EPA-907/9-74-001
February 1974

Water Quality Index Application In The Kansas River Basin

U.S. Environmental Protection Agency
1735 Baltimore Street
Kansas City, Missouri 64108

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WATER QUALITY INDEX APPLICATION
IN THE
KANSAS RIVER BASIN

By

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Contract No. 68-01-0761

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ABSTRACT

The Water Quality Index (WQI) is an empirical expression which integrates nine significant physical, chemical, and microbiological parameters of water quality into a single number. It was developed by the National Sanitation Foundation (NSF) in response to the need for a uniform method of measuring and reporting water quality in consistent, comprehensible terms.

To meaningfully demonstrate the responsiveness of WQI to variations in water quality, and to determine optimum frequencies for computing and reporting WQI, a comprehensive field sampling, laboratory analysis, and data management program was systematically developed for applying WQI to selected sites on the Kansas River and its major tributaries. Nearly 600 samples from 26 sites - 14 main stem and 12 tributary - were included in the study. Seventeen parameters were measured in the laboratory - the nine in WQI and eight closely related parameters - to determine the validity of term substitution in the index expression. Parameters most responsible for quality variation in both main stem and tributary stations were identified by least squares regression. Results, expressed as WQI, indicated that the NSF water quality index is an effective method for measuring and reporting overall quality variations in the Kansas River. The operational methodology and results of the study are presented in detail in this report.

This report was submitted in fulfillment of Contract Number 68-01-0761 by The National Sanitation Foundation under the sponsorship of the Environmental Protection Agency. Work was completed as of January 1974.

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ACKNOWLEDGMENTS

The outstanding cooperation of Jerome H. Svore, Regional Administrator, EPA Region VII, and Aleck Alexander, Project Officer, is gratefully acknowledged. Special appreciation is also expressed to EPA Region VII personnel who cooperated with the project staff by providing guidance and assistance in developing the study plan; providing laboratory space, equipment, and analytical services; collecting special samples; and entering the data to the STORET system.

The cooperation of Melville W. Gray, Chief Engineer and Director, Division of Environmental Health, Kansas State Department of Health and the assistance of members of his staff in selecting sampling locations and providing reports and equipment for use in the project is also greatly appreciated.

The project was directed by Dr. Nina I. McClelland. The field staff, headquartered at the EPA Region VII laboratory in Kansas City, Kansas, included Steven W. Weeks, chemist, in responsible charge of laboratory and field operations; Carroll E. Reynolds, chemist; Joyce E. Thale, microbiologist; and Larry M. Pope and Bill W. Brown, sample collectors. Dr. Rolf A. Deininger and Jurate M. Landwehr served as consultants to the project for designing the sampling program and processing data through the Michigan terminal system at the University of Michigan.

SECTION I

CONCLUSIONS

To insure continued public and private support for water quality improvement programs, a uniform, comprehensible format must be adopted for measuring and reporting progress - or lack of progress - in attaining current and future program objectives. Through widespread application of the water quality index (WQI), developed and applied by the National Sanitation Foundation (NSF), a specific, simplistic method is available for quantitative, consistent practice in measuring and reporting water quality. *It is emphasized that WQI is a management and general administrative tool intended for use in communicating water quality information to the lay public and to legislative decision makers. It is not a complex predictive model for technical and scientific application.*

The WQI was applied to selected sites in the Kansas River and major tributaries through a comprehensive three month field sampling, laboratory testing, and data analysis program. Results of this project demonstrated that:

1) WQI is responsive to changes in water quality resulting from discharge of municipal and industrial waste effluents and agricultural runoff in the study area.
2) WQI can be used effectively in optimizing sampling frequencies.
3) Four specific parameters - BOD_5, turbidity, phosphates, and fecal coliforms - are responsible for more than 90% of the variation in quality, expressed as WQI, in

river and tributary stations included in this study. Although the same four parameters are indicated in main stream and tributary data, their order of relative importance varies.

4) Two sets of parameters are highly correlated in both main stem and tributary stations - suspended solids with turbidity, and total coliforms with fecal coliforms. Other parameters are not closely related and cannot logically be substituted in calculating WQI for the Kansas River.

5) WQI is an effective method for indicating and reporting overall quality and expressing quality trends in the study area.

SECTION II

RECOMMENDATIONS

1) Data acquired during this study should be expanded to include all seasons of the year. Changes in quality which occur as normal seasonal variations are not reflected in this report as a result of the limited period of performance. A program should be implemented for applying WQI as a continuing water quality management tool throughout Region VII.

2) Comprehensive planning for future water quality objectives in Region VII should include the use of WQI as an integral part of interpreting changes in the overall quality of streams in the Region and reporting these changes to the public.

3) An education/public information program should be developed in Region VII to acquaint water quality control administrators, legislative decision makers, and the public with the meaning and use of WQI in evaluating stream quality.

4) WQI should be adopted on a national level to provide a basis for uniform water quality management operations. It is strongly recommended that programs similar to the Region VII study be implemented at the earliest opportunity in at least three additional regions. These regions should be widely separated geographically to demonstrate that WQI is responsive to changes in quality without respect to location. Each of these demonstrations should include an education/public information component.

SECTION III

THE WATER QUALITY INDEX

Definition

By definition, the Water Quality Index (WQI) is a single numerical expression which reflects the composite influence of nine significant physical, chemical, and microbiological parameters of water quality. It was developed and field evaluated by the National Sanitation Foundation (NSF) to provide a uniform method for indicating and reporting the benefits - or lack of benefits - realized from billions of public and private dollars invested in stream quality improvement programs.

Rationale

The need for a water quality index is well documented. In January 1959 the Committee on National Water Policy of the Conference of State Sanitary Engineers (CSSE) proposed that an objective study be initiated to develop a uniform method for indicating water quality. As a result of this action, the CSSE Committee and the Conference of State and Interstate Water Pollution Control Administrators (CSIWPCA) began developing criteria for demonstrating the progress of water pollution control programs, but nothing tangible emerged from this effort.

In 1965 the Environmental Pollution Panel of the President's Science Advisory Committee recommended that the federal government stimulate development of an index of chemical pollution, which would "allow us to follow many important changes in general water quality."(1)

The Environmental Study Group of the National Academy of Science proposed that various environmental indices, including "water purity" be developed and weighted into an overall Environmental Quality Index (2), a concept supported in a report to the Senate Committee on Public Works (3).

In its third annual report, the President's Council on Environmental Quality stated that, "Accurate and timely information on status and trends in the environment is necessary to shape sound public policy and to implement environmental quality programs efficiently. Further, the American people are entitled to know whether the public and private money being spent to protect the environment returns a commensurate improvement in environmental quality."(4)

The Honorable Russell E. Train, in addressing the National Conference on Managing the Environment, said "*Accurate and timely information on the status of the environment is necessary to shape sound public policy and to implement environmental quality programs efficiently. It is virtually impossible to develop effective programs and to monitor their implementation without good monitoring data. Very detailed data are necessary for certain types of planning and enforcement. For top management and general public policy development, monitoring data must be shaped into easy-to-understand indices that aggregate data into understandable forms. I am convinced that much more effort must be placed on the development of better monitoring systems and indices than we have in the past. Failure to do so will result in sub-optimum achievement of goals at much greater expense.*"(5)

These statements and recommendations are consistent with stated objectives for the NSF Water Quality Index, to:

1) Make available a tool for dependably treating water quality data and presenting them as a single numerical index, and
2) Promote utilization of a process for effectively communicating water quality conditions to all concerned.

Methodology

Development of WQI was undertaken by NSF as an unsponsored project. The basic methodology attempted to incorporate many aspects of DELPHI (6), an opinion research technique developed by the Rand Corporation. Individual judgements of a large panel of experts were integrated to produce a group decision. Through controlled feedback, each panelist was given the opportunity to compare his individual response with that of the group, and to change his response to more nearly conform with the group if he considered it desirable to do so.

A panel of 142 persons with expertise in water quality management was carefully selected for this study. Wide geographical distribution and diverse specialties - regulatory responsibility (federal, interstate, state, territorial, and regional), local public utilities management, consulting, and teaching - were represented. The panelists received a series of mailed questionnaires.

In the first questionnaire, the respondents were asked to consider the 35 parameters, shown in Table 1, for possible inclusion in a water quality index. Opportunity was provided to include additional parameters. Each parameter was to be designated according to one of the following categories: "do not include," "undecided," or "include."

Table 1. PARAMETERS CONSIDERED FOR WQI IN QUESTIONNAIRE NO. 1

Parameter
Dissolved oxygen
Fecal coliforms
pH
Biochemical oxygen demand (5-day)
Coliform organisms
Herbicides
Temperature
Pesticides
Phosphates
Nitrates
Dissolved solids
Radioactivity
Phenols
Chemical oxygen demand
Carbon chloroform extract
Ammonia
Total solids
Oil and grease
Turbidity
Chlorides
Alkalinity
Iron
Color
Manganese
Fluorides
Copper
Sulfates
Calcium
Hardness
Sodium and potassium
Acidity
Bicarbonate
Magnesium
Aluminum
Silica

Respondents were asked to rate only those parameters marked "include," according to their significance to overall water quality. This rating was done on a scale of "1" (highest relative significance) to "5" (lowest relative significance). Of the total panel of 142 members, 102 respondents (72%) completed and returned the first questionnaire; however, of these, only 94 were returned in time to be included in the second round.

The second mailing included a computer printout of results from the first questionnaire. Respondents were instructed to note their individual responses for each parameter and compare them with those of the entire group. In view of this feedback information, respondents were then asked to review their original judgements and modify them if they wished. The intent was to gain greater convergence of opinion concerning how the various parameters rated with respect to their effect on overall water quality. (However, there was little change in the significance ratings expressed in Questionnaire No. 2 when compared with the initial round.)

Nine additional parameters, added to the first questionnaire by several respondents, were introduced for group consideration in the second questionnaire: chromium (hexavalent), total organic carbon, cyanides, conductivity, lead, arsenic, cadmium, selenium, and zinc. In addition, panelists were asked to designate not more than 15 parameters, which they considered to be the "most important" for inclusion in a water quality index. The complete list of parameters was presented, arranged in decreasing order of significance as determined by the average rating of the entire group from Questionnaire No. 1. Of 94 respondents receiving the second questionnaire, 77 completed and returned it for an 82%

response rate. Utilizing expert opinion derived from initial rounds of the study, 11 parameters, or groups of parameters, were listed for further consideration.

In Questionnaire No. 3, respondents were asked to assign values for the variation in level of water quality produced by different levels of the nine individual parameters. This was accomplished by utilizing a series of graphs. Levels of "water quality" from 0 to 100 were indicated on the ordinate, and various levels (or strengths) of the particular parameter were arranged along the abscissa.

The respondents were asked to draw a curve which, in their judgement, represented the variation of water quality produced by the various possible measurements of each respective parameter. "Judgements" of all panelists were then combined to produce a set of "average curves" - one for each parameter. A complete set of curves is included as Appendix A of this report.

Special procedures seemed necessary for "pesticides" and "toxic elements," two "groups of parameters," and the respondents were asked to evaluate these. For pesticides it was proposed that "if the total content of detected pesticides (of all types) exceeds 0.1 mg/l (100 ppb), the water be automatically registered at zero, the lowest value on the water quality index scale." The suggested procedure for including "toxic elements" in the WQI "would be to set a critical upper limit for the presence of each element. If any toxic element exceeded its assigned upper limit, the water quality index would automatically register as zero." The maximum permissable levels for toxic elements contained in the current Drinking Water Standards (7) were proposed as those to be observed. The panelists agreed with this procedure for handling each of the groups of parameters.

The third mailing also sought information which contributed to the formation of "parameter weightings" in a final numerical expression. Thus, respondents were asked to compare relative overall water quality, using a scale of "1" (highest relative value) to "5" (lowest relative value). This operation differed from the initial rating of significance (Questionnaire No. 1) in that now only the final 11 parameters (or groups) were being considered. From these data, weightings were derived for each parameter included in the final WQI, according to the following procedure, summarized in Table 2.

1) Arithmetic means were calculated for the significance ratings returned for all parameters (except "pesticides" and "toxic elements").
2) Ratings were converted into weights by assigning a "temporary weight" of 1.0 to the parameter which received the highest significance rating; i.e., dissolved oxygen.
3) To preserve the ordering and relative ratios returned by the panelists, other temporary weights were obtained by dividing each individual mean rating into the highest rating.
4) Each "temporary weight" was then divided by the sum of all weights to obtain the final weights, w_i.

Table 2. SIGNIFICANCE RATINGS AND WEIGHTS FOR NINE PARAMETERS INCLUDED IN THE WQI

Parameters	Mean of all significance ratings returned by respondents	Temporary Weights	Final Weights
Dissolved Oxygen	1.4	1.0	0.17
Fecal Coliform Density	1.5	0.9	0.16
pH	2.1	0.7	0.11
Biochemical Oxygen Demand (5-day)	2.3	0.6	0.11
Nitrates	2.4	0.6	0.10
Phosphates	2.4	0.6	0.10
Temperature	2.4	0.6	0.10
Turbidity	2.9	0.5	0.08
Total Solids	3.2	0.4	0.07
		Total = Σ =	1.00

With parameter selection, quality curves, and relative parameter significance determined, the project staff proposed an additive expression for WQI:

$$WQI = \sum_{i=1}^{n} w_i \, q_i \qquad (1)$$

where WQI = the Water Quality Index, a number between 0 and 100 (theoretical),

q_i = the quality of the ith parameter, a number between 0 and 100, (read from the quality curves),

w_i = the unit weight of the ith parameter, a number between 0 and 0.17, and

n = the number of parameters.

In the WQI expression (Equation 1), n = 9 and includes:

- dissolved oxygen (DO), expressed as percent saturation
- fecal coliform density (FC), no./100 ml
- pH
- nitrates (NO_3), mg/l NO_3-N
- phosphates (PO_4), mg/l PO_4-P
- 5 day biochemical oxygen demand (BOD_5), mg/l
- temperature (T), °C departure from equilibrium*
- total solids (TS), mg/l, and
- turbidity, JTU (Jackson turbidity units)

*"Equilibrium" temperature is defined as that which is known to occur without the influence of heated or cooled discharge. In field application of WQI, two temperatures are taken:

one at the sampling site and one at some point upstream where heated or cooled discharge is known to be absent.

For samples from stations known to include pesticides or toxic elements, laboratory analysis of these constituents is required. When any level exceeds its maximum permissible limit, the index is automatically "zero."

Field Evaluation

Progress in developing WQI was first reported in a paper presented at the National Symposium on Data and Instrumentation for Water Quality Management, held in Madison, Wisconsin in July 1970 (8). Consistent with the concern that WQI be used responsibly, data from the quality curves (q_i) were not made available in this presentation. In response to requests for q_i data, NSF proposed that field application of WQI be undertaken as a coordinated effort. As a result, water quality management agencies (listed in Table 3) reported laboratory data to NSF from routine surveillance programs at more than 80 sites for periods up to 15 months. Again, this activity was entirely unsponsored. Site selection and sampling frequency were, in general, a function of availability of staff and fiscal resources within the participating agency. Data for the nine parameters in WQI were reported monthly; WQI's were calculated at NSF and returned to each participant.

A wide variety of quality characteristics were reflected in the data. Samples were taken from clean, upper reaches of

Table 3. LIST OF PARTICIPANTS IN INITIAL FIELD APPLICATION OF WQI

State	Agency
California	Sacramento Subdistrict, U.S. Geological Survey
	State Department of Natural Resources
Colorado	Larimer County Department of Health
Maryland	State Department of Natural Resources
Michigan	Grand River Watershed Council
	Grand Rapids Wastewater Treatment Plant
	Jackson Community College
	Jackson Wastewater Treatment Plant
	State Department of Natural Resources
Ohio	Cleveland Department of Public Utilities
Pennsylvania	State Department of Environmental Resources
	Allegheny County Bureau of Tests
	Pennypack Watershed Association
Tennessee	Tennessee Valley Authority

small streams, downstream from municipal wastewater treatment plants and points of industrial waste discharge, and lakes with seasonally diverse population densities. Results of the study showed clearly that quality variations are consistent with - and can be reported by - changes in WQI. They illustrated dramatically the fallacy of reporting quality variations in terms of changes in single parameter values. For example, at one station in Pennyslvania, downstream from two overloaded package wastewater treatment plants, least squares regression analysis of the data from 40 samples taken during the period July 1971 to August 1972 established that approximately 87% of the variation in WQI (R^2=0.8695) was determined by DO, BOD_5, pH, and total solids. At a station further downstream, just below the discharge from a mine pump, 92% (R^2=0.9169) of the WQI was determined by fecal coliform density, pH, and phosphates.

Quality profiles from three stations on a Michigan stream with recreational lakes scattered throughout the area reflected changes attributed to high density vacation populations. Flow patterns and mixing characteristics of treated wastewater effluent from a large city in Michigan were observed by plotting WQI values from stations on both sides of the receiving stream, above and below the treatment plant. These data are described in detail in a paper presented at the ASCE National Meeting on Water Resources Engineering (9), and in the final report prepared for each participant in the study (10).

Further Efforts to Evaluate WQI

Despite the apparent responsiveness of WQI to changes in water quality conditions, analysis of data from the field study suggested that the additive WQI lacked sensitivity in adequately reflecting the effect of a single low value parameter on overall water quality. Initially, the additive model was selected because it is conceptually simple, easy to calculate, and entirely reproducible. O'Connor noted that, "the additive model is a good choice when all parameters are within a reasonable range, but a multiplicative form is more sensitive to discontinuities in overall quality which may result with zero or poor quality in any parametric dimension."(11)

As a result, a multiplicative form of WQI was proposed (9):

$$WQI(M) = \prod_{i=1}^{n} q_i^{w_i} \qquad (2)$$

where WQI(M) = the multiplicative water quality index, a number between 0 and 100 (theoretical),

q_i = the quality of the ith parameter, a number between 0 and 100,

w_i = the unit weight of the ith parameter, a number between 0 and 0.17, and

n = the number of parameters.

To determine relative merits of adopting the additive WQI (WQI(A)) versus WQI(M) historical data for both "good" and "poor" quality stream conditions were accessed from STORET. WQI(A) and WQI(M) were calculated for all data and differences in the two values evaluated with respect to physical conditions known to exist at each reported site. Again, a wide variety of quality conditions were considered: upstream and downstream from refineries, steel mills, and municipal wastewater treatment plants. Data influenced by industrial wastes were significantly different when reported as WQI(A) versus WQI(M). As expected, WQI(M) was significantly more sensitive to the effect of a single bad parameter.

In addition to evaluating historical data, a questionnaire was mailed to 160 water quality management experts - more than 70 who participated in developing WQI, and others assumed to be new to the concept. The questionnaire was designed to determine, 1) how water quality ratings assigned by the experts related to WQI(A) versus WQI(M), and 2) whether or not original group judgement differed significantly from the opinions of other water quality experts.

Values for each of the nine WQI parameters in 20 actual stream samples - data from the Kansas study, the initial evaluation of WQI in Pennsylvania, Michigan, etc., and data accessed from STORET - were included in the questionnaire. The experts were asked to review the data for each individual sample and return both a numerical (0 to 100) and a verbal ("excellent," "good," "medium," "bad," or "very bad") rating which, in their judgement, described the quality of that sample.

More than 100 responses were returned, with 30 from the original group. Results of the survey to date indicate that:

1) Calculation of WQI by the additive model produces a number which averages 10 to 15 WQI units higher than experts judgementally rate the same water. The difference is greatest at the low end of the scale.

2) Calculation of WQI by the multiplicative model produces a number which averages 6 WQI units different, distributed above and below the experts' judgemental ratings.

3) There is no significant difference between the way original and new expert panelists rate water quality.

Although results of this survey are not yet complete, it is clear that the multiplicative WQI is closely related to expert judgement of water quality conditions. NOTE: *Because this report was completed prior to the survey, data in tables and figures are reported principally as WQI(A); however, WQI(M) values have been added to the tables in Appendix D, and plotted, for purposes of comparison, in Figure 3, 5, and 7.*

Questionnaire responses differed widely with regard to verbal ratings. A feedback questionnaire, to be mailed in the near future, will permit each panelist to review his response with respect to group judgement, and attempt to better define what the expert calls "good" or "bad" water quality.

SECTION IV

PROJECT DESCRIPTION

Objectives

Principal objectives of this project were to:

1) Apply WQI to selected sites in the Kansas River Basin through a comprehensive field sampling and laboratory analysis program, and
2) Evaluate the effectiveness and utility of WQI as an indicator of water quality variations.

Secondary objectives included determining optimum frequencies for sampling, computing, and reporting WQI.

Study Area

The main stem of the Kansas River originates at the confluence of the Republican and Smoky Hill Rivers, east of Junction City, and empties into the Missouri River 170 miles to the east at Kansas City. It is a wide, shallow river of moderate velocity with a shifting sand bottom. In terms of flow, it is the largest stream in Kansas.

Treated municipal wastes from more than 40 cities and towns ranging in population from 106 to 123,000, and effluents from at least 20 small wastewater treatment plants serving restaurants, mobile home parks, high schools, etc. are discharged to the Kansas River (12). The largest city, Kansas City, is heavily industrial; Topeka and Lawrence are characterized by light industry (principally food and kindred products, printing and publishing, fabricated metal products, and chemical processing). Other portions of the study area are essentially rural-agricultural, with river valleys commonly devoted to truck farming, and hilly areas, to pasturelands.

Selection of this area for application of WQI was a direct result of the high level of interest which water quality administrators in the area continue to express for the index concept in general, and WQI in particular. Administrative and technical staffs from EPA Region VII and the Kansas Department of Health contributed extensively to planning and conducting the project.

Sampling Sites

Twenty-six sites between Junction City and Kansas City - 14 on the Kansas River and 12 on major tributaries - were sampled for this study. Routine surveillance sites and stations from previous special studies were included. Intermediate sites were added when long distances occurred between the regular stations.

Sampling locations are listed in Table 4 and shown schematically in Figure 1. It is apparent from Figure 1 that flow in the study area is affected by a number of large impoundments, constructed for flood control, water supply, conservation, augmentation of flow for downstream uses, and recreation. Sampling was limited to sites downstream from the reservoirs.

Sampling Scheme

In designing the sampling program, a principal concern was to

Table 4. SAMPLING STATION LOCATIONS

Station No.	River Mile	Location
†1	0.3	Kansas River at James Street Bridge, Kansas City, Wyandotte County, Kansas
†2	3.5	Kansas River at 7th Street Bridge (Highway U.S. 169), Kansas City, Wyandotte County, Kansas
†3	9.3	Kansas River at Turner Bridge (State Highway K-132), Kansas City, Wyandotte County, Kansas
†4		Mill Creek near Zarah, 2 miles above mouth at State Highway K-10 Bridge, Johnson County, Kansas
*†5	20.3	Kansas River at State Highway K-7 Bridge, 0.6 miles east of Bonner Springs, Wyandotte County, Kansas
†6	25.0	Kansas River at Wyandotte Street Bridge in DeSoto, Kansas
†7		Stranger Creek 0.5 miles above mouth, at State Highway K-32 Bridge near Linwood, Kansas
†8	42.4	Kansas River at Eudora Bridge on FAS 209, Eudora, Douglas County, Kansas

* Indicates USGS gauging station

† Indicates Kansas Department of Health routine sampling station

Table 4. SAMPLING STATION LOCATIONS (CONTINUED)

Station No.	River Mile	Location
†9		Wakarusa River, 0.5 miles above mouth, at county road bridge on FAS 209, 0.5 miles north of Eudora, Douglas County, Kansas
†10	53.1	Kansas River at U.S. 59 Highway Bridge in Lawrence, Douglas County, Kansas
*†11	63.5	Kansas River at county road bridge on FAS 330, 0.5 miles north of Lecompton, Douglas County, Kansas
†12		Delaware River, 1.5 miles above mouth, at U.S. 24 Highway Bridge, 0.5 miles west of Perry, Jefferson County, Kansas
†13		Shunganunga Creek, 1.5 miles above mouth, on Croco Road (FAS 614), 1.5 miles west of Tecumseh, Shawnee County, Kansas
*†14	83.1	Kansas River at Sardou Bridge, Topeka, Shawnee County, Kansas
*†15		Soldier Creek, 6 miles above mouth, 0.25 mile west of Highway U.S. 75, 4 miles north of Topeka

* Indicates USGS gauging station

† Indicates Kansas Department of Health routine sampling station

Table 4. SAMPLING STATION LOCATIONS (CONTINUED)

Station No.	River Mile	Location
16	98.0	Kansas River, at county bridge on FAS 315 just north of Willard
†17		Mill Creek, 6 miles above mouth, at county bridge on FAS 1071, 0.5 mile west and 1 mile south of Maple Hill, Wabaunsee County, Kansas
†18	115.4	Kansas River at Paxico Bridge, on FAS 1070, Pottawatomie County, Kansas
†19		Vermillion River, 0.25 mile above mouth, on Highway U.S. 24 Bridge, 4 miles east and 0.5 mile north of Wamego
*†20	127.0	Kansas River on State Highway K-99 in Wamego, Pottowatomie County, Kansas
*†21		Big Blue River, 7.5 miles above mouth, at Casement Bridge, 2 miles below Tuttle Creek Dam
†22	149.2	Kansas River at State Highway K-177 bridge in Manhattan, Riley County, Kansas
†23		Clark Creek, 4 miles above mouth, 5.5 miles east, 1.5 miles north of Junction City, Kansas

* Indicates USGS gauging station

† Indicates Kansas Department of Health routine sampling station

Table 4. SAMPLING STATION LOCATIONS (CONTINUED)

Station No.	River Mile	Location
*24	168.9	Kansas River, 1.6 miles below confluence of Republican and Smoky Hill Rivers, downstream side of Military Bridge in Fort Riley
†25		Republican River, 0.25 mile above mouth, at State Highway K-18 bridge, Junction City, Kansas
*†26		Smoky Hill River, 2 miles above mouth, on Highway Alternate U.S. 40, 1 mile east of Junction City, Geary County, Kansas

* Indicates USGS gauging station

† Indicates Kansas Department of Health routine sampling station

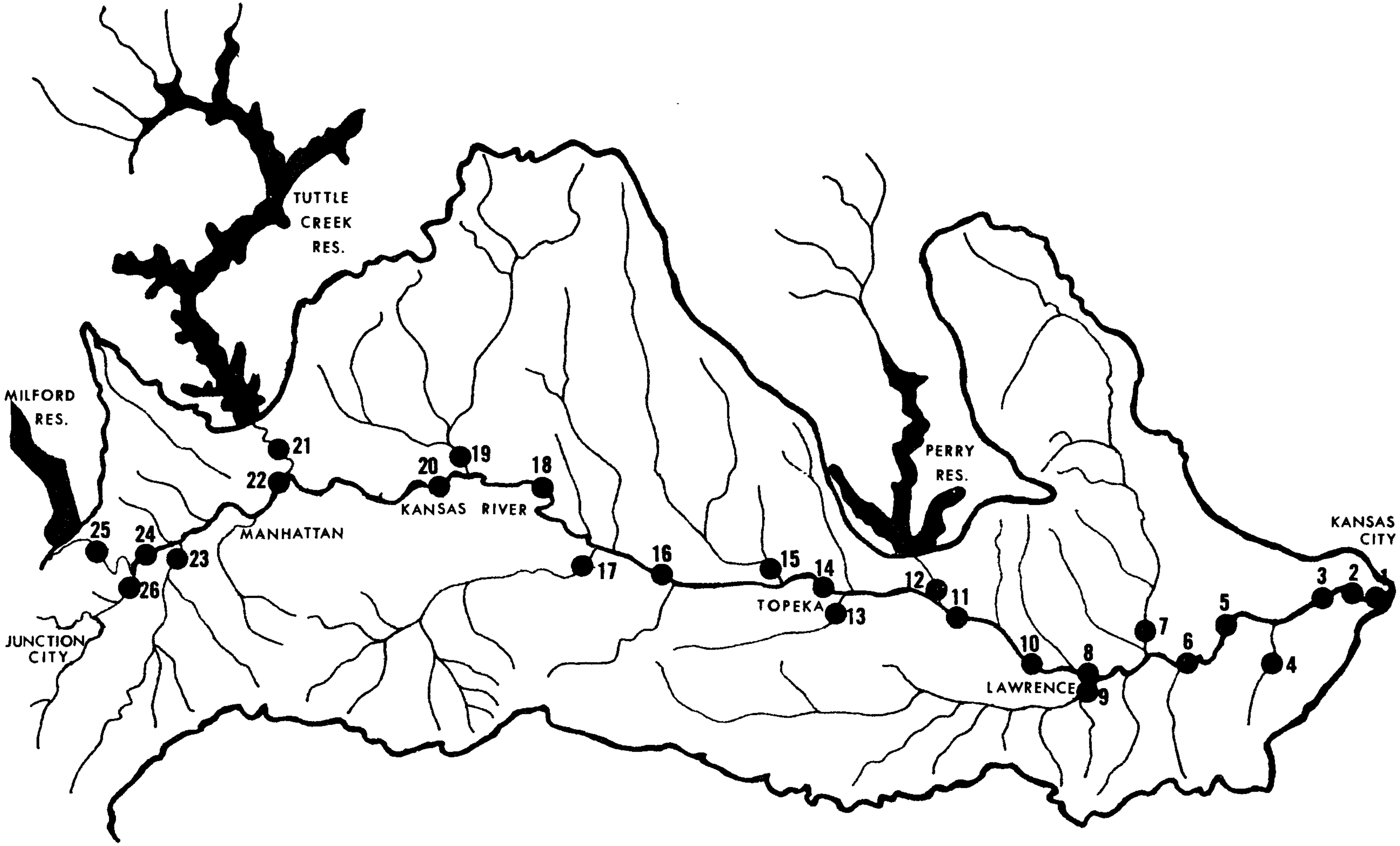

Figure 1. Schematic illustration of sampling sites in Kansas River application of WQI.

provide a sufficiently large data base to be statistically significant in the evaluation process. A uniform pattern was established for sampling nine main stem stations considered to be critical for reflecting quality variations (high frequency stations); five main stem and four tributary stations considered somewhat less critical (medium frequency stations); and eight tributary stations (low frequency stations). The high frequency stations were sampled every other day; medium frequency stations, every fourth day. Sampling times for these stations were coincident with every second sample of the high frequency series.

