A PRE-IMPOUNDMENT WATER QUALITY INVESTIGATION for the PROPOSED TREXLER LAKE

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CHAPTER I -- INTRODUCTION

(1)

A. Purpose

The water quality investigation described in this report was initiated in response to a request made by the Philadelphia District Corps of Engineers in a letter dated February 29, 1972.

B. Scope:

The scope of this report is limited to the presentation and interpretation of analytical data relative to the existing water quality of waters which will constitute the Trexler Lake.

C. Objectives:

(1) Establish a base-line record of water quality for Trexler Lake and the Jordan Creek below the proposed dam.

(2) Determine the effects of the proposed impoundment on the water quality for the proposed uses.

D. Authority:

This investigation was conducted and the report prepared under the provisions of Section 102 of the Federal Water Pollution Control Act Amendments of 1972 (33 U.S.C. 1151) which authorizes the Administrator of the United States Environmental Protection Agency to cooperate with other Federal agencies to make joint water quality investigations for impoundment of water by reservoirs.

E. Acknowledgement of Aid and Assistance

During the course of this investigation it was necessary to obtain data and information from various sources. We are indeed grateful for the aid given and wish to express our appreciation to the following:

(1) Data and Information

Geological Survey (Department of the Interior)
Harrisburg, Pennsylvania

Department of Wastewater Treatment and Filtration
City of Allentown, Pennsylvania

(2) Field Laboratory Facilities

Wastewater Treatment Plant Laboratory
City of Allentown, Pennsylvania

Water Filtration Plant Laboratory
City of Allentown, Pennsylvania

Appreciation is also expressed to the Environmental Protection Agency's Charlottesville Technical Support Laboratory for providing field sampling and field laboratory personnel and analysis of samples necessary to complete this investigation, especially to James La Buy, Aquatic Biologist who prepared the section on biological quality.

Chapter II

Summary and Conclusions

An intensive field investigation, including sampling and flow measurements, and laboratory analysis were conducted to determine the existing water quality of the Jordan Creek for the proposed impoundment. The summary for this study is as follows:

1. The Jordan Creek watershed, which is a sub-basin of the Lehigh River, has a drainage area of about 53.0 square miles.
2. The waters of the Jordan Creek Basin are classified by Pennsylvania as:
   - (a) water supply for domestic, industrial, live stock, wilklife and irrigation purposes;
   - (b) recreational use for warm and cold water fishery and water contact sports;
   - (c) treated waste assimilation and power.
3. There are two municipal wastewater treatment facilities, both of which have tertiary treatment. One is located at an elementary school, the other at a housing development. Both appear to be maintained and operated properly. The elementary school facility was not sampled because the school was closed anc the treatment facility was not in operation.

4. Major and minor nutrient concentrations far exceed the levels generally found to be necessary to stimulate the growth of algae and aquatic weeds thereby accelerating eutrophication within the proposed impoundment.

5. The oxygen balance of the streams investigated is satisfactory.

6. The physical-chemical characteristics provide an environment which is excellent for the propagation of fish and other aquatic life.

7. Bacteriological data show high counts of indicator microorganisms, indicating the potential presence of disease-causing bacteria, suggesting direct discharges from individual homes to the receiving stream and livestock waste discharges.

8. Biological data indicated extremely good water quality, for aquatic life, within the streams investigated.

9. The summary of all the physical, chemical, biological, and bacteriological information indicates:

(a) The existing water quality does not meet the requirements for water supply or water contact sports.

(b) Impoundment may accelerate eutrophication.

10. If this impoundment is constructed steps must be taken to eliminate the problems outlined above.

Chapter III

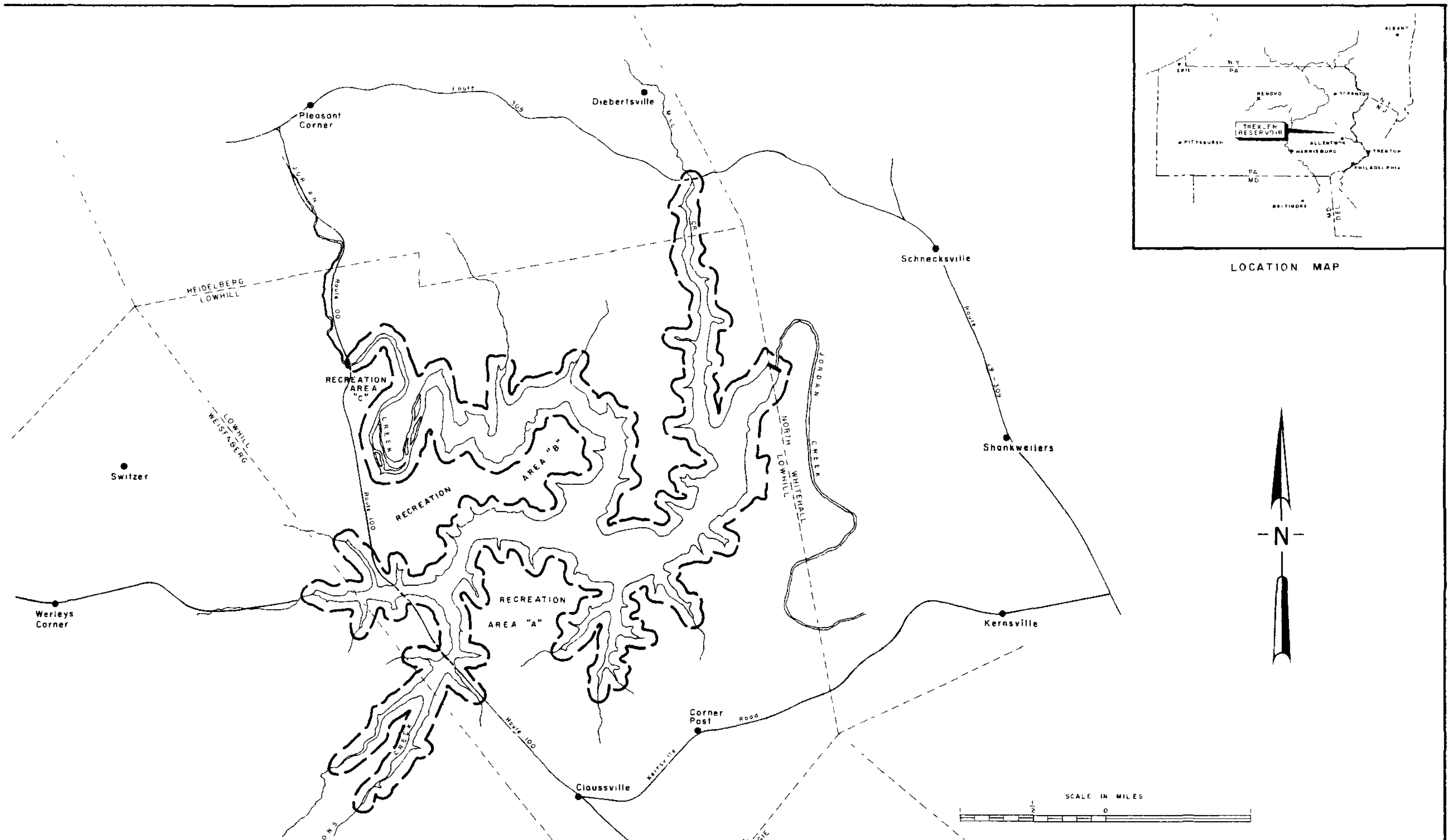
Description of Area

A. General:

The proposed impoundment reservoir is located on the Jordan Creek 17.3 miles upstream from its confluence (River Mile 0) with the Lehigh Creek. The lake formed by this impoundment will extend upstream to approximately River Mile 25 and includes approximately 2 miles of Mill Creek, a tributary, approximately 6 miles of Lyon Creek, a tributary, and more than 3 unnamed tributaries. The total drainage area is 53.0 square miles, all of which is located in townships of Lowhill, North Whitehall, Heidelberg and Weisenberg, Lehigh County. The drainage basin has primarily agricultural activities and includes Pennsylvania State Game Lands and the Trexler-Lehigh County Game Preserve. (See Figure I)

B. Physiography

This drainage basin is located in the physiographic province called the Valley and Ridge Province. The province is characterized by rolling, well rounded hills, and well wooded with broad intervening valleys.



JORDAN CREEK SUB BASIN
DELAWARE RIVER BASIN

PROPOSED
TREXLER RESERVOIR
IMPOUNDMENT

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION III PHILADELPHIA, PA.

C. Geology:

The area is underlain by shale, slate, sandstone, and limestone. The ground water that seeps into streams from the carbonate rocks is alkaline. The Jordan Creek is underlain by extensive beds of Cambrian and Ordovician limestone, dolomite, and shale and slate. Such rocks greatly influence the chemical quality of the streams that cross them. The limestones are dense, hard, brittle and cavernous. The channel is tortuous, through slate and shale in the upper basin where the lake will be located and limestone in the lower basin.

D. Climatology: (U.S. Weather Bureau, 1964)

The mean annual precipitation averages about 45 inches (1931-1960). The lowest monthly average, 216 inches, normally occurs in February, and the highest monthly average, 4.9 inches, in July.

Mean annual air temperature is 11°C (Allentown) and ranges from an average low of $_{-2}$o in winter to an average high of 22° C in summer. A severe flood occurred in this area on June 23, 1972, which caused the investigation to be rescheduled to September 1972.

E. Hydrology:

The profile of the channel below the impoundment site has a rate of fall of 9.8 feet per mile. For 11.5 miles above the site the rate of fall is 17.4 feet per mile, while above that the rate is 46.7 feet per mile.

The US Geological Survey Stream Gage Station No. 0145180 (Jordan Creek near Schnecksville, Pennsylvania) is located approximately 0.2 miles downstream from the proposed dam. The maximum recorded (Oct. 1970-Sept. 1971) discharge was 2020 cfs (1548 MGD) and the minimum recorded discharge was 6.9 cfs (4.5 MGD). The average mean discharge for 5 years was 76.8 cfs (49.6 MGD). The relationship between rainfall and stream runoff for this area is one (1) inch yields 0.9 cubic feet per square mile or 47.7 cubic feet for this drainage basin (53.0 sq. miles)

Chapter II

Investigation Methodolgy

A. Time Period of Study

The investigation was started on June 7, 1972. The field work was completed on September 22, 1972, and all laboratory analysis, except the biological, was completed December 15, 1972. The biological analysis was completed on March 29, 1973.

B. Sampling and Analytical Methods:

All sampling and analysis were performed in accordance with either "Standard Methods for the Examination of Water and Wastewater", Thirteenth Edition, or the Environmental Protection Agency "Methods for chemical Analysis of Water and Wastes", (1971 Edition). The field laboratories were established in the City of Allentown Wastewater Treatment Plant and Water Filtration Plant Laboratories. The field laboratories were supplemented by the Environmental Protection Agency Technical Support Laboratory at Charlottesville, Virginia.

C. Hydrological Methods:

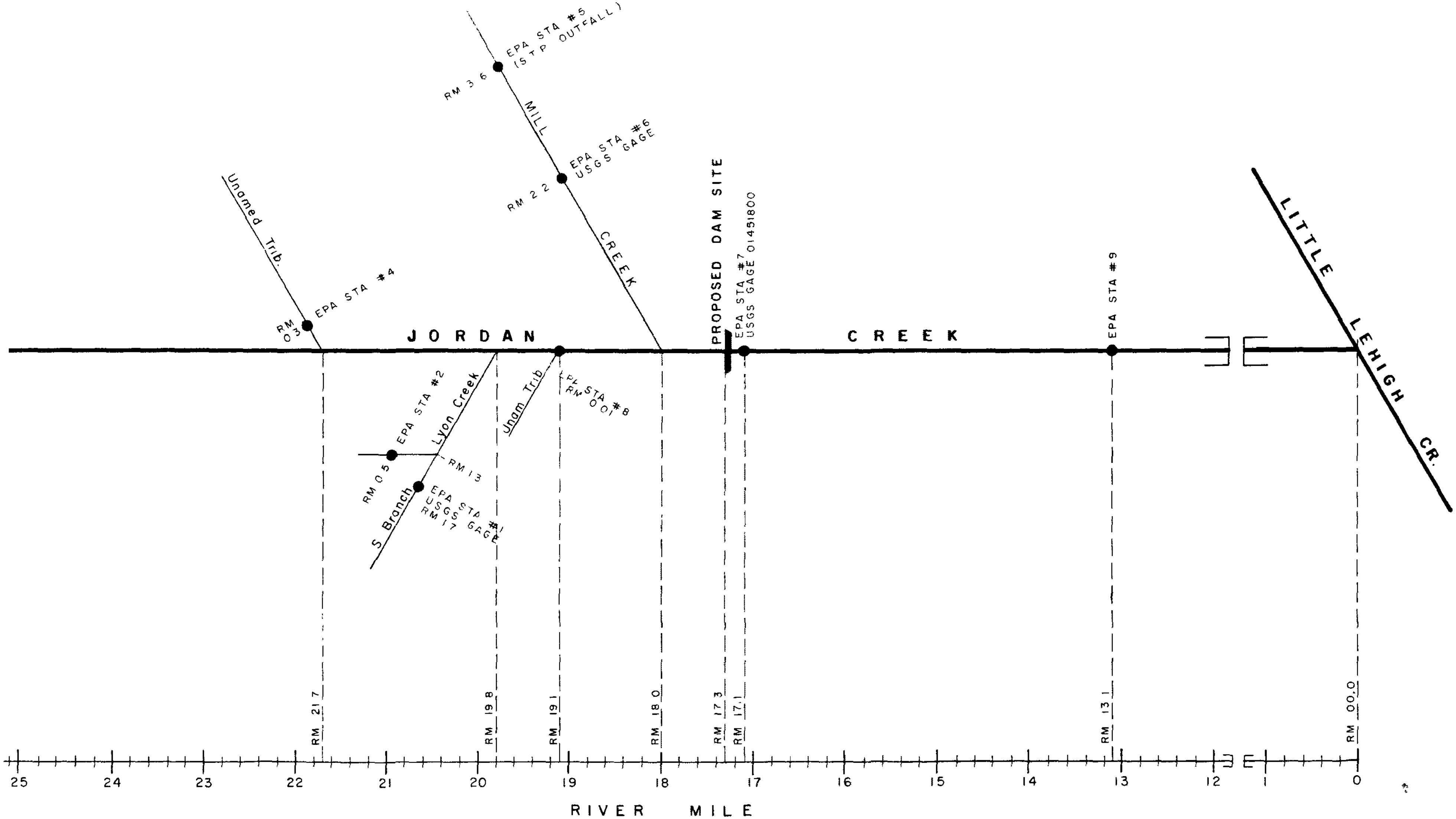
Stream flow data was obtained from the U. S. Geological Survey, Harrisburg, Pennsylvania and by the utilization of a National Bureau of Standards Calibrated "Pigmy" Flow Meter. The wastewater flow measurements were obtained from the wastewater treatment plot flow meter.

D. Description and Location of Sampling Stations:

Table A

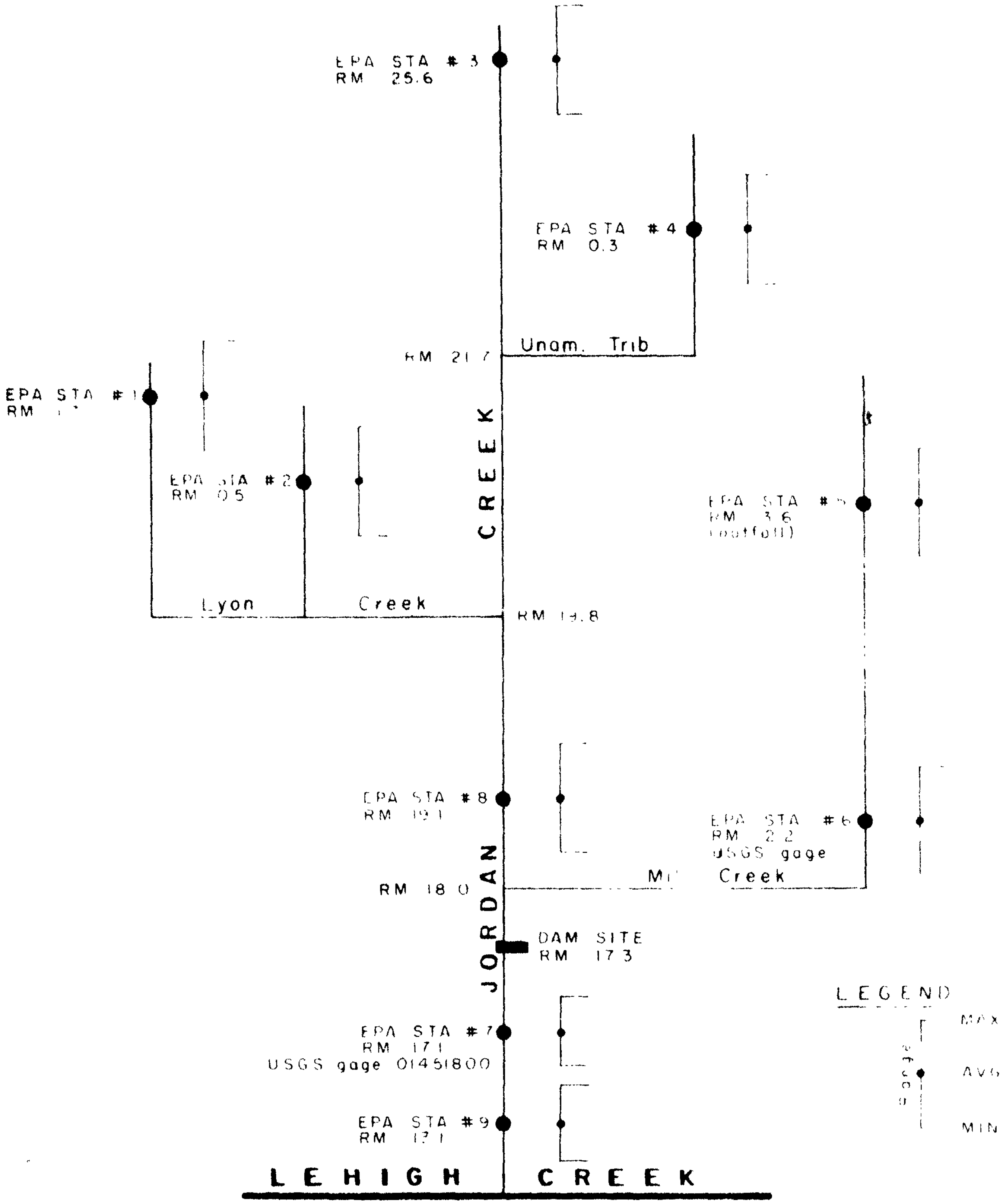
Station No.	River Mile	Station Description
1	J 19.8 +S.L. 1.7	South Branch Lyon Creek at Township Route T633 bridge at Lyon Valley, Pa.
2	J 19.8 + N.L. 1.8	North Branch Lyon Creek at Township Route T658 bridge at Lyon Valley, Pa.
3	J 25.6	Jordan Creek at Pa. Route 100 bridge at Lowhill, Pa.
4	J 21.7 + U 0.3	Unnamed tributary to Jordan Creek at Township Route T649 bridge near Lowhill, Pa.
5	J 18.0 + M 3.6	Heidelberg Heights STP outfall on Mill Creek near Schnecksville, Pa.
6	J 18.0 + M 2.2	Mill Creek at Pa. Route 309 bridge near Schnecksville, Pa.
7	J 17.1	Jordan Creek at covered bridge on L.R. 39058 near Schnecksville, Pa. (U.S.G.S. Gage Station 01451800)
8	J 19.1	Unnamed tributary to Jordan Creek near L.R. 39057 & L.R. 39060 at Wiedasville, Pa.
9	J 13.1	Jordan Creek at Township Route T-593 near Siegersville, Pa.

