .005	< 2	-
LVB-7	Avg.	0.4	0.4	< 0.1	.005	2	< 2
	Max.	1.3	0.5	-	-	-	-
	Min.	0.3	0.3	-	-	-	-

TABLE A-III

BOULDER BEACH BACTERIOLOGICAL RESULTS

May 1966

Station	Date	Total Coliform MPN/100 ml	Fecal Coliform MPN/100 ml
SI-1	5-28-66	< 2	< 2
	5-30-66	< 2	< 2
	5-31-66	8	< 2
	5-31-66	6	2
	Avg.	< 4	< 2
M-2	5-28-66	13	< 2
	5-30-66	8	< 2
	5-31-66	2	< 2
	5-31-66	22	2
	Avg.	11	< 2
BB-3	5-28-66	170	130
	5-30-66	33	13
	5-31-66	49	2
	5-31-66	7	2
	Avg.	37	9
BB-4	5-28-66	350	310
	5-30-66	1,400	700
	5-31-66	17	2
	5-31-66	17	5
	Avg.	101	38
BB-5	5-28-66	79	49
	5-30-66	490	23
	5-31-66	23	2
	5-31-66	26	2
	Avg.	69	8
BB-6	5-28-66	8	2
	5-30-66	17	< 2
	5-31-66	2	< 2
	5-31-66	5	2
	Avg.	8	< 2
BB-7	5-28-66	4	< 2
	5-30-66	17	< 2
	5-31-66	4	< 2
	5-31-66	11	2
	Avg.	9	< 2

TABLE A-IV

SUMMARY OF TDS CONCENTRATION
LAS VEGAS WASH STATIONS
MAY 19-22, 1966

Station No.	Station	Average TDS Concentration mg/l
CC-1	Clark County S.T.P. effluent	1,055
LV-2	Las Vegas S.T.P. effluent	783
SP-3	Sunrise Power Co. effluent	2,832
W-4	Las Vegas Wash confluence	1,135
W-5	Las Vegas Wash at USGS Gage	2,400
BMI-15	BMI Lower Ponds Influent	1,658
NP-16	Nevada Power Co. effluent	2,843
BMI-9	BMI Upper Ponds Influent	4,955
W-11	Las Vegas Wash at North Shore Road	5,287