Low frequency stations were sampled every eighth day, with sampling times coincident with every second sample in the medium frequency series, and every fourth sample in the high frequency series. One extra set of the low frequency samples was included in the schedule to compensate for the period when no low frequency samples would be collected if the every eighth day algorithm were strictly observed.

The overall sampling scheme, shown in Appendix B, is summarized as follows:

11 days,	26 stations	(9+9+8)	=	286 samples
8 days,	18 stations	(9+9)	=	144 samples
18 days,	9 stations		=	162 samples
		TOTAL		592 samples

The desirability of reflecting day to day variation was also considered in designing the sampling schedule. Sampling every second, fourth, or eighth day over an eight week period insured that at least one sample would be taken from each station on each day of the week. Variations which could be attributed to morning versus afternoon sampling times were considered by varying the direction of sampling; i.e., east to west or west to east, according to a predetermined pattern.

To optimize mileage logged for sampling, two sample collectors worked on the project. One, based in Kansas City, routinely sampled stations numbered 1 through 12; the other, based in Topeka, sampled stations 13 through 26, always in numerical order; e.g., 1 through 12 or 12 through 1. On high frequency sampling days, one man collected all nine samples. The Topeka-based collector worked on "west to east days," and the Kansas City-based collector worked on "east to west days." Time of travel for sample collectors ranged from five to eight hours in accordance with the predetermined daily schedule.

SECTION V

EXPERIMENTAL

Sample Collection and Preparation

Samples were collected from the downstream side of bridges, approximately midway across the stream and from a depth of two feet (except when river staging was too low to permit sampling at this depth). Bacteriological samples were collected in sterile bottles and iced for transport to the EPA Region VII laboratory in Kansas City, Kansas, which served as project headquarters. Samples for physical and chemical analyses were collected with an APHA-type DO sampler, dropped three times at each station. One, 300 ml BOD bottle was filled in the sampler, fixed in the field, and returned to the laboratory in a dark box for measurement of DO by the Winkler method. Excess sample was placed in two, one liter cubitainers and iced for transport. Temperature was measured in the field.

Sample preservation and maximum holding periods were in accordance with those described in Standard Methods (13) or the EPA Methods Manual (14). Maximum time lapse between collection and receipt of samples at the laboratory was six hours.

At the laboratory, DO titrations, BOD dilutions, and all bacteriological samples were processed immediately. Approximately 800 ml was removed from one cubitainer for the BOD test. The excess was preserved with mercuric chloride ($HgCl_2$, 1%) and refrigerated for subsequent analysis of nutrients (NO_3+NO_2, NH_3, and PO_4). A sample from the second cubitainer was placed in a four ounce bottle, preserved with HCl (2 ml), and refrigerated prior to shipping to Ann Arbor for measuring TOC. Excess sample was refrigerated overnight (approximately 12 hours) at 4°C. The following morning, it was warmed to 25°C, mixed by inversion, and used for immediate determination of pH, conductivity, and turbidity. The excess was again refrigerated for subsequent chloride, solids (total and suspended), and COD analyses. A schematic illustration of sample distribution and preparation is shown in Figure 2.

Methods

Seventeen parameters were measured in the laboratory - the nine in WQI and eight closely related parameters - to determine the validity of term substitution in the index expression. (The eight additional parameters included: suspended solids, chemical oxygen demand (COD), total organic carbon (TOC), total coliform density, and fecal streptococci.) Analytical procedures were performed in accordance with Standard Methods (13) or the EPA Methods Manual (14). The specific methods used in this study are shown in Table 5.

Quality control procedures were employed routinely throughout the laboratory phase of this project. EPA analytical reference standards for all parameters were included at random with routine analyses. Instruments were standardized regularly before and during each use. In general, quality control procedures were performed in accordance with the EPA Handbook for Water and Wastewater Laboratories (15).

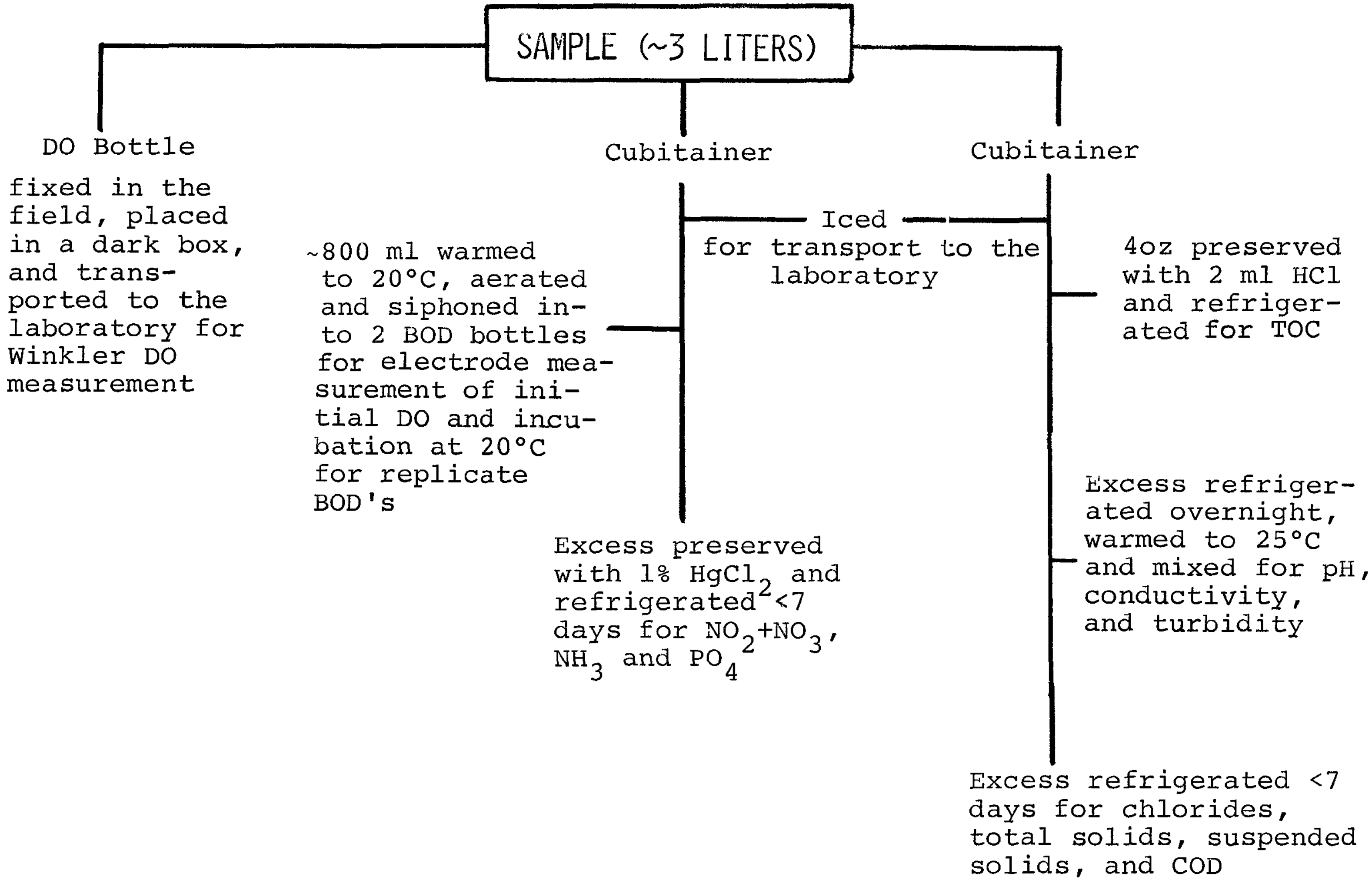

Figure 2. Sample distribution and handling scheme for chemical and physical parameters.

Table 5. SUMMARY OF ANALYTICAL METHODS

Parameter	Method	Reported As	STORET Parameter Code
Dissolved oxygen (DO)	Azide Modification of Winkler method (lab measurement)	mg/l DO, and % saturation	00300 00301
5-day biochemical oxygen demand (BOD_5) at 20°C	Modified polarographic electrode technique (Yellow Springs Instrument Company, Model No. 54)	mg/l BOD_5 (mean depletion of 2 replicate samples)	00310
Temperature (T)	Thermometer (field measurement)	°C	00010
Conductivity	Wheatstone Bridge-type conductivity meter (Yellow Springs Instrument Conductivity Bridge, Model No. 31)	µmhos/cm	00095
pH	Glass indicator - Saturated calomel reference electrodes and meter with digital readout (Instrumentation Laboratory Inc., Model No. 205)	pH units	00400
Turbidity	Nephelometry (Hach Turbidimeter, Model No. 2100)	Jackson Turbidity Units (JTU)	00070

Table 5. SUMMARY OF ANALYTICAL METHODS (CONTINUED)

Parameter	Method	Reported As	STORET Parameter Code
Chloride (Cl)	Mercuric nitrate with automated titration (Fisher titralyzer Model No. 41)	mg/l Cl	00940
Phosphate (PO_4)	Automated stannous chloride (Technicon Autoanalyzer) following manual ammonium persulfate - sulfuric acid digestion	mg/l P	00665
Nitrate (NO_3) + nitrite (NO_2)	Automated cadmium - copper reduction method for NO_3-NO_2 (Technicon Autoanalyzer) NOTE: nitrite (NO_2) levels were shown to be negligible when measured separately.	mg/l N	00630
Ammonia (NH_3)	Automated alkaline phenol hypochlorite method (Technicon Autoanalyzer)	mg/l N	00610
Total solids (T.S.)	Evaporation @103-105°C for 24 hours.	mg/l T.S.	00500

Table 5. SUMMARY OF ANALYTICAL METHODS (CONTINUED)

Parameter	Method	Reported As	STORET Parameter Code
Suspended solids (S.S.)	Filtration through a gooch crucible lined with standard glass fiber filter paper; residue dried @103-105°C.	mg/l S.S	00530
Chemical oxygen demand (COD)	Potassium dichromate oxidation. NOTE: the high level method was followed routinely. The procedure was repeated using the low level method when indicated.	mg/l COD	00340 (high level) 00335 (low level)
Total organic carbon (TOC)	N_2 stripping to remove inorganic forms; catalytic combustion oxidizing carbonaceous materials to CO_2; infrared measurement of CO_2, (Beckman Single Channel Total Carbon Analyzer)	mg/l TOC	00680
Total coliforms	Bacto-M Endo Broth MF Difco #0749-01	#/100 ml	31501

Table 5. SUMMARY OF ANALYTICAL METHODS (CONTINUED)

Parameter	Method	Reported As	STORET Parameter Code
Fecal coliforms	Bacto-M FC Broth Base Difco #0883-01	#/100 ml	31616
Fecal streptococci	Bacto-KF Streptococci Agar Difco #0496-01	#/100 ml	31673

NOTE: *All analytical data from this study have been entered into the EPA STORET system. They can be retrieved by using Code No. 117INDX and numbers of respective individual parameters, shown in Table 5.*

SECTION VI

RESULTS

WQI(A) and WQI(M) were calculated for all sampling days except October 6 when aliquots prepared for NO_3+NO_2 (and NH_3) were accidentally discarded. In all calculations, temperature, expressed as degrees C departure from equilibrium, was assumed to be zero. No effects of heated or cooled discharge were known to occur at any sampling station included in the study. Two temperatures were taken during the early sampling runs - one at the site and one upstream - to confirm this hypothesis.

Data for each of the 17 individual parameters and time of sampling are shown by station in Appendix C (Tables C-1 through C-26). Flow, provided by the U.S. Geological Survey from gauging stations in the study area, are also reported in tables in Appendix C. WQI(A), WQI(M), and quality ratings (q_i) for each parameter in WQI are reported by station in the tables (D-1 through D-26) in Appendix D. Note that temperature q_i is consistently reported as 94.9 as a result of assuming zero degrees departure from equilibrium for all samples.

Summary statistics for each variable in WQI(A), including the number of analyses (n), arithmetic mean, standard deviation, standard error of the mean, minimum, and maximum values are shown in Appendix E (Tables E-1 through E-26) for each individual station.

In Appendix F (Figures F-1 through F-26), WQI(A) is plotted versus time (date) of sampling for each station.

Water quality index profiles - WQI(A) versus distance - are shown in Appendix G (Figures G-1 through G-36). Note that distances (station locations) are approximate in this series of figures. River stations are connected by solid line; tributary WQI's are shown as individual points, not connected to the solid line. Numbers near the data points refer to flow, in cfs, recorded at USGS gauging stations at the time of sampling.

SECTION VII

DISCUSSION

Quality Variations

Deininger reported that values ±5 WQI are significantly different, and "WQI is probably sensitive down to a two point difference"(16). In discussing the data from this study variations ±5 WQI(A) or WQI(M) are assumed to be significant.

Mean values for WQI(A) and WQI(M) at all stations over the entire period of observation are plotted in Figure 3. Main stem stations are connected by a solid line and tributary stations are shown as isolated points, as described in the legend. From the data in Figure 3, it is apparent that quality in the main river showed no significant variation over the study period when expressed as mean WQI(A) (range 65-68), and varied only slightly as mean WQI(M) (range 51-58). The quality at Willard, Lawrence, and Paxico was significantly better than at Eudora or Topeka, and at Willard, it also exceeded the quality at the James Street station in Kansas City (as WQI(M)).

The greater range and sensitivity of WQI(M) is further illustrated in Figures 4 and 5 (mean, high, and low WQI(A) and WQI(M), respectively, for main river stations) and Figures 6 and 7 (mean, high, and low WQI(A) and WQI(M) for tributaries). The effect of one or two unusually "bad" parameters is apparent by visual comparison of the range of WQI values reported for the Delaware River (Figures 6 and 7). This was the "best" quality tributary over the period of observation. In the sample taken on November 13th, turbidity and fecal coliforms were unusually high - 140 JTU and 2900/100 ml, respectively. The highest turbidity level in any other Delaware

KANSAS RIVER STUDY

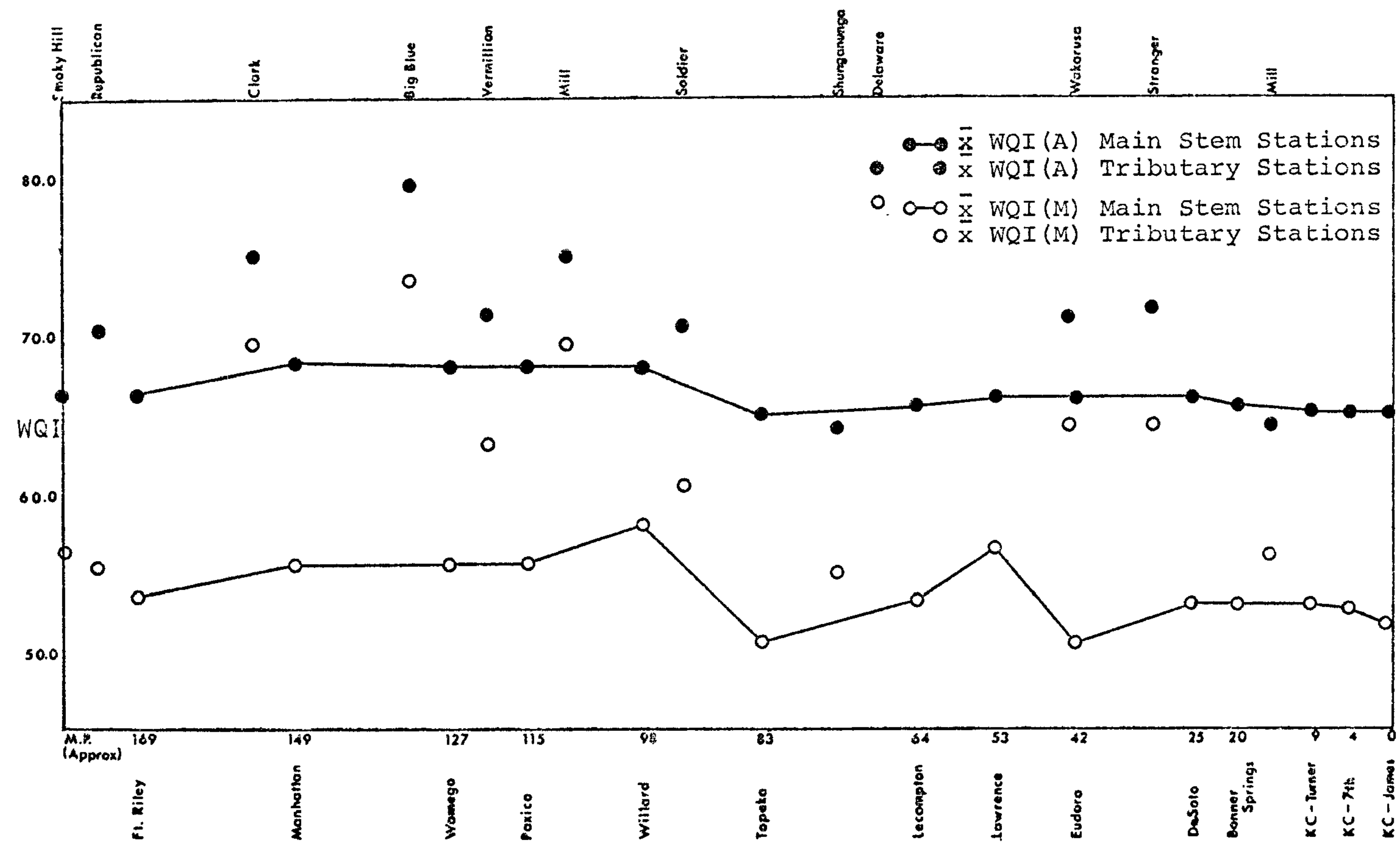

Figure 3. Mean values for WQI(A) and WQI(M) at all stations for entire observation period (09/26/72 - 12/07/72).

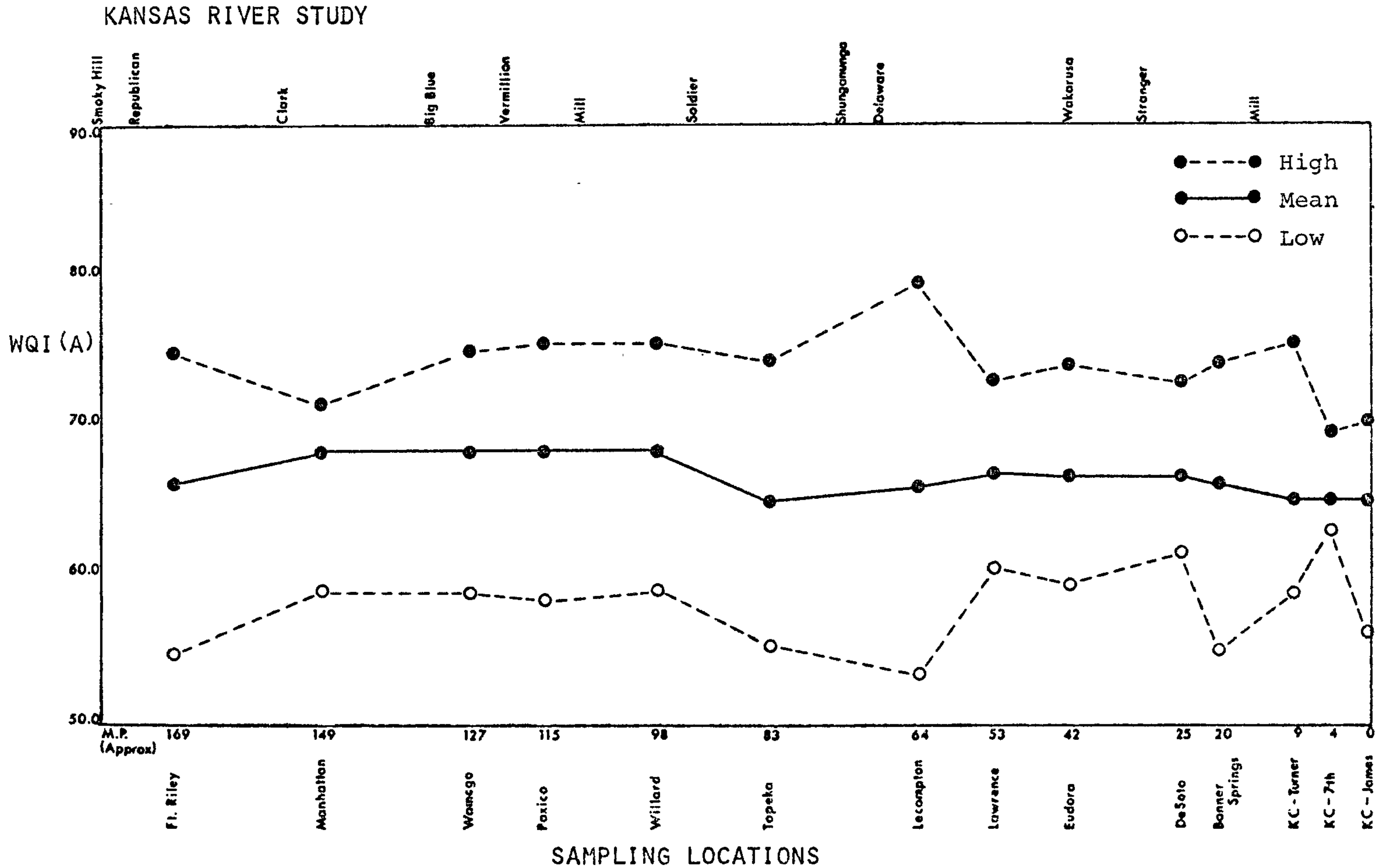

Figure 4. Mean, high, and low WQI(A) for Kansas River stations.

KANSAS RIVER STUDY

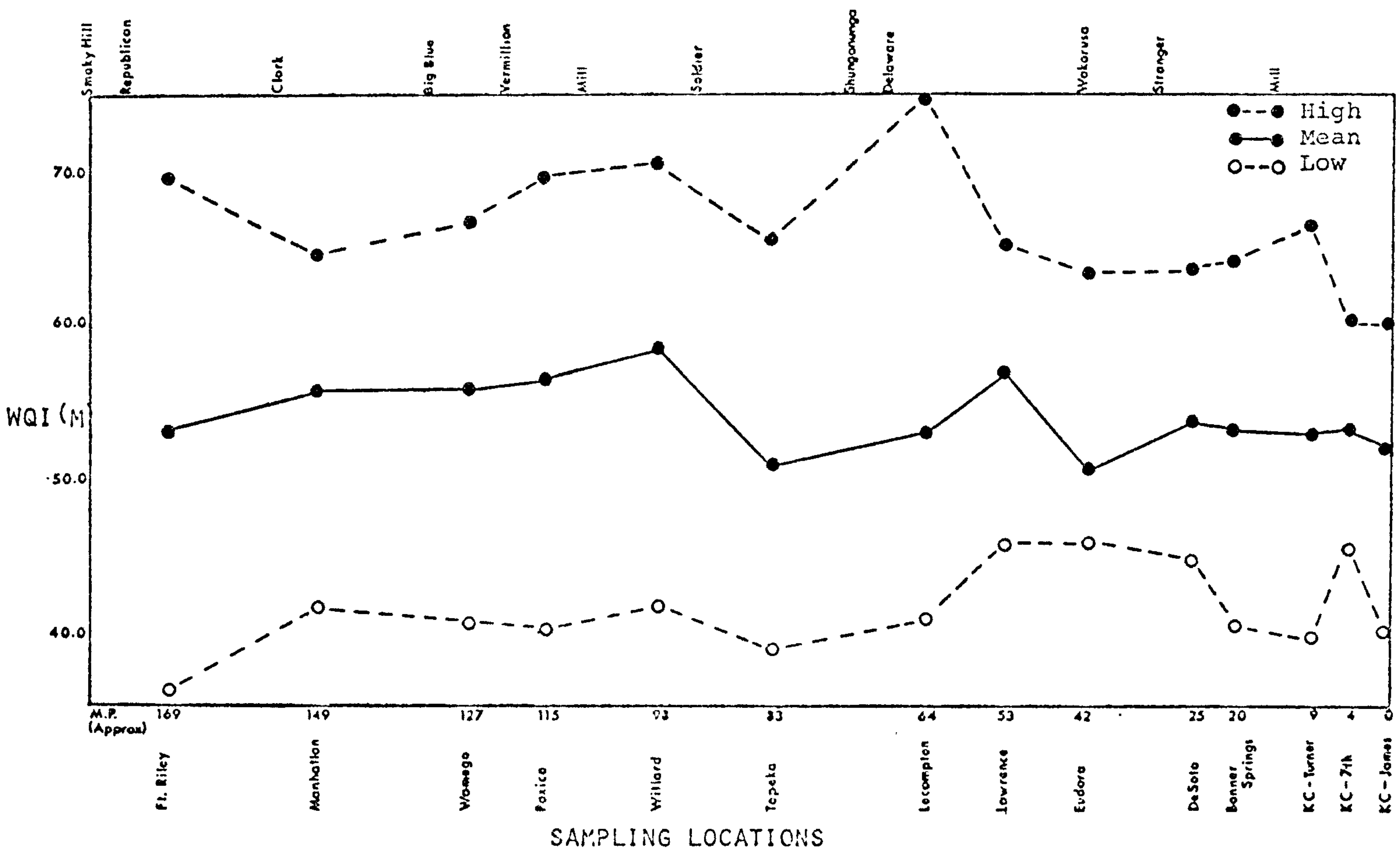

Figure 5. Mean, high, and low WQI(M) for Kansas River stations.