J - Jordan Creek
S.L. - South Branch - Lyon Creek
N.L. - North Branch - Lyon Creek
M. - Mill Creek
U - Unnamed Tributary



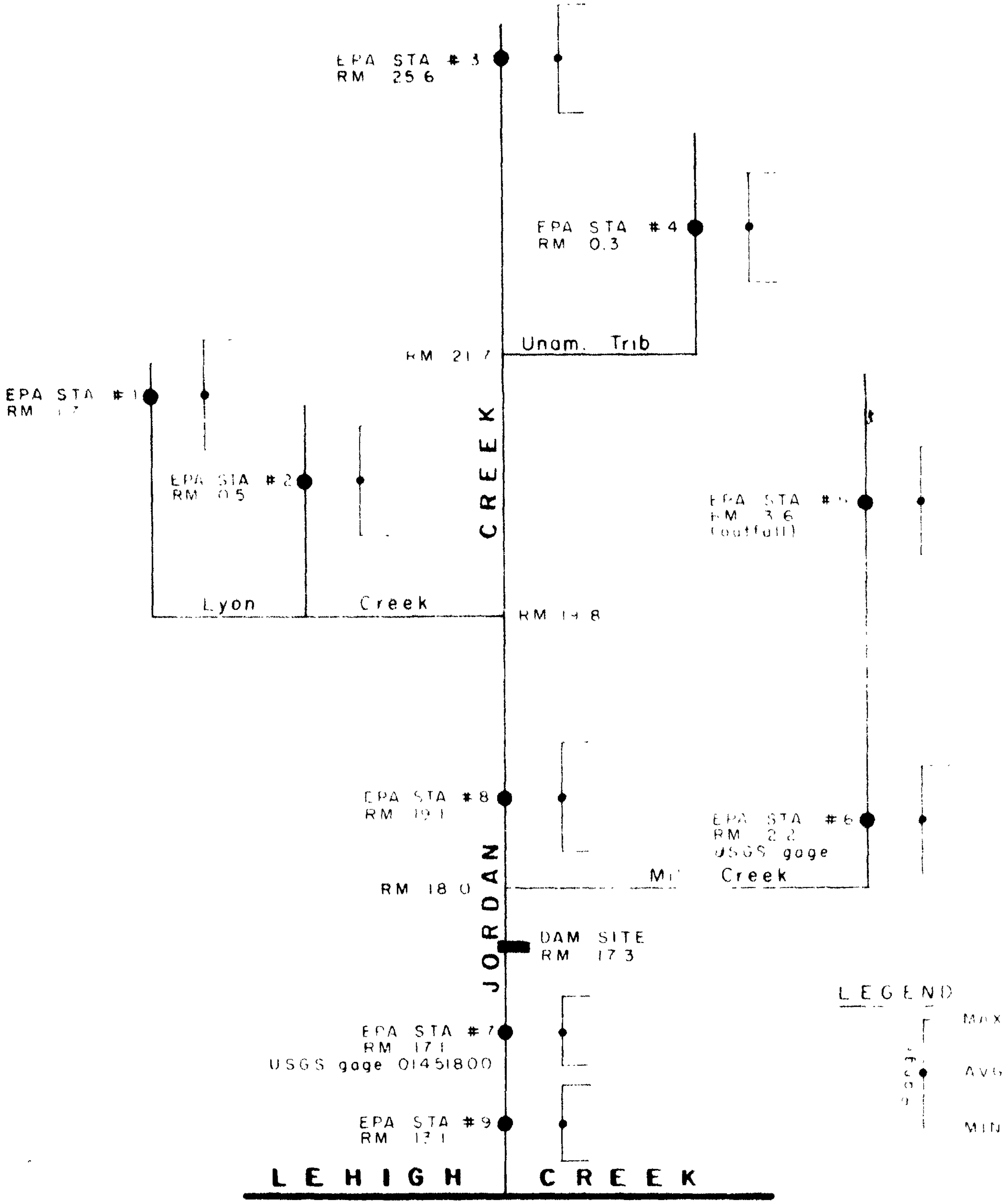
SCHEMATIC DIAGRAM – JORDAN CREEK SAMPLING STATIONS

FIGURE 2



TREXLER LAKE
WATER QUALITY INVESTIGATION
SAMPLING STATIONS

FIGURE III



TREXLER LAKE
WATER QUALITY INVESTIGATION
SAMPLING STATIONS

FIGURE III

Chapter III

Analysis and Interpretation of Data

A. Water Quality Standards:

Recommended national water quality criteria were developed by the National Technical Advisory Committee to the Secretary of the Interior and were completed April 1, 1968. A summary of these criteria appear in Table B.

Water quality criteria were also developed by the Pennsylvania Sanitary Water Board specifically for the Jordan Creek. These criteria appear in Tables C & D.

TABLE B
WATER QUALITY CRITERIA

Water Quality Parameter	National Water Quality Standards							
	Recreation & aesthetic	Public Water Supply Permissible	Public Water Supply Desirable	Fresh Water organisms	Wild life	Farm Water supplies	Livestock	Irrigation
1. Temperature °F	85°	85°	85°	83-96°				55-85°
2. Temperature °C	24.9°	24.9°	24.9°	28.3°-35.6° for 6 hr.				12.8°-24.9°
3. Dissolved oxygen, mg/1		3.0	Near to saturation	4.0	Bottom aerobic			
4. carbon dioxide mg/1				25				
5. pH, Units	5.0-9.0	6.0-8.5		6-9	7.0-9.2	6.0-8.5		4.5-9.0
6. Alkalinity ($CACO_3$) mg/1		30-500	30-500	20	35-200			
7. Hardness ($CACO_3$) mg/1		60-120	60-120					
8. Chloride, mg/1		250	25					
9. Sulfate, mg./1		250	50					
10. Total dissolved solids, mg/1		500	200			500-5000	10,000	0-5000

TABLE B
WATER QUALITY CRITERIA

Water Quality Parameter	National Water Quality Standards							
	Recreation & aesthetic	Public Water Supply Permissible	Public Water Supply Desirable	Fresh Water organisms	Wild life	Farm Water supplies	Livestock	Irrigation
11. Ammonia, mg/1		0.5	Absent	2.5-1.5#				
12. Nitrates, mg/1		10.0(N) Ind. NO_2	Virtually absent			45.0		
13. Nitrates & Nitrites Mg/1		10	Virtually absent					
14. Phosphorus ug/1		50	50	50				
15. Pesticides: ug/1								
Aldrin		17	Absent	Absent	Absent	17	Absent	
DDT		42	"	"	"	42	"	
Dieldrin		17	"	"	"	17	"	
Endrin		1	"	"	"	1	"	
Heptachlor		18	"	"	"	18	"	
Heptachlor epoxide		18	"	"	"	18	"	
Lindane		56	"	"	"	56	"	
Methoxychlor		35	"	"	"	35	"	
16. Fecal coliform no/100 ml	400-200	2000	20					1000
17. Total Coliform no/100 ml		10,000	100			100		5000

pH 8.0 only

Table C

USES FOR PENNSYLVANIA WATERS

Jordan Creek

1.0 Aquatic Life

1.1 Cold Water Fishes - Maintenance and propagation of the family Salmonidae and fish food organisms.

1.2 Warm Water Fishes - Maintenance and propagation of fish food organisms and all families of fishes except Salmonidae.

2.0 Water Supply

2.1 Domestic Water Supply - Use by humans after conventional treatment, for drinking, culinary and other purposes.

2.2 Industrial Water Supply - Use by industry for inclusion into products, for processing and for cooling.

2.3 Livestock Water Supply - Use by livestock and poultry for drining and for cleansing.

2.4 Wildlife Water Supply - Use for waterfowl habitat and by wildlife for drining and cleansing.

2.5 Irrigation Water Supply - Used to supplement precipitation for growing crops.

3.0 Recreation

3.2 Fishing - Use of the water for the taking of fish by legal methods.

3.3 Water Contact Sports - Use of the water for swimming and related activities.

3.4 Natural Area - Use of the water as an esthetic setting to recreational pursuits.

4.0 Other

4.1 Power - Use of the water energy to generate power.

4.3 Treated Waste Assimilation - Use of the water for the assimilation and transport of treated waste waters.

Table C - Cont'd

GENERAL CRITERIA

The water shall not contain substances attributable to municipal, industrial, or other waste discharges in concentrations or amounts sufficient to be inimical or harmful to water uses to be protected or to human, animal, plant or aquatic life. Specific substances to be controlled include, but are not limited to, floating debris, oil, scum and otherfloating materials; toxic substances; substances that produce color, taste, odors or settle to form sludge deposits.

CRITERIA

pH	Not less than 6.0; not to exceed 8.5
Dissolved oxygen	For lakes, ponds and impoundments only, no value less than 5.0 mg/l at any point. Minimum daily av. 7.0 mg/l; no value less than 6.0 mg/l
Total Iron	Not to exceed 1.5 mg/l
Temperature	Not to be increased by more than 5°F above natural temperatures or to be increased above 58°F.
Dissolved solids	Not to exceed 500 mg/l as a monthly av. value; not to exceed 750 mg/l at any time.
Total coliforms	For the period 5/15-9/15 of any year; not to exceed 1000/100 ml as an arithmetic av. value; not to exceed 1,000/100 ml in more than 2 consecutive samples; not to exceed 2,400/100 ml in more than 1 sample
Fecal coliforms	The fecal coliform density in five consecutive samples shall not exceed a geometric mean of 200/100 ml.

B. Physical and Chemical Quality:

(1) Pennsylvania's temperature standards were exceeded at all sampling points. Impounded water tends to increase temperatures. The warm temperatures of the streams have the following concomitant effects:

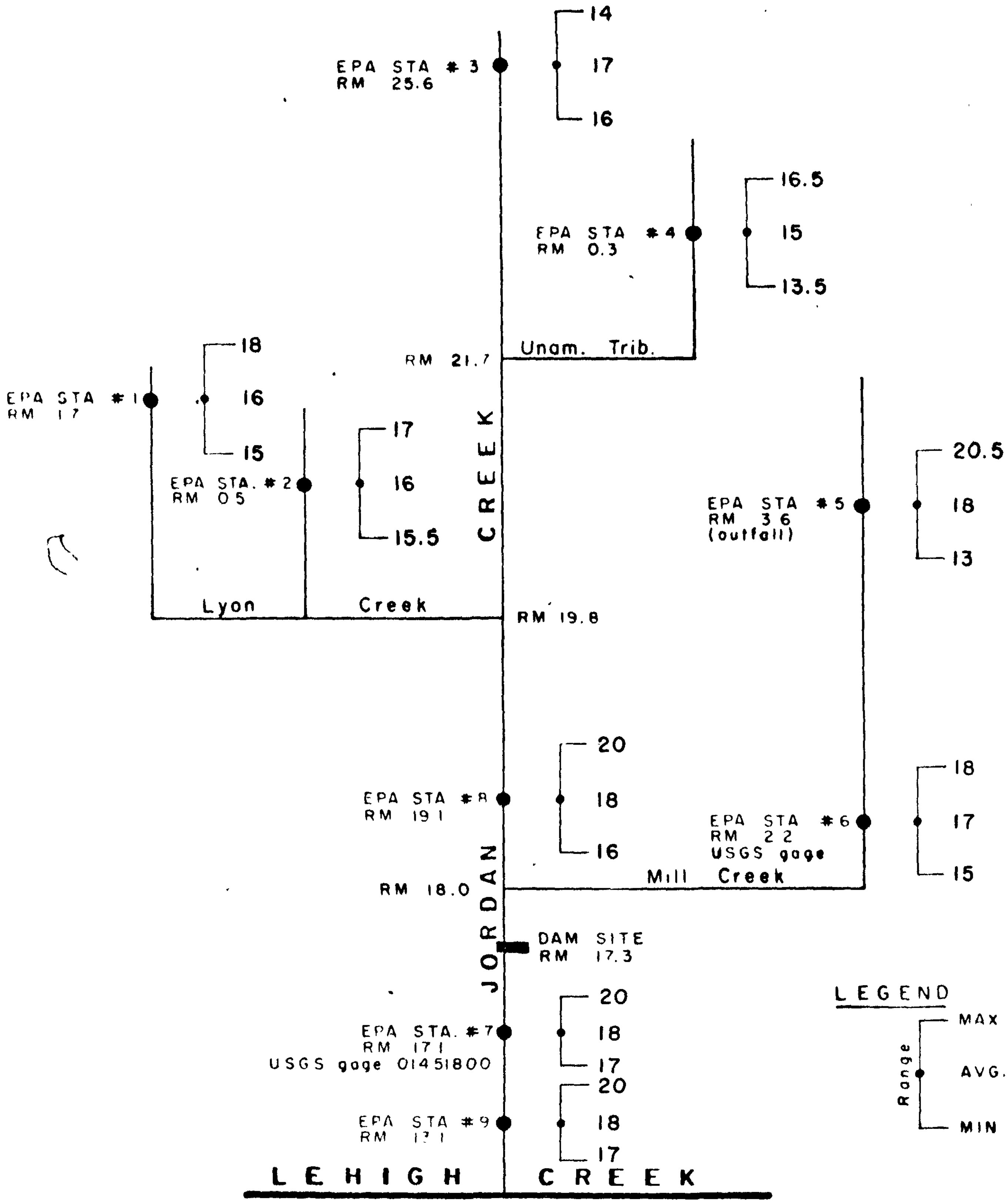
(a) higher temperatures diminish the solubility of dissolved oxygen and thus decrease the availability of this essential gas,

(b) elevated temperatures increase the metabolism, respiration, and oxygen demand of fish and other aquatic life, approximately doubling the respiration for a 10°C rise in temperature; hence the demand for oxygen is increased under conditions where the supply is lowered,

(c) the toxicity of many substances is intensified as the temperature rises,

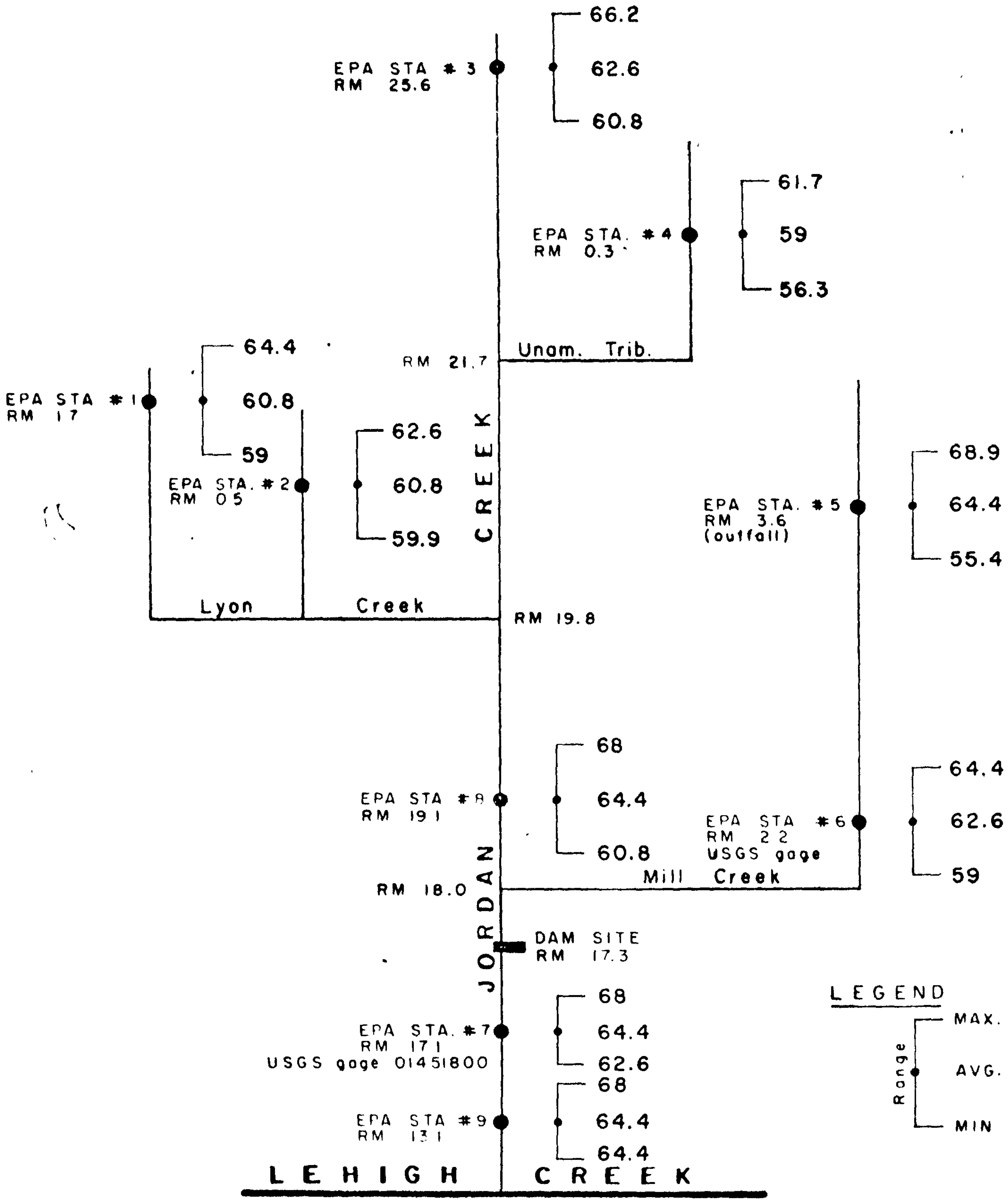
(d) higher temperatures mitigate against desirable fish life by favoring the growth of sewage fungus and the putrefaction of sludge deposits, and finally

(e) even with adequate dissolved oxygen and the absence of any toxic substances, there is a maximum temperature that each species of fish or other organism can tolerate; higher temperatures produce death in 24 hours or less. (See Figures IV a. & b)



TREXLER LAKE
WATER QUALITY INVESTIGATION
TEMPERATURE (°C)

FIGURE IVa



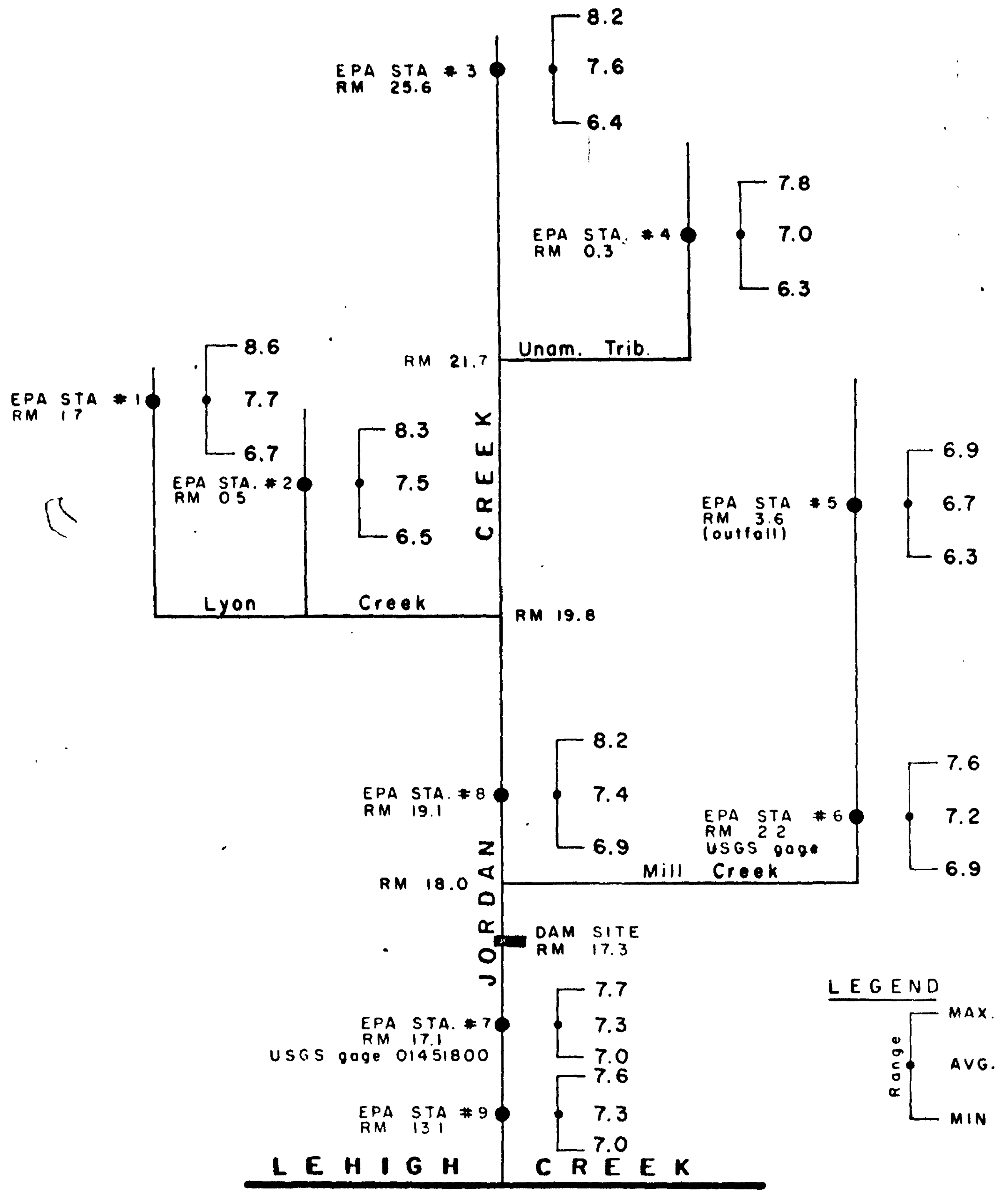
TREXLER LAKE
WATER QUALITY INVESTIGATION
TEMPERATURE (°F)

FIGURE IVb

(2) pH in most fresh, natural waters usually has a range between 6.5 and 8.5. In primary contact recreation waters, the pH should be within the range of 6.5 and 8.3. The pH range for surface water criteria for public water supplies is 6.0 and 8.5, which is the same standards for this stream set by the State of Pennsylvania Standards, except one reading at Station 6 which is attributable to the discharge from the Heidelberg Heights wastewater treatment.plant. (See Figure V)

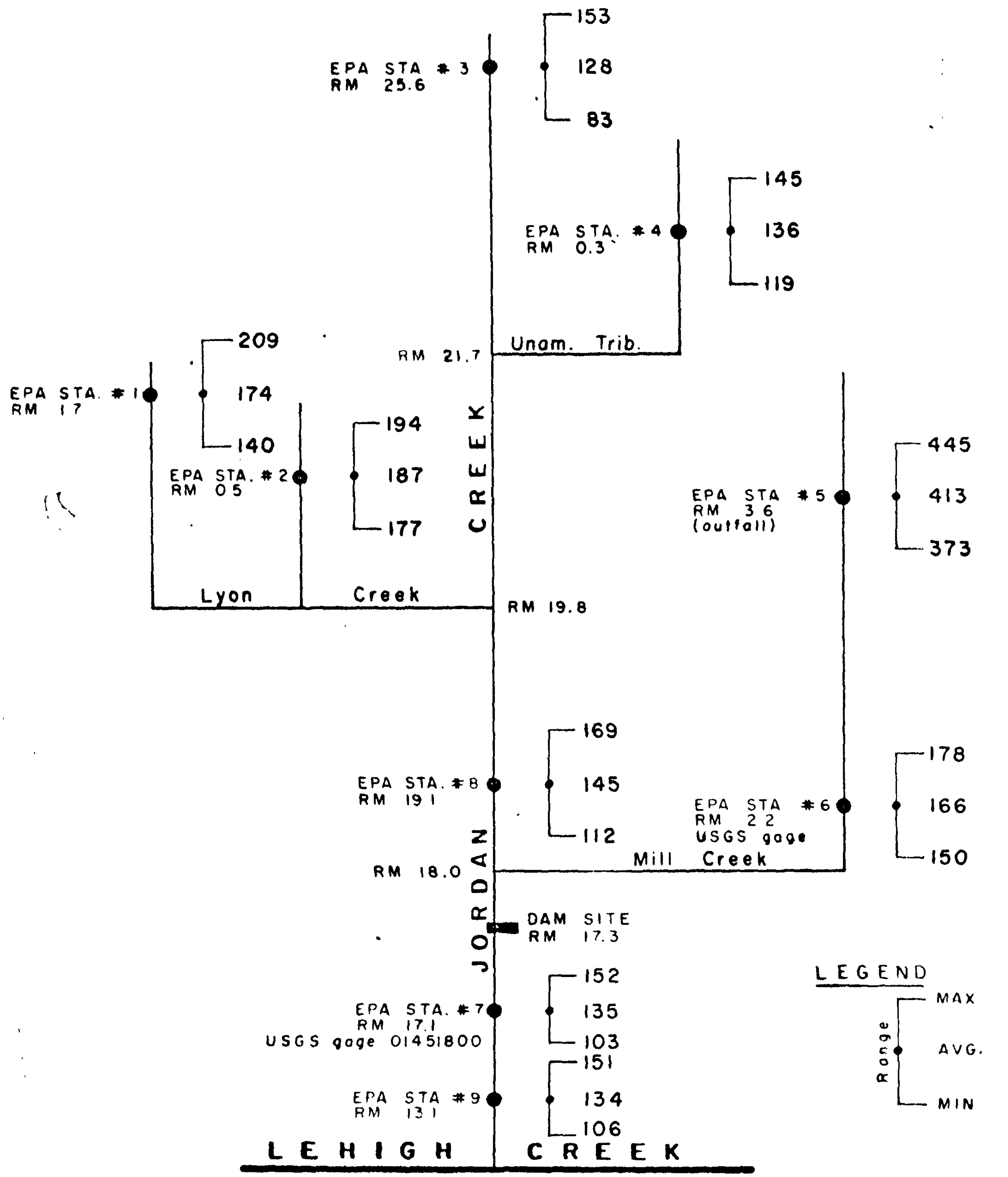
(3) Stream solid concentrations are within the limits of water quality criteria for designated usage. Solids from Heidelberg Heights wastewater plan are higher than desirable. Dissolved solid concentrations limit the light penetration, which in turn limits the food chain for aquatic growth. (See Figure VI for total solids)

(4) The Specific Conductance of the streams were low and indicated a low mineral content. The Heidelberg Heights Wastewater treatment plan effluent value was slightly high and is reflected in the solids analysis. However, all values were within acceptable levels for the proposed usage. The specific conductance of inland waters, such as the Jordan Creek, supporting good fish fauna lies between 150-500 micro-mhos per cu. cm. (See Figure VII).



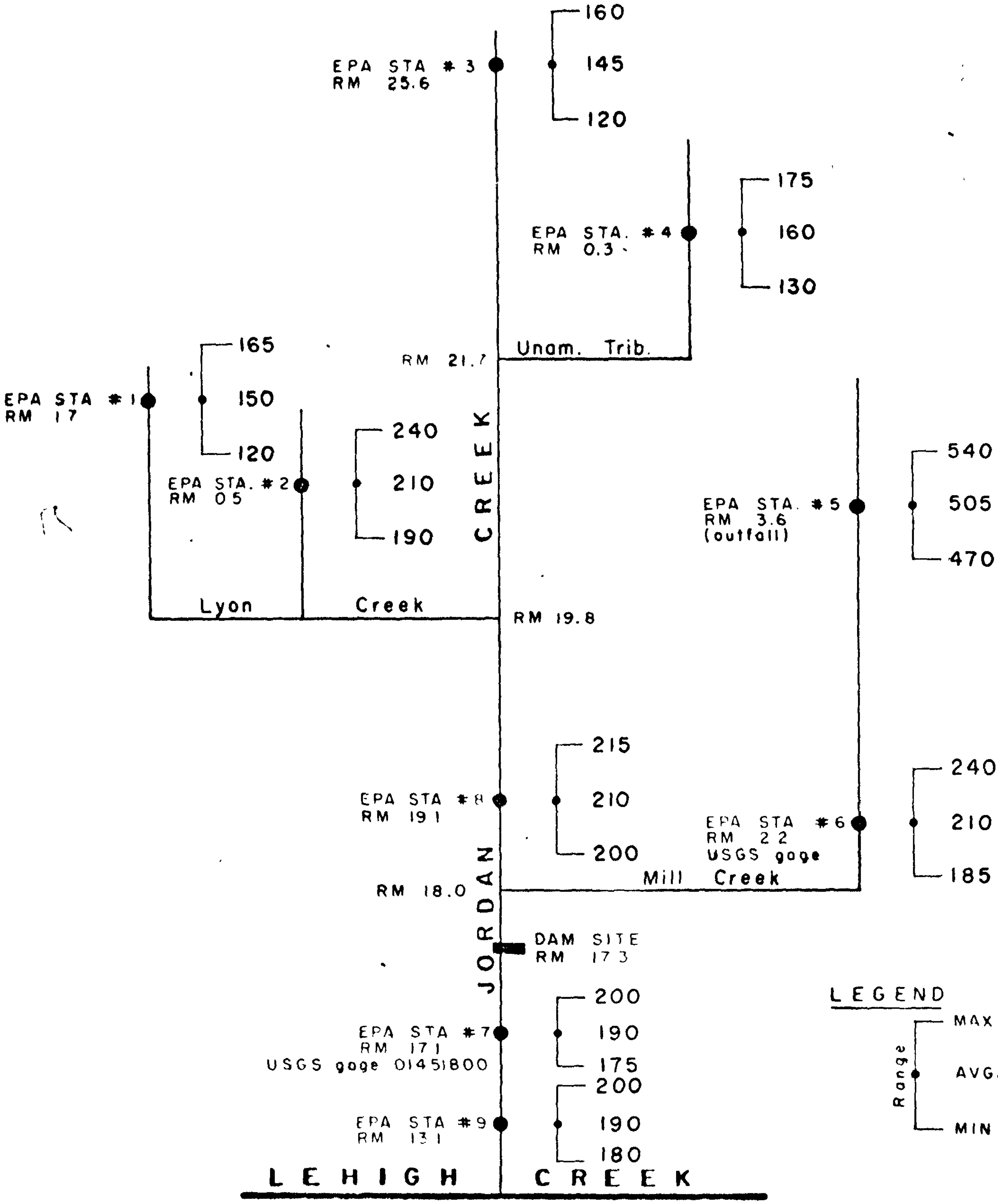
TREXLER LAKE
WATER QUALITY INVESTIGATION
pH (units)

FIGURE V



TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL SOLIDS (mg/l)

FIGURE VI



TREXLER LAKE
WATER QUALITY INVESTIGATION
SPECIFIC CONDUCTANCE
(micromhos/eubic centimeter)

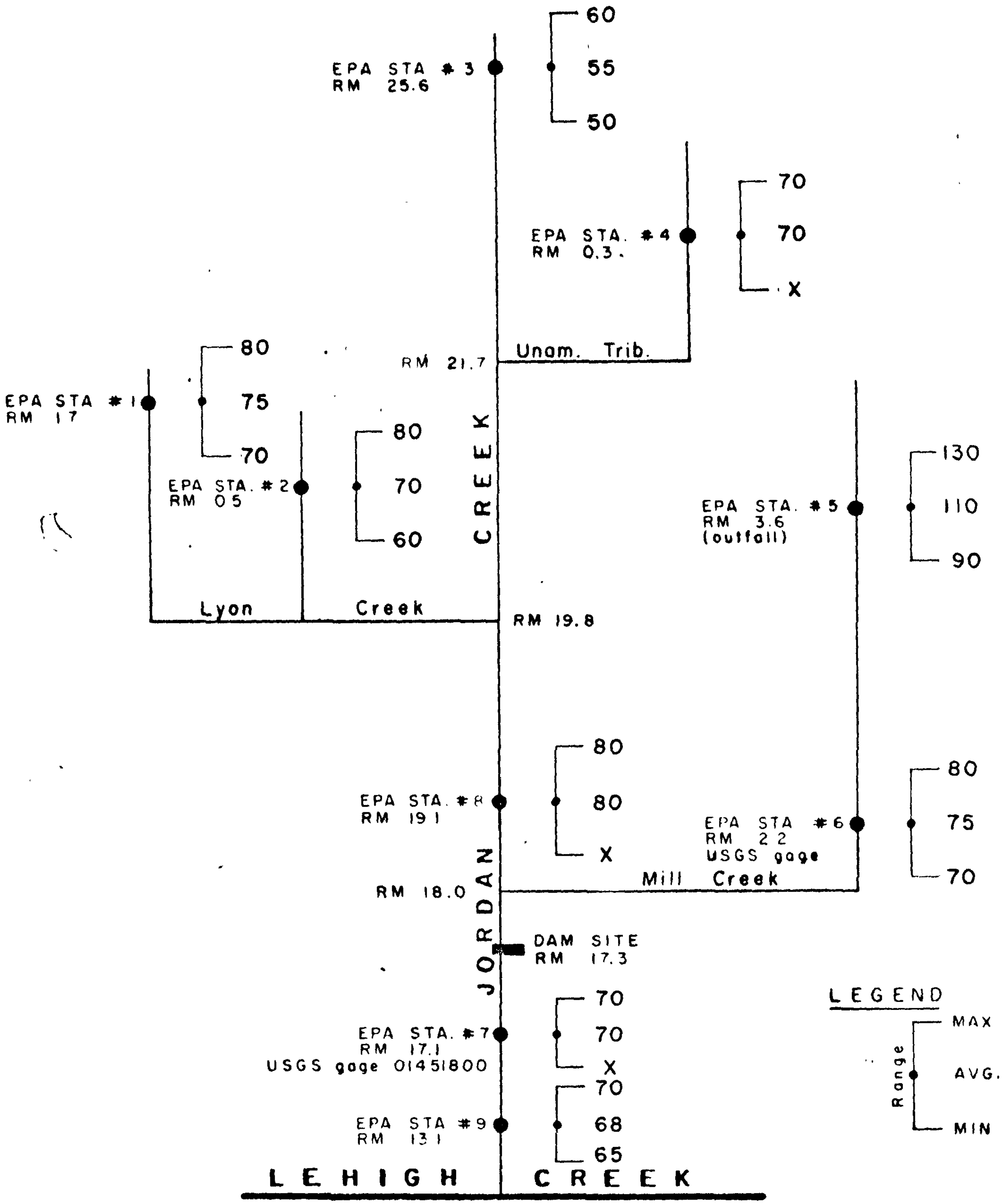
FIGURE VII

(5) The degree of Total Hardness of this stream can be classified as being primarily soft. Various investigators have found a negative correlation between hardness in the domestic water supply of an area and the death rates from cardiovascular diseases. Therefore, the soft water of this basin may cause problems if used as a public water supply. Soft water solutions increase the sensitivity of fish to toxic substances. (See Figure VIII)

Total Hardness mg/l (as $CaCo_2$)	Description
0-75	soft
75-150	moderately hard

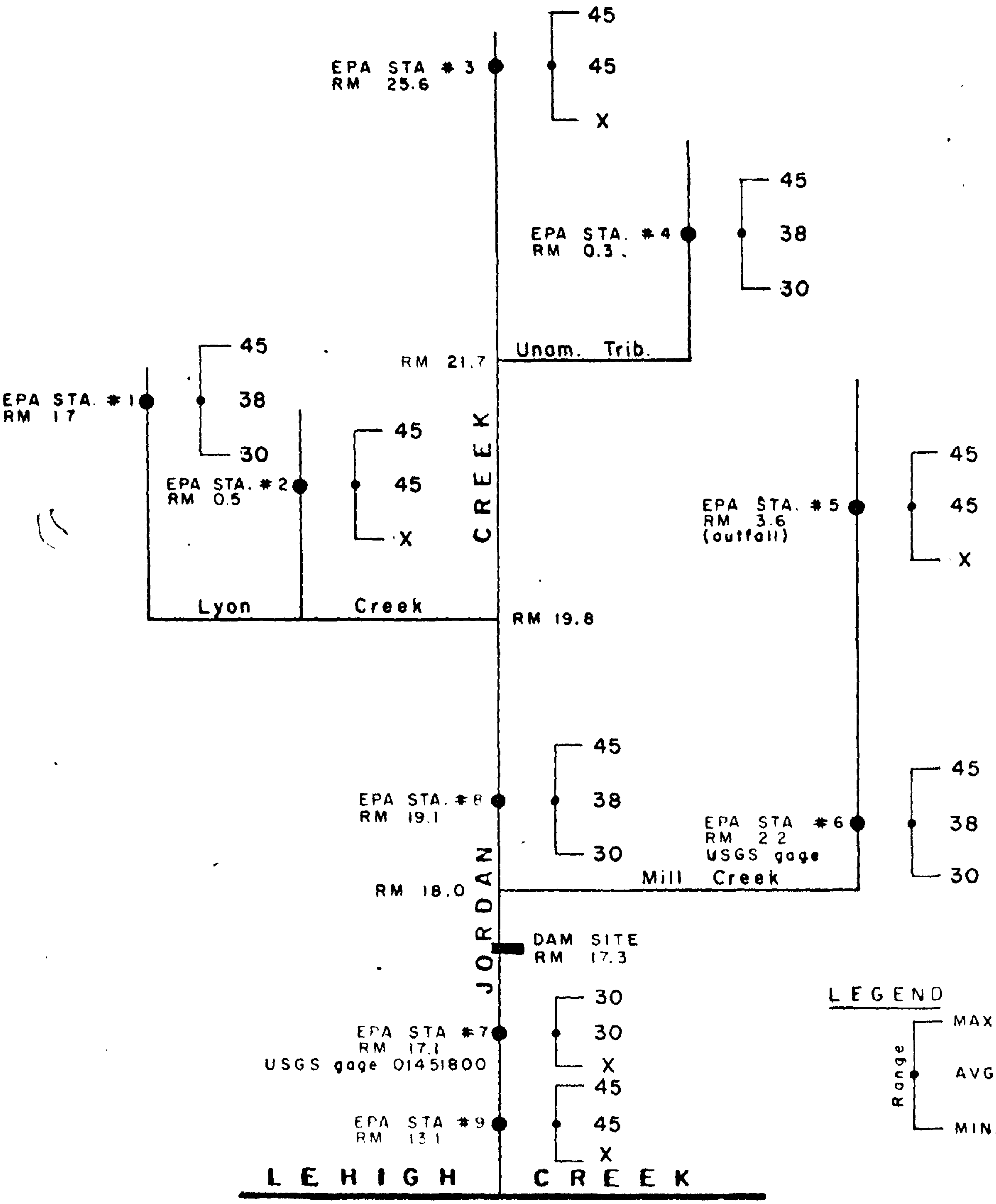
(6) The Total Alkalinity in this stream is equal to the Bicarbonate Alkalinity since the pH is less than 8.3. For the best support of diversified aquatic life the pH values should be between 7 and 8, and have a total alkalinity of more than 90 mg/l. This alkalinity also serves as a buffer should there be a sudden change in pH. Although these waters have alkalinity concentrations of less than 90 mg/l they do meet National Criteria and can be biologically classified as being medium to high productivity for aquatic fauna and flora. Waters with a methyl orange alkalinity greater than 40 mg/l, such as the Jordan Creek, show a higher algae productivity rate. (See Figure IX)

(7) A Langelier Index of zerio indicates the waters to be in chemical balance, and a negative value indicates a corrosive tendency. All index values for Jordan Creek, tributaries and wastewater treatment plant were negative, therefore, corrosive in nature. (See Figure X)



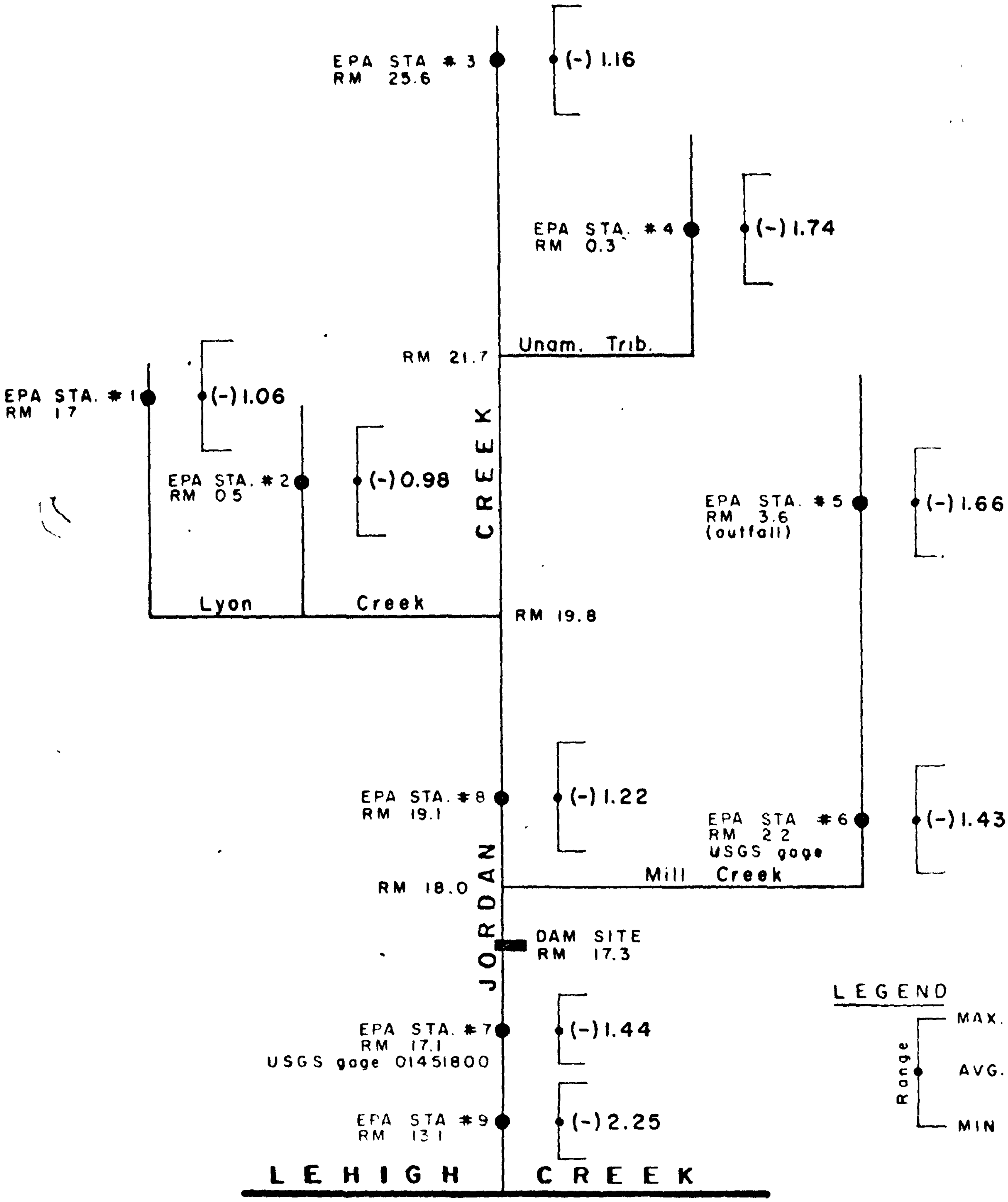
TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL HARDNESS ($CaCO_3$ mg/l)