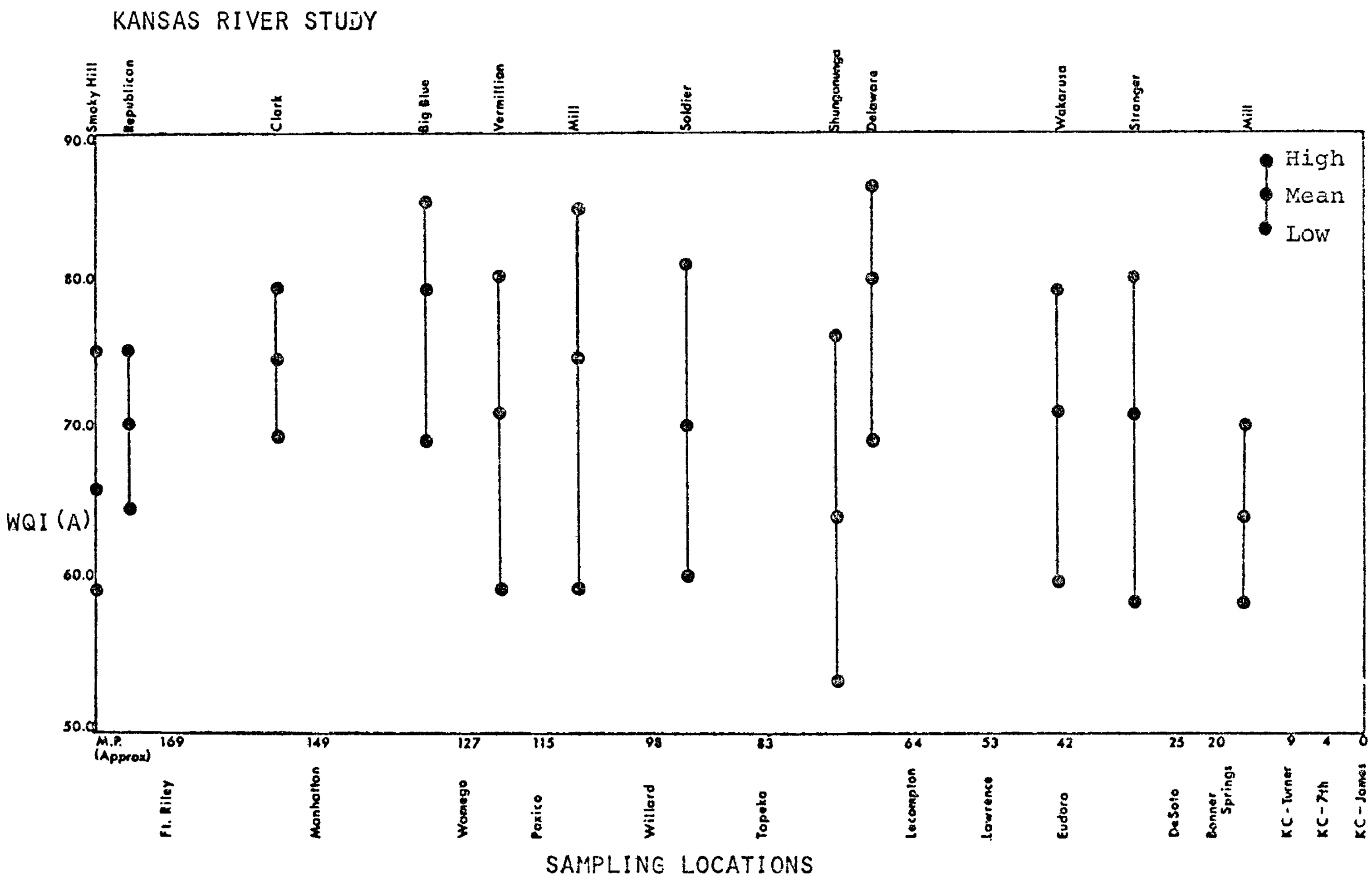

Figure 6. Mean, high, and low WQI(A) for tributary stations.

KANSAS RIVER STUDY

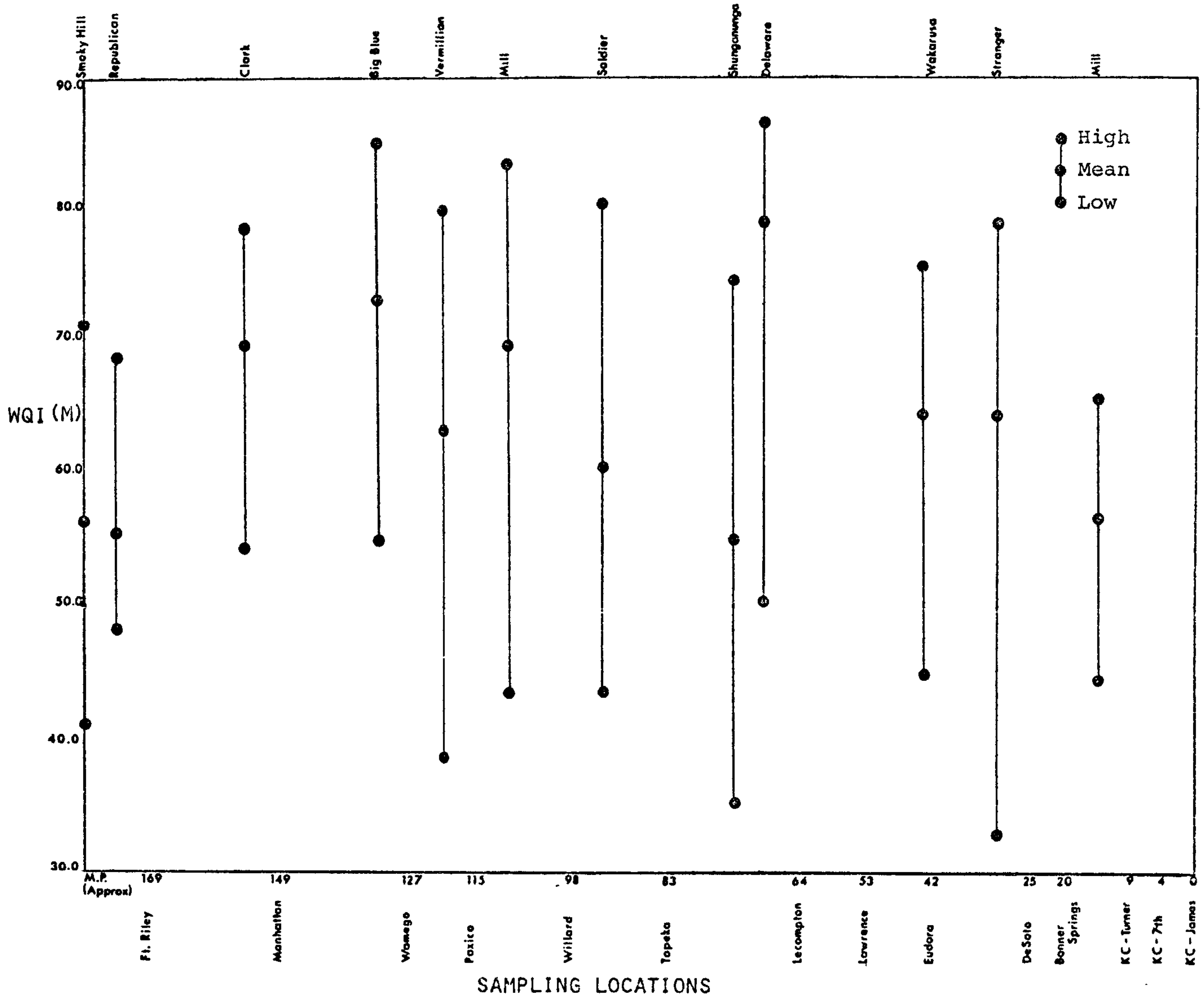

Figure 7. Mean, high, and low WQI(M) for tributary stations.

River sample was 40 JTU; the mean for all other samples was 15.5 (JTU) (Table C-12, Appendix C). Expressed as q_i, a turbidity of 140 JTU equals 5.00; a turbidity of 40 JTU equals 44.7 (Table D-12, Appendix D). Fecal coliform density in the Delaware on November 13th was 2900/100 ml. The mean of all other samples was 202/100 ml. Expressed as q_i, these values are 14.6 and 34.8, respectively. Other unusually high data for this sample are not included in the WQI expression; e.g., suspended solids and total coliforms. Comparison of the range of WQI values shown in Figures 6 and 7 for the Delaware River demonstrate the improved sensitivity of WQI(M) for treating unusually bad parameter values. The maximum is the same in both figures, the mean, only slightly less for WQI(M), but the low WQI(M) is significantly lower than the lowest WQI(A).

Data from Figures 3, 4, 5, 6, and 7 are summarized in Table 6. Willard, the "best quality" Kansas River station, is a small town (population 94) about midway between Paxico and Topeka. Small creeks discharge to the Kansas River between Paxico and Willard, but there is no reason to expect any of them to contribute significant pollutional loadings. The Willard location was sampled principally because of the long distance between Paxico and Topeka.

"Best" tributary quality was recorded from the Delaware and Big Blue Rivers, discharging from Perry and Tuttle Creek Reservoirs, respectively. Because reservoir retention provides time for self purification and sedimentation, the quality at these stations was expected to be consistently high.

"Poorest" quality in the main river occurred at the station near Eudora, just downstream from Lawrence, and at Topeka. "Poorest" quality in a tributary was observed in Shunganunga Creek. Quality variations at the Eudora station result

Table 6. SUMMARY OF WQI(A) AND WQI(M) FOR KANSAS RIVER AND TRIBUTARY STATIONS

Observed Characteristic	Kansas River Stations: Location	WQI(A) Mean/Range	Kansas River Stations: Location	WQI(M) Mean/Range	Tributary Stations: Location	WQI(A) Mean/Range	Tributary Stations: Location	WQI(M) Mean/Range
Best Quality	No statistically significant difference in quality between stations at level of ±5 WQI(A)		Willard	58	Delaware Big Blue	81 79	Delaware Big Blue	78 73
Poorest Quality			Topeka Eudora	51 51	Shunganunga Mill Creek	64 64	Shunganunga	55
Most Variation	Lecompton	53-79	Lecompton	41-75	Mill Creek Stranger Creek	59-85 57-81	Stranger Creek	33-78
Least Variation	Kansas City @7th Street	63-69	Kansas City @7th Street	45-60	Republican River	65-76	Republican River	48-68

principally from municipal and separate industrial waste discharges in the Lawrence area. (Wastes from Eudora are discharged to the Wakarusa River which enters the Kansas just downstream from the Eudora station.) Lawrence discharges 4.57 mgd directly to the Kansas River from a primary plant treating a waste of 45,700 population equivalent, with contributions from at least nine industries including organic dyes and inks, blood, and various food processing wastes. Industrial wastes discharged directly to the Kansas River include: an electric utility (.01 mgd treated by extended aeration plus .43 mgd cooling water), an industrial and agricultural chemical company (500 gpm of untreated process wastes containing phosphates, suspended solids, and hexavalent chromium), and a paper and container board company (900 gpm of treated wastes containing suspended solids, sulfates, and organics with a mean BOD of 80 mg/l.

Topeka is the second largest city in the study area, and discharges both municipal and industrial wastes directly to the main river. The principal municipal wastewater treatment plant is located downstream from the Topeka sampling location and would not be expected to have an affect on quality at this point. A smaller plant (designed for 12,500 P.E. and loaded at approximately 1000 P.E.) upstream from the sampling location discharges its effluent along the north bank of the river and would likely not be well mixed with water in the river at the referenced sampling point. It may be reasonable to assume that either an unidentified direct industrial waste discharge or storm water from Topeka contributed to the relatively low mean WQI value observed at the Topeka location. Storm water discharge and effluents from the wastewater treatment plant serving Forbes Air Force Base may also contribute significantly to the observed mean WQI for Shunganunga Creek, which flows through the City of Topeka.

The main stem station with the widest range of reported WQI was at Lecompton, just downstream from the point where the Delaware River discharges to the Kansas, and downstream from Topeka. The Delaware contributes good quality flows to the Kansas with discharges from Perry Reservoir; however, it appears that the main river may be stratified at the Lecompton station and that the stratification line may change as a function of relative flows in the two streams. Thus samples collected from midstream may have been in different strata at various times of sampling. Least variation in main stream stations was observed in Kansas City at 7th Street.

NOTE: *From Table 6, it is apparent that characteristics observed at any sampling location were the same whether calculations were additive or multiplicative in format.*

Despite the brevity of the field phase of this study, quality in the Kansas River and its tributaries generally improved over the period of observation. Initial and final WQI(A) values for each sampling location are plotted in Figure 8. At a level of ± 5 WQI units, all main river stations except Kansas City at 7th Street, DeSoto, Lawrence, and Ft. Riley, and all tributary stations except the Delaware River, Soldier Creek, and Clark Creek, showed significant improvement. This effect can likely be attributed to normal seasonal variation associated with the colder weather.

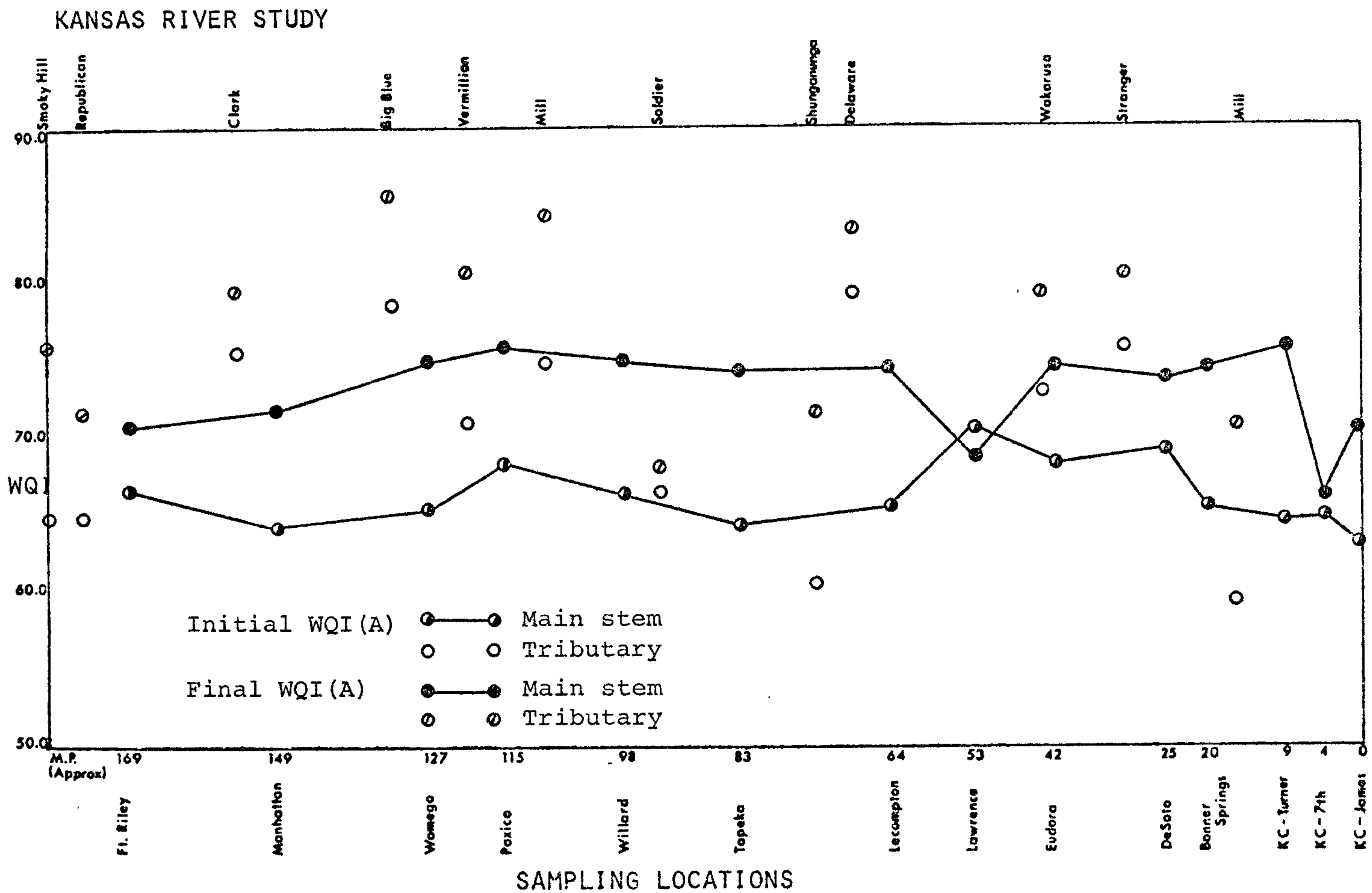

Figure 8. Initial and final WQI(A) values for all sampling stations.

Although no significant variation in quality expressed as mean WQI(A) is demonstrated in the main river over the entire sampling period, short term variations are apparent from the figures in Appendices F and G. WQI(A) versus time is plotted for each station in Figures F-1 through F-26 (Appendix F), and profiles, WQI(A) versus distance, are shown for each sampling day in Figures G-1 through G-36 (Appendix G). In Appendix G, main stem stations are connected by solid lines, tributary stations are shown as isolated points, and flow, from USGS gauging stations, by numbers (as cfs) near the quality designations.

In general, the quality of tributaries is better than that in the main stream (Appendix G); however, Mill and Shunganunga Creeks are frequent exceptions. (Two "Mill" Creek sampling stations are included in the study. These were on two separate creeks, one considerably east (upstream) of the other. Reference to "Mill Creek" quality in the previous statement relates to the creek to the east, near Kansas City.) Bridge construction near the Mill Creek station may have affected the data acquired at this location.

From the figures in Appendix F, it is apparent that quality in rivers and tributaries does vary between sampling periods, and that these variations can be expressed as WQI. This single number expression of nine important water quality parameters is much more meaningful than similar plots of single parameter values, and provides a sound basis for water quality management decision making.

Short term variations at individual stations are shown in the data plotted in Appendix F. The quality changed significantly (±5 WQI units) from sample to sample six times in the main river at Kansas City-James Street (10-14/16, 10-20/22, 10-22/24, 11-07/09, 11-11/13, 11-15/17), and nine times at

Lecompton (10-02/04, 11-11/13, 11-15/17, 11-19/21, 11-23/25, 11-27/29, 11-29/12-02, 12-02/03, 12-03/05). Lecompton was the high frequency station previously reported (Table 6) to be "most variable" on the main river. Most of the variation occurred late in the study. Every other sample from November 09-23, and every sample from November 23-December 05 was significantly different from the sample taken either just before - or just after -, or both. Four individual parameters - PO_4, total solids, turbidity, and BOD_5 - varied appreciably during this period.

Data from Kansas river stations at Topeka and Lecompton and from tributary stations discharging between these two main river stations - Soldier Creek (which receives industrial wastes from a rubber company), Shunganunga Creek, and the Delaware River - are plotted in Figure 9. Data only from days on which all stations were sampled are included. The upstream station, Topeka, is shown in the open circle, solid line format, and the downstream station, Lecompton, in the closed circle, solid line format. The ability of WQI to reflect the effect of tributary contributions on overall quality of the main stream is demonstrated in this figure. During the period 09-26 to 10-04, downstream quality was significantly altered by the relatively poor quality discharged from Shunganunga Creek. Flow in the creek was so low at the time of sampling on 10-04 that the sample depth was two inches (routinely two feet), thus temperature was high; percent DO saturation, low; fecal coliform density, high; etc. Flow in the main stream was also relatively low during this period, thus the apparent effect of the tributary contribution was dramatic. Downstream quality improved on 10-12, apparently as a result of rainfall that provided dilution, and the release of high quality water from Perry Reservoir, and peaked on 10-20 with good quality contributions from all tributary sources. Conversely,

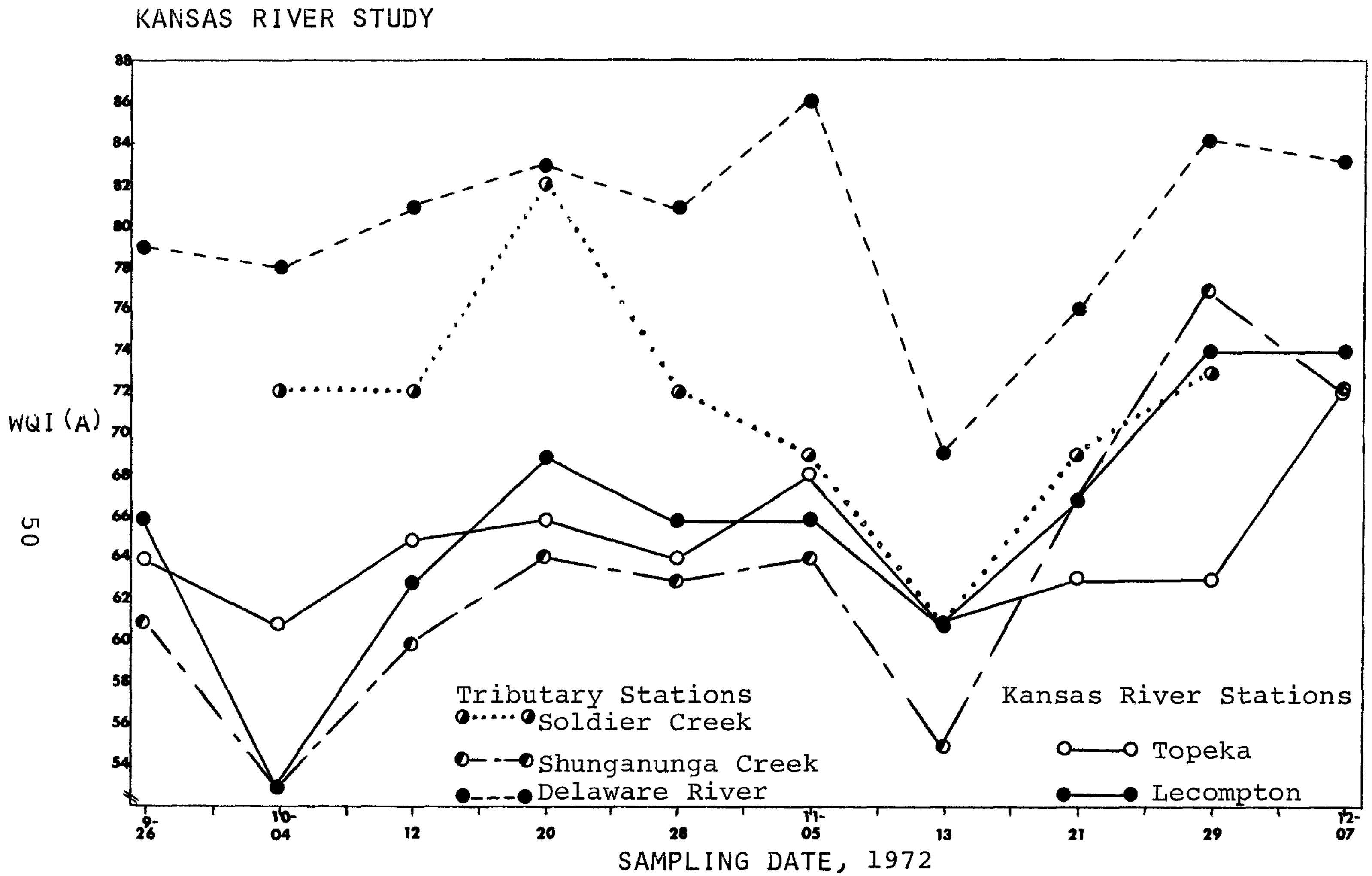

Figure 9. Effect, expressed as WQI(A), of three tributaries on quality in Kansas River at Topeka and Lecompton.

quality dropped in all the tributaries on 11-13, and downstream quality again reflected these changes. Flow on this date was relatively high at all stations - from 1800 cfs on 11-05 at Topeka to 4000 cfs on 11-13; 150 cfs on 11-05 on the Delaware River to 500 on 11-13; 40 cfs on Soldier Creek to 3000 cfs; and 2600 cfs to 5200 cfs at Lecompton. It would appear that these flows had a scouring effect on the streams which reflected in calculated values of WQI. Flows recorded for Topeka, the Delaware River, and Lecompton between the intervals shown in Figure 9 continued to increase, then became relatively consistent for Lecompton; e.g., 11-15, 12,000 cfs; 11-17, 10,000 cfs; 11-19, 9600 cfs; 11-21, 8000 cfs; 11-23, 7400 cfs; 11-25, 7400 cfs; 11-27, 7700 cfs (from Table C-11, Appendix C) - until peak quality was observed on 11-29. With some basic knowledge of the sampling sites, flow characteristics, etc., it is possible to explain the apparent trends in Figure 9, and to use this information to predict future effects of changes in quality at these locations. WQI provides an ideal method for presenting overall quality variations as a function of time and distance. No single parameter data could be used in achieving similar objectives.

Frequency of Sampling, Computing, and Reporting WQI

In determining optimum sampling frequency, "true mean" and "true standard deviation" were computed for the largest data base available; i.e., WQI values for the nine high frequency stations. For every station (i) in this group, there were thirty-seven WQI values [$W_{i,1}$, $W_{i,2}$, $W_{i,3}$..., $W_{i,37}$] which refer to every other sampling day (1, 3, 5, 7..., 37) during the study.

The data record was then divided in half by arranging the WQI's into two sets. Consecutive values in each set now refer to samples taken four days (d) apart; i.e.,

I	II
WQI_{d_1}	WQI_{d_2}
d_3	d_4
d_5	d_6
⋮	⋮
d_{37}	d_{36}

Mean (M_{i_1} and M_{i_2}) and percent deviation (PD_{i_1} and PD_{i_2}) from the mean were calculated for each of these two sets.

To estimate deviation from the true mean if samples were taken every fourth rather than every second day, average percent deviation was calculated. The steps are summarized as follows:

1) $[W_{i,1}, W_{i,2}, W_{i,3} \ldots, W_{i,37}] \rightarrow TM_i$ and TSD_i (3)

where
i = station 1, 2, 3,...9
W = $WQI_1 \ldots WQI_{37}$ at station i
TM = true mean
TSD = true standard deviation

2) $[W_{i,1}, W_{i,3}, W_{i,5} \ldots, W_{i,37}] \rightarrow M_{i,1} \rightarrow PD_{i,1}$

$$= \frac{(TM_i - M_{i,1})}{TM_i} \times 100 \qquad (4)$$

and

$$[W_{i,2}, W_{i,4}, W_{i,6} \ldots, W_{i,36}] \rightarrow M_{i,2} \rightarrow PD_{i,2}$$

$$= \frac{(TM_i - M_{i,2})}{TM_i} \times 100 \qquad (5)$$

3) $APD_i = PD_i = 1/2\ (PD_{i,1} + PD_{i,2})$ (6)

This process was continued for three through 19 sets of sub records; i.e., percent deviation of mean WQI was estimated for samples taken every fourth, sixth, eighth. . . fortieth day versus the "true mean" experienced with sampling every second day. Using this approach, the lowest percent deviation from the true mean occurred for samples taken every sixth day for six of the nine stations.

For all nine stations, twenty-day sampling frequencies provided WQI values with less than (<) 2% average deviation from the mean. If this is sufficient accuracy for routine surveillance programs in the study area, the every twenty-day sampling scheme should be adopted. Results of this analysis are shown in Table 7.

The practice of calculating WQI each time data for all nine parameters are available is recommended. With calculators and computers generally available, calculation of WQI is a simple "next step" in processing water quality data. Hand calculation, though more tedious, is also manageable.

The optimum frequency for reporting WQI is a function of variations in data which may occur as a result of local

Table 7. SAMPLING FREQUENCY

Average % Deviation from "True Mean"

Skip By	Sample Every N Days	KC-James	KC-Turner	Bonner Springs	Eudora	Lecompton	Topeka	Willard	Wamego	Ft. Riley
1	4	0.916	0.931	1.325	0.080	0.390	0.499	0.341	0.930	1.623
2	6	0.485	0.660	0.668	0.388	0.331	0.660	0.762	0.321	0.870
3	8	0.943	0.943	1.333	0.749	0.395	1.115	0.386	0.957	1.630
4	10	0.942	1.402	1.334	1.328	1.246	1.340	1.301	0.399	0.967
5	12	1.255	1.025	1.598	0.889	1.703	1.300	2.300	1.953	2.241
6	14	1.821	1.353	1.738	1.780	1.073	1.106	0.977	1.140	1.483
7	16	1.339	0.947	1.832	1.085	0.656	2.333	1.005	1.562	2.168
8	18	0.908	0.872	1.168	0.848	1.918	1.094	1.523	1.344	1.260
9	20	1.504	1.943	1.648	1.691	1.819	1.389	1.994	1.646	1.804
10	22	2.354	2.431	2.038	1.984	2.689	2.686	2.247	2.422	2.816
11	24	2.119	3.155	2.342	2.184	3.165	2.143	3.013	2.813	3.485
12	26	2.291	2.737	2.623	2.845	2.489	2.754	2.708	1.612	3.302
13	28	2.336	2.613	2.736	2.589	1.836	3.124	1.457	1.985	3.897
14	30	2.387	2.220	2.657	3.196	1.376	2.572	2.307	1.574	3.882
15	32	2.122	2.063	3.005	3.008	2.834	3.533	2.958	2.365	3.357
16	34	2.889	2.588	2.627	3.215	3.775	3.198	3.922	3.264	3.302
17	36	2.896	2.707	3.335	3.184	4.724	3.633	10.161	3.922	3.987
18	38	2.770	3.064	3.136	3.497	4.415	4.162	5.395	4.054	3.641
19	40	3.246	3.818	3.280	3.364	4.386	4.039	5.512	4.086	4.228

conditions. The duration of the field sampling phase of this study was too short to reflect seasonal variations, and improperly timed to be coincident with high temperature, low flow conditions. A firm recommendation for frequency of reporting WQI should be made only when these additional data are available for consideration. Review of statistical data (Appendix E) from the period of observation suggests that reporting only once every three months or more is sufficient to indicate water quality conditions during the fall months.

By applying least squares regression, four parameters were shown to account for more than 90% of the variance in WQI over the period of observation. Results of these analyses are summarized in Table 8. The summary is grouped to include 1) all data and 2) all main stem river stations. Although the same four parameters are indicated in both groups of data, variation in their relative importances is noted. By difference, it is apparent that fecal coliform density accounts for most of the variance in quality at tributary stations but is a considerably less important parameter at river stations. Although there is no adequate substitute for adopting a uniform method of reporting water quality, this information, when related to costs for laboratory analysis of each parameter, is useful in planning routine data acquisition programs. In reporting WQI all nine parameters in the expression must be measured. However, more frequent analysis of fewer parameters may be used to show intermittent trends in stream quality, particularly at critical locations.

Table 8. REGRESSION ANALYSIS OF WQI PARAMETERS BY FORWARD SELECTION

All Data (From Quality Ratings)		All River Stations (From q_i)	
Parameter	R^2	Parameter	R^2
Fecal coliforms	.524	BOD_5	.407
BOD_5	.726	Turbidity	.718
Turbidity	.826	PO_4	.843
PO_4	.916	Fecal coliforms	.904
- - -	- - -	- - -	- - -
DO (% Sat)	.956	Total solids	.938
Total solids	.987	DO (% Sat)	.973
pH	.997	pH	.994
$NO_3 + NO_2$	1.000	$NO_3 + NO_2$	1.000

SECTION VIII

SPECIAL STUDIES

Parameter Correlations

In field application of WQI, the feasibility of parameter substitution is frequently discussed. To establish the effect of modifying parameters, as well as reducing the number of total parameters in the index expression, laboratory analysis in this study was extended to include 15 parameters for all samples, and 17 parameters on 11 predetermined sampling days. Analytical data for all samples included the following measurements:

- all nine parameters in WQI, plus
- conductivity, μmhos/cm
- suspended solids, mg/l
- ammonia, mg/l NH_3-N
- chlorides, mg/l
- total coliform density, #/100 ml
- fecal streptococci, #/100 ml

Analytical data for samples collected on 9-28, 10-6, 10-10, 10-18, 10-26, 11-3, 11-11, 11-15, 11-19, 11-27, and 12-5 included two additional parameters:

- chemical oxygen demand (COD), mg/l and
- total organic carbon (TOC), mg/l.

Correlation coefficients for eight selected pairs of parameters are shown in Table 9: total solids versus conductivity, total solids versus suspended solids, turbidity versus suspended solids, fecal coliforms versus total coliforms, and fecal coliforms versus fecal streptococci.

Table 9. CORRELATION COEFFICIENTS FOR SELECTED PARAMETERS

Parameters	All Data R @ 95. = .083 R @ 99. = .109	All River Stations R @ 95. = .094 R @ 99. = .123
Total solids versus Conductivity	.385	.456
Total solids versus Suspended solids	.742	.575
Turbidity versus Suspended solids	.932	.937
Fecal coliforms versus Total coliforms	.855	.849
Fecal coliforms versus Fecal streptococci	.165	.131

In each pair, the parameter in WQI is listed first; the related parameter follows.

Data are grouped to include all data, and all main river stations, with correlation coefficients expressed at 95 and 99 percent levels of confidence.

The degree of correlation at 95 and 99 percent confidence levels was determined for each individual station included in the study. These data are summarized in Table 10. Results of individual station correlation are shown in Appendix H. From the summary (Table 10), it is apparent that suspended solids can be substituted for turbidity measurements, and total coliforms for fecal coliforms with a high level of confidence. Other parameters were not shown to be closely related.

Hourly Variations

One twenty-four-hour study was undertaken on November 6, 1972 from the 7th Street Bridge in Kansas City. Samples were taken every two hours and brought to the laboratory for measurement of the nine parameters in WQI. Data for each individual parameter and the WQI's are listed in Table 11. No significant variations in WQI occurred during this period; however, the data may have been affected by heavy rainfall at 1000, 1200, and 1400 hours and light rain at 1600 and 1800 hours. Flow rate was not measured, thus actual effects of the rainfall are not determined. It is entirely possible that flow patterns for storm water discharge followed the banks too closely for detection at midstream, where samples for this study

Table 10. CORRELATIONS - SUMMARY

Parameters	Kansas River Stations No. @99%	Kansas River Stations No. @95%	Kansas River Stations No. ≠	Tributary Stations No. @99%	Tributary Stations No. @95%	Tributary Stations No. ≠
Total solids versus Conductivity	0	2	12	3	2	7
Total solids versus Suspended solids	6	1	7	6	0	6
Turbidity versus Suspended solids	14	0	0	10	1	1
Fecal coliforms versus Total coliforms	8	3	3	10	1	1
Fecal coliforms versus Fecal streptococci	0	1	13	4	2	6
BOD_5 versus COD	1	0	8	-	-	-
BOD_5 versus TOC	0	1	8	-	-	-
Fecal coliforms versus TOC	0	1	8	-	-	-

Table 11. HOURLY VARIATIONS

Kansas River at Kansas City-7th Street

Quality Ratings and WQI

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%DO Sat	WQI(A)
11/06	0200	17.4	88.6	66.5	94.9	71.7	94.9	52.5	37.5	92.9	69.0
11/06	0400	15.7	88.7	61.0	94.9	92.5	94.9	52.5	42.8	93.0	70.7
11/06	0600	17.7	85.7	71.2	94.8	49.7	94.9	53.3	38.8	91.6	66.9
11/06	0800	14.0	87.3	71.2	94.8	92.5	94.9	53.3	34.2	93.3	70.8
11/06	1000	12.9	85.7	65.7	94.8	67.2	94.9	53.3	42.8	92.6	67.9
11/06	1200	13.1	84.3	61.0	94.7	64.5	94.9	54.1	45.7	94.2	67.6
11/06	1400	10.7	84.9	51.5	94.9	63.6	94.9	55.8	37.5	94.8	65.9
11/06	1600	12.6	86.2	50.9	94.9	87.1	94.9	55.0	40.1	94.8	68.7
11/06	1800	17.1	84.0	59.4	95.0	68.1	94.9	55.8	42.8	92.1	67.9
11/06	2000	14.8	86.2	64.1	95.1	90.7	94.9	55.8	35.9	91.1	69.9
11/06	2200	14.4	84.3	63.4	95.2	72.6	94.9	55.8	45.7	89.5	68.2
11/06	2400	15.2	86.0	67.3	95.3	93.5	94.9	57.8	40.1	87.5	70.4

were obtained. There is no reason to assume that sampling or analytical errors contributed to the uniform quality reflected in reported WQI.

Transverse and Vertical Variations

On December 5 and 8, 1972, samples were taken from a boat to reflect transverse and vertical variations in Kansas River quality at the Kansas City-7th Street sampling station. A profile of the stream at this station is shown in Figure 10. Sampling sites for both studies are indicated on the profile. Points 1, 3, and 5 are two feet below the water surface. Point 2 is six feet, Point 4 is seven feet, and Point 6 is eight feet below the surface.

On December 5th, beginning at 0830 hours, samples were taken in sequence from each of the six points indicated in Figure 10. A single bottle Dunker sampler, flamed at the inlet tube and in the chamber with a propane torch, was used for sampling. Sampling was repeated at each point in sequence beginning at 1000 hours and again at 1100 hours. Microbiological data obtained from this study are reported in Table 12.

In a similar study on December 8th, two sets of samples were taken at approximately three hour intervals from the same six points, beginning at about 1000 hours. These samples were analyzed for the nine parameters in WQI. Samples for fecal coliforms were taken with a flamed Dunker sampler. Samples for all other parameters were obtained in a Kemmerer sampler and transported to the laboratory in cubitainers. Data from this study are shown in Table 13. Little if any significant change is apparent over the period of observation.

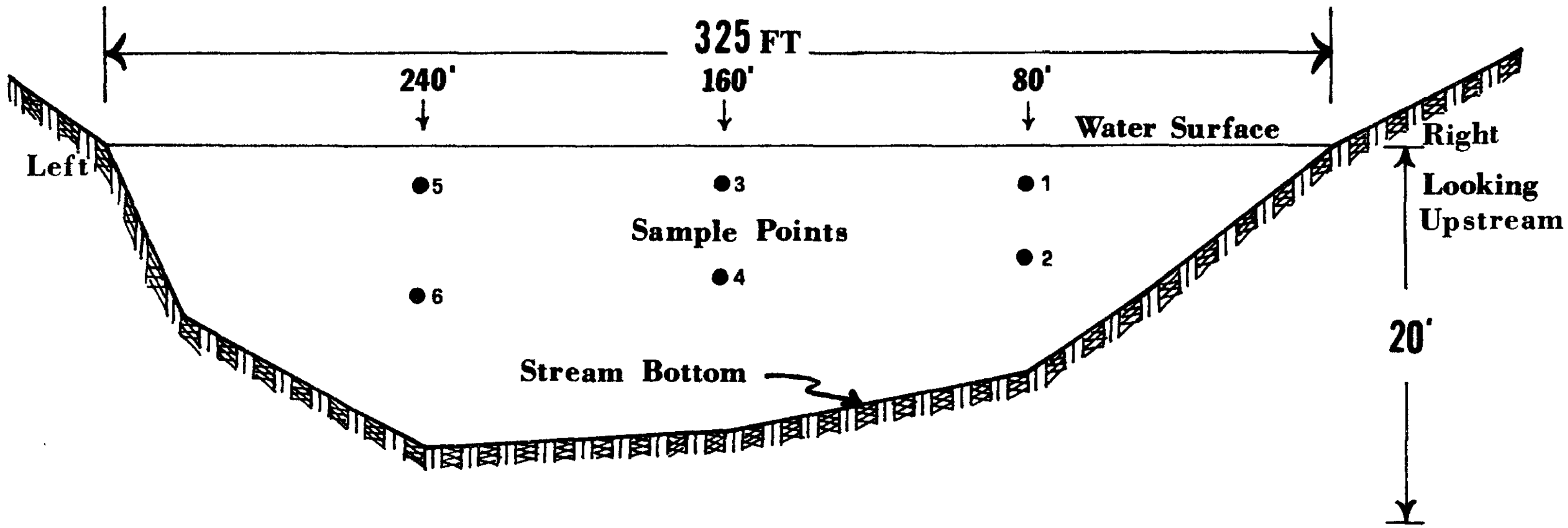

Figure 10. Profile of Kansas River at 7th Street Bridge
Kansas City, Kansas
December 1972

Table 12. RESULTS OF MICROBIOLOGICAL STUDY
KANSAS RIVER AT KANSAS CITY-7TH STREET
December 5, 1972

Time	Pt. No.	Total Coliforms	Fecal Coliforms	Fecal Streptococci
0830	1	45,000	3,700	2,300
	2	62,000 (1)	4,100	2,600
	3	46,000	2,800	1,900
	4	41,000	3,500	1,200
	5	49,000	3,600	1,300
	6	38,000	3,600	1,700
1000	1	40,000	5,700 (1)	1,500
	2	59,000	4,600	1,900
	3	40,000	3,800	1,700
	4	35,000	3,400	1,500
	5	31,000	3,200	1,700
	6	35,000	3,100	1,400
1100	1	55,000	5,600	2,800 (1)
	2	48,000	3,800	2,300
	3	35,000	4,300	2,200
	4	40,000	5,300	1,400
	5	39,000	2,900	1,400
	6	28,000 (2)	2,600 (2)	1,100 (2)

(1) Maximum

(2) Minimum

Table 13. DATA FROM STUDY OF TRANSVERSE AND VERTICAL QUALITY VARIATIONS IN THE KANSAS RIVER AT KANSAS CITY-7TH STREET

Individual Parameters and WQI

Date, 1972	Time	Pt. No.	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp (°C)	Turb	Total Solids	DO (mg/l)	WQI (A)
12/08	0957	1	3800	8.0	2.1	0.86	0.32	1.0	37	540	13.4	68.0
12/08	1010	2	3900	8.0	2.0	0.88	0.06	1.0	27	490	13.2	72.1 (1)
12/08	1033	3	4500	7.9	1.6	0.89	0.23	0.0	26	490	13.8	71.1
12/08	1050	4	4700	7.9	1.5	0.85	0.18	0.0	26	490	13.8	71.7
12/08	1107	5	2300	8.1	1.15	0.86	0.27	0.0	30	480	13.3	70.8
12/08	1135	6	1700	7.8	1.55	0.88	0.24	0.0	29	470	13.75	72.1 (1)
12/08	1240	1	5600	8.0	1.3	0.90	0.20	1.0	30	470	10.2	67.9
12/08	1247	2	3600	8.2	1.7	0.90	0.25	1.0	34	490	10.5	66.6 (2)
12/08	1258	3	2100	8.1	1.5	0.91	0.15	0.0	30	470	11.45	70.0
12/08	1320	4	2000	8.1	1.45	0.90	0.04	0.0	27	490	10.15	69.1
12/08	1333	5	1900	7.9	1.5	0.90	0.07	0.0	30	470	11.65	71.6
12/08	1345	6	2700	8.05	1.45	0.89	0.27	0.0	29	480	11.6	69.1

(1) Maximum

(2) Minimum

Biological Sampling

At the outset of this project, it seemed desirable to attempt to relate biological data to WQI by installing rock filled sampling baskets at various locations in the stream and observing the diversity of species which collected on the rocks over a period of six weeks. On October 17, 1972, five sets (two each) of baskets were installed: one set in the Kansas River at Lecompton, one at Willard, two at Fort Riley, and one in Soldier Creek. Within the first week, all but two sets, at Lecompton and Willard, were vandalized. These two sets remained intact and were retrieved on November 28th.

The organisms which persisted are identified in Appendix I. The sample size was too small for statistical analysis of species diversity, richness, evenness, redundancy, dominance, etc.; however, the taxa identified can be said to represent a stable community composed of predators, filter feeders, grazers, and other omnivores. The diversity of this community and its food and feeding habits would characterize the following conditions of its aquatic environment:

1) Fairly rapidly moving water (0.6-1.5 ft/sec.) which contains phytoplankton, detached algae, and other suspended materials,
2) Bottom composed mostly of rubble, gravel, and some sand which is covered with periphyton (attached algae) and aquatic moss,
3) Oxygen levels usually above 80% saturation. This is particularly true of water at Willard where three species of stoneflies (Plecoptera) were found. (This group

usually is the first to be eliminated when oxygen concentration is decreased.)

4) Turbidity (silt, shifting sand) relatively low at Willard during this period of observation. Stoneflies (Plecoptera) and mayflies (Ephemeroptera) are well represented.

5) A more stable community at Willard than that at Lecompton, suggesting better water quality at Willard. This observation is supported by WQI(M) calculation reported in Table 6.

SECTION IX

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SECTION X

APPENDICES

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WATER QUALITY INDEX

DISSOLVED OXYGEN

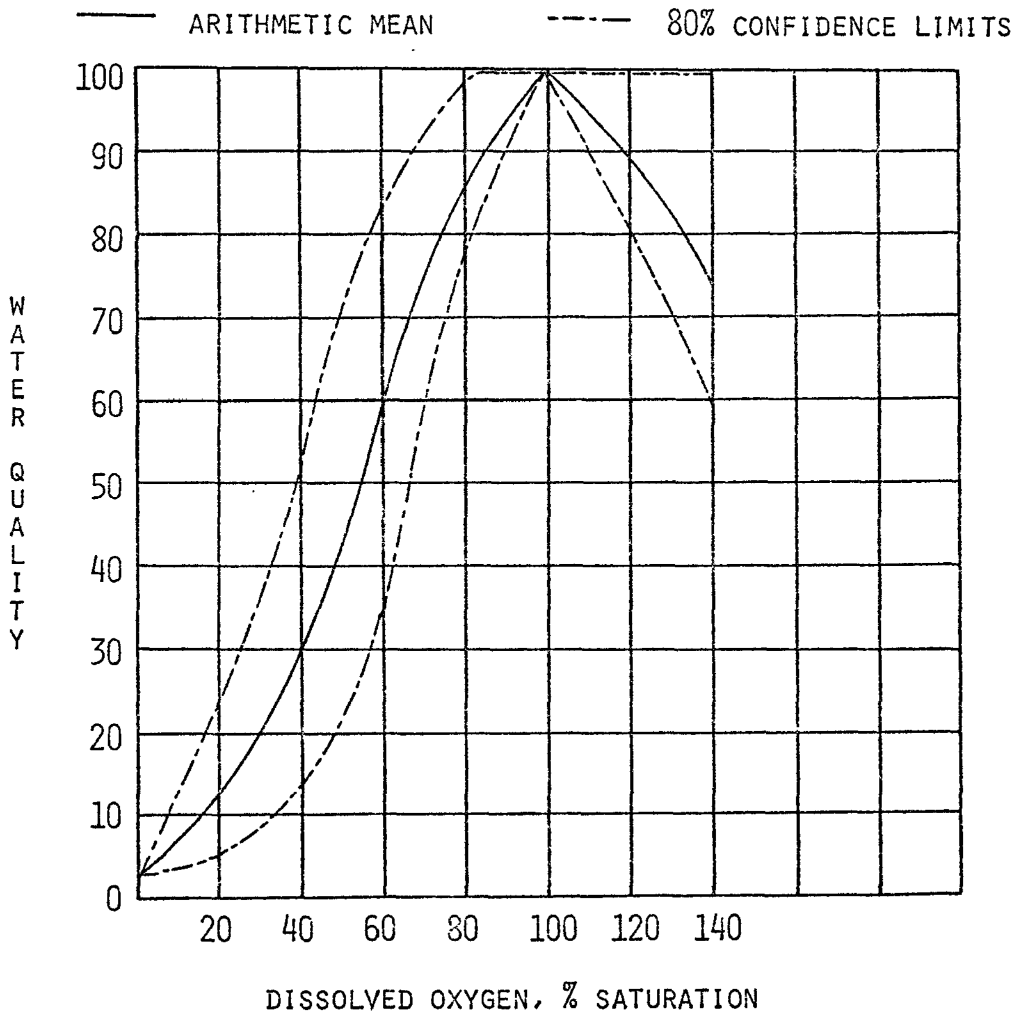


Figure A-1

W = 0.17

NOTE:
FOR D.O. >140% SAT, q_i = 50.

WATER QUALITY INDEX

FECAL COLIFORMS

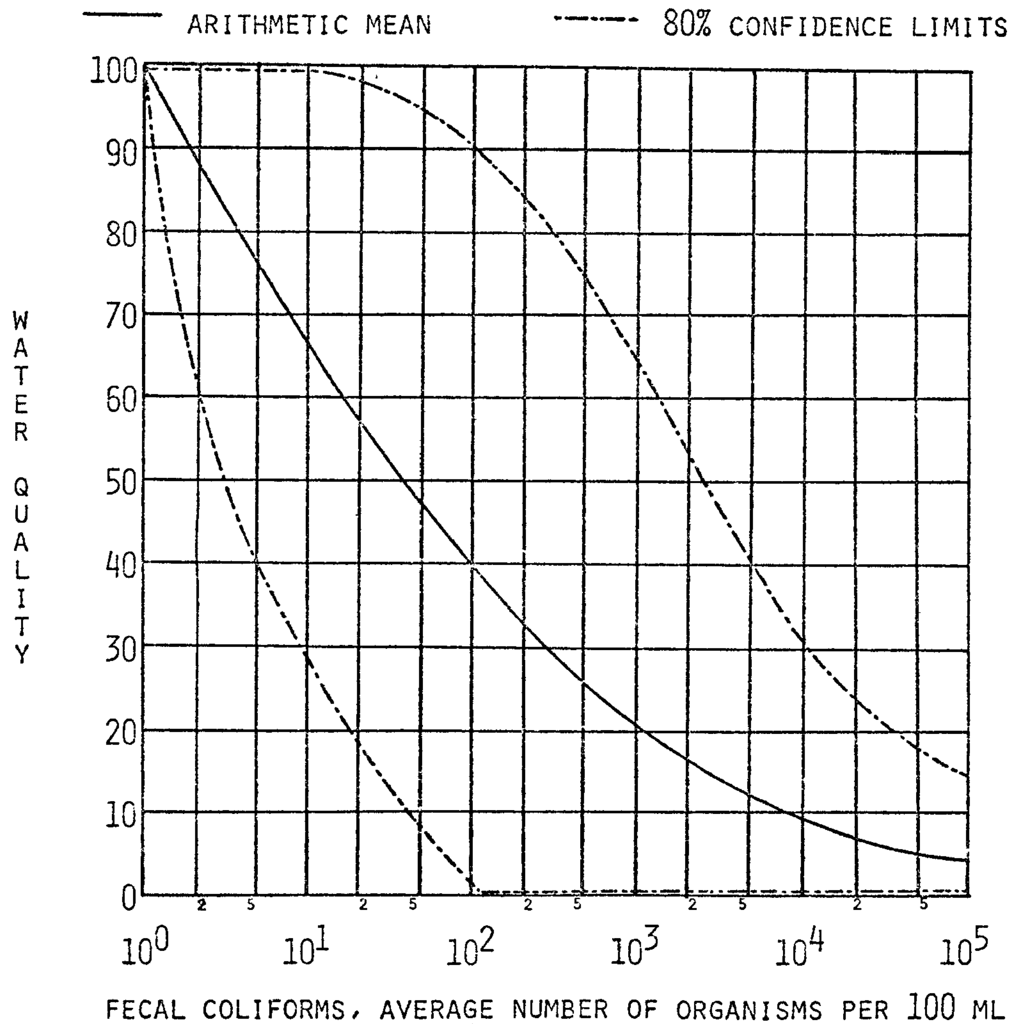
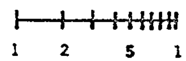


Figure A-2

W = 0.15



KEY FOR LOG SCALE INTERPOLATION

NOTE:
FOR F.C. >10(5)/100ML
q_i = 2.

WATER QUALITY INDEX

pH

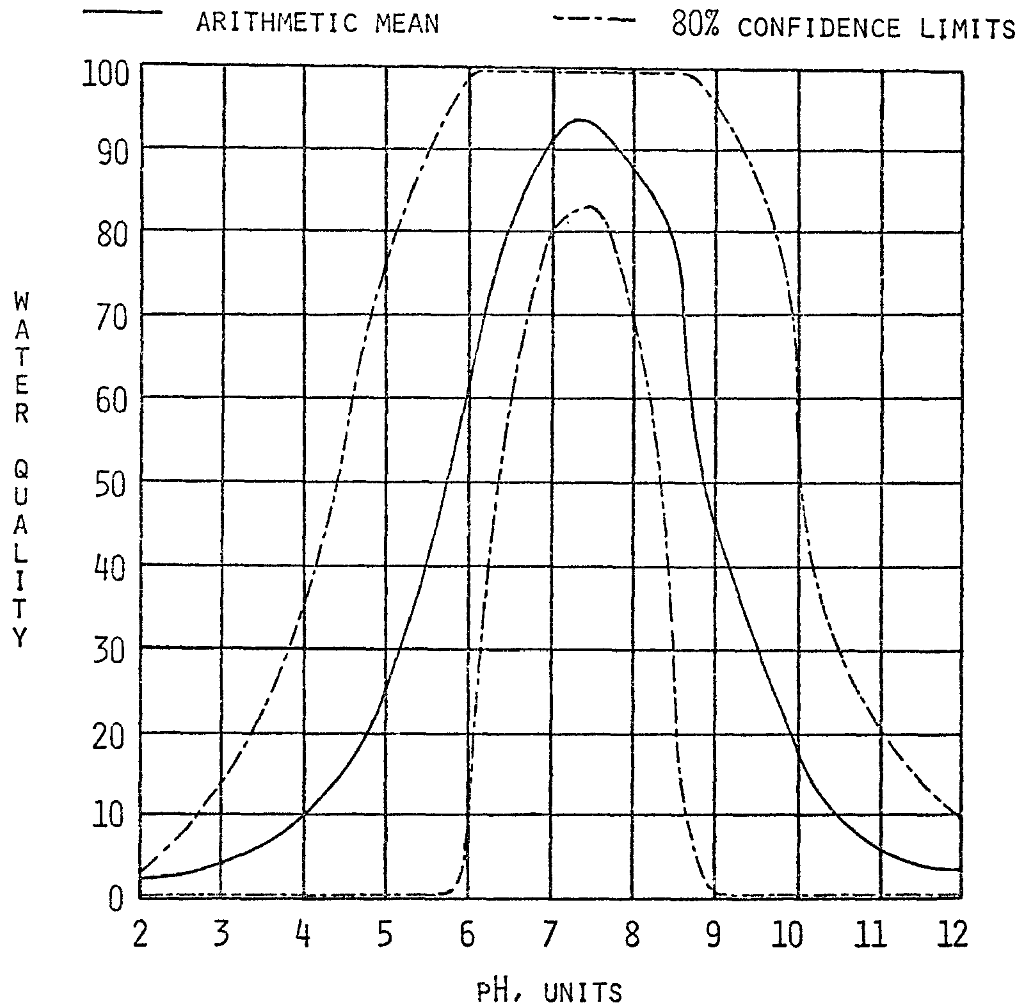


Figure A-3

W = 0.12

WATER QUALITY INDEX

BOD_5

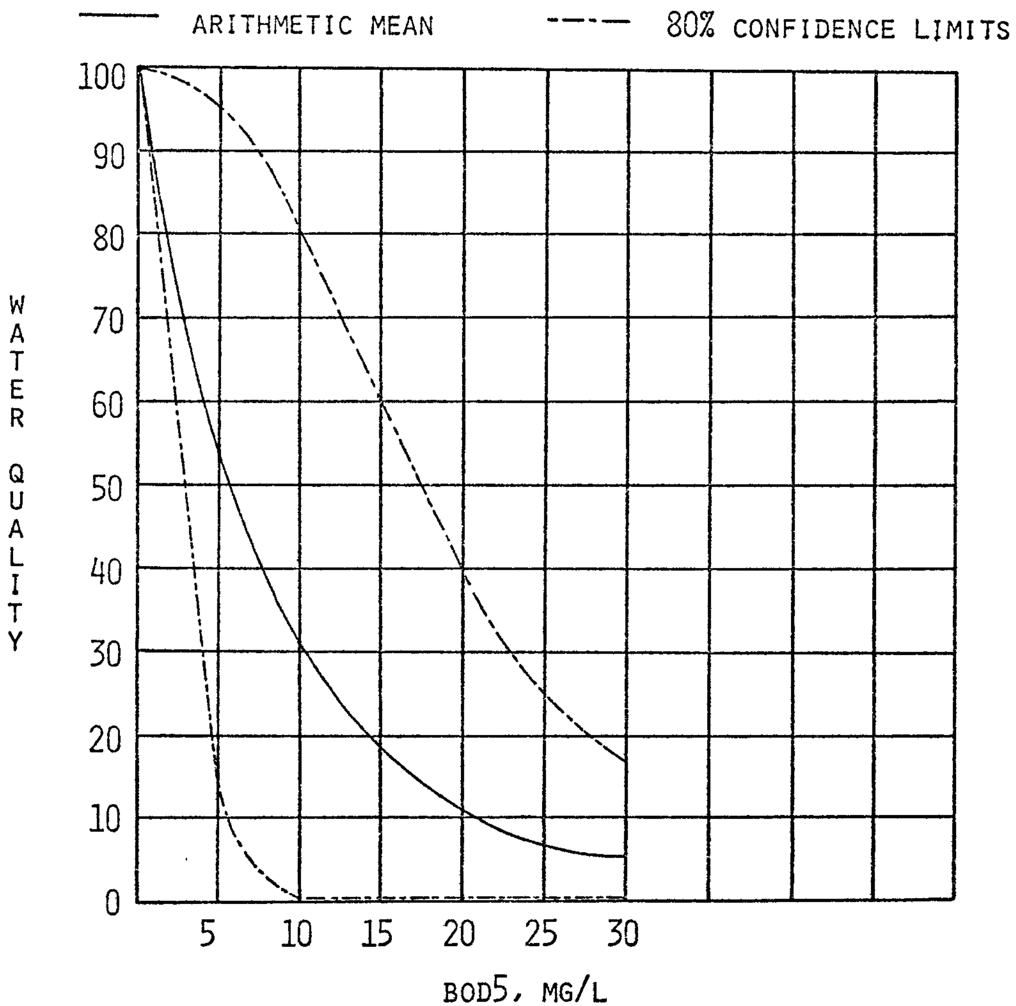


Figure A-4

W = 0.10

NOTE:
FOR BOD_5 >30, q_i = 2.