FIGURE VIII



TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL ALKALINITY ($CaCo_3$ mg/l)

FIGURE IX



TREXLER LAKE
WATER QUALITY INVESTIGATION
LANGELIER INDEX

FIGURE X

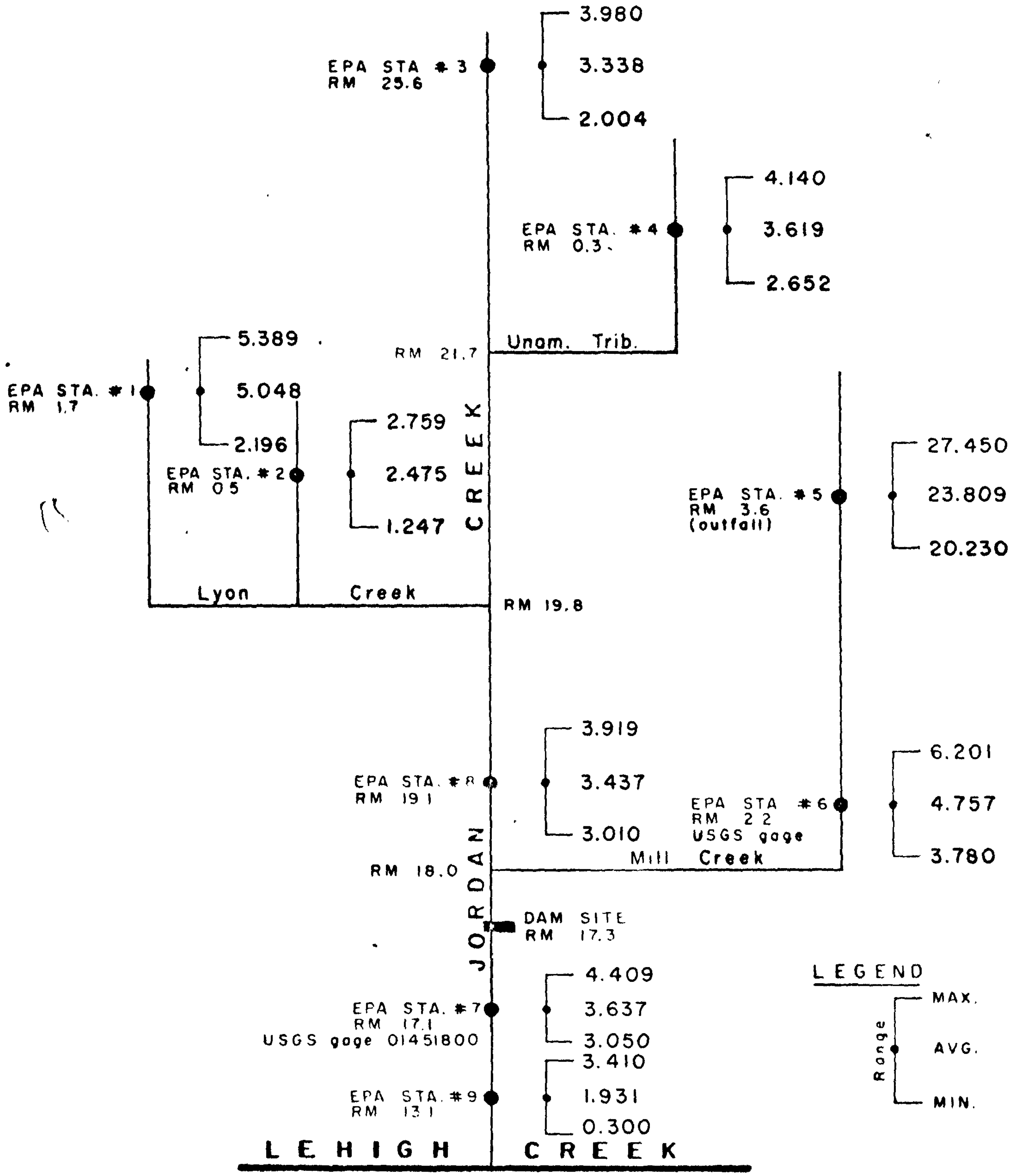
(8) Acidity concentrations and pH values indicate that the waters are in the carbon dioxide acidity range and are not detrimental for the proposed usages.

(9) Carbon Dioxide concentrations are less than National Criteria for freshwater organisms.

(10) Chloride concentrations are lower than the National Criteria for water supplies. Good fish fauna waters contain less than 170 mg/l of chlorides; these waters contain less than this concentration.

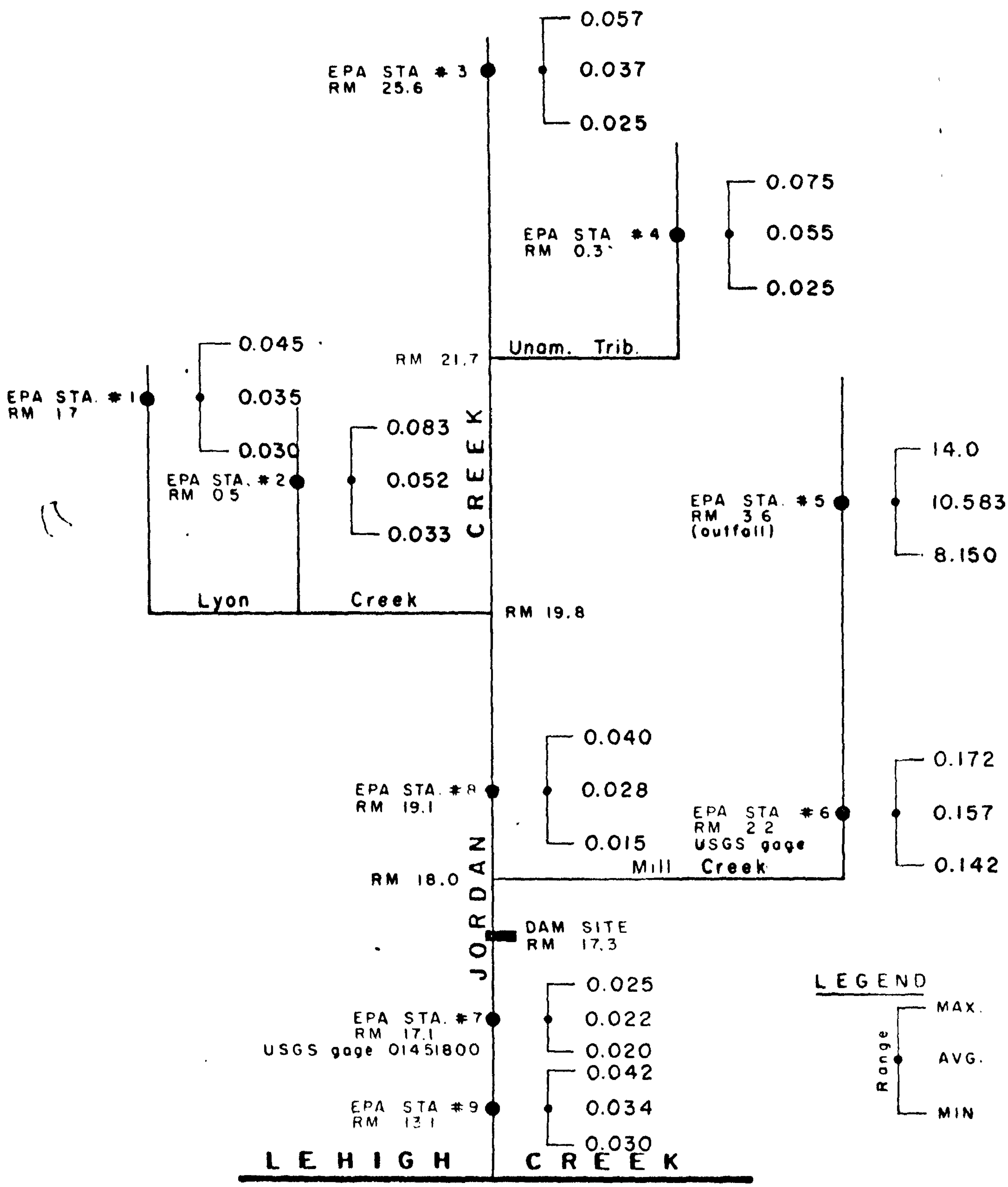
(11) Sulfate concentrations are lower than the National Criteria for water supplies. These waters contain less than 90 mg/l of sulfates, which indicates that game fish are not in jeopardy.

(12) Nitrogen and phosphorous concentrations are adequate to stimulate growth of algae and aquatic plants. A concentration of more than 0.30 mg/l of inorganic (or 0.6 mg/l of total nitrogen) nitrogen and more th 0.01 mg/l of soluble phosphorus (or 0.05 mg/l of total phosphorus) at the start of the active growing season could produce nuisance blooms. The total phosphorus concentrations of Lyons Creek and an unnamed tributary exceed National Criteria for fish, other aquatic life and wildlife requirements. Jordan Creek for the most part has less than 4.2 mg/l of nitrates which indicates a good fish environment. (See Figure XI - Total Nitrogen and Figure XII - Total Phosphorous).



TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL NITROGEN (mg/l)

FIGURE XI



TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL PHOSPHOROUS (mg/l)

FIGURE XII

13. Pesticide concentrations at all sample points indicate that standards have not been exceeded.

14. The oxygen demand analyses evaluates the relationship of dissolved oxygen (D.O.), biochemical oxygen demand (B.O.D.), chemical oxygen demand (C.O.D.), total organic carbon (T.O.C.), theoretical oxygen demand (T.O.D.) and photosynthetic productivity. The oxygen balance of a stream is dependent upon a number of factors. Some parameters add oxygen to the waters and others remove or utilize the oxygen. Photosynthesis adds oxygen; respiration of plants, aquatic animals and aerobic bacteria removes or utilizes oxygen, and diffusion either supplies or removes oxygen dependent upon the existing concentration of dissolved oxygen in relation to saturation temperature, atmospheric pressure and liquid-gas interface.

The evaluation of the diurnal oxygen study, in-situ oxygen study and chlorophyll a determinations indicate that there is an abundance of algae and aquatic plants in the streams investigated. The low B.O.D. values were attributed to the respiration caused by the lighted B.O.D. incubator. The k_2 values were erratic, ranging from 0.01 and 0.21.

The high supersaturation of dissolved oxygen as shown in the diurnal oxygen study along with the various nutrient concentrations previously discussed indicates a possible algal bloom problem. The probably reason this situation does not occur now is the velocity of flow and bacteria competition.

Table E shows the average values for the various oxygen demands. Table F compares the ratios of these parameters.

The 5-day B.O.D.'s indicate all streams investigated are fairly clean. T.O.C. values were all higher than the 12-day B.O.D. values except the South Branch Lyon Creek. C.O.D. concentrations during the June investigation were very much lower than the concentrations of the September investigation, which cannot be explained . Recent studies of the B.O.D./D.O. ration by the Information Systems and Analysis Branch, Surveillance and Analysis Division, Region III, have proven ratio values between 0.1 and 0.2 indicate a normal healthy stream, values higher than 0.4 indicates the stream is under stress and more than 0.6 the stream is degraded. The values calculated verify the streams investigated are healthy. The South Branch of Lyon Creek shows a slight stress. Evaluating all the ratios shown in Table F the stations located on the South Branch of Lyon Creek and the Unnamed tributary (Station 8) indicate higher values which could be caused by non=point source discharges (agriculture) or malfunctioning septic tanks. The D.O. saturation values shown on Figure XIII show low values at Mill Creek (Station 6) and Unnamed tributary (station 4). The basin area for the Unnamed tributary (station 4) has a heavy tree cover, is very shallow and has low flow. The low D.O. saturation value, high C.O.D. and T.O.C. values at the Mill Creek Station 6 may be caused by septic tanks because of the large number of dwellings located on the banks of this stream with the discharge of the wastewater treatment plant 1.4 miles upstream.

TABLE E

Sta. No.	D.O. mg/l	B.O.D. 5 day mg/l	T.O.C. mg/l	C.O.D. mg/l	T.O.D. mg/l(a)	Temp. °C
1	9.0	2.5	4	18.8	20.4	16
2	9.4	1.1	7.5	7.7	22.7	16
3	9.4	0.9	4.5	28.0	15.6	17
4	8.7	0.7	3.5	6.4	12.9	15
5 (b)	4.5	2.7	12.5	27.0	46.6	18
6	8.8	1.1	10.5	5.9	29.9	17
7	9.5	0.7	4.5	12.8	14.5	18
8	9.3	1.9	4	11.4	12.4	18
9	9.9	1.2	4.5	28.5	14.1	18

(a) T.O.D. - (T.O.C. x 2.67) + (T.K.N. x 4.57) + (NO_2 - Nx1.14)

(b) Wastewater treatment plant effluent

TABLE F

Sta. No.	BOD/ D.O	BOD/ TOC	BOD/ TOD	COD/ TOC	TOD/ TOC
1	0.28	0.63	0.12	4.70	5.10
2	0.12	0.15	0.05	1.03	3.05
3	0.10	0.20	0.06	6.22	3.47
4	0.08	0.20	0.05	1.83	3.68
5 (a)	0.60	0.22	0.06	2.16	3.74
6	0.13	0.11	0.04	0.47	2.39
7	0.07	0.16	0.05	2.85	3.22
8	0.20	0.48	0.15	2.85	3.10
9	0.12	0.27	0.09	6.34	3.14

(a) Wastewater treatment plant effluent

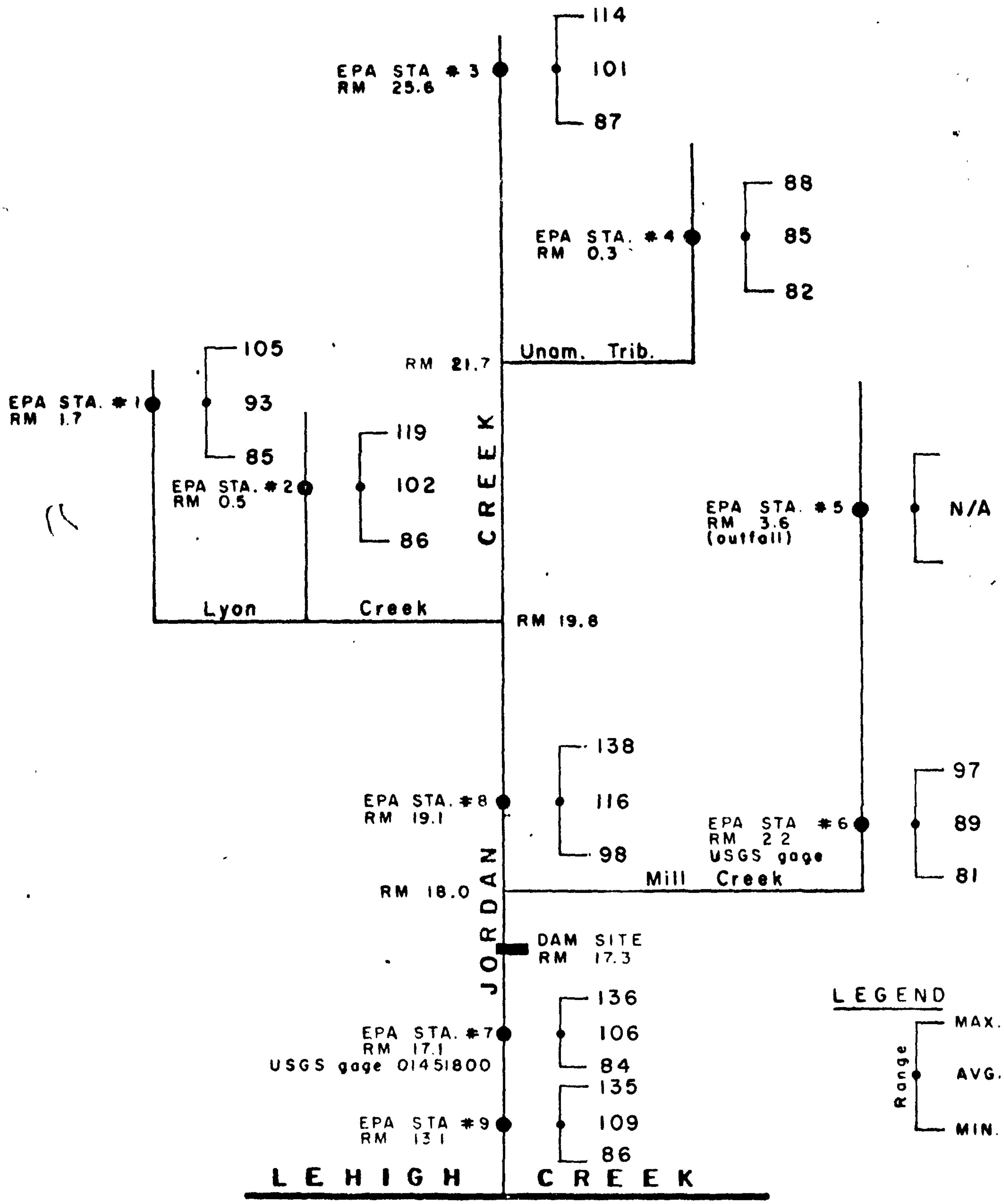
Table G

In-Situ Photosynthetic Production
(Light-Dark Bottle Technique)

Station	Net Photosyntheis O_2 mg/l/h	Respriation O_2 mg/l/h	Gross Photosyntheis O_2mg/l/h
1	(-) 0.20	0.23	0.03
	(-) 0.10*	0.14*	0.04*
2	(-) 0.31	0.34	0.03
	(-) 0.28*	0.28*	0.00*
3	(-) 0.22	0.11	(-) 0.11
	(-) 0.14*	0.24*	0.10*
4.	(-) 0.12	0.12	0.00
	F.A.	F.A.	F.A.
6.	0.85	(-) 0.78	0.07
	(-) 0.09	0.13	0.04
7	0.71	(-) 0.66	0.05
	(-) 0.28*	0.32*	0.04*
8	0.54	(-) 0.52	0.02
	(-) 0.48*	0.48*	0.00*
9	0.75	(-) 0.70	0.05
	(-) 0.63*	0.63*	0.00*

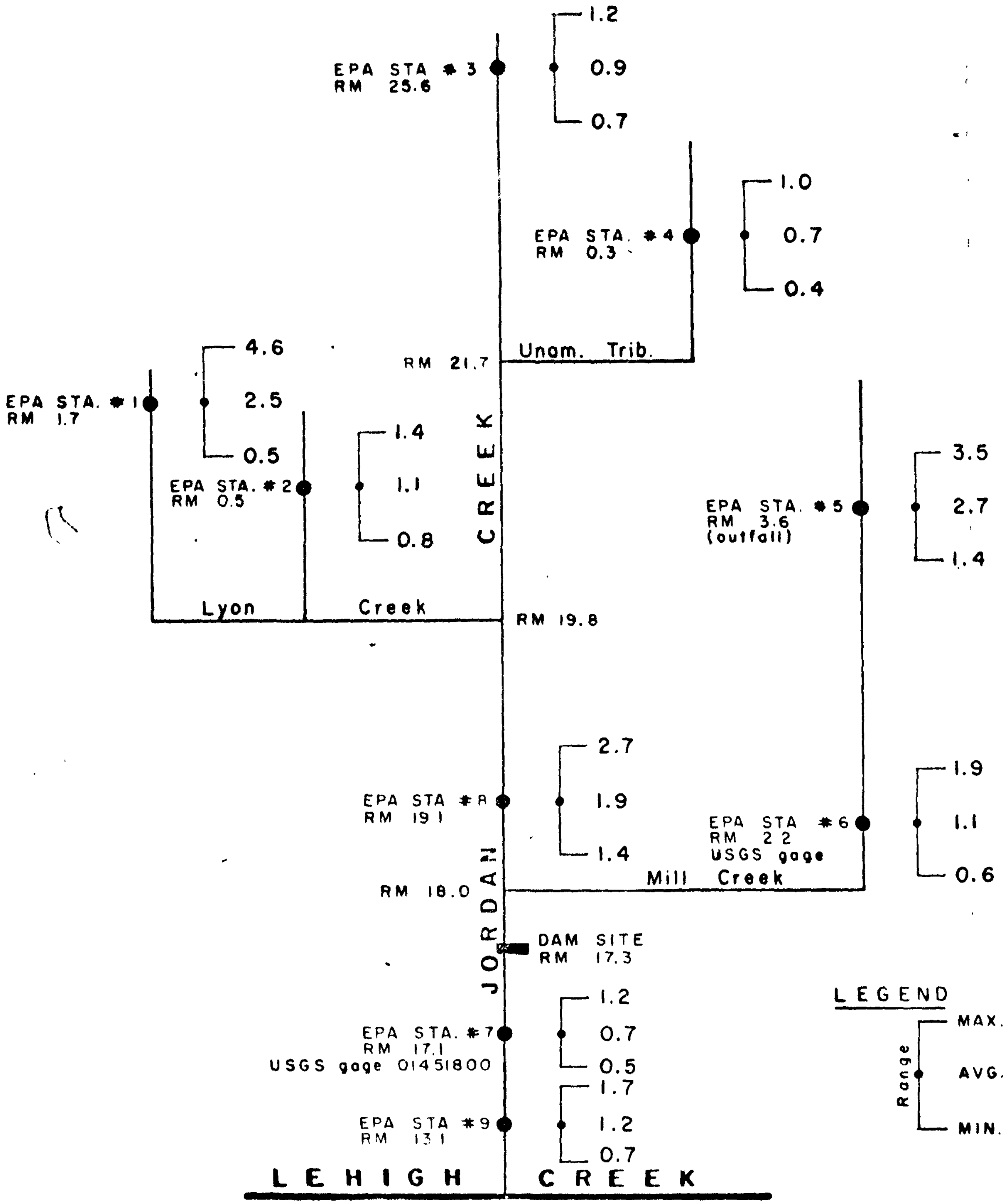
F.A. - Field Accident
* - Dissolved Oxygen concentration was more than 100% Saturation at start of incubation.