WATER QUALITY INDEX

NITRATES

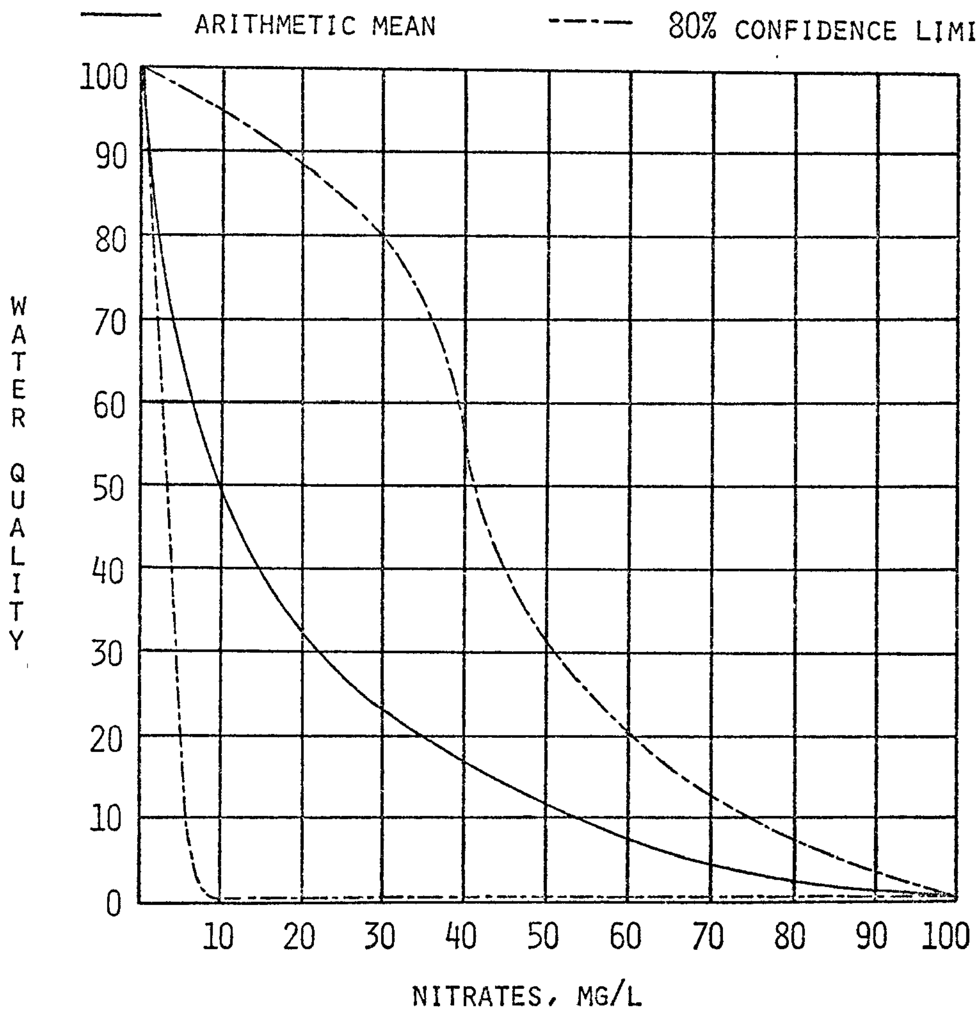


Figure A-5

W = 0.10

NOTE:
FOR NITRATES >100 MG/L
q_i = 1.

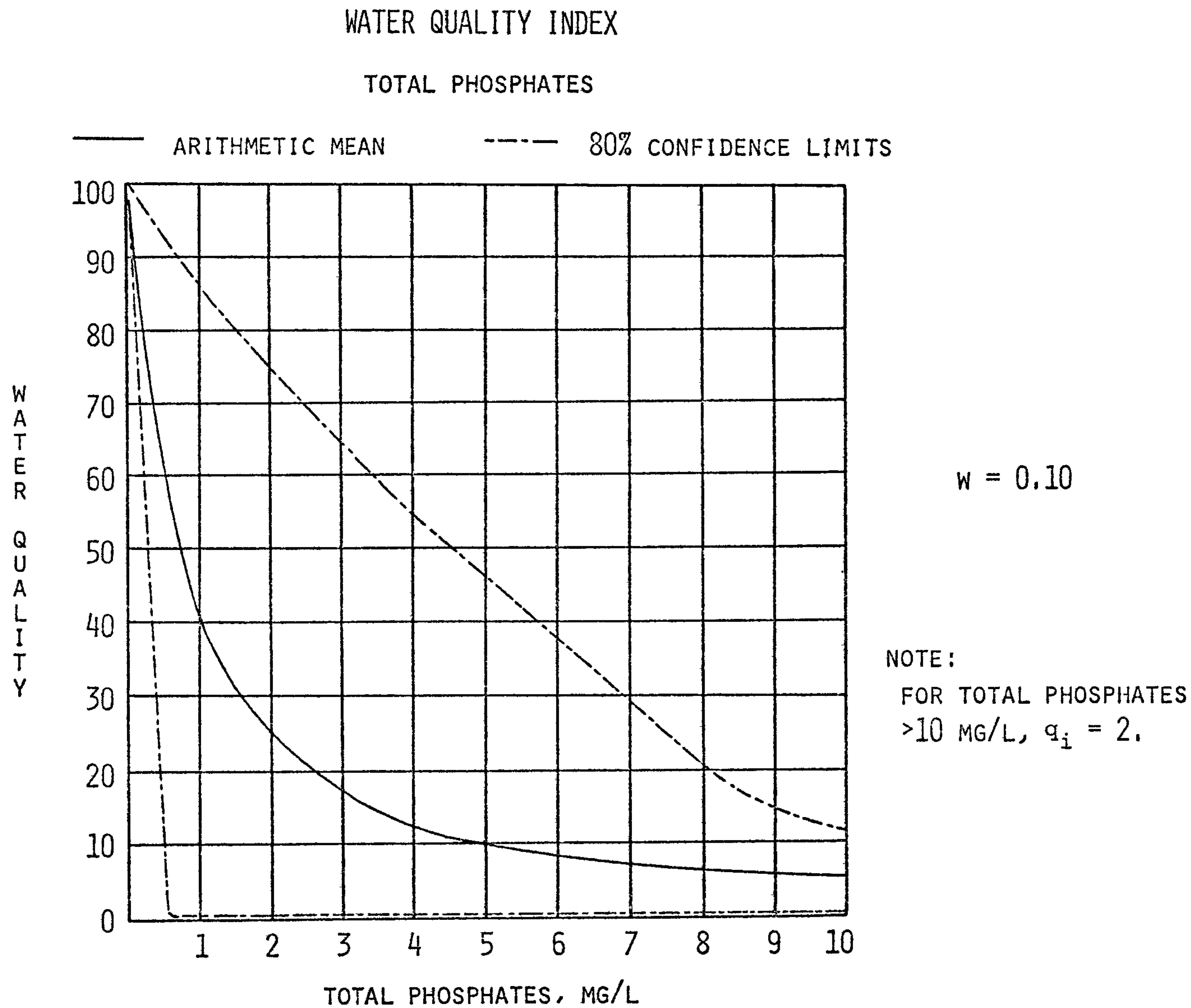
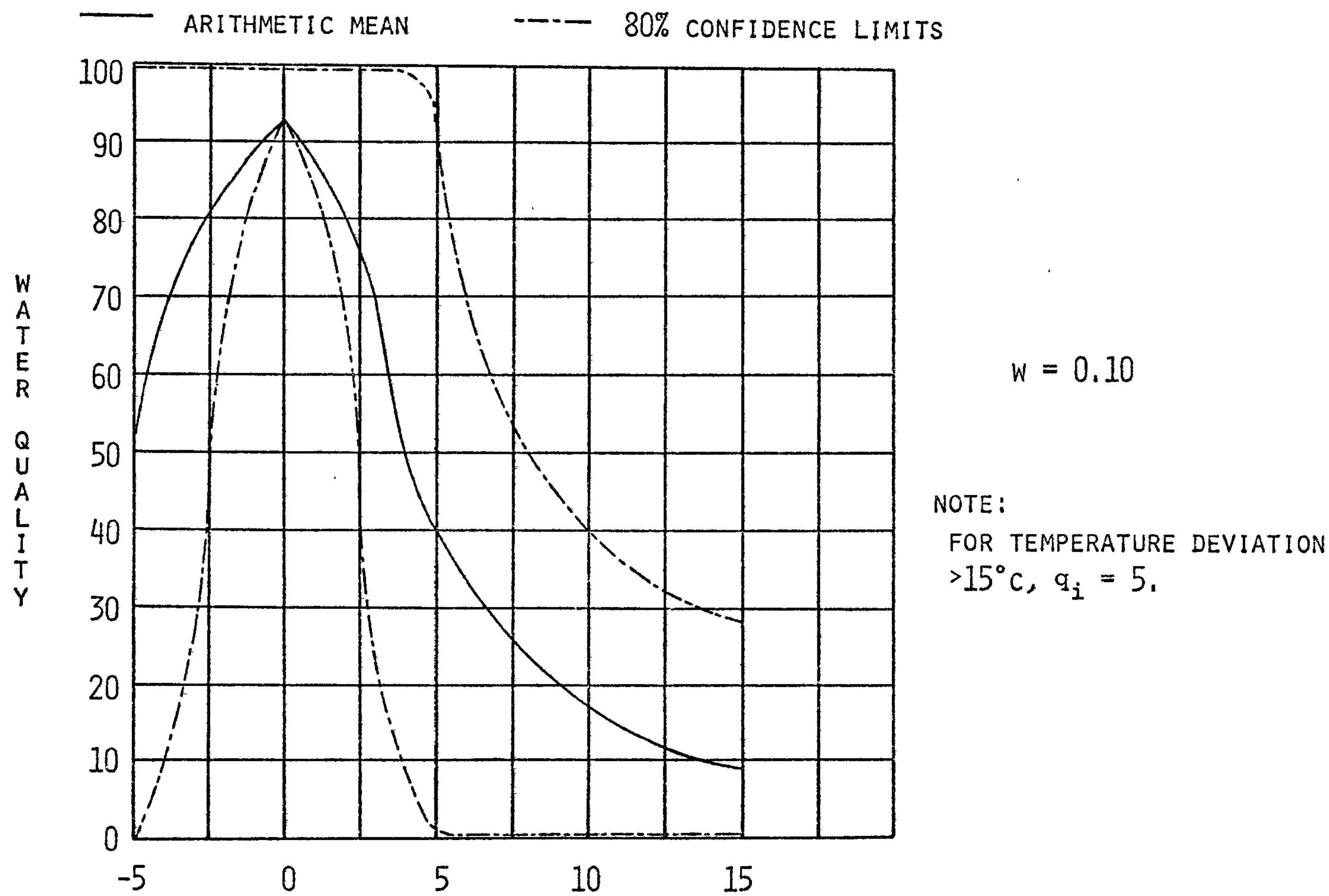

WATER QUALITY INDEX
TOTAL PHOSPHATES
ARITHMETIC MEAN
80% CONFIDENCE LIMITS
100
90
80
70
60
50
40
30
20
10
0
WATER QUALITY
1 2 3 4 5 6 7 8 9 10
TOTAL PHOSPHATES, MG/L
W = 0.10
NOTE:
FOR TOTAL PHOSPHATES
>10 MG/L, q_i = 2.

Figure A-6

WATER QUALITY INDEX

TEMPERATURE



TEMPERATURE, DEGREES CENTIGRADE DEPARTURE FROM EQUILIBRIUM TEMPERATURE (0)

Figure A-7

WATER QUALITY INDEX

TURBIDITY

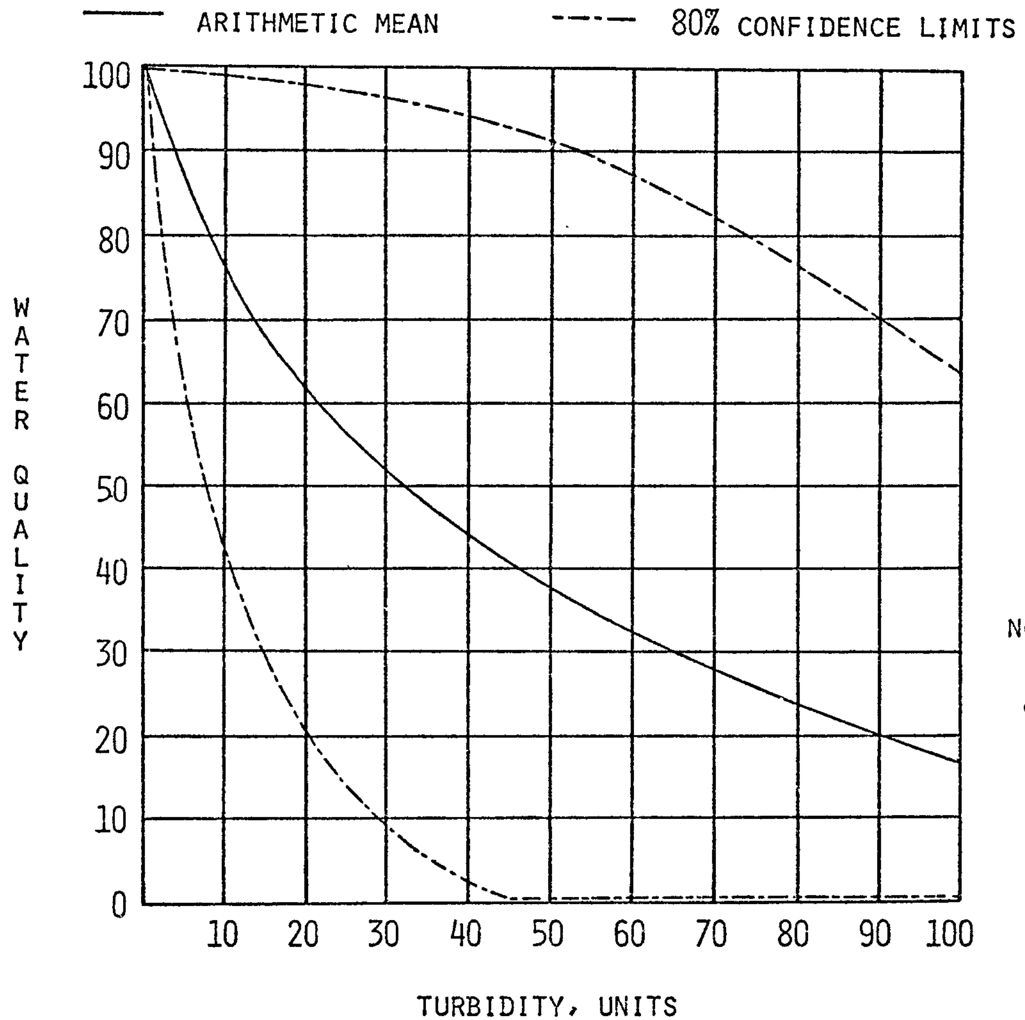
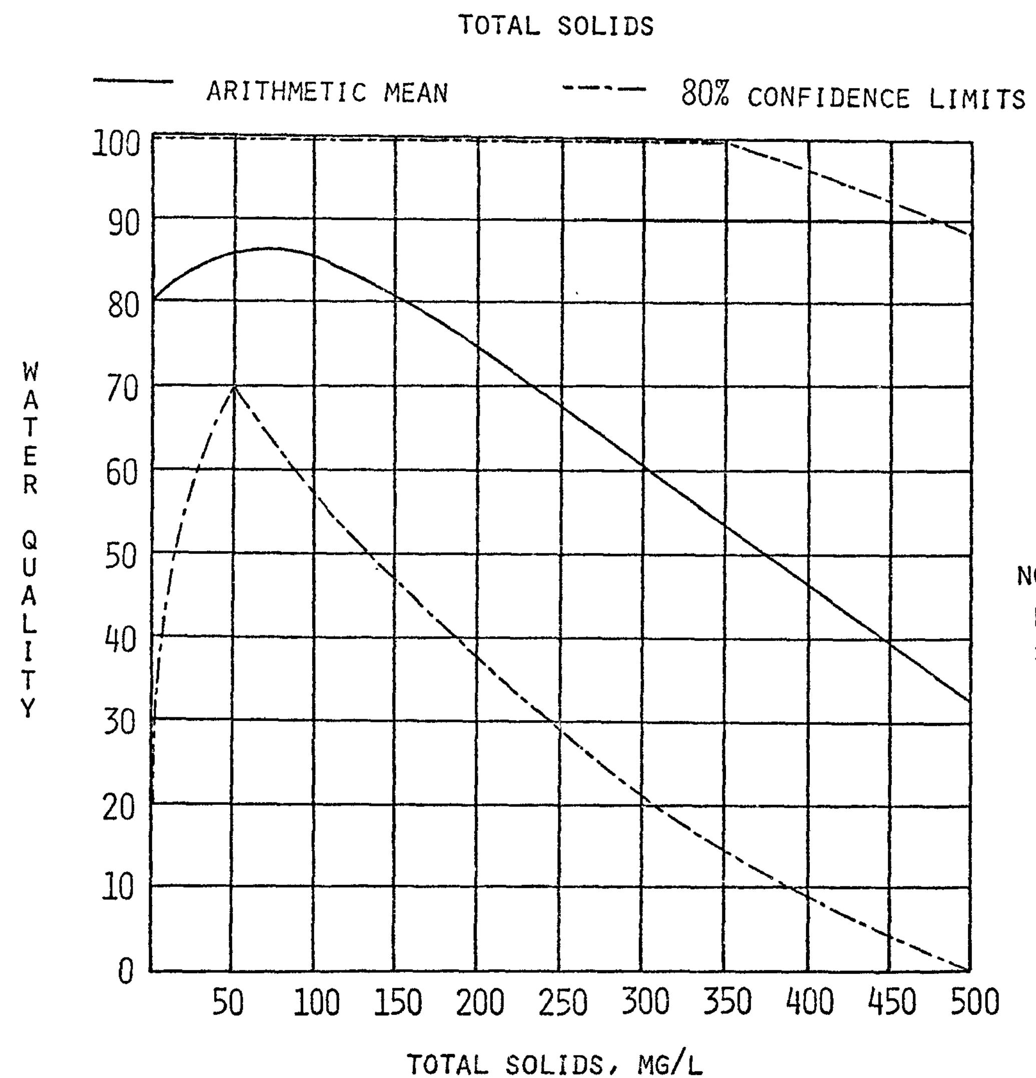


Figure A-8

W = 0.08

NOTE:
FOR TURBIDITY >100 JTU
$q_i = 5$.

WATER QUALITY INDEX



W = 0.08

NOTE:
FOR TOTAL SOLIDS >500 MG/L, q_i = 20.

Figure A-9

APPENDIX B

OVERALL SAMPLING SCHEME

KANSAS RIVER STUDY

	Sampler Stationed in Kansas City	Sampler Stationed in Topeka
H: High Frequency Stations Every 2nd day	On west to east days: #1, 3, 5, 8, 11, 14, 16, 20, 24	On east to west days: #1, 3, 5, 8, 11, 14, 16, 20, 24
M: Medium Frequency Stations Every 4th day	#2, 6, 10, 12	#18, 21, 22, 25, 26
L: Low Frequency Stations Every 8th day (plus 1 extra day)	#4, 7, 9	#13, 15, 17, 19, 23

Table C-1. DATA FROM KANSAS RIVER AT KANSAS CITY-JAMES STREET

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2+NO_3 [1] mg/l	NH_3 [2] mg/l	TPO_4 [3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0820	22.0	8.0	7.3	2.9	551	1.00	0.27	0.39	42	70	580	228	190	7600	3200	-	7.1	-
09/28	1400	21.0	8.2	8.4	4.9	536	0.51	0.48	0.27	45	59	500	112	100	15000	320	27.1	-	-
09/30	1120	18.0	8.2	8.5	5.2	595	0.34	0.57	0.29	56	51	530	140	44	1800	280	-	-	-
10/02	1405	17.0	8.7	11.2	6.7	663	0.47	0.37	0.52	60	42	570	111	300	6200	2700	-	-	-
10/04	0708	18.0	8.7	9.0	6.4	722	0.11	0.69	0.81	60	45	440	110	69	3000	3200	-	-	-
10/06	0725	18.5	8.4	9.9	6.5	650	-	-	0.10	68	36	470	96	250	4700	1300	50.4	8.0	-
10/08	0730	17.0	7.9	6.1	7.1	769	0.02	0.09	0.27	87	41	550	99	74	5400	2100	-	-	-
10/10	0735	16.5	8.0	9.3	8.7	854	0.02	0.25	0.49	109	35	560	117	81	3700	600	36.3	10.8	-
10/12	1240	18.5	7.9	7.9	8.7	844	0.02	0.05	0.20	101	27	560	75	67	7000	650	-	-	-
10/14	1335	18.5	7.8	7.0	8.5	823	0.04	0.05	0.30	111	29	600	44	100	16000	3900	-	-	-
10/16	0735	16.0	8.3	8.9	8.2	862	0.02	0.04	0.07	102	27	590	51	59	3300	230	-	-	-
10/18	0720	13.0	8.1	9.8	10.6	801	0.01	0.05	0.57	101	20	660	34	64	3300	630	24.0	11.2	-
10/20	1340	10.0	8.1	11.2	10.9	839	0.00	0.03	0.16	104	18	530	51	62	4400	1200	-	-	-
10/22	1450	11.0	8.4	11.4	9.5	956	0.37	0.24	1.34	116	18	650	25	200	4300	6500	-	-	-
10/24	1720	9.5	8.0	10.6	7.1	1047	0.54	0.25	0.54	130	19	680	36	19	860	20000	-	-	-
10/26	0805	9.0	8.2	11.9	6.6	992	0.69	0.21	0.54	125	22	620	37	13	1400	980	33.0	7.1	-
10/28	0640	11.0	8.0	10.5	6.0	893	0.55	0.18	0.46	114	18	620	47	25	600	510	-	-	-
10/30	0800	12.5	8.3	11.9	6.6	980	0.35	0.21	0.36	109	16	600	25	19	1600	670	-	-	-
11/01	0745	12.0	8.2	8.5	6.5	985	1.24	0.69	0.50	102	17	660	41	54	4300	1100	-	-	-
11/03	1335	10.0	8.3	10.6	5.1	896	0.67	0.34	0.31	109	18	580	36	32	3100	2800	17.0	7.0	-
11/05	0910	10.0	7.9	9.1	4.5	730	0.70	0.22	0.37	72	27	460	37	32	1300	1900	-	-	-
11/07	1430	11.0	7.9	9.5	4.4	766	0.65	0.21	0.62	83	21	595	33	44	2100	4900	-	-	-
11/09	0805	9.0	7.8	9.4	4.0	713	0.73	0.22	0.00	69	35	440	30	24	3000	3900	-	-	-
11/11	0639	9.0	7.8	8.9	3.2	663	0.95	0.31	0.33	58	42	450	35	-	1900	1800	20.0	15.9	-
11/13	1355	8.0	7.7	9.8	4.9	479	0.90	0.23	0.40	35	85	540	120	77	14000	13000	-	-	-
11/15	1340	5.5	7.7	10.1	6.8	479	0.88	0.15	0.91	26	460	1660	840	170	12000	21000	85.0	21.0	-
11/17	1115	4.0	7.8	11.6	4.5	349	0.87	0.15	0.24	23	190	880	380	200	9800	48000	-	-	-
11/19	0640	3.5	7.9	12.1	4.5	320	1.24	0.17	0.05	40	250	800	460	90	5800	17000	47.0	19.5	-
11/21	1115	3.5	7.8	12.0	3.8	492	1.35	0.20	0.18	27	220	700	386	73	2900	7000	-	-	-
11/23	1245	5.0	7.7	11.9	2.2	530	1.10	0.21	0.46	29	120	560	183	49	4400	5500	-	-	-
11/25	0825	4.5	7.7	11.5	4.5	510	0.78	0.29	0.14	23	71	400	186	57	5000	1400	-	-	-
11/27	1335	4.5	8.0	11.7	1.7	534	1.10	0.19	0.38	29	54	500	164	35	2000	2600	-	12.7	-
11/29	1305	4.5	8.1	12.2	2.3	567	0.97	0.19	0.30	27	76	550	214	30	2400	3000	-	-	-
12/02	1250	6.0	7.9	11.6	1.8	572	0.94	0.17	0.10	33	61	510	165	37	3400	3200	-	-	-
12/03	1120	4.0	8.2	11.7	1.7	590	1.13	0.36	0.22	30	43	500	77	49	3600	870	-	-	-
12/05	1435	1.0	8.1	12.6	2.3	580	0.94	0.31	0.10	32	87	650	294	33	4000	1500	-	7.3	-
12/07	0710	0.0	8.1	12.6	1.8	709	0.90	0.33	0.07	36	48	430	141	110	3600	2800	-	-	-