O_2 mg/l/hr - Dissolved Oxygen in milligrams per liter per hour



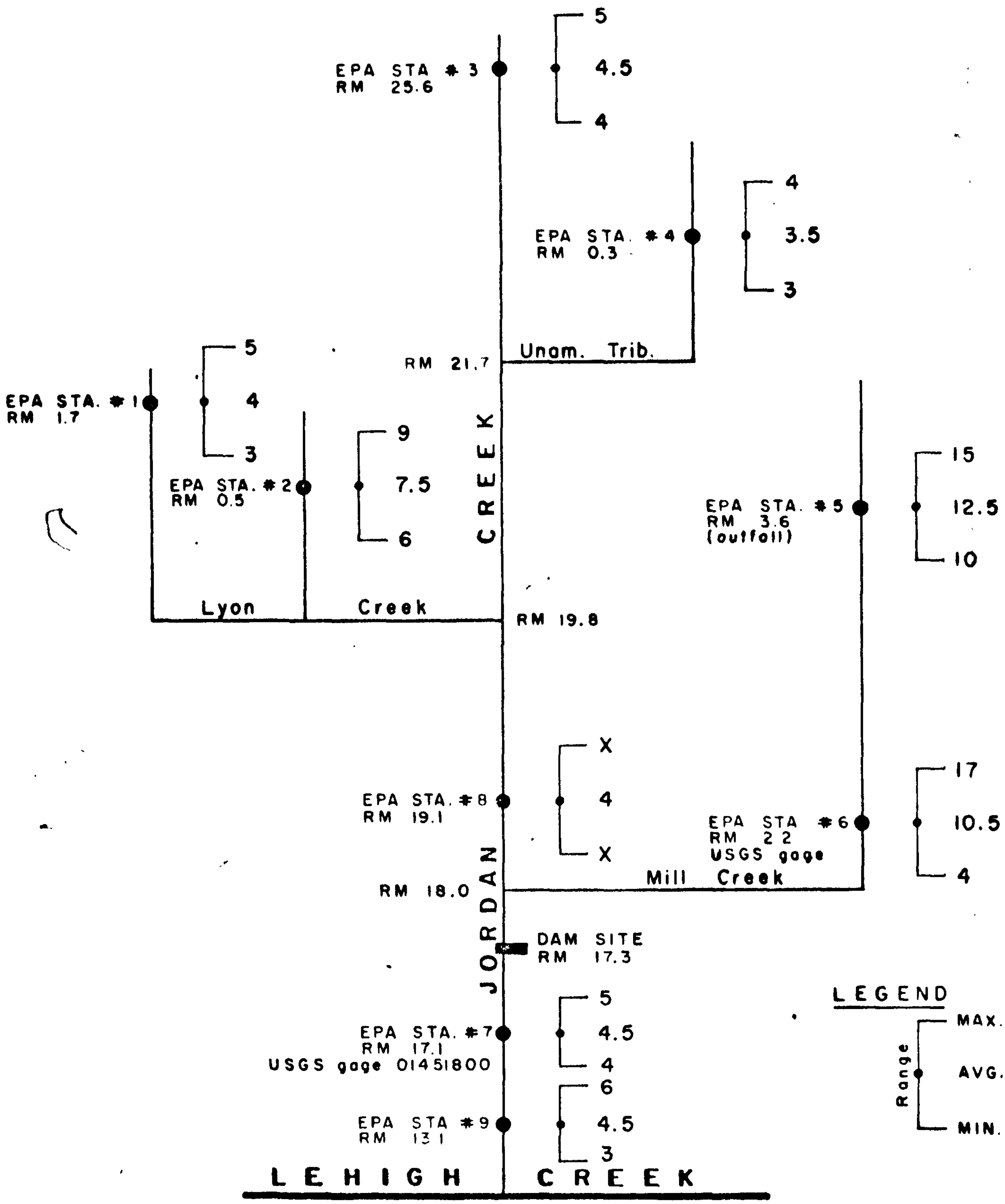
TRExLER LAKE
WATER QUALITY INVESTIGATION
DISSOLVED OXYGEN (% SATURATION)

FIGURE XIII



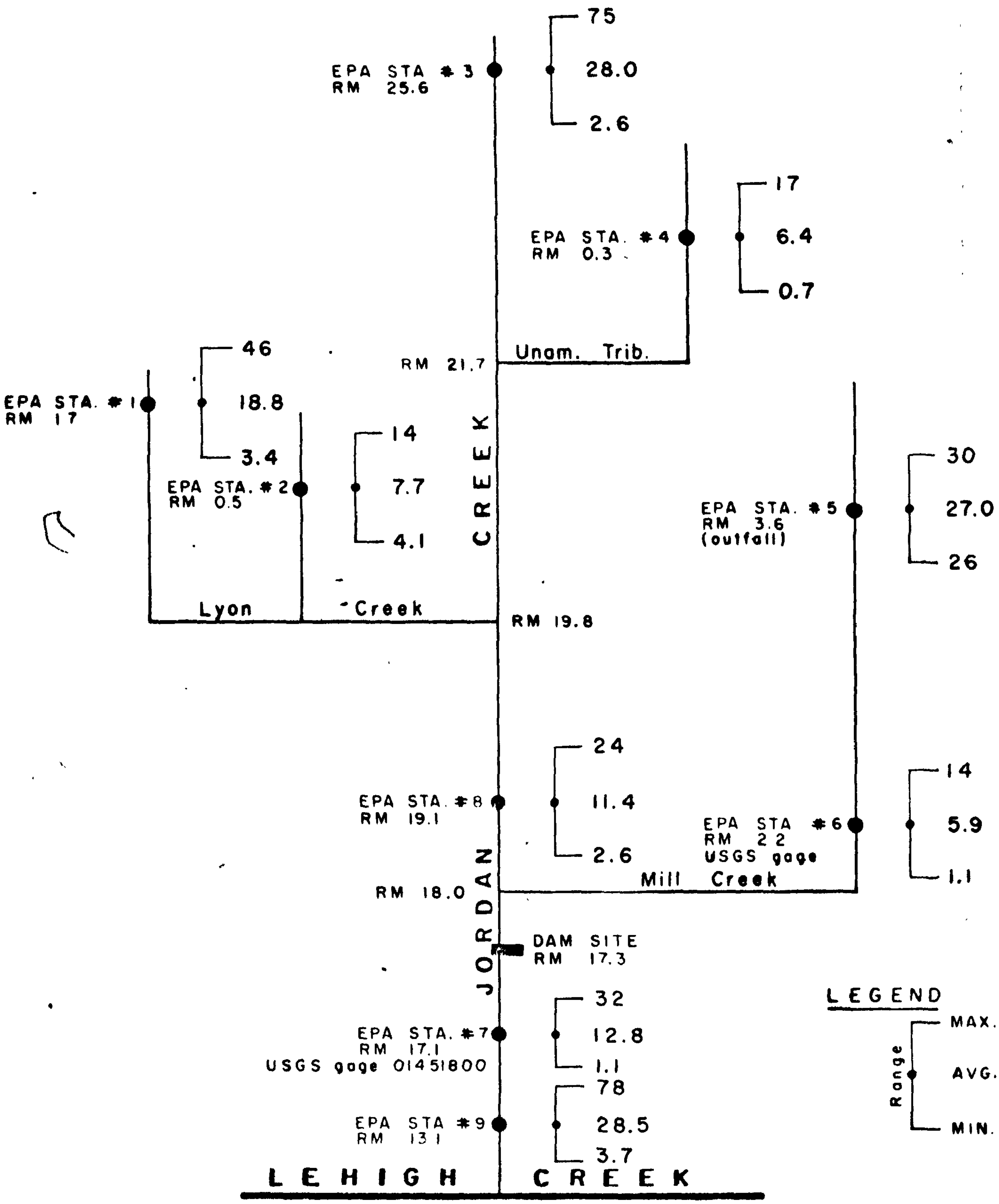
TREXLER LAKE
WATER QUALITY INVESTIGATION
B.O.D. - 5 DAY (mg/l)

FIGURE XIV



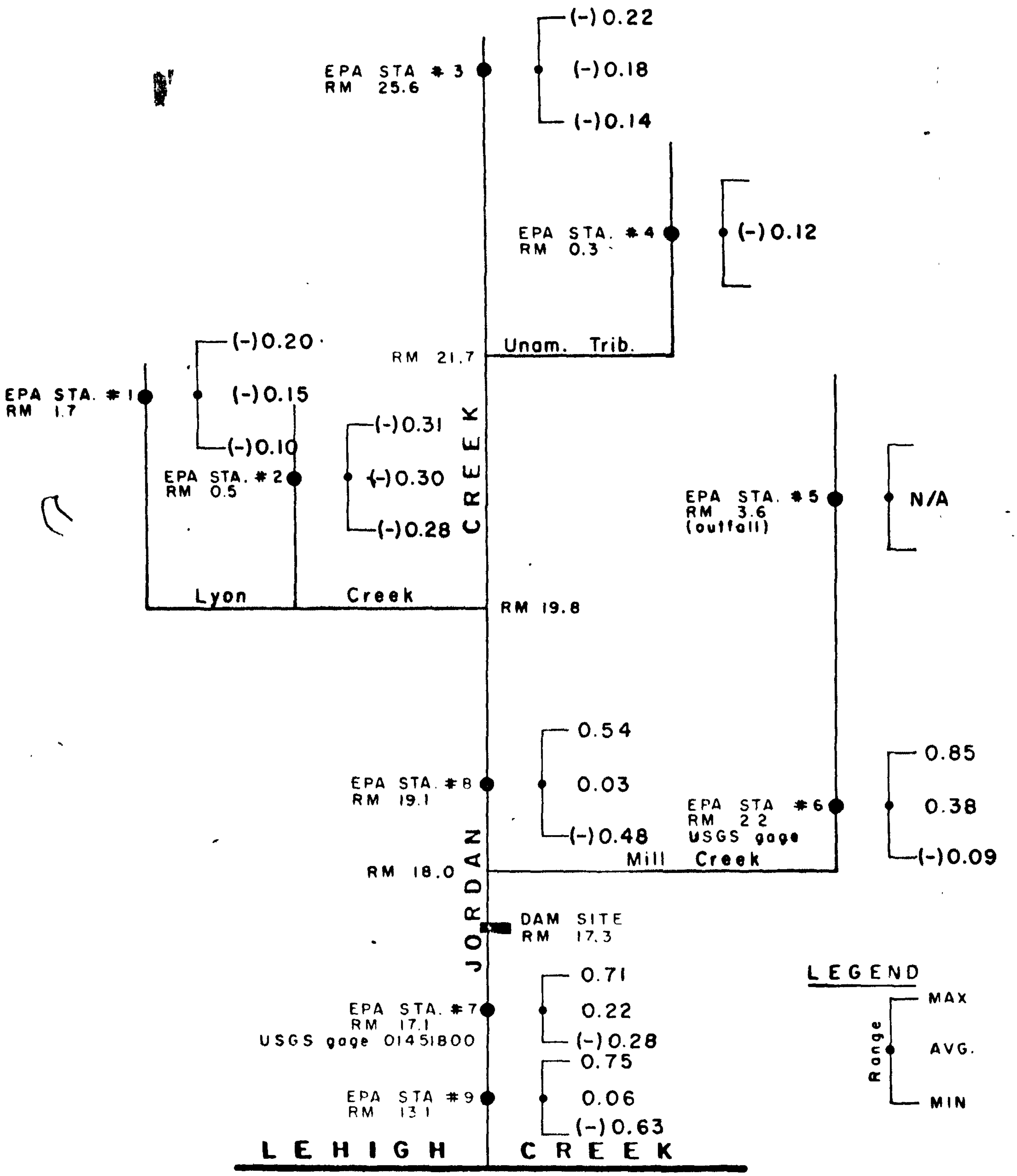
TRExLER LAKE
WATER QUALITY INVESTIGATION
TOTAL ORGANIC CARBON (mg/l)

FIGURE XV



TREXLER LAKE
WATER QUALITY INVESTIGATION
CHEMICAL OXYGEN DEMAND (mg/l)

FIGURE XVI



TREXLER LAKE
WATER QUALITY INVESTIGATION
NET PHOTOSYNTHEIS (mg/l/hr)

FIGURE XVII

C. Bacteriological Quality:

All bacteriological determinations were accomplished by the Membrane Filter technique.

(1) Total coliforms are introduced to water courses via water run-off and wastewater outfalls. They are considered significant as indicator organisms because of the predominance in the intestinal tracts of warmblooded animals. The total coliform density is roughly proportional to the amount of excremental waste present. With exceptions, elevated coliform populations are suggestive of significant contamination by excretement of warmblooded animals. Several factors which cause fluctuations in total coliform populations are summarized as follows:

Higher	Lower
Sewage intrusion	pH changes
Nutritive effluents (Containing sugar, dairy wastes, etc.)	Temperature changes
Storm drains	Land run-off (prolonged flow)
Land run-off (Initial flow)	Toxic wastes

Table H

Fecal Coliform vs Fecal Streptocci

(No./100 ml)

Sta. No.	Average Fecal Coliform	Average Fecal Streptococci	FC/FS
1	1181	614	1.92
2	128	143	0.90
3	211	222	0.95
4	186	151	1.23
5 (a)	28	52	0.54
6	342	69	4.96
7	309	167	1.85
8	31	178	0.17
9	65	233	0.27

(a) Wastewater treatment plant effluent

Lyong Creek and Mill Creek total coliform densities exceed mini-mem National Criteria permissible requirements for public water supply and all sample point densities exceed desirable public water supply and farm water supply requirements. Six sample point densities exceed irrigation water criteria. (See Fig. XVIII).

(2) Fecal coliforms are gaining acceptance as pollution indicies because of their relatively infrequent occurrence, except in association with fecal pollution. Moreover, because survival of the fecal coliform group is shorter in water courses than for the coliform group as a whole, high fecal coliform levels indicate relatively recent pollution.

Fecal coliform densities at all sample points exceed National Criteria for public and farm water supplies. The fecal coliform density for the South Branch of Lyon Creek also exceeded National Criteria for irrigation usage. (See Figure XIX)

(3) Fecal Streptococci do not occur in pure water or virgin soil; their presence in water courses indicates the existence of warmblooded animal pollution. Their validity as an index of pollution is enhanced by their inability to reproduce in water courses. The following points should be considered when interpret-ing fecal streptococci data:

(a) The presence of this indicator in untreated water indicates the presence of fecal pollution by warmblooded animals.

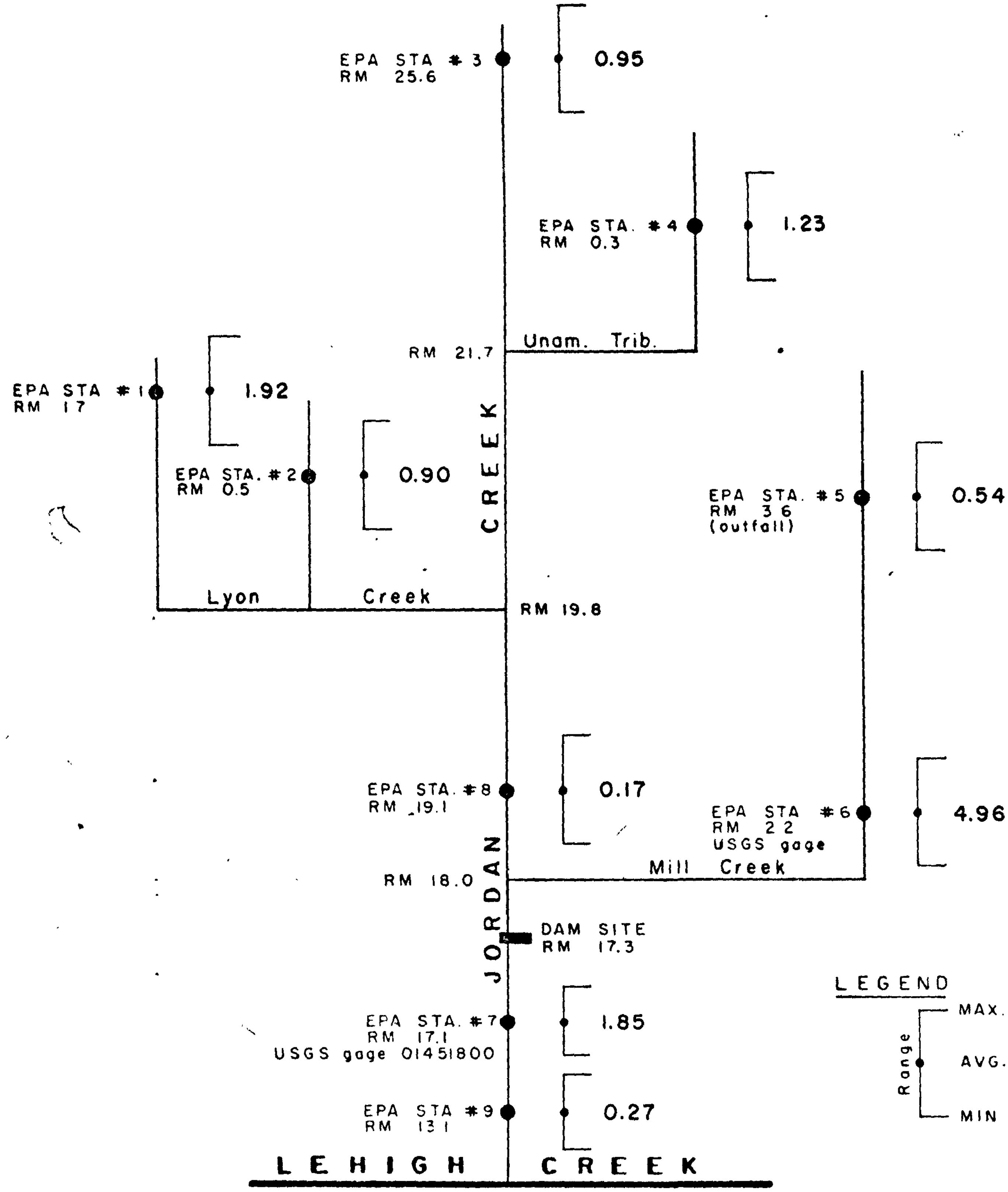
(b) Where the source and significance of the coliform group are questionable, the presence of this group should be interpreted as indicating that at least a portion of the coliform group is derived from fecal sources. Water quality criteria for fecal streptococci has not been established; however, their presence in the entire watershed is an indication that there is fecal pollution present. (See Figure XX)

(4) Fecal streptocci determinations, when accompanied by fecal coliform studies, serve as a valuable tool in the differentiation of animal from human wastes. In intestinal wastes of human origin, the ratio of number of fecal coliforms to number of fecal streptococci tends to be greater than four. When this ratio is less than 0.7, this suggests pollution derived predominately or entirely from livestock or poultry wastes. Ratios falling between 4.0 and 0.7 are not quite so certain. Limitations to this ratio are:

(a) Samples taken within 24 hours of flow time from origin of pollution.