(1) & (2) as N (3) as P

KANSAS RIVER STUDY

Table C-2. DATA FROM KANSAS RIVER AT KANSAS CITY-7TH STREET

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2 + NO_3 [1] mg/l	NH_3 [2] mg/l	TPO_4 [3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0905	23.0	8.2	7.7	3.5	562	0.87	0.19	0.33	41	47	450	112	260	16000	700	-	-	-
09/30	1052	17.0	8.6	9.0	4.7	640	0.31	0.48	0.37	56	40	510	89	100	9100	530	-	-	-
10/04	0736	17.0	8.6	8.3	5.8	728	0.18	0.77	0.39	60	38	520	90	16	2100	3200	-	-	-
10/08	0755	16.3	8.2	8.0	7.7	807	0.01	0.14	0.22	89	36	580	81	49	2300	400	-	-	-
10/12	1215	18.5	7.6	7.5	8.6	831	0.01	0.03	0.40	103	24	540	72	39	6900	580	-	-	-
10/16	0805	15.5	8.2	9.5	8.1	852	0.01	0.04	0.30	104	23	550	39	52	2600	500	-	-	-
10/20	1310	8.5	8.4	13.0	10.2	866	0.00	0.03	0.17	108	18	570	62	57	3200	2100	-	-	-
10/24	1655	10.0	8.1	12.0	7.0	1066	0.55	0.20	0.50	128	21	710	46	27	2300	7200	-	-	-
10/28	0705	11.0	8.2	11.1	6.0	921	0.25	0.08	0.33	122	22	665	53	26	600	360	-	-	-
11/01	0815	12.5	8.3	9.7	6.0	964	0.57	0.22	0.31	105	22	680	46	31	3000	980	-	-	-
11/05	0935	9.5	7.9	9.8	3.8	697	0.66	0.19	0.26	67	31	490	39	30	2200	2200	-	-	-
11/09	0850	9.5	8.0	10.0	3.4	725	0.62	0.09	0.26	74	45	390	84	33	2700	4100	-	-	-
11/13	1325	8.0	7.8	10.3	3.4	489	0.90	0.17	0.09	32	150	540	160	60	5000	16000	-	-	-
11/17	1050	3.5	7.8	11.6	3.8	344	0.85	0.16	0.24	24	155	730	400	81	5200	37000	-	-	-
11/21	1050	3.5	7.9	12.1	2.1	494	1.30	0.17	0.17	28	230	730	97	48	2800	7600	-	-	-
11/25	0845	4.5	7.9	11.6	2.5	551	1.14	0.16	0.40	21	78	480	266	54	3500	2300	-	-	-
11/29	1245	4.5	7.9	12.4	2.3	545	0.95	0.16	0.42	26	84	590	260	54	3500	2100	-	-	-
12/03	1055	3.0	8.2	11.9	1.4	583	1.12	0.32	0.15	31	44	520	110	52	2400	780	-	-	-
12/07	0735	0.0	7.9	12.3	2.5	518	0.88	0.28	0.03	34	195	790	308	38	4500	3300	-	-	-

[1] & [2] as N

[3] as P

Table C-3. DATA FROM KANSAS RIVER AT KANSAS CITY-TURNER STREET

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2 + NO_3 [1] mg/l	NH_3 [2] mg/l	TPO_4 [3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0945	22.0	8.2	7.7	2.6	543	0.83	0.13	0.35	40	68	540	232	85	4500	400	-	-	-
09/28	1330	20.0	8.4	8.8	5.3	523	0.32	0.32	0.24	51	51	480	105	270	9000	560	27.1	6.0	-
09/30	1020	15.0	8.5	9.0	4.7	636	0.44	0.35	0.49	54	38	480	95	230	9000	500	-	-	-
10/02	1330	18.0	8.9	11.0	7.5	680	0.12	0.34	0.52	60	37	660	107	270	5600	100	-	-	-
10/04	0808	16.5	8.8	9.5	6.7	730	0.17	0.76	0.56	63	37	550	100	100	3000	1700	-	-	-
10/06	0755	18.0	8.1	9.2	8.2	635	-	-	0.47	83	48	530	141	66	3200	270	54.0	7.8	-
10/08	0820	15.2	8.2	11.1	9.2	769	0.01	0.13	0.31	91	38	590	93	84	3100	390	-	-	-
10/10	0800	16.5	8.2	10.3	9.2	861	0.02	0.29	0.38	121	31	540	110	89	5900	510	29.4	10.0	-
10/12	1155	19.0	8.0	8.2	8.7	844	0.01	0.03	0.20	101	24	570	89	41	3300	190	-	-	-
10/14	1300	18.0	8.5	11.5	8.7	823	0.04	0.05	0.30	105	28	630	40	70	4800	570	-	-	-
10/16	0830	14.5	8.2	10.7	8.1	830	0.00	0.03	0.05	103	18	600	43	94	5300	500	-	-	-
10/18	0750	12.0	8.1	10.3	11.3	814	0.00	0.04	0.06	101	25	640	45	64	4400	400	26.0	9.5	-
10/20	1235	7.5	8.3	12.2	8.3	976	0.28	0.04	0.12	127	17	610	71	130	3000	1200	-	-	-
10/22	1420	11.0	8.3	11.1	6.7	995	0.31	0.03	0.44	131	23	710	36	58	2400	500	-	-	-
10/24	1625	9.0	8.0	11.5	5.8	1009	0.82	0.38	0.55	119	26	690	39	47	1500	3200	-	-	-
10/26	0830	9.0	8.1	10.6	5.6	831	0.59	0.26	0.37	96	32	550	56	20	2700	500	19.0	7.1	-
10/28	0735	11.0	8.4	11.1	6.0	907	0.31	0.02	0.38	118	30	700	82	38	1500	390	-	-	-
10/30	0820	11.5	8.5	10.6	5.6	989	2.04	1.00	0.52	102	18	590	37	51	4900	370	-	-	-
11/01	0840	11.5	8.3	10.0	6.7	981	0.30	0.07	0.24	114	27	700	65	28	3600	390	-	-	-
11/03	1305	9.5	8.0	9.8	4.6	734	0.71	0.21	0.00	81	54	520	110	89	12000	9800	19.0	10.7	-
11/05	1000	10.0	8.1	10.0	4.1	730	0.68	0.08	0.11	75	39	570	72	35	1200	2100	-	-	-
11/07	1355	10.5	8.1	10.6	3.8	750	0.57	0.07	0.26	80	29	610	60	999*	3000	1700	-	-	-
11/09	0920	10.0	8.0	10.0	4.2	755	0.62	0.06	0.23	78	56	540	138	43	2100	4500	-	-	-
11/11	0705	8.5	7.9	10.2	3.0	739	0.81	0.18	0.41	67	57	570	134	-	4600	2200	25.0	17.9	-
11/13	1300	7.5	7.9	10.2	4.8	515	0.86	0.11	0.12	35	165	690	376	47	3500	10000	-	-	-
11/15	1310	5.0	7.6	10.5	6.8	428	0.88	0.13	0.52	20	520	1760	1350	280	18000	20001	92.0	19.6	-
11/17	1020	3.5	8.0	11.9	4.0	367	0.85	0.12	0.45	26	150	790	440	120	6500	14000	-	-	-
11/19	0710	3.0	8.0	12.3	4.2	290	1.23	0.11	0.15	30	265	910	590	70	4600	28000	48.0	17.0	-
11/21	1025	3.0	7.9	12.2	3.2	506	1.28	0.14	0.44	30	220	660	142	82	3700	21000	-	-	-
11/23	1215	5.0	7.8	12.1	2.5	513	1.06	0.13	0.40	30	110	600	114	110	5900	5800	-	-	-
11/25	0900	4.5	7.9	12.1	1.7	489	1.11	0.11	0.37	24	55	350	81	26	1700	2700	-	-	-
11/27	1305	4.0	8.0	12.2	1.7	553	1.10	0.17	0.27	28	48	510	99	32	3200	3000	-	9.0	-
11/29	1220	4.5	8.1	12.5	2.1	556	0.95	0.13	0.28	26	49	460	118	31	3000	3100	-	-	-
12/02	1225	5.5	8.1	11.8	2.6	581	0.92	0.13	0.06	33	48	480	135	60	3300	2600	-	-	-
12/03	1025	3.0	8.3	12.0	1.3	593	1.08	0.30	0.23	31	40	500	111	39	3200	710	-	-	-
12.05	1410	0.5	8.0	13.1	1.9	580	0.92	0.20	0.12	32	38	450	94	37	4900	1900	-	6.2	-
12.07	0800	0.0	8.1	14.4	1.4	513	0.89	0.18	0.03	34	30	320	63	16	1200	1800	-	-	-

[1] & [2] as N [3] as P * #/100 ml

KANSAS RIVER STUDY

Table C-4. DATA FROM MILL CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2+NO_3[1] mg/l	NH_3[2] mg/l	TPO_4[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1040	20.0	8.0	6.5	3.5	765	2.08	0.06	1.29	35	34	550	76	18	2000	1200	-	-	-
10/04	0903	14.5	7.8	7.1	2.5	1006	2.70	0.64	2.10	59	33	720	60	11	600	2100	-	-	-
10/12	1115	17.0	7.8	6.3	3.6	1108	2.96	0.04	1.58	76	36	820	73	18	1000	540	-	-	-
10/20	1200	7.5	7.9	9.5	4.0	842	2.92	0.03	2.72	74	17	590	22	2	260	2700	-	-	-
10/28	0805	9.5	7.6	8.5	3.1	589	1.81	0.08	1.85	39	23	480	39	3	140	530	-	-	-
11/05	1030	9.5	7.9	9.4	3.9	626	1.71	0.19	1.32	37	24	470	21	4	200	320	-	-	-
11/13	1230	8.0	7.9	9.7	9.0	517	1.20	0.71	0.02	29	235	710	336	75	3000	20001	-	-	-
11/21	1005	2.5	8.0	11.3	3.9	742	1.87	0.95	1.65	41	12	500	19	7	99	100	-	-	-
11/29	1145	3.5	8.0	12.2	4.0	727	1.87	1.02	2.01	42	12	490	10	999*	30	190	-	-	-
12/07	0840	0.0	8.0	13.7	2.9	971	1.82	1.73	2.73	64	9	640	11	1	25	90	-	-	-

[1] & [2] as N   * #/100 ml

[3] as P

KANSAS RIVER STUDY

Table C-5. DATA FROM KANSAS RIVER AT BONNER SPRINGS

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2 + NO_3 (1) mg/l	NH_3 (2) mg/l	TPO_4 (3) mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1120	20.0	8.3	8.3	3.2	596	0.79	0.09	0.31	40	43	480	131	210	7400	1000	-	-	4160
09/28	1255	20.0	8.5	10.2	5.7	573	0.32	0.28	0.33	57	45	480	102	200	13000	490	36.2	8.5	3500
09/30	0948	14.0	8.4	9.8	4.8	655	0.52	0.31	0.19	54	37	470	95	70	9000	200	-	-	2570
10/02	1255	18.0	8.9	13.0	6.8	707	0.11	0.37	0.18	61	44	630	125	85	1500	80	-	-	2340
10/04	0922	16.0	8.6	9.4	6.6	732	0.13	0.69	0.55	66	31	490	90	120	2800	130	-	-	1900
10/06	0825	17.5	8.3	8.4	8.0	714	-	-	0.44	93	33	520	95	130	3300	400	57.6	9.8	1820
10/08	0850	14.5	8.3	9.5	8.6	819	0.01	0.13	0.40	96	27	500	81	420	7100	100	-	-	1700
10/10	0825	16.0	8.3	8.8	8.4	1000	0.01	0.11	C.10	132	24	570	96	53	1100	100	24.2	9.0	1680
10/12	1055	17.5	8.3	8.8	8.9	856	0.01	0.04	0.42	114	21	570	64	91	3700	100	-	-	1680
10/14	1230	18.0	8.8	15.1	8.8	830	0.03	0.05	0.21	107	25	620	66	58	2800	90	-	-	1650
10/16	0900	14.5	8.3	10.1	7.8	842	0.19	0.03	0.29	102	16	550	37	43	1100	150	-	-	1320
10/18	0815	11.0	8.3	10.2	8.7	852	0.09	0.04	0.38	108	19	700	48	63	6100	120	31.0	10.3	1200
10/20	1145	8.0	8.4	12.4	9.0	1032	0.25	0.04	0.19	140	13	640	49	78	500	760	-	-	-
10/22	1350	12.5	8.3	12.3	6.5	1063	0.67	0.30	0.45	137	16	710	46	58	1000	310	-	-	1290
10/24	1600	10.0	8.1	12.9	7.1	974	0.38	0.08	0.40	120	30	650	69	-	-	-	-	-	1990
10/26	0900	9.0	8.1	10.7	6.6	958	0.30	0.04	0.43	121	29	640	51	35	860	580	31.0	10.8	1680
10/28	0820	10.5	8.1	9.7	6.1	907	0.41	0.03	1.54	113	16	650	44	55	1300	280	-	-	1410
10/30	0850	12.0	8.3	10.7	6.6	989	0.51	0.12	0.43	112	13	595	37	10	1300	150	-	-	1340
11/01	0905	11.0	8.2	9.7	6.1	999	0.92	0.33	0.28	117	15	650	35	100	6000	1800	-	-	1300
11/03	1240	10.0	8.1	10.7	6.5	765	0.60	0.17	0.01	86	82	690	224	130	8600	8000	26.0	13.0	3200
11/05	1045	10.0	8.1	10.7	4.3	772	0.65	0.06	0.04	77	36	540	44	35	800	900	-	-	2500
11/07	1330	11.0	8.1	11.7	4.4	760	0.66	0.09	0.18	85	38	660	96	39	1500	680	-	-	3000
11/09	0940	10.0	7.9	10.1	4.4	725	0.69	0.10	0.00	72	100	610	309	62	2500	6600	-	-	4100
11/11	0725	8.5	8.0	10.3	2.8	782	0.81	0.21	0.31	70	51	580	118	-	2700	2300	23.0	16.0	3800
11/13	1215	7.0	8.0	10.8	5.0	542	0.80	0.15	0.03	35	240	740	388	8	3300	14000	-	-	5200
11/15	1240	5.0	7.6	10.8	7.2	397	0.84	0.13	0.33	17	530	1720	1320	190	18000	20001	95.0	27.5	23000
11/17	0955	3.5	7.9	12.1	4.2	408	0.87	0.20	0.24	31	140	700	356	96	6400	37000	-	-	10000
11/19	0735	3.0	7.9	11.8	3.6	266	1.29	0.14	0.42	26	265	810	445	90	6200	25000	47.0	26.5	9800
11/21	0950	3.5	7.9	12.2	2.1	525	1.12	0.20	0.13	33	220	670	320	80	3400	18000	-	-	8500
11/23	1150	5.0	7.8	11.9	2.5	551	1.06	0.14	0.22	31	110	630	83	63	3100	5600	-	-	7500
11/25	0930	4.0	7.9	12.4	1.5	492	1.10	0.13	0.33	23	55	400	164	47	3600	2600	-	-	7500
11/27	1240	4.5	8.1	12.2	2.0	550	1.15	0.16	0.29	27	48	510	158	28	2600	2400	-	11.0	8200
11/29	1130	5.0	8.1	12.2	2.4	570	0.97	0.16	0.26	28	44	450	108	39	3500	2000	-	-	8100
12/02	1200	6.5	8.0	11.8	1.4	604	0.96	0.16	0.15	33	41	470	105	53	2200	6800	-	-	8800
12/03	1000	3.0	7.6	12.0	1.8	603	1.14	0.42	0.28	32	38	500	102	57	4500	1200	-	-	8400
12/05	1345	0.5	8.1	13.4	1.7	586	0.91	0.20	0.12	32	36	450	91	43	6600	8200	-	6.0	7900
12/07	0900	0.0	8.0	14.2	1.7	513	0.85	0.20	0.02	34	30	400	68	21	2600	3000	-	-	-

(1) & (2) as N (3) as P

KANSAS RIVER STUDY

Table C-6. DATA FROM KANSAS RIVER AT DESOTO

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond mhos	NO_2+NO_3 [1] mg/l	NH_3 [2] mg/l	TPO_4 [3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1210	20.0	8.3	8.8	2.8	616	0.68	0.09	0.02	42	48	470	111	350	11000	1200	-	-	-
09/30	0912	14.5	8.1	9.1	4.4	672	0.55	0.38	0.14	59	38	510	93	420	16000	2200	-	-	-
10/04	0952	17.5	8.5	10.0	6.6	769	0.18	0.61	0.46	74	30	550	80	250	6200	680	-	-	-
10/08	0920	15.5	8.1	9.6	7.7	831	0.01	0.13	0.39	97	25	530	87	120	4600	440	-	-	-
10/12	1025	17.5	8.4	7.8	8.7	870	0.03	0.04	0.13	111	19	580	71	210	6800	380	-	-	-
10/16	0930	14.0	8.4	9.9	8.3	889	0.00	0.03	0.29	104	16	540	38	43	1300	310	-	-	-
10/20	1125	8.0	8.1	11.5	9.0	1048	0.27	0.03	0.23	141	12	650	47	23	1700	1700	-	-	-
10/24	1530	10.0	7.8	11.4	5.9	883	0.58	0.28	0.49	105	35	630	75	93	4200	6700	-	-	-
10/28	0840	11.0	8.1	9.7	5.8	867	0.31	0.08	0.55	110	17	650	58	100	3400	760	-	-	-
11/01	0935	11.5	8.2	10.0	5.0	1027	0.60	0.35	0.29	121	20	690	35	240	11000	1500	-	-	-
11/05	1115	10.0	8.1	11.0	5.0	857	0.52	0.10	0.01	93	28	640	50	94	2400	950	-	-	-
11/09	1010	9.5	7.8	9.9	5.2	659	0.85	0.16	0.00	63	132	590	302	150	7400	9200	-	-	-
11/13	1155	7.5	8.0	10.3	4.3	532	0.83	0.20	0.00	35	205	830	355	78	5400	11000	-	-	-
11/17	0930	4.0	7.9	12.1	4.3	440	0.81	0.16	0.40	38	120	690	330	140	5100	9300	-	-	-
11/21	0920	4.0	8.0	12.3	2.6	499	1.25	0.12	0.34	27	190	630	254	45	2300	7200	-	-	-
11/25	0950	4.5	8.0	12.0	2.2	503	1.12	0.16	0.27	26	47	410	111	47	2300	1200	-	-	-
11/29	1105	5.0	8.0	12.3	2.3	550	0.92	0.11	0.23	27	39	440	128	30	1400	3100	-	-	-
12/03	0930	3.0	8.1	11.8	1.0	526	0.99	0.21	0.07	30	37	470	89	39	4600	690	-	-	-
12/07	0920	0.0	8.1	14.2	1.5	546	0.84	0.20	0.22	33	29	360	58	28	2500	920	-	-	-

[1] & [2] as N
[3] as P

Table C-7. DATA FROM STRANGER CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3 [1], mg/l	NH_3 [2], mg/l	TPO_4 [3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1240	22.0	8.2	9.4	3.1	593	0.38	0.06	0.11	6	24	410	10	5700*	100	300	-	-	35
10/04	1013	16.0	7.9	8.1	2.1	567	0.54	0.34	0.26	9	13	330	20	3	300	300	-	-	25
10/12	1010	17.5	8.0	8.5	2.2	551	0.16	0.03	0.16	9	11	420	42	11	470	150	-	-	-
10/20	1105	8.0	8.1	11.2	2.5	532	0.12	0.03	0.09	10	10	310	11	3	100	680	-	-	-
10/28	0900	10.0	7.7	9.4	2.9	445	1.07	0.12	0.25	12	34	410	71	5	310	770	-	-	-
11/05	1130	10.0	8.0	9.9	3.3	415	1.16	0.06	0.11	9	59	400	121	18	2700	750	-	-	130
11/13	1140	7.5	7.6	9.4	6.8	314	1.04	0.08	0.09	8	500	1830	1590	120	2000	72000	-	-	2100
11/21	0905	3.0	8.0	12.3	2.1	499	1.58	0.11	0.09	9	34	410	96	15	1000	24000	-	-	320
11/29	1050	3.5	7.9	-	2.3	510	1.39	0.10	0.23	11	38	390	56	19	200	6200	-	-	190
12/07	0945	0.0	8.1	13.2	1.1	544	1.38	0.14	0.06	10	7	390	9	999*	60	370	-	-	95

(1) & (2) as N * #/100 ml

(3) as P

Table C-8. DATA FROM KANSAS RIVER AT EUDORA

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2+NO_3[1], mg/l	NH_3[2], mg/l	TPO_4[3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1315	22.0	8.4	9.1	2.1	645	0.59	0.11	0.27	46	43	480	115	200	15000	1000	-	-	-
09/28	1215	20.0	8.3	9.4	5.8	591	0.53	0.32	0.26	59	42	470	80	300	23000	700	22.6	8.9	-
09/30	0842	15.0	8.2	8.8	4.8	644	0.55	0.48	0.39	62	34	560	80	440	20000	2800	-	-	-
10/02	1210	18.0	8.6	11.1	5.7	716	0.54	0.41	0.56	66	34	640	88	370	6300	520	-	-	-
10/04	1058	17.5	8.5	10.6	7.3	822	0.17	0.67	0.64	84	32	570	80	470	22000	3800	-	-	-
10/06	0907	17.5	8.3	7.8	7.3	730	-	-	0.14	100	27	520	76	920	31000	1900	46.8	8.7	-
10/08	0947	15.5	8.0	9.5	8.3	856	0.32	0.15	0.20	101	21	570	59	440	13000	2700	-	-	-
10/10	0900	16.0	8.3	8.5	8.0	1000	0.27	0.11	0.40	138	21	610	76	520	17000	1800	24.2	13.5	-
10/12	0955	18.5	8.1	7.3	8.7	897	0.01	0.04	0.42	114	19	620	62	680	42000	800	-	-	-
10/14	1150	17.5	8.3	10.6	8.9	855	0.19	0.05	0.48	112	26	640	66	360	9000	1800	-	-	-
10/16	0950	14.0	8.1	9.8	8.0	881	0.28	0.05	0.36	110	12	620	26	270	6700	1400	-	-	-
10/18	0855	11.0	8.0	9.3	8.9	1013	0.68	0.44	0.31	136	19	760	42	660	68000	2300	21.0	10.5	-
10/20	1055	8.0	8.1	10.8	9.4	1085	0.46	0.33	0.50	149	14	730	41	620	48000	3500	-	-	-
10/22	1315	11.5	8.2	10.8	5.6	1117	0.69	0.50	0.16	150	20	770	29	190	4300	1700	-	-	-
10/24	1510	10.0	7.9	12.1	5.4	974	0.57	0.54	0.46	123	26	650	50	77	5500	10400	-	-	-
10/26	0935	9.0	7.9	10.3	5.7	975	0.47	0.38	0.44	123	25	650	40	260	14000	8200	27.0	10.0	-
10/28	0915	11.0	8.0	9.9	5.6	959	5.20	5.12	0.46	115	14	680	44	560	25000	3000	-	-	-
10/30	0925	12.0	8.1	10.3	5.7	1088	0.32	0.24	0.44	131	14	640	29	190	9200	1800	-	-	-
11/01	1005	12.0	8.2	8.7	4.8	1062	0.42	0.25	0.26	132	17	720	42	340	37000	3100	-	-	-
11/03	1205	9.5	8.0	10.7	3.8	711	0.48	0.21	0.00	87	48	570	94	110	13000	7200	17.0	7.3	-
11/05	1150	11.0	8.2	11.3	4.5	886	0.45	0.11	0.12	99	23	630	42	60	1500	520	-	-	-
11/07	1250	11.0	8.1	11.3	3.9	771	0.55	0.10	0.34	89	33	630	68	63	2700	4000	-	-	-
11/09	1030	10.0	7.9	10.2	4.0	701	0.84	0.21	0.32	69	78	560	182	103	7000	4900	-	-	-
11/11	0800	8.5	7.9	10.6	3.7	782	0.63	0.20	0.32	71	46	620	144	-	7800	3100	23.0	9.3	-
11/13	1130	7.5	7.9	10.8	4.9	537	1.18	0.54	0.57	38	290	830	380	90	10000	13000	-	-	-
11/15	1200	4.5	7.7	11.3	6.7	373	0.73	0.11	0.15	15	560	1930	1210	17	22000	79000	99.0	30.0	-
11/17	0910	4.0	7.9	12.4	3.8	551	0.81	0.19	0.37	49	130	760	320	69	5200	9200	-	-	-
11/19	0805	3.5	8.0	12.3	4.8	280	1.25	0.16	0.16	29	235	830	475	110	6100	25000	48.0	14.0	-
11/21	0850	4.0	7.9	12.4	3.4	497	1.29	0.19	0.16	28	210	650	330	16	3400	6000	-	-	-
11/23	1115	4.5	7.7	12.5	1.8	543	0.58	0.23	0.30	31	105	520	154	43	2500	3000	-	-	-
11/25	1010	4.5	7.9	12.2	1.9	468	1.14	0.20	0.23	28	40	400	126	34	2200	2000	-	-	-
11/27	1200	4.0	8.0	12.5	1.9	558	0.99	0.11	0.28	29	53	520	85	30	1500	2300	-	8.0	-
11/29	1035	4.5	8.0	12.7	2.1	564	0.96	0.18	0.21	30	35	720	120	32	2100	1700	-	-	-
12/02	1130	5.5	7.9	11.8	1.5	588	1.00	0.25	0.09	32	36	450	98	30	2000	1700	-	-	-
12/03	0905	4.0	8.2	12.4	1.2	583	1.06	0.38	0.10	32	36	490	97	48	2200	960	-	-	-
12/05	1305	0.5	8.2	13.6	1.6	571	0.85	0.18	0.19	33	33	420	74	45	5000	1700	-	9.5	-
12/07	1020	0.0	8.0	14.0	1.9	578	1.00	0.35	0.07	38	26	390	53	16	3400	800	-	-	-

[1] & [2] as N [3] as P

Table C-9. DATA FROM WAKARUSA RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1340	21.0	8.2	7.3	3.3	548	0.56	0.07	0.09	8	20	830	28	2700*	100	200	-	-	-
10/04	1105	16.5	7.9	7.3	3.9	582	0.34	0.37	0.30	11	17	400	20	6	300	400	-	-	-
10/12	0945	17.0	7.9	10.6	5.3	587	0.02	0.07	0.24	13	12	460	37	7	620	40	-	-	-
10/20	1040	9.0	7.8	4.2	3.6	565	0.24	0.10	0.08	21	20	320	31	2	60	670	-	-	9
10/28	0920	10.0	7.8	865.0	2.6	491	0.36	0.10	0.22	11	28	430	64	7	180	390	-	-	30
11/05	1200	10.0	7.9	9.1	2.7	527	0.35	0.04	0.05	10	34	430	50	3	120	750	-	-	50
11/13	1120	7.5	7.9	9.5	5.5	500	0.50	0.05	0.38	11	155	570	220	34	2300	20000	-	-	950
11/21	0840	2.5	8.0	12.4	2.5	525	1.33	0.11	0.05	11	32	410	61	13	1700	6100	-	-	220
11/29	1025	3.0	8.1	12.4	2.0	610	1.07	0.09	0.07	90	21	410	32	18	2100	5000	-	-	150
12/07	1035	0.0	8.2	13.7	1.0	625	1.02	0.05	0.12	12	16	420	29	999*	70	260	-	-	100