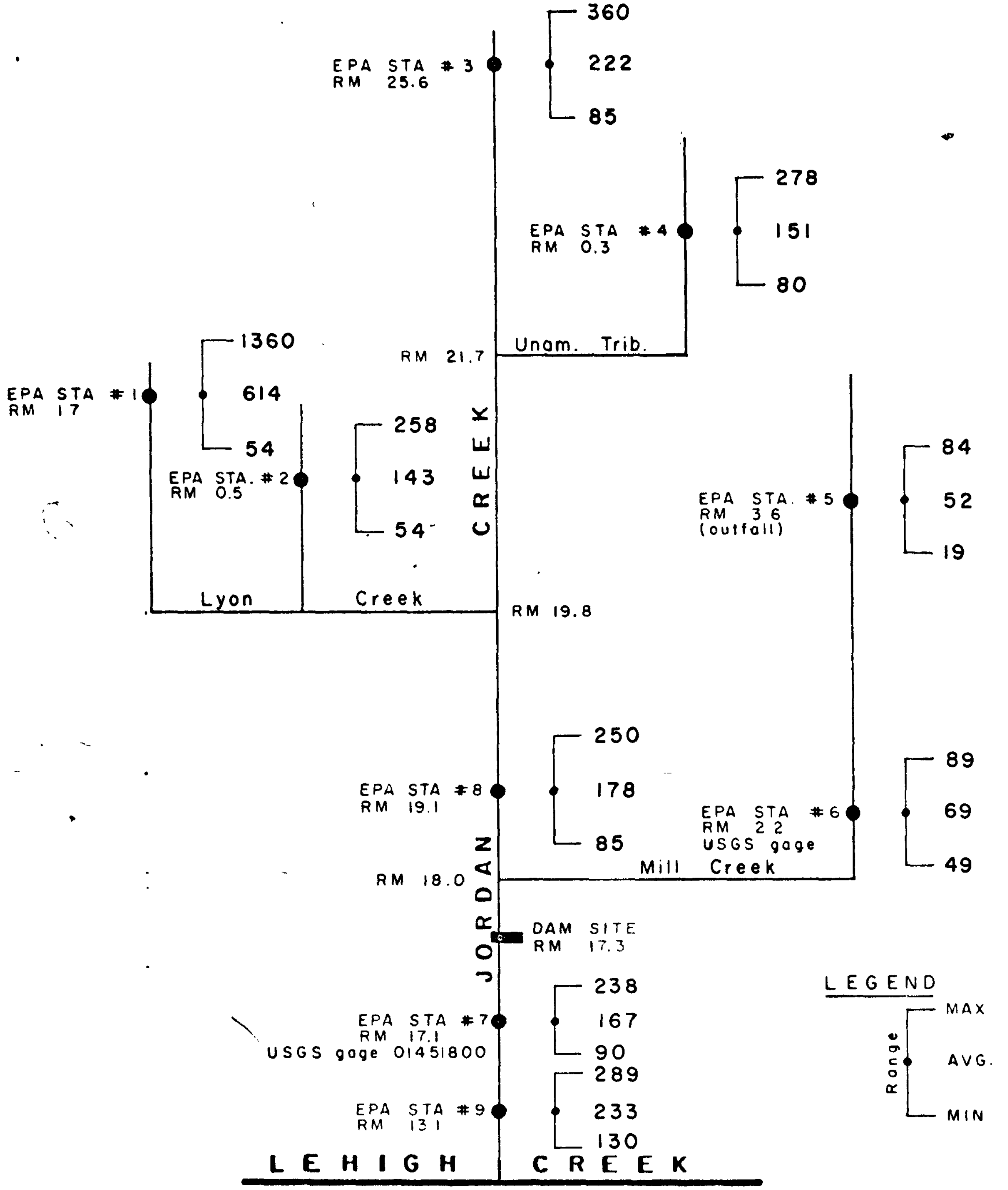
(b) pH range of 4.0 to 9.0.

These limitations do not affect the results of this investigation. The results of this investigation indicate the cause of bacteriological pollution is questionable. Two ratios indicate an animal origin and one ratio - human wastes. The other locations are within the grey area. (See Figure XXI).



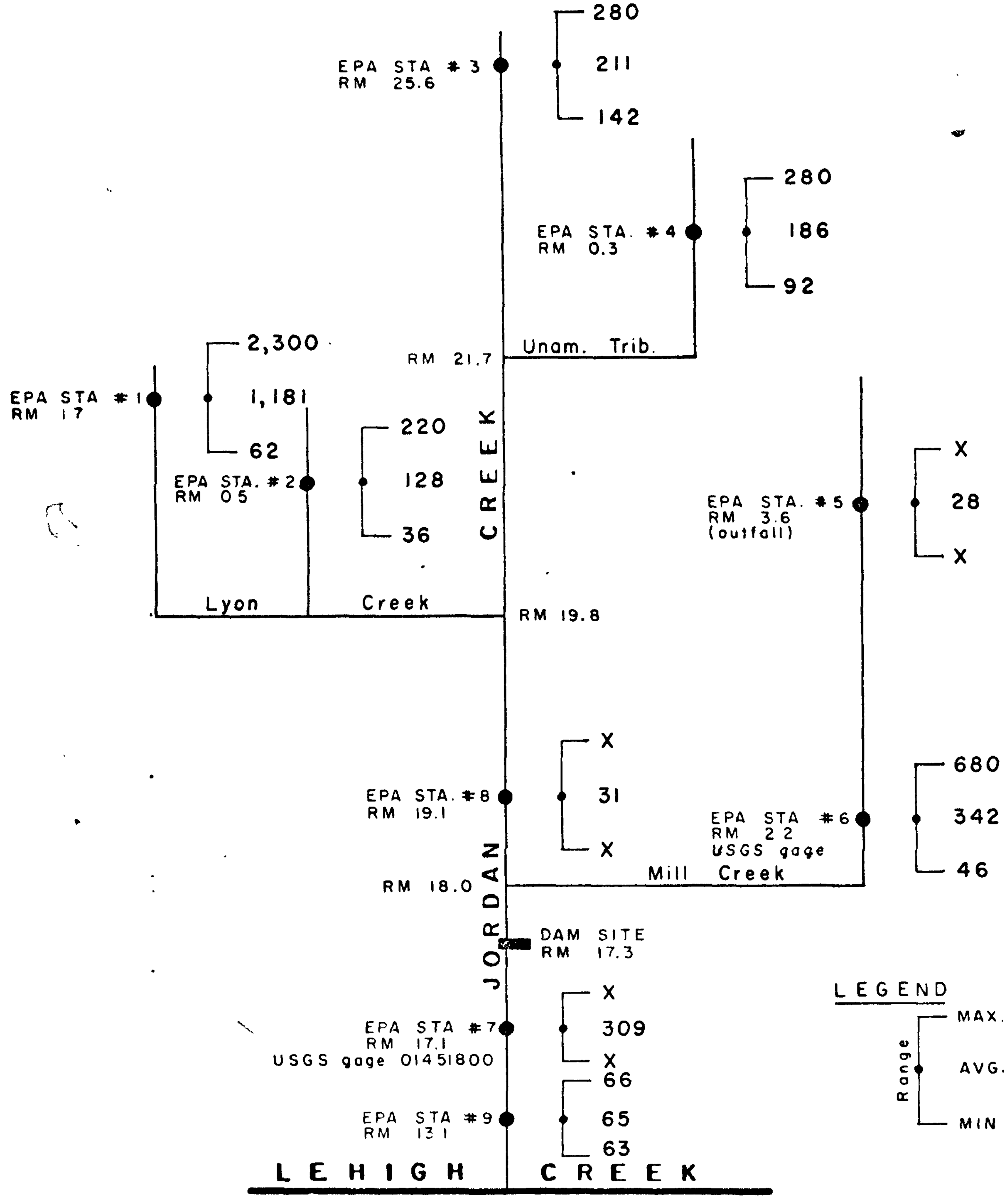
TREXLER LAKE
WATER QUALITY INVESTIGATION
FECAL COLIFORM/FECAL STREPTOCOCCI

FIGURE XXI



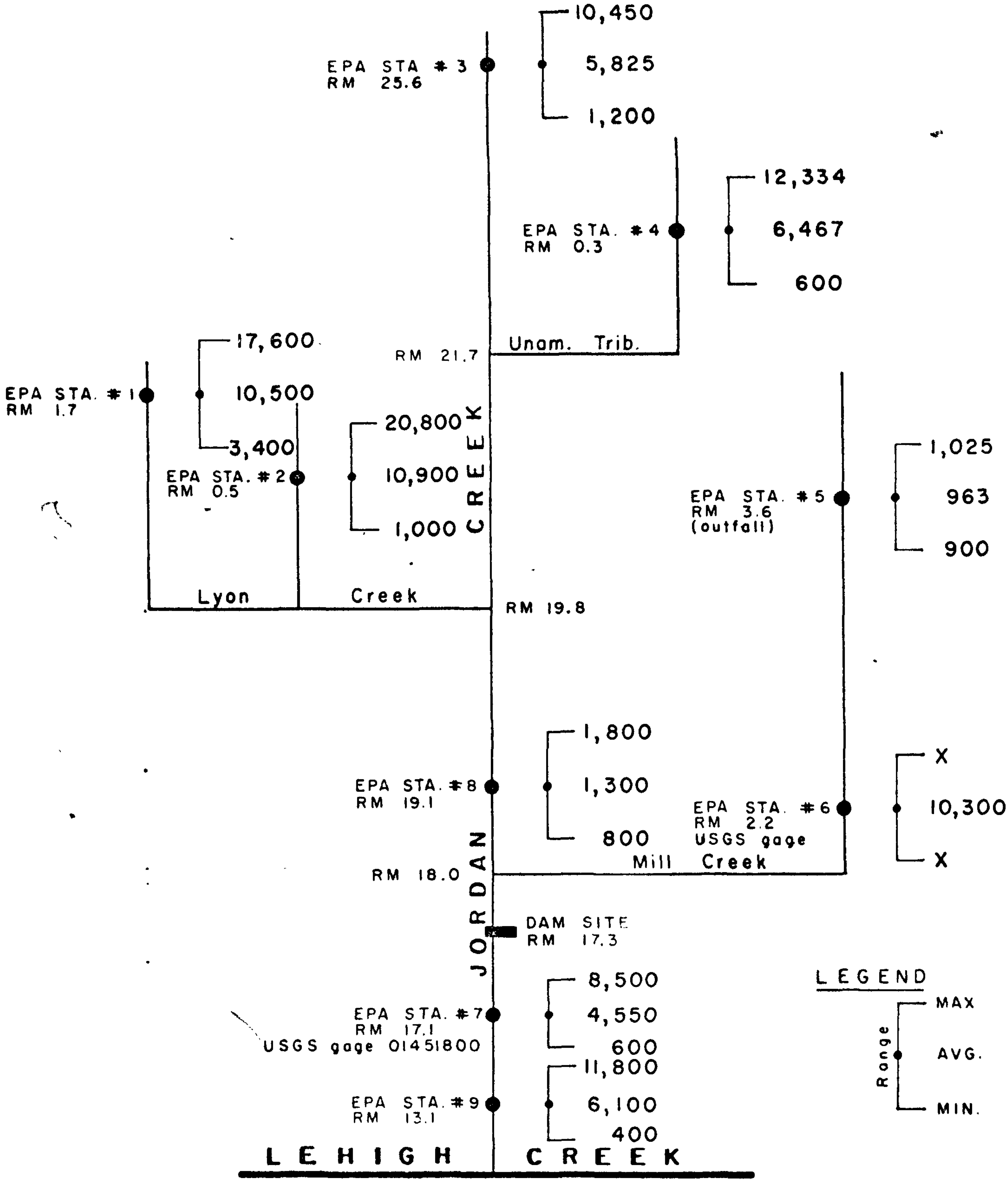
TREXLER LAKE
WATER QUALITY INVESTIGATION
FECAL STREPTOCOCCI (No./100 ml)

FIGURE XX



TREXLER LAKE
WATER QUALITY INVESTIGATION
FECAL COLIFORM (No./100 ml/l)

FIGURE XIX



TREXLER LAKE
WATER QUALITY INVESTIGATION
TOTAL COLIFORM (No. / 100 ml / l)

FIGURE XVIII

D. Biological Quality:

1. Introduction

On June 20, 1972, chlorophyll a samples were collected from nine stations in the Jordan Creek Watershed, Pennsylvania, (Table I), as part of a preimpoundment survey for the proposed Trexler Lake in Lehigh County, Pennsylvania.

On June 20, 1972, Stations Nos. 4, 5A, 5B, 6, 8A, and 8B, were samples for bottom organisms. These stations were all located on tributaries to Jordan Creek. On June 21, Jordan Creek's water level began to rise rapidly due to heavy rains brought on by "Hurricane Agnes." Further biological sampling was terminated until water levels returned to normal.

On September 12, 1972, we returned to the basin to complete the biological sampling of the bottom organisms. A qualitative sample was taken at Stations Nos. 4, 5A, 5B, 6, 8A, and 8B to see if there was any change in the bottom organism population following "Hurricane Agnes." Since the June samples appeared to correlate quite well with the September samples, it was decided to use the June samples for evaluation purposes. Stations No.s 1,2,3,7, and 9, were sampled for bottom organisms September 12-13,1972.

2. Methods

A qualitative benthic sample was taken at each station and a quantitative Surber Square Foot Sample was taken at each station, except at 5A and 8A. A quantitative sample was not taken at 5A, which was taken on an unnamed tributary receiving the effluent from the Heidelberg Heights

Treatment Plant. This station was located upstream from the sewage treatment plant effluent and was not taken because of the sparse benthic population which would have prevented a meaningful quantitative sample.

Only a qualitative sample was taken at Station No. 8A, which was located on a small tributary entering a farm pond adjacent to Jordan Creek. A qualitative and square foot sample were taken on the pond outlet 8B, which entered Jordan Creek. Since we were primarily,interested in what was entering Jordan Creek, it was not essential to take a quantitative sample at 8A which emptied into the farm pond.

The water samples to be analyzed for chlorophyll a (Table I) were collected and filtered at the motel. The filters were dissolved in approximately 8 ml of 90% v/v acetone in 15 ml graduated centrifuge tubes and were returned to the Charlottesville,Virginia laboratory where they were analyzed by a method adapted from Strickland and Parsons (1960). The DU-2 Spectrophotometer was used for the readings.

The benthic organisms were qualitatively collected at each station by sampling the various types of habitat at each station such as gravel, rocks, wood, vegetation, and silt, and preserved in 5% formalin. The quantitative samples were taken with the Surber Sq. Foot Sampler and also preserved in 5% formalin. The square foot samples were taken in the center of the stream in a habitat most representative of the station usually in riffle areas. The preserved samples were then returned to the Charlottesville, Va. EPA Laboratory, where they were identified with taxonomic keys by Pennack, Ward and Whipple; Eddy and Hodson; Needham and Needham; Leonard and Leonard; Pain, George H., Frison, and Burks. Identification was taken down to genus whenever possible.

In Table J, the benthics were broken down into intolerant (sensitive), facultative (intermediate), and tolerant categories based on the tolerance of various macroinvertebrate taxa to decomposable organic wastes. The subtotals for each station are shown as well as the grand totals. If the organism was only found in the qualitative sample, it was indicated by an X.

In Table K, there is a breakdown of the benthic organisms by percentage into the intolerant (sensitive), facultative (intermediate), and tolerant categories.

3. Definitions

For purposes of this report, the community of bottom macroinvertebrates was selected as the main indicator of the biological conditions in the stream since they serve as the preferred food source for higher aquatic forms and exhibit similar reactions to adverse stream conditions. Macro bottom organisms are animals that live in direct association with the stream bottom and are visible with the unaided eye. They are further distinguished from micro organisms by the fact they are retained in a 30 mesh sieve (approximately 0.5 mm aperature). The combination of limited locomotion and life cycles of one year or more for most benthic species provide a long-term indicator of stream water quality.

Classification of organisms in this report is considered in three categories: Intolerant (pollution sensitive), facultative (intermediate), and pollution tolerant to decomposable organic wastes.

Intolerant (pollution sensitive) organisms are those organisms that have not been found associated with even moderate levels of organic contaminants and are generally intolerant of even moderate reductions in dissolved oxygen.

Facultative (intermediate) organisms are those organisms having a wide range of tolerance and frequently associated with moderate levels of organic contamination.

Tolerant organisms are those organisms frequently associated with gross organic contamination and generally capable of thriving under anaerobic conditions.

In unpolluted streams, a wide variety of intolerant clean water associated bottom organisms are normally found. Typical groups are stoneflies, mayflies, caddisflies, and riffle beetles. These sensitive organisms usually are not individually abundant because of natural predation and competition for food and space; however, the total count or number of organisms at a given station may be high because of the different varieties present. Sensitive genera (kinds) tend to be eliminated by adverse environmental conditions (e.g., chemical and/or physical) resulting from wastes discharging into the stream.

In waters enriched by organic wastes comparatively fewer kinds of animals are found, though great numbers of certain genera may be present. Organic pollution-tolerant forms such as sludgeworms, rattailed maggots, certain species of bloodworms (red midges), certain leeches, and some species of air-breathing snails may multiply and become abundant because of a favorable habitat and food supply. These organic pollution-tolerant bottom organisms may also exist in the natural environment, but are generally found in small numbers. The abundance of these forms in streams heavily polluted with organics is due to their physiological and morphological abilities to servive environmental conditions more adverse than conditions tolerated by other organisms. Under conditions where inert silts or organic sludges blanket the stream bottom, the natural home of bottom organisms is destroyed, which also causes a reduction in the number of kinds of organisms present.

Streams grossly polluted with toxic wastes such as mine drainage, etc., will support little, if any aquatic life and will reduce the population of both sensitive and pollution-tolerance organisms.

In addition to intolerant (sensitive) and pollution-tolerant forms, some bottom organisms are termed facultative (intermediate) in that they are capable of living in moderately polluted areas as well as in limited numbers, and therefore cannot serve as effective indicators of water quality.

Diversity indices such as $\bar{d}$ provide an additional diagnostic tool for measuring water quality and the effect of induced stress on the structure of the macroinvertebrate community. The use of these indices is based on the generally observed phenomenon that relatively undistrubed environments support communities having large numbers of genera with no individual general present in overwhelming abundance. If the genera in such a community are ranked on the basis of their numerical abundance, there will be relatively few genera with large numbers of individuals and increasing numbers of genera represented by only a few individuals. Many forms of stress tend to reduce diversity by making the environment unsuitable for some genera or by giving some genera a competitive advantage.

For purposes of uniformity, the Shannon-Wiener function was used for calculating mean diversity "d" as recommended in <u>Biological</u> Field and Laboratory Methods by EPA, National Environmental Research Center Analytical Quality Control Laboratory, Cincinnati, Ohio, 1972.(8)

The machine formula as presented by Lloyd, Zar and Karr (14) is:

$$d=\frac{c}{n}\ (NLog_{10}N- \Sigma niLog_{10}ni).$$

Where c = 3.321928 (converts base 10 log to base 2 bits), N= total number of individuals, n_1 = total number of individuals in the 1^{th} genera.

Mean diversity, d, as calculated in this formula is affected both by richness of species and by the distribution of individuals among the genera and may range from zero to 3.321928 log N.

The component of diversity due to the distribution of individuals among the genera can be evaluated by comparing the calculated d with a hypothetical maximum d based on an arbitrarily selected distribution. The measure of redundancy proposed by Margalef (16) is based on the ratio between d and a hypothetical maximum. In nature, equality of genera is quite unlikely, so Lloyd and Ghelardi (13) proposed the term "equitability" and compared d with a maximum based on the distribution from MacArthur's (15) broken stick model. The MacArthur model results in a distribution quite frequently observed in nature with a few relatively abundant genera and increasing numbers of genera represented by only a few individuals. It is not necessary (nor should it be expected) that sample data conform to the MacArthur model, since it is only being used as a yardstick against which the distribution of abundances is being compared. Lloyd and Ghelardi (13) present a table for determining equitability by comparing the number of genera (s) in the sample with the number of genera (s) expected from a community which confirms to the MacArthur model. Using their table and the proposed measure of equitability: $e = \frac{s^1}{s}$ where s equals the number of genera in the sample and s^1 equals the tabulated value.

Equitability "e" as calculated may range from 0 to 1 except in the unusual situation where the distribution in the sample is more equitable than the distribution resulting from the MacArthur model. Such an eventuality will result in values of "e" greater than 1 and occasionally occurs in samples containing only a few specimens with several taxa represented. The estimate of "d" and "e" improves with increased sample size, and samples containing less than 100 specimens should be evaluated with caution, if at all.

Wilhm (21) recently reported diversity d, values calculated from the data of numerous authors collected from a variety of "polluted" and "unpolluted" waters. He found that in "unpolluted" waters d was generally between 3 and 4, while in "polluted" water d was generally less than 1. Unfortunately, where degradation is at alight to moderate levels, d lacks the sensitivity to demonstrate differences. Equitability "e", however, has been found to be very sensitive to even "e", however, to even slight levels of degradation. Equitability levels below 0.5 usually are never encountered in streams know to be unaffected by oxygen-demanding wastes, and in such streams "e" generally ranges between 0.6 and 0.8. Even slight levels of degradation have been found to reduce equitability below 0.5 and generally to a range of 0.0 and 0.3.

4. Station Evaluation

Station #1 - South Branch of Lyon Creek (Tributary to Jordan Creek) samples at Lyon Valley, Pennsylvania.

Basically good water quality was suggested by the nineteen genera of bottom organisms which number 890 in square foot sample and was dominated by 677 caddisfly larvae. The quantitative sample consisted of 86.2% intolerant (sensitive) forms, 12.8% facultative (intermediate), and 1.0% tolerant. The mean d (diversity index) of 167 makes a clear cut evaluation impossible; however, the equitability level was only 0.2, which suggests that this station was subject to periodic oxygen stress conditions.

The water was clear and minnows were readily observed. In addition, a mudpuppy (Necturus maculosus), an amphibian, was collected in the quantitative sample.

Cows throughout the area have access to the stream and algae was present on the rocks. The chlorophyll a reading was 43.5 ug/l. Using the ug/l figure to represent problem areas, it would appear that his stream might have eutrophication problems in the not too distant future.

Station #2 - North Branch to Lyon Creek near Lyon Valley, Penna.

Good water quality was suggested by the 18 genera of bottom organisms which was dominated by the 640 caddisfly larvae and the 152 mayflies. The 1,004 organisms in the square foot sample consisted of

91.6% intolerant forms, 8.2% of facultative, and 0.2% tolerant. The mean d of 2.13 (diversity index) prohibits a clear-cut evaluation, however, the equitability level was only 0.3 which suggests that this station was subject to periodic oxygen stress conditions.

A large minnow population was easily observed throughout the area and two mud puppies (Necturus maculosus) were collected.

Cows have access to the stream and algae was present. The chlorophyll reading of 51.0 ug/l at this station suggests this stream already has a eutrophication problem.

Station #3 - Jordan Creek at Route 100 near Lowhill, Pennsylvania

Good water quality was indicated by the 11 genera of benthic organisms dominated by 78 caddisflies and 40 mayflies in the square foot sample of 123 organisms. Intolerant forms made up 95.9% and facultative 4.1% of the quantitative sample. The mean d of 2.20 does not permit meaningful interpretation but the equitability level of 0.5 suggests borderline conditions for periodic oxygen stress conditions.

A large fish population was observed, consisting principally of suckers 10" to 15". Eutrophication conditions were indicated by a chlorophyll a reading of 75.0 ug/l.

Station #4 - Unnamed tributary to Jordan Creek

High water quality was indicated by the two genera of stoneflies, the eight genera of mayflies, three genera of caddisflies, and one genera of riffle beetles. It is further substantiated by the mean d of 4.76 and the equitability level of 2.2.

Eutrophication does not appear to be a problem based on a chlorophyll a reading of 7.5 ug/l.

Station #5A - Unnamed tributary to Mill Creek (tributary to Jordan Creek)

This station was located upstream from the effluent outfall from the Heidelburg Heights, Pennsylvania, Sewage Treatment Plant. Bottom organisms were generally sparse and only five genera of bottom organisms were found. Because of the sparse population, a quantitative sample was not taken. Only a few caddisflies, midge larvae, blackfly larvae flatworms, and a bristleworm were collected. Based on a mean d of 2.32 no meaningful interpretation can be made. With an equitability of 1.4, oxygen stress conditions do not appear to be a factor. Fair biological conditions were indicated.

Station #5B - Unnamed tributary to Mill Creek (tributary to Jordan Creek) downstream from the Heidelberg Heights, Pa. Sewage Treatment Plant

Although the number of genera had increased to 10 at this station, 70% of the forms were facultative and 30% were tolerant.

Only fair water quality was indicated at this location in spite of a mean d of 3.19 and an "e" level of 1.3. While there doesn't appear to be an oxygen stress condition, it appears that chlorine from the sewage treatment plant may be responsible for the absence of sensitive forms although they were sparse upstream from the sewage treatment plant.

Station #6 - Mill Creek (tributary to Jordan Creek)(near Schnecksville, Pennsylvania

Good water quality as far as oxygen stress conditions would appear to be indicated at this station based on the 14 genera which included five kinds of mayflies, one kind of caddisfly, and two kinds of riffle beetles. Good conditions would also appear to be indicated by the d of 3.5 and equitability level of 1.2. However, eutrophication is taking place based on a chlorophyll a reading of 79.5 ug/l.

Station #7 - Jordan Creek at the covered bridge.

Good water quality was indicated by the 16 genera of bottom organisms which consisted of 78.6% clean water forms in the 475 organisms in the square foot sample. However a d reading of 2.23 and an equitability level of 0.4 indicates this area is already experiencing occasional oxygen stress conditions.

A chlorophyll a reading of 48.0 ug/l suggests this reach is approaching a eutrophication problem. This could possibly be originating from the Pennsylvania Game Farm located upstream.

In spite of the above suggested problems, numerous minnows, carp, bass, and sunfish were observed throughout the area.

Station #8A - This station is located on an unnamed tributary entering a pond which in turn drains into Jordan Creek.

Good water quality was indicated by 15 genera of benthics which consisted of 67% clean water associated forms, such as five genera of mayflies, one genera of stoneflies, three genera of caddisflies and one genera of riffle beetles. The diversity index of 3.81 and an equitability of 1.3 further suggests good biological conditions.

Station #8B - This station was located on the outlet from the small pond (est. 1/4 acre) which drained into Jordan Creek.

Good water quality was still indicated by the twenty genera of benthic organisms which consisted of 65% clean water associated forms.

One genera of stoneflies, four genera of mayflies, three genera of caddisflies and one genera of riffle beetle were present. The d reading of 3.71 and an equitability reading of 1.0 further substantiate this evaluation.

Eutrophication does not appear to be a problem based on a chlorophyll reading of 4.5 mg/l.

Station #9 - Jordan Creek downstream from the proposed dam site.

Good water quality was indicated by the twenty-three genera of bottom organisms which consisted of 95.6 clean water associated forms in the square foot sample of 495 organisms. Occasional oxygen stress conditions are suggested by the diversity index (d) of 2.25 and an equitability level of 0.3.

Algae was very heavy in areas, but a chlorophyll a reading of only 37.5 ug/l was recorded. However, this may suggest a future problem and may account for the low equitability ("e") level.

Minnows (primarily dace) and suckers were very abundant and appeared to be the predominant forms.

Table I. Chlorophyll a Data on Trexler Lake, Jordan Creek, Pennsylvania Preimpoundment Study

Station	Chlorophyll a Reading
#1	43.5 ug/l
#2	51.0 ug/l
#3	75.0 ug/l
#4	7.5 ug/l
#5	16.5 ug/l
#6	79.5 ug/l
#7	48.0 ug/l
#8	4.5 ug/l
#9	37.5 ug/l

TABLE J - SURVEY RESULTS OF BENTHIC ORGANISMS
Trexler Lake, Pennsylvania Preimpoundment Study

Station	1	2	3	4	5A	5B	6	7	8A	8B	9
	Intolerant or Pollution Sensitive Organisms (to decomposable organic wastes)										
Stoneflies											
Isoperla sp.				X						2	
Nemoura sp.									X		
Neophasganophora sp.				X							
Mayflies											
Ameletus sp.	61	142	26	2			X	5	X	5	108
Baetis sp.				X					X		
Epeorus sp.			2	X			X			1	X
Ephemera sp.	1										
Ephemerella sp.				1			X		X	1	1
Heptagenia sp.				X			X				
Iron sp.				X							
Isonychia sp.	2	9	12						X		13
Leptophlebia sp.										11	
Paraleptophlebia sp.	1			4							
Stenonema sp.	3	1	X	1			X		X		2
Tricorythodes sp.								X			X
Caddisflies											
Chimarra sp.	32	70	17	1				138		1	99
Glossosoma sp.				X					X	1	
Hydropsyche sp.	645	570	61	2	X		X	146	X	6	238
Rhyacophila sp.									X		
Riffle Beetles											
Ectobria sp.							X				
Psephenus sp.	X	X		5			4		X		X
Stenelmis sp.	22	12						81		1	3
Midges											
Brillia sp.											4
Metriocnemus sp.		115	X			X				X	5
Pentaneura sp.		1									
Diamesinae										X	
SUBTOTAL (per square foot)	767	920	118	16			4	373		29	473
SUBTOTAL KINDS (genera)	9	9	7	14	1	1	8	6	10	11	12

TABLE J

Station	1	2	3	4	5A	5B	6	7	8A	8B	9
	Facultative or Intermediate Organisms (to decomposable organic wastes)										
Flatworms											
Dugesia sp.	5	49	1		X		X	96	X	8	X
Nematomorpha (Gordian worms)	4							1			
Bristleworms											
Dero sp.	3	2				1					
Nais sp.					X						
Sowbugs											
Asellus sp.									X	2	
Crayfish											
Cambarus sp.										2	
Caddisflies											
Cheumatopsyche sp.	X	X	X	X			X				
Blackflies											
Simulium sp.	3	5			X	X					6
Craneflies											
Antocha sp.			2								
Limnophila sp.	9	8								1	2
Pedicia sp.				1							
Tipula sp.						1					
Midges											
Brillia sp.											
Polypedilum sp.	76	18				3	X		X		
Procladius sp.	14		2		X	1	X		X	3	10
Damselflies											
Argia sp.		X									X
Chromagrion sp.											
Enallagma sp.											
Ischnura sp.											
Lestes sp.		X									

TABLE J

Station	1	2	3	4	5A	5B	6	7	8A	8B	9
Dragonflies											
Boyeria sp.								X			
Cordulegaster sp.								X			
Predaceous Diving Beetles											
Dytiscidae						1					
Air Breathing Snail											
Gyraulus sp.											X
Fingernail clams											
Sphaerium sp.											X
SUBTOTAL (per square foot)	114	82	5	1	-	7	-	97	-	16	18
SUBTOTAL KINDS (genera)	8	8	4	2	4	6	4	6	4	6	7
Pollution Tolerant Organisms (to decomposable organic wastes)											
Bristleworms											
Lumbriculidae	9	2		6			2	5		1	4
Sludgeworms											
Limnodrilus sp.						1					
Tubifex sp.						1				X	
Air Breathing Snail											
Helisoma sp.											X
Physa sp.									X	X	X
Ferrissia sp.	X										
Bloodworms (Midges)											
Tendipes sp.						1					
SUBTOTAL (per square foot)	9	2	-	6	-	3	2	5	-	1	4
SUBTOTAL KINDS (genera)	2	1	-	1	-	3	1	1	1	3	3

TABLE J

Station	1	2	3	4	5A	5B	6	7	8A	8B	9
GRAND TOTAL (per sq. ft.)	890	1004	123	23	-	10	6	475	-	46	495
NO. OF KINDS	19	18	11	18	5	10	14	16	15	20	23
Mean (diversity index)	1.67	2.13	2.20	4.76	2.32	3.19	3.5	2.23	3.81	3.71	2.25
"e" (equitability)	0.2	0.3	0.5	2.2	1.4	1.3	1.2	0.4	1.3	1.0	0.3

X = Present but not collected in quantitative sample.

For purposes of calculating d and "e" those organisms present only in the qualitative sample (X) were assigned a value of 1.

Table K - Breakdown of Benthic Organisms by Percentage into Tolerant, Facultative (Intermediate) and Intolerant (Sensitive) Categories (based on the tolerance of various macro-invertebrate taxa to decomposable organic wastes).

Station	Tolerant	Facultative	Intolerant
#1	1.0%	12.8%	86.2%
#2	0.2%	8.2%	91.6%
#3	-	4.1%	95.9%
#4	26%	4.4%	69.6%
* #5A	-	80.0%	20.0%
#5B	30.0%	70.0%	-
#6	-	33.3%	66.7%
#7	1.0%	20.4%	78.6%
* #8A	6.0%	27.0%	67.0%
#8B	2.2%	34.8%	63.0%
#9	0.8%	3.6%	95.6%

*On those stations where a quantitative sample was not taken, a value of 1 was given to each genera for computation purposes.

REFERENCES CITED

1. Anon., 1968-Water Quality Criteria, Federal Water Pollution Control Administration, U. S. Dept. of Interior, Washington, D. C.

2. Anon., 1971-Standard Methods for the Examination of Water and Wastewater, AWWA, APHA, WPCF, 13th Ed.

3. Anon., 1971-Methods for Chemical Analysis of Water and Wastes, EPA, National Environmental Research Center; Analytical Control Laboratory, Cincinnati, Ohio

4. McKee, J. E. and H. W. Wolfe, 1963, Water Quality Criteria, Publication No. 3-A, State Water Quality Control Board, Sacramento, California

5. Winton, E. F. and L. J. McCabe, 1970. Studies relating to Water Mineralization and Health, & Journal AWWA Vol. 62, No. 1

6. McCarven, E. F. and W. B. Keighton, 1969, Water Quality and Discharge of Streams in the Lehigh River Basin, Pennsylvania, Water Supply Paper 1879-H, U. S. Geological Survey, U. S. Dept. of Interior, Washington, D. C.

7. Geldreich, E. E. 1966. Sanitary Significance of Fecal Coliforms in the Environment. Publication WP-20-3, Federal Water Pollution Control Administration, Washington

8. Anon., 1972. Biological Field and Laboratory Methods by EPA, National Environmental Research Center Analytical Quality Control Laboratory, Cincinnati, Ohio

9. Burks, B. D., 1953. The Mayflies, or Ephemeroptera, of Illinois. Bull. Ill. Nat. Hist. Surv. 26:1-216

10. Eddy, Samuel and Hodson, A. C., 1950. Taxonomic Keys to the Common Animals of the North Central States Exclusive of the Parasite Worms, Insects and Birds. Burgess Publishing Co., Minneapolis, Minnesota

11. Frison, T. H., 1935. The Stoneflies, or Plecoptera, of Illinois. Bull. Ill. Nat. Hist. Surv. 20: 281-371

12. Leonard, Justin W. and Fannie A., Leonard. 1962. Mayflies of Michigan Trout Streams. Carnbrook Institute Sci. Michigan. 139pp.

13. Lloyd, Monte, and R. J. Ghelardi, 1964. A Table for Calculating the "Equitability" Component of Species Diversity. Am. Mid. Nat. 79 (2) : 217-225

14. Lloyd, Monte, Jerrold H. Zar, and James R. Karr. 1968. On the Calculation of Information-Theoretical Measures of Diversity. Am. Mid. Nat. 79 (2) : 257-272

15. MacArthur, R. H. 1957. On the Relative Abundance of Bird Species. Proc. Nat. Acad. Sci., Washington, 43:293-295

16. Margalef, D. Ramon. 1957. Information Theory in Ecology. General System 3:36-71. English translation by W. Hall

17. Needham, James G. and Paul R. Needham, 1962. A Guide to the Study of Fresh-Water Biology. Holden-Day, Inc. San Francisco, California

18. Paine, George H., Jr. Illustrated Flow Chart to Certain Groups of Chironomid Larvae. U. S. Dept. of HEW, Public Health Service, Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio 9pp.

APPENDIX

Station 1. South Branch Lyon Creek
@ Lyon Valley, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	[illegible]
Temperature, water	$0^{o}C$	15.5	18	16	17	15		
	$0^{o}F$	599	64.4	60.8	62.6	59		
Oxygen, dissolved	mg/l	10.2	9.0	8.0	-	8.6		
Flow,	cfs	10.5	9.2	86.3	14.3	14.5	16.2	24.8
*CO_2	mg/l	0	0					
pH (field)	unit	8.2	8.6	6.7	7.8	7.3		
Specific conductance	um/cm	120	165	-	-	160		
Total alkalinity	mg/l	30	45					
Pheno. Alkalinity	mg/l	0	0					
Acidity	mg/l	40	24					
Chloride	mg/l	25						
Ca	mg/c	16	20					
Sulfate	mg/l	57						
Total Hardness	mg/l	80	70					
Carbonated Hard.	mg/l	30	45					
Ca Hardness	mg/l	40	50					
Mg "	mg/l	40	20					
Non carbonate Hrd.	mg/l	50	25					
Total Coliforms/100 ml.		L.A	-	17600	3400			
Fecal Coliforms/100 ml.		L.A	-	62	2300			
Fecal Strep/100 ml.		1360	-	104	377			
BOD_2	mg/l	3.1	0.5			1.5		
BOD_5	mg/l	4.6	0.5			2.5		
BOD_7	mg/l	5.9						
BOD_{13}	mg/l	7.8	1.3					
Chlorophyll a	μg/l			43.5				
TOC	mg/l	3	5			-		
COD	mg/l	7.1	3.4			46		
NO_2-N	mg/l	0.017	0.021			0.016		
NO_3-N	mg/l	3.302	3.399			2.18		
NH_3-N	mg/l	0.004	0.004			0.013		
TKN	mg/l	2.07	0.04			0.04		
Total N	mg/l	5.389	3.430			2.196		
Total P	mg/l	0.030	0.030			0.045		
Ortho P	mg/l	0.025	0.010			0.033		
Total Solids	mg/l	209	173			140		
Suspended Solids	mg/l	27.6	13.6			6.4		
Volatile Solids	mg/l	-	-			55		

* Computed
L. A. - Lab Accident

Station 2. North Branch Lyon Creek
near Lyon Valley, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	0°C	15.5	17	16	17	17		
	0°F	59.9	62.6	60.8	62.6	62.6		
Oxygen, dissolved	mg/l	9.6	9.3	8.8	-	9.8		
Flow,	cfs	2.4	2.1	50.0	3.3	3.3	3.7	5.8
* CO_2	mg/l	1.4	0					
pH (Field)	unit	7.8	8.3	6.5	7.6	7.5		
Specific conductance	um/cm	190	200			240		
Total alkalinity	mg/l	45	45					
Pheno. alkalinity	mg/l	0	0					
Acidity	mg/l	48	24					
Chloride	mg/l	20						
Ca	mg/l	24	20					
Sulfate	mg/l	35						
Total Hardness	mg/l	80	60					
Carbonate hard.	mg/l	45	45					
Ca Hardness	mg/l	60	50					
Mg "	mg/l	20	10					
Non Carbonate hard.	mg/l	35	15					
Total coliforms/100 ml.		L.A.		20,800	1000			
Fecal coliforms/100 ml.		L.A.		36	220			
Fecal Strep/100 ml.		258		54	116			
BOD_2	mg/l	1.0	0.5			0.4		
BOD_5	mg/l	1.1	0.8			1.4		
BOD_7	mg/l	1.5						
BOD_{12}	mg/l	2.1	1.6					
Chlorophyll a	µg/l			51.0				
T.O.C.	mg/l	6	9			-		
COD	mg/l	4.1	4.9			14		
NO_2-N	mg/l	0.010	0.013			0.007		
NO_3-N	mg/l	2.189	2.287			1.24		
NH_3-N	mg/l	0.56	0.04			0.011		
TKN	mg/l	0.56	0.04			0.04		
Total N	mg/l	2.759	2.300			1.247		
Total P	mg/l	0.083	0.033			0.040		
Ortho P	mg/l	0.010	0.020			0.23	0.023	
Total Solids	mg/l	194	177			190		
Suspended Solids	mg/l	7.2	8.8			6.4		
Volatile Solids	mg/l	-	-			37		

*Computed
L.A. - Lab Accident

Station 3. Jordan Creek
@ Lo·.hill, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	^{o}C	16.0	19	16	17	17		
	^{o}F	60.8	66.2	60.8	62.6	62.6		
Oxygen, dissolved	mg/l	9.1	9.0	10.2	-	9.3		
Flow,	cfs	32.4	20.5	319	44.1	44.7	59.0	68.0
* CO_2	mg/l	1.4	0					
pH (Field)	units	7.8	8.2	6.4	8.0	7.6		
Specific conductance	um/cm	120	155			160		
Total alkalinity	mg/l	45	45					
Pheno. alkalinity	mg/l	0	0					
Acidity	mg/l	36	24					
Chloride	mg/l	20						
Ca	mg/l	16	12					
Sulfate	mg/l	17						
Total Hardness	mg/l	60	50					
Carbonate Hardness	mg/l	45	45					
Ca Hardness	mg/l	40	30					
Mg "	mg/l	20	20					
Non-carbonate hard.	mg/l	15	5					
Total Coliforms/100 ml.		L.A.		10,450	1200			
Fecal Coliforms/100 ml.		L.A.		142	230			
Fecal Strep/100 ml.		360		85	222			
BOD_2	mg/l	0.8	0.4			0.0		
BOD_5	mg/l	1.2	0.7			0.8		
BOD_7	mg/l	1.8						
BOD_{12}	mg/l	1.9	0.9					
Chlorophyll a	ug/l			75.0				
T.O.C.	mg/l	4	5		-	-		
C.O.D.	mg/l	6.4	2.6		75			
NO_3-N	mg/l	0.010	0.015			0.004		
NO_3-N	mg/l	2.829	2.905			2.00		
NH_3-N	mg/l	0.04	0.04			0.005		
TKN	mg/l	0.44	1.06			0.04		
Total N	mg/l	3.279	3.980			2.004		
Total P	mg/l	0.057	0.028			0.025		
Ortho P	mg/l	0.01	0.010			0.015		
Total Solids	mg/l	148	153			83		
Suspended Solids	mg/l	7.2	7.2			0.4		
Volatile Solids	mg/l	-	-			23		

*Computed
L.A. - Lab Accident

Station 4. Unnamed tributary to Jordan Creek near Lowhill, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	°C	13.5	15.5	14	16	16.5		
	°F	56.3	59.9	57.2	60.8	61.7		
Oxygen, dissolved	mg/l	9.2	9.3	8.6	-	8.6		
Flow,	cfs	0.04	0.03	0.35	0.05	0.05	0.07	0.07
* CO_2	mg/l	3	1.4					
pH (Field)	units	7.3	7.8	6.3	7.3	6.3		
Specific conductance	um/cm	130	175			170		
Total Alkalinity	mg/l	30	45					
Pheno. Alkalinity	mg/l	0	0					
Acidity	mg/l	48	24					
Chloride	mg/l	10						
Ca	mg/l	20	20					
Sulfate	mg/l	34						
Total Hardness	mg/l	70	70					
Carbonate Hard.	mg/l	30	45					
Ca Hardness	mg/l	50	50					
Mg "	mg/l	20	20					
Non-Carbonate hard.	mg/l	40	25					
Total Coliforms/100 ml		L.A.		12334	600			
Fecal Coliforms/100 ml.		L.A.		92	280			
Fecal Strep/100 ml.		80		94	278			
BOD_2	mg/l	0.4	0.4		0.0			
BOD_5	mg/l	1.0	0.6		0.4			
BOD_7	mg/l	1.4						
BOD_{12}	mg/l	1.6	0.8					
Chlorophyll a	ug/l			7.5				
T.O.C.	3	4			-			
C.O.D.	1.5	0.7			17			
NO_2-N	mg/l	0.005	0.005		0.002			
NO_3-N	mg/l	3.140	2.720		2.65			
NH_3-N	mg/l	0.04	0.04		0.005			
TKN	mg/l	1.00	0.56		0.04			
Total N	mg/l	4.140	3.280		2.652			
Total P	mg/l	0.066	0.025		0.075			
Ortho P	mg/l	0.060	0.020		0.040			
Total Solids	mg/l	145	143		119			
Suspended Solids	mg/l	8.0	15.6		18.4			
Volatile Solids	mg/l	-	-		22			

* - Computed

L. A. - Lab Accident

Station 5. Heidelberg Heights S.T.P. Outfall
near Schnecksville, Pa.