[1] & [2] as N   * #/100 ml

[3] as P

KANSAS RIVER STUDY

Table C-10. DATA FROM KANSAS RIVER AT LAWRENCE

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1430	21.0	8.3	9.0	2.5	630	0.48	0.09	0.24	41	42	460	77	18	700	100	-	-	-
09/30	0800	14.5	8.3	8.7	4.3	676	0.32	0.43	0.36	60	36	470	78	70	3600	600	-	-	-
10/04	1130	17.5	8.6	9.3	6.7	841	0.03	0.65	0.72	93	39	610	110	51	2900	130	-	-	-
10/08	1018	16.0	8.2	9.7	7.7	876	0.01	0.14	0.35	107	22	560	53	21	700	210	-	-	-
10/12	0920	19.0	8.2	8.2	8.8	883	0.00	0.03	0.11	112	24	650	85	9	1000	10	-	-	-
10/16	1020	14.0	8.2	10.0	7.6	914	0.00	0.03	0.29	114	17	620	52	9	4000	20	-	-	-
10/20	1010	8.5	8.2	10.5	6.4	1053	0.01	0.04	0.40	151	19	680	47	1	80	80	-	-	-
10/24	1445	10.0	7.9	10.6	4.6	1066	0.12	0.06	0.41	141	26	700	55	28	3900	14000	-	-	-
10/28	0955	12.0	8.0	9.8	5.7	907	0.03	0.03	0.35	116	20	700	65	5	320	140	-	-	-
11/01	1030	12.0	8.1	9.2	4.2	1077	0.11	0.13	0.34	137	22	750	37	26	5200	520	-	-	-
11/05	1230	11.5	8.2	11.1	3.5	831	0.39	0.04	0.15	94	20	540	27	10	530	500	-	-	-
11/09	1055	9.5	7.9	9.8	3.1	735	0.63	0.09	0.22	73	55	490	70	12	2200	3000	-	-	-
11/13	1055	7.5	8.0	10.5	3.5	548	0.75	0.08	0.31	40	145	600	188	33	1900	13000	-	-	-
11/17	0845	4.5	8.0	11.5	4.3	440	0.89	0.07	0.46	32	145	730	310	130	2100	24000	-	-	-
11/21	0810	4.5	7.9	11.9	3.7	458	0.98	0.08	0.09	22	160	530	192	43	4000	4900	-	-	-
11/25	1040	4.5	8.0	11.6	4.2	574	0.88	0.08	0.27	23	49	290	84	23	1000	3200	-	-	-
11/29	0955	4.5	7.9	12.3	2.5	488	0.70	0.08	0.15	87	30	360	52	14	1600	1000	-	-	-
12/03	0835	4.0	8.1	11.5	2.0	565	0.76	0.10	0.08	29	32	650	75	34	1600	670	-	-	-
12/07	1100	0.0	8.1	13.7	2.2	618	0.88	0.19	0.05	41	72	570	226	24	4800	1200	-	-	-

[1] & [2] as N

[3] as P

KANSAS RIVER STUDY

Table C-11. DATA FROM KANSAS RIVER AT LECOMPTON

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 +NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1525	22.0	8.4	10.0	4.2	782	0.52	0.12	0.34	20	35	590	91	100	1120	500	-	-	3550
09/28	1120	20.0	8.2	9.1	6.4	622	0.49	0.30	0.23	79	44	530	80	73	12000	410	18.1	10.0	3150
09/30	0726	13.0	8.2	9.0	3.6	783	0.38	0.41	0.48	80	37	570	93	140	14000	660	-	-	2460
10/02	1120	17.0	8.7	11.3	5.6	870	0.11	0.30	0.36	92	35	640	65	330	7700	250	-	-	2320
10/04	1212	19.0	8.6	13.2	7.8	879	0.03	0.60	0.66	102	34	580	100	47	2500	140	-	-	1860
10/06	0955	17.5	7.8	8.1	7.1	740	-	-	0.13	110	34	500	90	31	2100	100	50.4	11.0	1800
10/08	1053	15.5	8.2	11.2	8.0	856	0.01	0.14	0.36	110	25	560	64	550	24000	830	-	-	1710
10/10	0945	15.5	8.5	10.1	7.7	984	0.01	0.11	0.45	146	26	590	86	37	2000	140	22.5	9.0	1800
10/12	0855	18.5	7.9	7.8	8.8	912	0.00	0.03	0.44	118	25	700	76	31	2200	60	-	-	1720
10/14	1100	17.5	8.2	11.3	8.8	928	0.03	0.02	0.50	118	17	620	39	51	4600	280	-	-	1520
10/16	1100	14.5	8.1	11.2	7.7	1012	0.00	0.02	0.43	134	13	660	30	3	540	160	-	-	1420
10/18	0950	10.0	8.0	10.0	8.0	1053	0.00	0.04	0.44	152	17	780	28	6	700	60	22.0	6.8	1300
10/20	0940	8.0	8.2	10.8	6.5	1119	0.02	0.11	0.29	166	8	730	24	5	410	360	-	-	1300
10/22	1230	12.0	8.1	10.5	5.5	1193	0.08	0.21	0.34	167	11	770	10	33	4900	630	-	-	1530
10/24	1415	10.0	7.8	12.9	5.6	1087	0.10	0.16	0.42	135	25	700	54	81	8600	6100	-	-	1760
10/26	1025	10.0	7.9	10.8	4.6	1028	0.15	0.08	0.38	129	22	660	31	39	2300	560	29.0	9.8	1660
10/28	1035	11.5	7.9	10.0	5.7	1053	0.05	0.03	0.47	147	14	760	49	56	4700	480	-	-	1510
10/30	1030	12.5	8.1	10.8	4.6	1195	0.03	0.05	0.35	158	12	640	14	11	1100	150	-	-	1510
11/01	1120	12.0	8.0	10.5	4.7	1175	0.09	0.23	0.44	152	16	740	27	77	23000	6200	-	-	1800
11/03	1120	9.0	8.1	10.3	5.2	861	0.60	0.17	0.08	99	73	730	221	110	15000	5800	26.0	11.0	2500
11/05	1340	12.0	8.1	11.2	5.5	886	0.51	0.14	0.22	105	30	650	64	99	8400	680	-	-	2600
11/07	1205	11.0	7.9	10.5	5.0	891	0.47	0.09	0.31	112	46	800	123	97	9200	6900	-	-	3100
11/09	1145	10.0	7.9	10.1	4.2	891	0.60	0.12	0.32	99	51	550	132	37	4800	2700	-	-	3000
11/11	0845	8.0	7.7	10.0	6.2	570	0.84	0.08	0.00	42	325	150	1124	-	5000	37000	76.0	25.7	6800
11/13	1010	7.5	8.1	10.7	4.2	622	0.73	0.17	0.42	54	120	670	224	70	4200	7200	-	-	5200
11/15	1120	4.0	7.7	11.2	5.4	517	0.75	0.12	0.00	30	470	1510	1090	210	9000	71000	78.0	16.5	12000
11/17	0820	4.0	7.9	11.3	6.6	503	1.26	0.09	0.54	50	200	1110	695	170	8600	38000	-	-	10000
11/19	0905	3.0	7.8	11.7	4.1	288	1.23	0.13	0.61	35	300	910	460	110	7700	24000	50.0	23.4	9600
11/21	0740	5.0	8.0	12.0	5.0	441	0.87	0.07	0.16	19	140	410	166	30	1500	3900	-	-	8000
11/23	1035	4.0	7.7	11.9	2.1	596	0.79	0.14	0.47	35	100	580	204	110	3100	3900	-	-	7400
11/25	1110	4.0	8.0	11.9	3.0	565	1.11	0.15	0.00	35	48	440	117	51	3800	1800	-	-	7400
11/27	1120	4.0	7.8	11.9	2.0	622	1.05	0.15	0.31	37	47	540	98	53	4900	2700	-	7.5	7700
11/29	0925	4.5	7.9	12.6	2.2	506	0.72	0.06	0.14	87	27	350	61	15	1800	1500	-	-	8400
12/02	1050	5.5	8.0	11.4	1.5	680	0.96	0.13	0.36	43	36	490	93	69	8900	2000	-	-	8900
12/03	0805	4.0	8.3	12.5	1.2	405	0.45	0.02	0.01	10	18	320	36	5500*	170	130	-	-	8900
12/05	1220	0.5	8.0	13.5	1.4	663	0.92	0.15	0.10	45	35	490	84	37	10000	1600	-	9.3	8400
12/07	1120	0.0	8.1	13.8	1.2	659	0.93	0.16	0.01	48	27	430	76	21	3100	1700	-	-	6200

[1] & [2] as N [3] as P * #/100 ml

Table C-12. DATA FROM DELAWARE RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,(1) mg/l	NH_3,(2) mg/l	TPO_4,(3) mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1550	22.0	8.2	9.3	1.9	356	0.43	0.11	0.10	5	17	290	31	1700*	100	99	-	-	938
09/30	0700	19.0	8.2	8.6	1.1	335	0.41	0.26	0.13	7	17	260	42	3400*	90	70	-	-	468
10/04	1230	19.0	7.8	7.7	1.6	389	0.43	0.33	0.18	8	12	290	20	2	200	250	-	-	25
10/08	1125	17.0	7.7	8.4	1.9	412	0.39	0.17	0.11	8	9	230	27	8	90	110	-	-	25
10/12	0840	17.5	8.0	9.4	3.0	390	0.24	0.05	0.15	8	11	310	28	2	40	130	-	-	25
10/16	1120	14.0	7.7	9.1	2.7	399	0.31	0.02	0.05	7	11	280	18	2	9	30	-	-	25
10/20	0930	10.5	8.0	9.2	1.8	398	0.33	0.05	0.04	9	8	280	13	999*	20	30	-	-	25
10/24	1405	11.0	7.6	8.1	1.5	404	0.32	0.03	0.03	8	23	270	28	6	780	3500	-	-	25
10/28	1055	12.0	7.8	9.4	1.2	406	0.41	0.04	0.09	7	14	280	38	999*	100	450	-	-	150
11/01	1135	11.5	7.9	9.1	1.6	399	0.41	0.05	0.00	8	22	280	27	17	2000	6900	-	-	150
11/05	1355	12.0	8.1	10.4	1.8	360	0.40	0.04	0.00	8	12	250	11	999*	9	140	-	-	300
11/09	1200	11.0	8.0	10.6	1.4	402	0.41	0.03	0.00	9	11	180	13	1	9	300	-	-	500
11/13	1000	8.5	8.0	10.3	2.6	369	0.49	0.06	0.01	8	140	430	172	36	2900	20000	-	-	500
11/17	0800	8.0	8.1	11.6	1.7	306	0.42	0.05	0.07	8	13	230	16	999*	20	920	-	-	1500
11/21	0725	7.0	8.2	12.1	9.3	342	0.45	0.05	0.06	8	13	220	23	999*	99	100	-	-	1500
11/25	1120	6.0	7.9	12.2	0.7	344	0.48	0.03	0.09	8	40	190	17	999*	10	160	-	-	1500
11/29	0910	5.5	8.0	12.7	3.1	376	0.43	0.05	0.06	65	16	230	23	999*	9	60	-	-	2500
12/03	0745	5.0	8.2	13.1	1.0	383	0.42	0.01	0.07	8	12	290	20	99*	5	10	-	-	2500
12/07	1140	2.0	8.2	13.5	1.7	349	0.47	0.09	0.03	9	10	200	14	400*	50	90	-	-	1500

(1) & (2) as N * #/100 ml
(3) as P

Table C-13. DATA FROM SHUNGANUNGA CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/ 100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0742	19.0	7.9	5.9	6.6	612	0.44	0.16	0.46	34	27	470	59	31	800	1200	-	-	-
10/04	0723	14.5	7.8	5.7	8.7	897	1.02	0.57	0.91	77	27	640	60	430	26000	1700	-	-	-
10/12	1400	15.0	8.0	7.6	7.6	926	0.76	0.05	0.58	86	25	700	65	100	11000	350	-	-	-
10/20	1410	7.0	7.9	9.3	5.4	926	1.54	0.06	0.90	106	20	580	27	2	200	120	-	-	-
10/28	0730	11.0	7.6	7.5	3.6	719	0.95	0.08	0.73	65	31	580	81	12	540	590	-	-	-
11/05	0720	8.0	7.5	8.8	5.2	697	1.13	0.22	0.44	52	35	470	45	15	1200	920	-	-	-
11/13	1440	7.0	7.6	9.6	9.0	300	0.98	0.26	0.83	11	265	890	655	300	37000	20001	-	-	-
11/21	1425	5.0	8.0	12.3	3.4	869	1.38	0.61	0.57	76	24	580	33	5	600	400	-	-	-
11/29	1355	4.0	8.0	13.8	2.5	788	1.52	0.46	0.56	120	13	490	19	999 *	10	40	-	-	-
12/07	0730	0.0	7.9	13.2	2.9	899	1.06	1.43	0.47	63	12	580	13	1900 *	100	120	-	-	-

[1] & [2] as N   * #/100 ml

[3] as P

KANSAS RIVER STUDY

Table C-14. DATA FROM KANSAS RIVER AT TOPEKA

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0812	19.5	8.4	8.0	6.3	882	0.47	0.15	0.28	30	42	590	91	43	800	500	-	-	2720
09/28	1030	20.0	8.3	8.3	8.9	616	0.48	0.57	0.44	80	44	940	-	970	91000	3000	22.6	10.0	2150
09/30	1320	14.0	8.6	10.9	4.7	777	0.40	0.35	0.33	86	39	550	89	220	5000	830	-	-	1970
10/02	1030	16.0	8.7	10.1	5.1	864	0.15	0.26	0.36	98	34	710	68	220	6000	2200	-	-	1830
10/04	0743	17.0	8.2	8.3	8.3	844	0.03	0.52	0.42	105	36	590	100	350	32000	1300	-	-	1790
10/06	1038	16.5	8.2	8.3	6.6	736	-	-	0.29	114	35	500	91	49	5500	730	46.8	10.4	1750
10/08	0745	14.5	8.3	9.0	8.0	904	0.03	0.16	0.31	120	33	570	92	370	43000	260	-	-	1740
10/10	1030	16.0	8.4	10.3	7.6	967	0.01	0.11	0.29	147	29	590	78	33	2500	510	25.9	12.5	1740
10/12	1340	17.0	7.9	8.8	5.5	831	0.02	0.05	0.37	115	27	620	82	280	40000	9800	-	-	1730
10/14	1015	17.0	8.3	9.4	7.2	876	0.03	0.02	0.30	119	23	600	57	68	4800	700	-	-	1710
10/16	0715	13.0	8.3	9.0	7.4	1078	0.01	0.03	0.19	159	21	700	48	62	4700	790	-	-	-
10/18	1030	9.0	8.2	10.8	6.4	1053	0.00	0.04	0.29	161	19	820	36	900	6100	1100	21.0	30.8	-
10/20	1355	7.5	8.4	11.5	6.0	1263	0.00	0.04	0.33	180	20	790	45	46	3900	1200	-	-	-
10/22	1140	12.5	8.0	8.7	12.2	920	0.15	0.58	0.14	129	34	630	51	1400	125000	35700	-	-	-
10/24	1230	9.0	8.1	11.6	4.7	1066	0.20	0.04	0.31	190	23	660	41	48	8100	3700	-	-	1520
10/26	1105	10.0	8.2	10.8	4.1	1009	0.11	0.03	0.33	132	23	650	34	65	4200	930	21.0	13.3	1350
10/28	0735	11.5	8.5	9.4	5.1	1082	0.01	0.02	0.29	160	25	790	77	49	7200	270	-	-	1300
10/30	1105	12.0	8.4	10.8	4.2	1222	0.01	0.03	0.30	172	18	730	31	64	10000	2800	-	-	1250
11/01	0700	11.0	8.3	9.5	9.6	901	0.20	0.20	0.01	119	51	670	97	390	18000	20000	-	-	1200
11/03	1030	8.5	8.4	10.8	4.2	1001	0.41	0.04	0.24	130	35	530	82	78	7900	4800	13.0	10.0	1600
11/05	0745	9.5	8.2	10.0	4.3	871	0.54	0.03	0.19	111	32	570	67	22	1000	870	-	-	1800
11/07	1035	9.5	8.1	9.4	7.4	777	0.66	0.04	0.77	94	250	1340	724	85	13000	33000	-	-	3200
11/09	0720	9.0	8.3	10.0	3.6	891	0.50	0.02	0.29	97	35	550	157	15	800	1800	-	-	1900
11/11	0920	8.0	7.9	10.2	4.2	629	0.80	0.04	0.34	51	175	840	476	-	7900	1500	41.0	17.0	5000
11/13	1420	7.5	8.2	10.7	7.1	648	0.73	0.25	0.22	63	100	770	292	260	26000	33000	-	-	4000
11/15	1040	3.5	8.0	11.5	5.1	688	0.78	0.12	0.30	48	260	1020	580	160	14000	69000	52.0	12.6	7500
11/17	1245	4.0	7.7	11.6	6.7	386	1.42	0.07	0.89	38	240	1120	670	140	7000	61000	-	-	8000
11/19	0950	3.0	8.0	11.8	4.4	289	1.19	0.07	0.15	39	230	800	380	70	4400	29000	47.0	12.5	7200
11/21	1410	5.0	8.3	11.9	3.4	537	1.25	0.10	0.18	41	250	690	396	130	5800	18000	-	-	6000
11/23	0950	3.0	8.0	12.7	2.2	571	0.73	0.06	1.07	58	90	580	109	110	3100	3900	-	-	5700
11/25	0720	4.0	8.1	11.9	1.1	465	1.09	0.04	0.05	37	47	420	79	28	1300	1500	-	-	5200
11/27	1040	4.0	8.1	12.2	1.9	605	1.00	0.09	0.26	39	40	520	119	76	9700	3000	-	11.4	5700
11/29	1335	4.0	8.2	12.3	2.4	638	10.98	0.07	0.30	108	49	500	105	34	3100	2100	-	-	6000
12/02	1015	5.0	8.1	12.3	1.3	659	0.95	0.06	0.10	45	36	480	101	38	900	1300	-	-	6200
12/03	1250	2.5	8.3	12.2	1.1	646	0.93	0.06	0.10	45	38	560	91	20	800	760	-	-	6100
12/05	1115	0.0	8.1	13.5	1.7	663	0.88	0.11	0.08	46	32	470	82	42	5800	3400	-	8.8	5700
12/07	0755	0.0	8.1	14.2	1.1	591	0.91	0.10	0.14	50	26	1330	39	4	250	500	-	-	5500

(1) & (2) as N (3) as P

KANSAS RIVER STUDY

Table C-15. DATA FROM SOLDIER CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2[1] $+NO_3$, mg/l	NH_3[2], mg/l	TPO_4[3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0853	18.0	8.3	8.7	3.6	698	0.45	0.09	0.04	16	12	-	27	2700*	99	1700	-	-	31
10/04	0810	14.0	8.0	8.6	2.2	686	0.05	0.26	0.14	19	7	470	20	190	17000	110	-	-	19
10/12	1310	15.0	8.2	9.6	2.1	665	0.01	0.03	0.14	20	13	500	29	120	16000	570	-	-	15
10/20	1330	7.0	8.4	12.8	1.5	721	0.02	0.02	0.08	22	6	420	11	999*	20	50	-	-	11
10/28	0823	10.0	8.2	9.4	2.0	702	0.08	0.03	0.10	14	15	530	39	999*	600	170	-	-	22
11/05	0810	7.5	8.0	10.4	3.5	480	0.56	0.05	0.00	11	62	520	90	7	1000	5700	-	-	40
11/13	1350	6.5	7.7	9.6	7.0	272	0.83	0.09	0.08	6	860	3770	3600	280	8000	92000	-	-	3000
11/21	1340	4.5	8.2	12.3	1.8	629	1.30	0.05	0.25	12	47	540	131	3	400	2100	-	-	200
11/29	1310	4.0	8.2	13.0	1.5	645	1.10	0.04	0.08	113	43	480	16	3	490	3800	-	-	280

[1] & [2] as N * #/100 ml

[3] as P

KANSAS RIVER STUDY

Table C-16. DATA FROM KANSAS RIVER AT WILLARD

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	0933	19.0	8.3	8.5	3.8	868	0.58	0.12	0.23	85	35	610	86	68	1800	800	-	-	-
09/28	0945	19.0	8.3	8.6	5.1	693	0.55	0.35	0.26	80	39	540	54	104	3100	140	18.1	10.5	-
09/30	1235	14.0	8.5	11.0	3.9	740	0.51	0.38	0.35	94	36	560	79	96	4600	310	-	-	-
10/02	0945	16.0	8.5	10.1	5.5	885	0.19	0.30	0.31	109	29	740	56	290	5200	320	-	-	-
10/04	0845	16.5	8.3	9.1	6.3	828	0.02	0.49	0.38	106	28	640	80	120	7100	70	-	-	-
10/06	1129	15.5	8.5	9.8	6.2	790	-	-	0.35	123	27	500	76	21	700	30	46.8	12.5	-
10/08	0820	14.0	8.4	9.1	6.2	1009	0.02	0.23	0.33	136	25	610	76	570	54000	70	-	-	-
10/10	1055	17.0	8.7	11.6	7.6	984	0.01	0.14	0.29	149	21	590	70	21	240	10	22.5	9.2	-
10/12	1240	16.0	8.3	9.5	7.6	883	0.01	0.03	0.28	123	21	650	71	230	24000	210	-	-	-
10/14	0930	17.0	8.5	8.6	5.4	986	0.03	0.02	0.14	135	16	690	32	4	250	60	-	-	-
10/16	0800	13.0	8.4	9.6	6.3	1147	0.00	0.02	0.06	175	16	720	42	3	40	70	-	-	-
10/18	1115	9.0	8.4	11.2	6.1	1096	0.00	0.03	0.25	161	14	800	20	2	40	10	14.0	6.7	-
10/20	1255	7.0	8.5	11.7	3.2	1278	0.02	0.03	0.24	199	9	790	25	2	30	20	-	-	-
10/22	1100	11.5	8.2	10.0	3.7	1230	0.13	0.02	0.28	183	12	780	26	19	1300	320	-	-	-
10/24	1150	9.0	8.1	11.7	4.0	1108	0.21	0.02	0.25	220	17	690	24	17	700	2900	-	-	-
10/26	1200	11.0	8.3	11.6	4.3	1028	0.15	0.03	0.27	141	18	680	18	1	160	250	25.0	9.1	-
10/28	0900	11.0	8.5	9.7	4.3	1134	0.01	0.02	0.24	177	15	780	46	999*	100	80	-	-	-
10/30	1145	12.0	8.4	11.6	4.3	1222	0.08	0.03	0.28	168	11	680	23	1	170	160	-	-	-
11/01	0745	10.0	8.3	10.1	3.3	1133	0.27	0.04	0.18	157	16	720	22	17	660	260	-	-	-
11/03	0950	8.5	8.3	10.7	4.4	992	0.38	0.02	0.21	128	47	700	139	35	7000	13000	19.0	10.2	-
11/05	0835	9.5	8.3	10.3	3.5	871	0.61	0.03	0.20	112	33	580	65	22	740	2100	-	-	-
11/07	1000	9.5	8.0	10.0	4.7	794	0.64	0.02	0.25	109	88	915	264	48	4400	18000	-	-	-
11/09	0805	9.0	8.0	10.2	3.3	850	0.59	0.02	0.22	91	26	510	50	19	1100	390	-	-	-
11/11	1005	7.5	7.9	10.0	5.4	534	0.69	0.04	0.46	37	235	1020	695	-	-	1600	50.0	17.3	-
11/13	1315	7.0	8.1	10.5	4.0	589	0.78	0.06	0.23	53	320	1070	310	73	8000	20001	-	-	-
11/15	0950	3.5	7.7	11.9	4.2	524	0.78	0.08	0.57	34	220	890	544	180	7900	16000	47.0	14.0	-
11/17	1200	4.5	7.7	11.3	5.2	367	1.37	0.07	0.78	30	200	990	540	170	4000	42000	-	-	-
11/19	1035	3.5	8.0	11.7	3.4	296	1.10	0.08	0.31	32	200	660	265	120	3300	18000	35.0	11.0	-
11/21	1310	5.0	8.1	11.7	2.2	525	1.21	0.06	0.42	36	200	520	234	62	1600	7100	-	-	-
11/23	0920	3.5	7.8	12.2	1.9	563	0.73	0.05	0.48	35	75	500	144	43	2800	3200	-	-	-
11/25	0800	4.0	8.1	11.0	1.0	442	1.10	0.04	0.05	34	40	310	100	-	1500	1600	-	-	-
11/27	0950	4.0	8.1	11.9	1.5	595	1.01	0.04	0.27	35	36	510	114	23	1300	4700	-	12.0	-
11/29	1235	4.5	8.2	12.2	1.5	603	1.01	0.05	0.22	99	37	450	36	15	700	1000	-	-	-
12/02	0915	4.5	8.0	11.9	1.5	628	0.95	0.05	0.05	41	29	450	79	31	1400	1600	-	-	-
12/03	1210	3.0	8.3	12.3	1.0	631	0.93	0.05	0.09	42	33	510	78	14	790	560	-	-	-
12/05	1020	0.5	8.1	13.5	1.2	629	0.92	0.07	0.21	97	27	440	59	15	500	1500	-	9.5	-
12/07	0900	0.0	8.0	13.9	1.0	618	0.93	0.09	0.19	47	24	410	44	11	610	450	-	-	-

(1) & (2) as N (3) as P * #/100 ml

KANSAS RIVER STUDY

Table C-17. DATA FROM MILL CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 (1) $+NO_3$, mg/l	NH_3 (2), mg/l	TPO_4 (3), mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1005	19.0	8.2	8.0	3.4	652	0.03	0.10	0.09	16	19	460	12	400*	99	1400	-	-	13
10/04	0905	15.5	8.0	7.8	2.2	649	0.02	0.35	0.18	194	13	490	20	96	5000	220	-	-	8
10/12	1218	16.0	8.0	7.6	2.9	665	0.01	0.03	0.15	19	16	470	36	200	18000	230	-	-	6
10/20	1225	9.0	8.3	9.9	2.5	663	0.00	0.03	0.08	21	8	460	9	4	20	70	-	-	5
10/28	0920	10.0	8.1	8.7	2.5	715	0.01	0.02	0.09	20	16	550	43	4	9	80	-	-	10
11/05	0855	9.5	8.0	8.9	3.2	730	0.02	0.02	0.00	21	10	560	10	999*	100	90	-	-	30
11/13	1245	7.0	7.7	7.7	5.2	430	0.67	0.07	0.22	10	130	460	122	25	8000	11000	-	-	330
11/21	1240	3.5	8.3	12.6	1.1	605	0.67	0.04	0.08	11	19	370	22	1	200	1700	-	-	90
11/29	1215	4.0	8.2	13.0	1.0	676	0.53	0.03	0.09	111	9	400	15	1	9	370	-	-	80
12/07	0925	0.5	8.2	14.0	0.7	607	0.31	0.02	0.04	14	8	450	7	1	10	160	-	-	70

(1) & (2) as N * #/100 ml

(3) as P

KANSAS RIVER STUDY

Table C-18. DATA FROM KANSAS RIVER AT PAXICO

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2[1] $+NO_3$, mg/l	NH_3[2], mg/l	TPO_4[3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1100	19.5	8.3	8.8	3.5	787	0.65	0.14	0.04	85	43	590	92	59	2600	1000	-	-	-
09/30	1200	14.0	8.2	10.6	3.7	837	0.51	0.38	0.37	101	40	610	86	81	5400	760	-	-	-
10/04	0937	17.5	8.4	9.7	5.1	868	0.01	0.57	0.44	116	28	-	70	170	6200	590	-	-	-
10/08	0845	14.5	8.4	9.5	4.8	890	0.16	0.16	0.11	124	24	640	56	320	23000	420	-	-	-
10/12	1140	16.0	8.6	9.1	5.4	912	0.01	0.03	0.12	127	17	590	58	270	22000	160	-	-	-
10/16	0830	13.0	8.5	9.6	5.8	1200	0.00	0.03	0.27	180	15	790	36	26	1400	180	-	-	-
10/20	1150	7.5	8.3	11.0	3.5	1377	0.16	0.03	0.14	209	9	820	23	24	1600	350	-	-	-
10/24	1120	9.5	8.0	11.3	3.6	1087	0.25	0.02	0.34	214	20	660	29	47	4500	6700	-	-	-
10/28	1000	11.0	8.4	9.9	4.4	1179	0.12	0.02	0.29	189	13	810	43	29	1600	350	-	-	-
11/01	0823	10.0	8.3	9.9	4.5	1116	0.36	0.03	0.27	165	18	760	50	45	5400	700	-	-	-
11/05	0930	10.5	8.3	10.5	3.7	948	0.55	0.03	0.02	132	27	630	61	33	620	600	-	-	-
11/09	0840	9.5	8.2	10.2	2.8	863	0.62	0.01	0.16	97	25	500	59	23	1100	290	-	-	-
11/13	1215	6.5	7.9	9.8	7.8	369	0.74	0.09	0.00	18	720	2660	2020	160	19000	91000	-	-	-
11/17	1130	5.0	7.7	10.8	5.4	380	1.33	0.08	0.63	35	225	1000	570	100	11000	45000	-	-	-
11/21	1205	5.0	8.2	11.5	2.4	556	1.17	0.06	0.00	31	68	470	82	75	1700	5900	-	-	-
11/25	0835	4.5	7.9	11.8	1.2	449	1.08	0.06	0.06	37	32	380	87	50	2700	1600	-	-	-
11/29	1140	5.0	8.2	12.0	2.0	617	0.99	0.06	0.22	101.	33	420	158	39	2100	1200	-	-	-
12/03	1135	3.0	8.1	12.1	1.0	658	0.90	0.08	0.15	48	29	500	56	45	1100	710	-	-	-
12/07	0955	0.0	8.2	13.9	1.0	621	0.91	0.11	0.05	33	20	370	35	11	760	650	-	-	-