		6/14	6/16	6/20	9/12	9/13	
Temperature, water	oC	18	20.5	13	20	20	
	oF	64.4	68.9	55.4	68	68	
Oxygen, dissolved	mg/l	7.4	5.2	-	-	0.9	
Flow,	cfs	36.2	36.4	74.6	19.5	33.3	
* CO_2	mg/l	11.5	11.5				
pH(Field)	units	6.9	6.9	6.7	6.3	3.3	
Specific conductance	um/cm	540	505			470	
Total alkalinity	mg/l	45	45				
Pheno. Alkalinity	mg/l	0	0				
Acidity	mg/l	108	90				
Chloride	mg/l	55					
Ca	mg/l	36	40				
Sulfate	mg/l	110					
Total Hardness	mg/l	90	130				
Carbonate Hard.	mg/l	45	45				
Ca Hardness	mg/l	90	100				
Mg "	mg/l	0	30				
Non-carbonate hard	mg/l	45	85				
Total coliforms		L.A.		1025	900		
Fecal coliforms/100 ml		L.A.		28	L.A.		
Fecal Strep/100 ml		0		19	84		
BOD_2	mg/l	2.9	1.3			0.0	
BOD_5	mg/l	3.1	3.5			1.4	
BOD_7	mg/l	4.5					
BOD_{12}	mg/l	5.5	7.0				
Chlorophyll a	µg/l						
TOC	mg/l	10	15			-	
C.O.D.	mg/l	26	26			30	
NO_2-N	mg/l	0.0006	0.011			0.097	
NO_3-N	mg/l	25.994	17.139			19.9	
NH_3-N	mg/l	0.04	0.04			1.45	
TKN	mg/l	1.45	3.08			3.75	
Total N	mg/l	27.450	20.230			23.747	
Total P	mg/l	8.150	9.60			14.0	
Ortho P	mg/l	6.700	8.60			10.5	
Total Solids	mg/l	445	421			373	
Suspended Solids	mg/l	20.7	16.4			4.0	
Volatile Solids	mg/l	-	-			126	

* - Computed
L.A. - Lab. Accident

Station 6. Mill Creek
[illegible]ar Schecksville, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	°C	15 59	18 64.4	17 62.6	16 60.8	17 62.6		
Oxygen, dissolved	mg/l	9.6	9.0	8.1	[illegible]	7.8	[illegible]	
Flow,	cfs	4.8	4.2	47.5	6.5	6.6	9.6	10.2
* CO_2	mg/l	11.5	2.3					
pH (Field)	units	6.9	7.4	7.0	7.6	5.0		
Specific conductance	um/cm	185	200			240		
Total alkalinity	mg/l	45	30					
Pheno. Alkalinity	mg/l	0	0					
Acidity	mg/l	24	36					
Chloride	mg/l	20						
Ca	mg/l	24	24					
Sulfate	mg/l	36						
Total Hardness	mg/l	80	70					
Carbonate Hardness	mg/l	45	30					
Ca Hardness	mg/l	60	60					
Mg. "	mg/l	20	10					
Non-carbonate hard.	mg/l	35	40					
Total Coliforms/100 ml		L.A.		10300	L.A.			
Fecal Coliforms/100 ml		L.A.		46	680			
Fecal Strep/100 ml		13600.A.		49	89			
BOD_2	mg/l	1.1	0.4			0.0		
BOD_5	mg/l	1.9	0.8			0.6		
BOD_7	mg/l	1.9						
BOD_{12}	mg/l	2.1	1.1					
Chlorophyll a	µg/l			79.5				
T.O.C.	mg/l	17	4			-		
C.O.D.	mg/l	2.6	1..			14		
NO_2-N	mg/l	0.009	0.013			0.021		
NO_3-N	mg/l	3.411	3.467			6.18		
NH_3-N	mg/l	0.04	0.04			0.025		
TKN	mg/l	0.39	0.39			0.04		
Total N	mg/l	3.780	3.870			6.201		
Total P	mg/l	0.155	0.142			0.172		
Ortho P	mg/l	0.040	0.140			0.007		
Total Solids	mg/l	178	169			150		
Suspended Solids	mg/l	8.0	9.2			1.2		
Volatile Solids	mg/l	-	-			51		

* - Computed
L.A. - Lab. Accident

Station 7. Jor 'an Creek
near Schecksville, Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	°C	17.5	20.	17	18	18		
	°F	63.5	68	62.6	64.4	64.4		
Oxygen, dissolved	mg/l	10.7	10.0	8.4	-	8.3		
Flow,	cfs	50	44	493	68	69	98	98
* CO_2	mg/l	3.9	3.9					
pH (Field)	units	7.2	7.2	7.0	7.7	7.5		
Specific Conductance	um/cm	175	190			200		
Total Alkalinity	mg/l	30	30					
Pheno. Alkalinity	mg/l	0	0					
Acidity	mg/l	24	24					
Chloride	mg/l	L.A.						
Ca	mg/l	24	19					
Sulfate	mg/l	27						
Total Hardness	mg/l	70	70					
Carbonate Hardness	mg/l	30	30					
Ca Hardness	mg/l	60	48					
Mg "	mg/l	10	22					
Non carbonate Hardness	mg/l	40	40					
Total Coliforms/100 ml		L.A.		8500	600			
Fecal Coliforms/100 ml		L.A.		309	L.A.			
Fecal Strep/100 ml		238		90	174			
BOD_2	mg/l	0.1	0.5			0.0		
BOD_5	mg/l	1.2	0.5			0.5		
BOD_7	mg/l	1.2						
BOD_{12}	mg/l	2.3	1.2					
Chlorophyll a				48.0				
T.O.C.	mg/l	4	5					
C.O.D.	mg/l	5.2	1.1			32		
NO_2	mg/l	0.010	0.015			0.010		
NO_3	mg/l	3.729	2.905			3.39		
NH_3	mg/l	0.04	0.04			0.014		
TKN	mg/l	0.67	0.33			0.04		
Total N	mg/l	4.409	3.050			3.400		
Total P	mg/l	0.020	0.025			0.020		
Ortho P	mg/l	0.010	0.010			0.007		
Total Solids	mg/l	152	149			103		
Suspended Solids	mg/l	7.2	6.8			0.8		
Volatile Solids	mg/l	-	-			28		

* Computed
L.A. - Lab. Accident

Station 8. Unnamed tributary to Jordan Creek
@ Wiedasville, Pa.

			6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water		°C	16	20	16	19	18.5		
		°F	60.8	68	60.8	66.2	65.3		
Oxygen, dissolved		mg/l	9.0	9.3	8.0	-	10.8		
Flow,		cfs	0.05	0.04	0.45	0.06	0.06	0.11	0.07
* CO_2		mg/l	1.8	5.7					
pH (Field)		Units	7.5	7.2	7.0	8.2	6.9		
Specific conductance		um/cm	215	215			200		
Total Alkalinity		mg/l	30	45					
Pheno.Alkalinity		mg/l	0	0					
Acidity		mg/l	48	24					
Chloride		mg/l	25						
Ca		mg/l	24	21					
Sulfate		mg/l	39						
Total Hardness		mg/l	80	80					
Carbonate Hardness		mg/l	30	45					
Ca Hardness		mg/l	60	52					
Mg "		mg/l	20	28					
Non-carbonate hard.		mg/l	50	35					
Total Coliforms/100 ml			L.A.		1800	800			
Fecal Coliforms/100 ml			L.A.		31	L.A.			
Fecal Strep/100 ml			250		85	200			
BOD_2		mg/l	0.6	0.5			0.5		
BOD_5		mg/l	1.4	1.6			2.7		
BOD_7		mg/l	1.4						
BOD_{12}		mg/l	1.8	1.7					
Chlorophyll a		μg/l			4.5				
T.O.C.		mg/l	4	4			-		
C.O.D.		mg/l	2.6	7.5			24		
NO_2		mg/l	0.014	0.027			0.009		
NO_3		mg/l	2.666	2.693			0.391	3.91	
NH_3		mg/l	0.04	0.04			0.005		
TKN		mg/l	0.33	0.33			0.04		
Total N		mg/l	3.010	3.050			3.919		
Total P		mg/l	0.015	0.030			0.040		
Ortho P		mg/l	0.01	0.010			0.013		
Total Solids		mg/l	169	153			112		
Suspended Solids		mg/l	5.2	4.8			1.2		
Volatile Solids		mg/l	-	-			28		

* - Computed
L.A. - Lab. Accidents

Station 9. Jordan Creek
near Siegersville. Pa.

		6/14	6/16	6/20	9/12	9/13	9/14	9/19
Temperature, water	°C	17	20	17	18	18.5		
	°F	62.6	68	62.6	64.4	65.3		
Oxygen, dissolved	mg/l	9.8	9.6	10.3	-	9.8		
Flow,	cfs	67	59	664	92	93	135	129
* CO_2	mg/l	3.7	7.1					
pH (Field)	units	7.4	7.1	7.2	7.6	7.0		
Specific conductance	um/cm	180	200			200		
Total Alkalinity	mg/l	45	45					
Pheno. Alkalinity	mg/l	0	0					
Acidity	mg/l	24	24					
Chloride	mg/l	15						
Ca	mg/l	24	20					
Sulfate	mg/l	28						
Total Hardness	mg/l	70	65					
Carbonate Hardness	mg/l	45	45					
Ca Hardness	mg/l	60	50					
Mg Hardness	mg/l	10	15					
Non Carbonate Hardness	mg/l	25	20					
Total coliforms/100 ml		L.A.		11800	400			
Fecal Coliforms/100 ml		L.A.		63	66			
Fecal Strep/100 ml		280		130	289			
BOD_2	mg/l	0.5	0.4			0.0		
BOD_5	mg/l	1.3	1.7			0.7		
BOD_7	mg/l	1.4						
BOD_{12}	mg/l	2.3	1.7					
Chlorophyll a	ug/l			37.5				
T.O.C.	mg/l	3	6			-		
C.O.D.	mg/l	3.7	3.7			78		
NO_2-N	mg/l	0.005	0.016			0.009		
NO_3-N	mg/l	0.075	2.784			1.66		
NH_3-N	mg/l	0.04	0.04			0.05		
TKN	mg/l	0.22	0.61			0.04		
Total N	mg/l	0.300	3.410			1.669		
Total P	mg/l	0.030	0.030			0.042		
Ortho P	mg/l	0.020	0.010			0.01		
Total Solids	mg/l	151	145			106		
Suspended Solids	mg/l	6.0	5.6			0.8		
Volatile Solids	mg/l					28		

* - Computed
L. A. - Lab Accident

Trexler Lake - Pesticides

Date: 12/15/72 C.E.O. EPA, REGION III, TECHNICAL SUPPORT LABORATORY DATA SHEET #1 of 1 Results are on PPB

Lab. No.	Sample No.	Date Sampled	Time	Flow	DDT	DOD	DOE	DIEL	ENDRIN	ALDRIN	HEPT.	HEPT. APOX.	BHC	METH-OXYCHLER	LINCANE	PCB's
1639	Station #1	9/13/72			N.D.	N.D.	<1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<1
1640	Station #2	"			N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1641	Station #3	"			N.D.	N.D.	<1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1642	Station #4	"			N.D.	N.D.	<1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<1
1643	Station #5	"			N.D.	N.D.	<1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<1.	<1
1644	Station #6	"			N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.
1645	Station #7	"			N.D.	N.D.	<1	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<1	<1
1646	Station #8	"			N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.		N.D.	<1
1647	Station #9	"			N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	N.D.	<1

N.D. = Not Detected at a senstivity to give a recorder response of one inch to 100 picograms of aldrin.

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin Date: 9/20/72

Station: (1) South Branch Lyon Creek at Lyon Valley, Pa. Crew: Kaeufer

Sunrise 0648 DIURNAL OXYGEN STUDY Sunset 1903

Depth Ft.	Time	Weather Conditions	Water Temp. °C	D. O. mg/l	% Saturation
0.5	0610	Dark & Cloudy	15.5	8.6	85
0.5	0755	Partly Sunny	15	9.0	88
0.5	0955	" "	15	9.2	91
0.5	1145	" "	17	9.6	99
0.5	1405	" "	19	9.9	105
0.5	1645	Cloudy	18.5	9.0	96
0.5	1905	Dark	19	8.4	89

IN-SITU BENTHAN OXYGEN DEMAND

Total Depth 0.5 ft.

	D. O. mg/l						
	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 0755 a.m.-1145 noon Temp. °C		9.0		8.2		8.1	0.5
(2) 1400 p.m.-1905 p.m. Temp. °C		9.9		9.4		9.2	0.5

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin — Date: 9/20/72

Station: (2) North Branch Lyon Creek near Lyon Valley, Pa. — Crew: Kaeufer

Sunrise 0648 — **DIURNAL OXYGEN STUDY** — Sunset 1903

Depth Ft.	Time	Weather Conditions	Water Temp. °C	D. O. mg/l	% Saturation
0.5	0620	Dark & Cloudy	15	8.8	86
0.5	0805	Partly Cloudy	14	10.0	96
0.5	1055	" "	15.5	10.8	107
0.5	1155	" "	17.0	11.2	115
0.5	1415	" "	19.0	11.2	119
0.5	1655	Cloudy	19.0	10.0	106
0.5	1920	Dark	16.5	8.7	88

IN-SITU BENTHAL OXYGEN DEMAND

D. O. mg/l

Total Depth 0.5 ft.

	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 0805 a.m.- 1155 Temp. °C		10.0		8.8		8.7	0.5
(2) 1415 p.m.-1920p.m. Temp. °C		11.2		9.8		9.8	0.5

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin

Date: 9/20/72

Station: (3) Jordan Creek at Lowhill, Pa.

Crew: Kaeufer

Sunrise 0648

DIURNAL OXYGEN STUDY

Sunset 1903

Depth Ft.	Time	Weather Conditions	Water Temp. °C	D.O. mg/l	% Saturation
0.5	0630	Dark & Cloudy	15.5	8.8	87
0.5	0820	Partly Sunny	15	9.4	92
0.5	1020	" "	16	10.2	102
0.5	1200	" "	17	10.7	110
0.5	1425	" "	18	10.8	114
0.5	1705	Cloudy	18	10.1	106
0.5	1930	Dark	17	9.6	99

IN-SITU BENTHAL OXYGEN DEMAND

Total Depth 0.5 ft.	D. O. mg/l						
	Background		Light Bottle		Dark Bottle		Depth
		D. O.		D. O.		D. O.	Set ft.
(1) 0820 a.m.-1200 noon		9.4		8.6		9.0	0.5
Temp. °C							
(2) 1425 p.m.-1930 p.m.		10.8		10.1		9.6	0.5
Temp. °C							

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin

Date: 9/20/72

Station: (4) Unnamed tributary to Jordan Creek near Lowhill, Pa.

Crew: Kaeufer

Sunrise 0648

DIURNAL OXYGEN STUDY

Sunset 1903

Depth Ft.	Time	Weather Conditions	Water Temp. °C	D. O. mg/l	% Saturation
0.5	0640	Dark & Cloudy	15	8.4	82
0.5	0845	Partly Sunny	15	8.6	84
0.5	1030	" "	15	8.6	84
0.5	1205	" "	16	8.7	87
0.5	1445	" "	16.5	8.7	88
0.5	1715	Cloudy	16.0	8.6	86
0.5	1945	Dark	16.0	8.4	84

IN-SITU BENTHAL OXYGEN DEMAND

Total Depth 0.5 ft.

	D. O. mg/l						
	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 0845 a.m.-1205 noon		8.6		8.2		8.2	0.5
Temp. °C		8.7					
(2) 1445 p.m.-1945 p.m.		8.7	Removed from stream by children				
Temp. °C			Recovered bottles				

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin — Date: 9/21/72

(6) Mill Creek near Schnecksville, Pa. — Crew: Kaeufer

Sunrise 0648 — **DIURNAL OXYGEN STUDY** — Sunset 1903

Depth Ft.	Time	Weather Conditions	Temp. °C	D. O. mg/l	% Saturation
0.5	0600	Dark	14.5	8.3	81
0.5	0750	Cloudy	15	8.4	82
0.5	1010	"	15	8.8	86
0.5	1155	"	16	9.2	92
0.5	1515	"	15.5	9.8	97
0.5	1805	"	15	9.6	94
0.5	1955	Dark	15	9.3	91

IN-SITU BENTHAL OXYGEN DEMAND

Total Depth 0.5 ft.

	D. O. mg/l						
	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 750 a.m. - 1155 a.m. Temp. °C		8.4		11.9		11.6	0.5
(2) 1515 p.m. - 1955 p.m. Temp. °C		9.8		9.4		9.2	0.5

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek   Date: 9/21/72

Station: (7) Jordan Creek near Schnecksville,Pa.   Crew: Kaeufer

Sunrise 0648   **DIURNAL OXYGEN STUDY**   Sunset 1903

Depth Ft.	Time	Weather Conditions	Temp. °C	D.O. mg/l	% Saturation
0.5	0615	Dark	15	8.6	84
0.5	0800	Cloudy	15	8.8	86
0.5	1030	"	15	9.8	96
0.5	1215	"	15	10.5	103
0.5	1500	"	17	13.2	136
0.5	1740	"	17	12.6	130
0.5	1935	Dark	17	10.6	109

IN-SITU BENTHAL OXYGEN DEMAND

Total Depth 0.5 ft.

	D.O. mg/l						
	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 8 a.m.-1215pm Temp. °C		8.8		11.8		11.6	0.5
(2) 1500 p.m.-1935 p.m. Temp. °C		13.2		10.9		10.7	0.5

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin

Date: 9/21/72

Station: (8) Unnamed tributary to Jordan Creek at Wiedasville, Pa.

Crew: Kaeufer

Sunrise 0648

DIURNAL OXYGEN STUDY

Sunset 1903

Depth Ft.	Time	Weather Conditions	Temp. °C	D. O. mg/1	% Saturation
0.5	0625	Dark	16	9.8	98
0.5	0815	Cloudy	16	10.1	101
0.5	1045	"	16	12.0	120
0.5	1235	"	16	11.4	114
0.5	1445	"	17.5	13.2	138
.5	1725	"	17	12.3	127
0.5	1920	Dark	16.5	11.9	120

IN-SITU BENTHAL OXYGEN DEMAND

D. O. mg/1

Total Depth 0.5 ft.

	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 815 a.m. - 1235 p.m. Temp. °C		10.1		12.5		12.4	0.5
(2) 1445 p.m.-1920 p.m. Temp. °C		13.2		11.0		11.0	0.5

DISSOLVED OXYGEN INVESTIGATIONS

Basin: Jordan Creek Basin | Date: 9/21/72

Station: (9) Jordan Creek near Sieglersville, Pa. | Crew: Kaeufer

DIURNAL OXYGEN STUDY

Sunrise 0648 | Sunset 1903

Depth Ft.	Time	Weather Conditions	Temp. °C	D. O. mg/1	% Saturation
0.5	0640	Dark	15	8.8	86
0.5	0835	Cloudy	15	8.9	87
0.5	1100	"	15.5	10.6	105
0.5	1250	"	16	11.2	112
0.5	1430	"	17	13.1	135
0.5	1710	"	17	12.0	124
0.5	1905	Dark	16.5	11.4	115

IN-SITU BENTHAL OXYGEN DEMAND

Total Depth 0.5 ft.

	D. O. mg/1						
	Background		Light Bottle		Dark Bottle		Depth
		D.O.		D.O.		D.O.	Set ft.
(1) 835 a.m. - 1250 Temp. °C		8.9		12.2		12.0	0.5
(2) 1430 p.m. - 1905 pm Temp. °C		13.1		10.2		10.2	0.5