[1] & [2] as N

[3] as P

KANSAS RIVER STUDY

Table C-19. DATA FROM VERMILLION RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1130	19.5	8.2	8.4	3.2	735	0.65	0.09	0.16	6	20	530	47	3	200	500	-	-	-
10/04	1000	16.0	8.0	8.7	2.7	681	0.31	0.37	0.26	11	17	480	30	71	5500	220	-	-	-
10/12	1121	16.0	8.1	8.7	2.4	718	0.16	0.05	0.21	12	15	450	31	200	2400	140	-	-	-
10/20	1135	8.5	8.2	10.4	1.6	762	0.19	0.04	0.05	15	13	440	13	5500*	600	40	-	-	-
10/28	1020	9.5	7.8	8.4	2.3	644	0.23	0.07	0.18	8	22	500	51	1	100	820	-	-	-
11/05	0950	9.0	8.0	9.4	3.5	540	0.51	0.05	0.13	9	51	520	81	1	1100	4200	-	-	-
11/13	1150	6.5	7.7	8.9	8.5	250	0.85	0.13	0.03	4	1000	3480	3150	420	32000	150000	-	-	-
11/21	1145	4.0	8.2	11.9	1.7	632	1.04	0.06	0.12	8	30	440	64	11	1200	3800	-	-	-
11/29	1125	3.0	8.2	12.3	1.4	603	0.84	0.04	0.12	111	21	390	38	8	580	3300	-	-	-
12/07	1020	0.0	8.2	13.8	0.6	737	0.95	0.17	0.03	15	8	440	8	999*	50	240	-	-	-

[1] & [2] as N * #/100 ml
[3] as P

KANSAS RIVER STUDY

Table C-20. DATA FROM KANSAS RIVER AT WAMEGO

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 [1] $+NO_3$, mg/l	NH_3 [2], mg/l	TPO_4 [3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1155	20.0	8.2	8.5	3.1	835	0.75	0.13	0.25	88	39	590	90	350	19000	1700	-	-	1770
09/28	0855	20.0	8.2	8.3	6.8	654	0.72	0.34	0.18	94	44	550	63	290	20000	1100	36.2	11.2	1460
09/30	1125	14.0	8.2	10.2	3.7	857	0.64	0.38	0.40	108	35	640	71	350	6500	1700	-	-	1310
10/02	0905	16.0	8.4	9.1	5.9	922	0.44	0.26	0.45	123	29	690	124	740	24000	410	-	-	1220
10/04	1015	17.5	8.3	10.1	4.8	901	0.51	0.23	0.49	124	27	580	50	330	6700	2900	-	-	1220
10/06	1213	16.0	8.4	10.2	4.6	846	-	-	0.36	141	23	520	77	140	17000	670	43.2	9.0	1140
10/08	0910	14.5	8.1	9.3	4.2	974	0.43	0.26	0.32	129	23	590	64	430	17000	550	-	-	1230
10/10	1140	16.5	8.6	11.4	4.8	984	0.28	0.14	0.32	153	20	600	53	200	6900	510	22.5	9.5	1250
10/12	1105	16.5	8.4	8.6	4.7	958	0.13	0.05	0.23	134	20	610	48	330	37000	440	-	-	1150
10/14	0845	17.0	8.2	8.6	4.7	1217	0.14	0.03	0.32	196	16	790	27	29	1500	130	-	-	860
10/16	0900	13.0	8.3	9.6	3.7	1264	0.03	0.02	0.07	199	13	790	28	19	660	110	-	-	794
10/18	1150	9.0	8.4	11.6	4.9	1249	0.06	0.03	0.23	210	15	900	22	43	1900	780	17.0	6.0	758
10/20	1115	8.0	8.2	10.9	3.8	1294	0.21	0.09	0.30	224	10	870	15	16	190	190	-	-	776
10/22	0915	12.0	7.9	9.4	4.2	1190	0.32	0.03	0.30	175	17	750	22	55	2600	5200	-	-	900
10/24	1055	9.5	8.0	11.0	3.4	1130	0.34	0.04	0.36	223	16	690	17	59	2800	7900	-	-	812
10/26	1235	10.5	8.3	12.2	4.1	1154	0.30	0.02	0.37	191	20	770	19	23	570	360	31.0	4.0	812
10/28	1030	11.0	8.2	10.2	3.9	1229	0.30	0.02	0.30	205	16	840	43	55	2800	530	-	-	765
10/30	1220	11.5	8.2	12.2	4.2	1295	0.36	0.04	0.35	192	13	725	31	62	3200	800	-	-	765
11/01	0845	10.0	8.1	9.7	3.5	1133	0.40	0.12	0.27	175	25	760	43	360	7900	20000	-	-	900
11/03	0907	9.0	8.3	10.4	3.3	934	0.67	0.07	0.26	127	32	600	79	180	8800	5300	13.0	8.0	1400
11/05	1000	10.5	8.3	10.3	3.4	948	0.65	0.04	0.24	129	31	610	74	210	2800	1800	-	-	1700
11/07	0910	9.5	8.1	10.3	2.9	877	0.66	0.04	0.15	110	27	590	56	99	6000	3100	-	-	1700
11/09	0910	10.0	8.0	10.0	2.8	735	0.74	0.03	0.11	73	36	350	77	73	6900	1300	-	-	2100
11/11	1035	8.0	8.0	10.6	1.8	684	0.80	0.05	0.22	65	33	500	80	-	6200	5500	17.0	15.7	2400
11/13	1130	7.5	7.9	10.4	5.0	637	0.81	0.08	0.19	62	120	640	172	140	7400	18000	-	-	3000
11/15	0910	5.0	7.9	10.9	5.2	688	0.94	0.07	0.67	48	220	910	384	200	7000	8200	45.0	15.5	5300
11/17	1100	5.5	7.8	11.1	1.0	339	1.22	0.06	0.70	28	195	800	330	140	7400	35000	-	-	6300
11/19	1115	4.5	8.0	11.5	2.8	264	1.06	0.07	0.26	29	190	530	196	71	3500	6900	30.0	12.0	5700
11/21	1125	6.0	8.0	11.4	2.5	510	1.15	0.06	0.24	30	63	420	132	64	1700	3500	-	-	4900
11/23	0840	4.0	7.7	11.8	2.1	486	0.75	0.06	0.39	31	60	490	125	53	3500	3500	-	-	4600
11/25	0910	5.5	7.9	11.5	0.8	423	1.05	0.05	0.18	33	31	290	73	45	3100	1600	-	-	4600
11/27	0905	5.0	8.0	11.5	1.8	555	0.99	0.05	0.23	37	28	450	81	39	1300	1000	-	20.7	4600
11/29	1100	5.0	8.0	12.0	1.6	556	0.98	0.05	0.25	90	28	370	28	39	2700	2000	-	-	5500
12/02	0840	5.0	7.8	11.6	1.2	584	0.96	0.07	0.08	37	28	410	68	40	2200	2700	-	-	5300
12/03	1110	3.0	8.0	12.2	1.1	580	0.91	0.06	0.09	38	28	450	48	30	700	530	-	-	5300
12/05	0925	1.0	8.2	12.9	1.6	577	0.93	0.08	0.16	98	24	390	47	29	2200	1400	-	11.5	5200
12/07	1045	0.0	8.1	14.0	1.1	518	0.97	0.09	0.17	49	20	330	33	19	1500	690	-	-	5000

[1] & [2] as N [3] as P

KANSAS RIVER STUDY

Table C-21. DATA FROM BIG BLUE RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2+NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1240	20.0	8.1	8.7	2.2	379	1.13	0.18	0.05	11	26	300	25	1600*	99	500	-	-	533
09/30	1050	18.0	8.1	9.1	2.2	375	1.03	0.43	0.14	13	26	260	43	16	900	90	-	-	528
10/04	1050	19.5	7.8	9.1	1.5	364	0.37	1.06	0.44	13	26	240	30	52	4400	80	-	-	522
10/08	0950	17.5	8.1	8.8	1.3	357	1.08	0.23	0.18	14	23	230	62	190	12000	200	-	-	522
10/12	1030	17.0	7.9	8.9	1.4	404	0.89	0.04	0.17	13	24	290	17	260	21000	210	-	-	178
10/16	0935	16.5	7.9	8.9	1.4	393	1.09	0.03	0.19	39	26	260	26	999*	50	110	-	-	171
10/20	1040	12.5	8.1	9.3	1.4	430	1.02	0.03	0.16	14	24	290	29	4	70	40	-	-	171
10/24	1015	12.5	7.9	10.0	1.0	514	0.89	0.04	0.19	72	28	270	14	999*	40	110	-	-	322
10/28	1115	12.0	8.0	9.9	0.8	421	1.00	0.03	0.18	13	27	330	47	999*	30	60	-	-	322
11/01	0915	12.0	8.0	9.9	1.5	452	1.05	0.05	0.00	14	28	300	25	42	17000	20000	-	-	330
11/05	1035	12.0	8.1	10.4	1.6	415	0.99	0.03	0.00	14	25	240	28	999*	40	70	-	-	950
11/09	0945	11.5	8.0	10.5	1.0	402	0.99	0.02	0.18	14	23	130	47	999*	20	30	-	-	1400
11/13	1050	9.5	8.3	10.5	1.5	389	0.89	0.05	0.20	14	90	360	82	17	6000	20001	-	-	1500
11/17	1020	8.0	7.8	11.4	4.2	314	0.95	0.03	0.22	14	29	280	26	999*	20	100	-	-	1900
11/21	1045	7.5	7.9	11.6	1.4	397	1.10	0.03	0.08	14	28	260	28	999*	10	100	-	-	1900
11/25	0945	6.5	8.0	11.7	0.9	297	1.06	0.03	0.22	13	18	150	19	1	740	10000	-	-	1900
11/29	1130	6.0	8.3	12.5	1.3	430	0.99	0.03	0.20	70	19	270	22	2	9	80	-	-	3000
12/03	1030	4.0	8.3	12.9	0.6	426	0.97	0.03	0.09	15	25	330	25	200*	5	50	-	-	2800
12/07	1245	2.0	8.0	13.5	0.5	395	0.99	0.05	0.17	8	17	240	13	120*	5	40	-	-	2800

[1] & [2] as N * #/100 ml
[3] as P

KANSAS RIVER STUDY

Table C-22. DATA FROM KANSAS RIVER AT MANHATTAN

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 [1] $+NO_3$, mg/l	NH_3 [2], mg/l	TPO_4 [3], mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1320	20.0	8.4	9.1	3.4	1091	0.52	0.13	0.42	30	44	780	110	160	14000	200	-	-	-
09/30	1010	12.0	8.2	10.1	3.4	1360	0.29	0.42	0.39	213	41	850	93	130	5500	240	-	-	-
10/04	1110	18.0	8.4	10.2	6.1	1417	0.50	0.01	0.43	242	27	900	50	86	4100	90	-	-	-
10/08	1005	14.5	8.4	10.1	4.3	1378	0.02	0.21	0.27	221	20	490	54	250	10000	60	-	-	-
10/12	1005	16.0	8.3	8.7	4.6	1314	0.01	0.03	0.29	234	16	970	31	300	30000	370	-	-	-
10/16	1000	13.5	8.4	10.1	4.1	1428	0.00	0.02	0.11	291	12	1020	22	8	680	10	-	-	-
10/20	1015	8.0	8.3	10.8	3.8	1627	0.02	0.03	0.28	294	9	1040	24	7	270	20	-	-	-
10/24	0955	9.0	8.2	10.9	4.3	1766	0.00	0.02	0.32	357	14	1080	17	4	1000	140	-	-	-
10/28	1140	10.0	8.4	11.4	5.1	1872	0.01	0.03	0.32	360	12	1230	32	4	710	120	-	-	-
11/01	0940	9.5	8.3	10.7	3.9	1773	0.05	0.03	0.18	319	9	1100	17	31	3300	720	-	-	-
11/05	1055	11.0	8.4	11.8	4.9	1743	0.20	0.03	0.24	310	16	1110	45	7	2300	60	-	-	-
11/09	1015	10.0	8.0	10.3	2.9	1169	0.50	0.02	0.00	159	24	620	65	28	1100	420	-	-	-
11/13	1020	6.5	8.1	10.6	4.1	1136	0.66	0.14	0.00	159	95	790	95	59	5100	4400	-	-	-
11/17	0955	4.0	7.8	11.7	6.5	380	1.48	0.07	0.70	42	230	1210	760	140	4000	53000	-	-	-
11/21	1020	5.0	8.1	11.6	3.5	704	1.27	0.08	0.01	50	108	600	242	120	2500	4100	-	-	-
11/25	1010	4.5	8.1	11.8	1.3	595	1.03	0.10	0.22	65	34	500	83	130	6100	4000	-	-	-
11/29	1005	3.5	8.0	12.6	1.7	895	0.92	0.10	0.22	139	26	580	56	77	4900	2100	-	-	-
12/03	1005	2.5	8.3	12.4	1.0	902	0.75	0.09	0.07	87	28	650	55	50	5100	920	-	-	-
12/07	1305	0.0	8.2	13.4	1.2	824	0.71	0.18	0.11	94	24	550	15	14	750	540	-	-	-

(1) & (2) as N

(3) as P

KANSAS RIVER STUDY

Table C-23. DATA FROM CLARK CREEK

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 +NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/ 100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1405	19.5	8.2	8.3	3.1	506	0.31	0.10	0.14	6	17	370	5	1400*	100	100	-	-	-
10/04	1145	16.5	7.9	7.9	2.6	523	0.30	0.22	0.31	8	16	320	30	56	4200	540	-	-	-
10/12	0930	17.0	8.1	7.1	2.7	565	0.14	0.04	0.16	8	18	380	19	200	26000	330	-	-	-
10/20	0940	8.0	8.2	10.0	2.6	600	0.12	0.03	0.12	11	11	340	16	1	40	130	-	-	-
10/28	1220	10.0	7.9	8.5	2.2	556	0.10	0.02	0.14	7	15	430	40	5500*	30	80	-	-	-
11/05	1125	10.0	8.0	9.3	2.8	568	0.11	0.03	0.07	9	12	340	14	999*	190	360	-	-	-
11/13	0940	6.5	8.1	9.3	3.2	565	0.19	0.05	0.06	8	18	360	10	6	1700	15000	-	-	-
11/21	0940	3.5	8.2	11.5	2.4	530	0.91	0.03	0.04	7	27	320	24	3	400	8100	-	-	-
11/29	0930	2.0	8.2	12.1	1.3	579	0.62	0.02	0.08	114	9	340	9	999*	140	3900	-	-	-

[1] & [2] as N   * #/100 ml

[3] as P

KANSAS RIVER STUDY

Table C-24. DATA FROM KANSAS RIVER AT FORT RILEY

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1430	20.0	8.4	8.7	3.0	1102	0.52	0.17	0.13	175	65	850	152	150	2800	500	-	-	786
09/28	0750	20.0	8.2	7.8	8.9	1057	0.43	0.44	0.28	209	51	920	-	210	13000	500	40.7	12.8	702
09/30	0930	13.0	8.2	9.5	4.0	1490	0.29	0.42	0.41	243	39	900	93	880	35000	510	-	-	584
10/02	0805	16.0	8.2	8.4	8.0	1598	0.01	0.33	0.35	266	38	1070	-	1510	370000	600	-	-	578
10/04	1210	19.0	8.1	10.3	6.2	1495	0.49	0.01	0.38	269	28	960	60	100	6300	190	-	-	572
10/06	1300	15.5	8.3	9.3	4.7	1206	-	-	0.28	238	20	790	53	240	21000	790	39.6	7.9	646
10/08	1035	16.0	8.1	9.4	4.6	1314	0.17	0.18	0.23	232	18	810	67	270	20000	310	-	-	632
10/10	1220	18.5	8.3	9.8	4.9	1670	0.17	0.14	0.24	252	17	890	57	117	6700	210	22.5	8.3	639
10/12	0903	16.5	8.1	7.9	4.6	1713	0.08	0.04	0.29	305	19	1070	41	560	55000	710	-	-	530
10/14	0755	17.0	8.1	7.6	5.5	1610	0.12	0.03	0.27	296	20	1040	24	300	37000	4300	-	-	566
10/16	1042	14.0	8.2	9.7	4.6	1791	0.09	0.03	0.27	327	17	1080	43	83	5900	360	-	-	492
10/18	1235	10.0	8.2	10.8	4.8	1732	0.09	0.06	0.25	329	16	1180	11	220	18000	810	10.0	8.1	536
10/20	0915	8.5	8.4	10.1	5.0	1820	0.06	0.03	0.14	318	14	1110	28	170	16000	740	-	-	475
10/22	0815	12.0	8.2	8.9	5.1	1795	0.05	0.03	0.12	316	17	1140	-	340	28000	900	-	-	409
10/24	0910	9.0	8.1	10.2	4.1	1823	0.04	0.05	0.19	385	16	1170	19	120	6700	1200	-	-	392
10/26	1315	12.0	8.3	10.2	4.9	2055	0.06	0.06	0.33	393	18	1290	33	11	1000	410	35.0	9.4	382
10/28	1240	10.0	8.2	11.2	4.1	1999	0.06	0.05	0.21	380	18	1340	43	65	6200	570	-	-	365
10/30	1310	12.5	8.3	10.2	4.9	2072	0.04	0.07	0.29	380	11	1200	25	93	5900	670	-	-	354
11/01	1024	10.0	8.3	10.2	4.5	1945	0.05	0.08	0.19	362	14	1220	18	130	8400	3000	-	-	400
11/03	0815	8.0	8.4	10.5	3.8	1777	0.19	0.04	0.14	369	10	1190	27	180	5900	910	15.0	11.7	500
11/05	1145	11.0	8.4	11.7	4.6	1896	0.35	0.03	0.09	337	16	120	41	7	820	210	-	-	600
11/07	0815	9.0	8.1	9.8	3.3	1470	0.48	0.02	0.27	232	18	1040	29	47	2200	430	-	-	600
11/09	1120	10.0	8.2	10.2	3.9	1490	0.54	0.05	0.18	231	22	740	42	61	3500	530	-	-	900
11/11	1125	8.0	8.0	10.1	4.9	1587	0.81	0.03	0.24	243	54	1110	168	-	3300	2400	28.0	41.3	1200
11/13	0920	7.5	8.2	10.2	3.2	1224	0.66	0.07	0.24	182	100	910	72	74	5500	2900	-	-	1200
11/15	0815	4.0	7.7	9.8	8.6	580	1.50	0.08	0.66	47	570	1830	1270	210	19000	20001	99.0	28.3	5300
11/17	0910	4.0	7.7	11.6	6.5	459	1.33	0.09	0.55	63	225	1130	630	150	3000	16000	-	-	4700
11/19	1200	3.5	7.8	11.8	5.6	391	1.82	0.21	0.61	82	310	1000	370	52	6600	64000	57.0	22.7	3000
11/21	0915	6.0	8.1	12.0	2.3	654	0.95	0.09	0.22	46	54	470	86	110	1100	2700	-	-	2600
11/23	0750	4.0	7.8	12.1	1.8	668	0.75	0.09	0.16	31	55	560	67	24	3400	3800	-	-	2400
11/25	1045	5.5	8.2	11.8	1.0	551	0.97	0.09	0.12	64	25	400	58	54	3300	1300	-	-	2400
11/27	0815	3.5	8.0	11.8	1.8	995	1.23	0.12	0.32	110	37	780	111	25	2300	2400	-	10.5	2400
11/29	0905	4.5	8.1	12.5	1.8	759	0.73	0.08	0.13	120	18	490	30	43	4000	1000	-	-	2400
12/02	0750	4.5	8.0	11.8	1.3	1133	0.90	0.14	0.25	125	25	920	48	37	1800	1100	-	-	2400
12/03	0920	2.5	8.2	12.2	1.1	1095	0.91	0.13	0.07	119	26	750	34	34	1000	270	-	-	2300
12/05	0820	1.0	8.1	13.6	1.1	1102	0.78	0.13	0.05	184	18	690	29	23	1400	400	-	8.3	2200
12/07	1345	0.5	8.2	13.1	1.8	1066	0.77	0.24	0.13	139	13	710	25	180	3900	1500	-	-	1100

[1] & [2] as N [3] as P

KANSAS RIVER STUDY

Table C-25. DATA FROM REPUBLICAN RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1507	20.0	8.3	7.3	6.5	586	0.34	0.61	0.41	41	11	420	-	220	9100	1600	-	-	-
09/30	0850	13.0	8.0	8.7	3.5	611	0.24	0.37	0.33	40	11	380	16	680	43000	2800	-	-	-
10/04	1235	20.5	8.1	9.6	3.9	598	0.48	0.20	0.62	39	09	270	17	630	11000	1100	-	-	-
10/08	1100	17.0	8.2	8.9	2.5	595	0.40	0.30	0.17	39	14	320	29	63	3700	240	-	-	-
10/12	0830	16.0	8.1	8.3	3.1	611	0.32	0.17	0.30	41	15	400	13	1070	89000	2900	-	-	-
10/16	1120	15.5	8.2	9.0	3.2	612	0.37	0.35	0.32	40	14	350	14	810	41000	3000	-	-	-
10/20	0845	10.0	8.2	9.1	2.9	614	0.32	0.17	0.11	43	10	410	11	620	53000	3900	-	-	-
10/24	0840	9.0	7.8	8.8	2.7	611	0.22	0.30	0.39	119	12	390	6	580	34000	4800	-	-	-
10/28	1305	10.0	8.4	11.7	4.0	608	0.18	0.62	0.41	39	12	430	16	870	86000	7800	-	-	-
11/01	1045	10.0	8.0	9.9	5.1	531	0.10	0.42	0.31	33	14	360	8	470	40000	11000	-	-	-
11/05	1215	13.0	8.3	10.4	4.0	600	0.38	0.32	0.19	43	12	360	19	300	7300	2800	-	-	-
11/09	1155	10.5	8.0	9.7	4.3	596	0.48	0.36	0.18	40	18	260	30	660	63000	5500	-	-	-
11/13	0850	8.5	8.3	10.0	2.8	559	0.50	0.14	0.04	38	23	360	20	230	19000	3900	-	-	-
11/17	0835	7.5	8.1	11.5	2.4	459	0.51	0.08	0.16	39	21	410	49	300	7800	1600	-	-	-
11/21	0845	7.0	8.2	12.1	2.3	608	0.59	0.09	0.15	40	24	370	32	90	2300	1400	-	-	-
11/25	1120	7.0	8.3	11.9	1.1	440	0.58	0.10	0.04	39	15	330	33	320	27000	1700	-	-	-
11/29	0835	5.0	8.1	12.5	1.9	558	0.60	0.08	0.12	98	12	380	26	130	900	1500	-	-	-
12/03	0845	3.5	8.3	12.5	0.9	596	0.55	0.07	0.13	41	16	390	19	72	3100	650	-	-	-
12/07	1420	1.0	8.1	13.0	2.8	604	0.52	0.33	0.19	41	12	360	13	310	24000	8000	-	-	-

(1) & (2) as N

(3) as P

KANSAS RIVER STUDY

Table C-26. DATA FROM SMOKY HILL RIVER

Date, 1972	Hour	Temp, °C	pH	D.O., mg/l	BOD_5, mg/l	Cond, mhos	NO_2 + NO_3,[1] mg/l	NH_3,[2] mg/l	TPO_4,[3] mg/l	Cl, mg/l	Turb, JTU	Total Solids, mg/l	Susp. Solids, mg/l	Total Coli, 1000/100ml	Fecal Coli, #/100ml	Fecal Strep, #/100ml	COD, mg/l	TOC, mg/l	Flow, cfs
09/26	1540	20.5	8.3	8.7	3.5	1238	0.55	0.19	0.33	215	71	930	144	35	1900	100	-	-	400
09/30	0820	13.0	8.2	9.4	5.7	1755	0.31	0.54	0.57	305	48	1080	108	570	23000	350	-	-	350
10/04	1300	19.5	8.4	11.5	7.8	1856	0.50	0.01	0.40	357	36	1200	82	160	6600	30	-	-	290
10/08	1120	16.0	8.2	10.6	7.6	2055	0.01	0.18	0.28	393	21	1200	58	130	15000	40	-	-	280
10/12	0805	17.5	8.0	8.1	7.1	2216	0.02	0.05	0.30	442	23	1320	36	540	53000	100	-	-	270
10/16	1150	15.0	8.5	10.6	5.3	2293	0.00	0.03	0.26	459	18	1390	59	999*	40	30	-	-	275
10/20	0815	8.0	8.4	10.5	7.0	2192	0.00	0.03	0.30	448	13	1440	33	1	100	10	-	-	255
10/24	0815	9.0	8.1	10.6	3.8	2174	0.00	0.02	0.32	451	17	1350	25	1	190	100	-	-	257
10/28	1335	10.0	8.3	11.7	4.4	2268	0.10	0.03	0.31	454	15	1490	50	999*	40	20	-	-	253
11/01	1105	9.5	8.3	10.7	4.2	2276	0.10	0.04	0.20	453	13	1440	24	10	310	260	-	-	273
11/05	1230	11.0	8.4	11.9	5.0	1801	0.42	0.05	0.00	344	20	1270	48	999*	120	90	-	-	430
11/09	1230	9.5	8.0	10.3	3.4	1908	0.52	0.02	0.15	325	15	1010	24	999*	2200	230	-	-	315
11/13	0820	7.0	8.2	10.1	4.3	1722	0.75	0.06	0.37	269	115	1230	122	16	1900	6200	-	-	504
11/17	0810	3.0	7.6	11.5	7.6	503	1.62	0.12	0.38	73	220	1380	680	130	6000	83000	-	-	2000
11/21	0820	3.0	7.9	11.9	4.3	723	1.87	0.14	0.06	65	290	770	218	24	1800	23000	-	-	812
11/25	1145	4.0	8.1	11.8	1.6	918	1.40	0.16	0.41	119	49	730	64	18	1700	2700	-	-	628
11/29	0810	2.0	8.2	11.9	2.7	1204	1.29	0.19	0.38	209	42	880	91	13	3400	3400	-	-	624
12/03	0820	2.5	8.2	11.9	1.3	1451	1.05	0.21	0.10	193	31	1060	60	15	1000	400	-	-	495
12/07	1445	0.0	8.1	13.1	0.9	1528	1.01	0.27	0.16	242	16	1100	24	999*	99	200	-	-	309

[1] & [2] as N * #/100 ml

[3] as P

Table D-1. QUALITY RATINGS AND WQI FOR
KANSAS RIVER AT KANSAS CITY-JAMES STREET

Date, 1972	Time	Fecal Coli	pH	BOD_5	$NO_2 + NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0820	10.2	85.7	73.2	92.7	63.6	94.9	27.5	20.0	89.3	63.2	49.6
09/28	1400	8.0	80.0	57.2	96.3	74.4	94.9	32.8	32.4	96.6	64.7	50.3
09/30	1120	17.4	80.0	55.0	97.5	72.6	94.9	37.3	20.0	94.3	64.8	54.5
10/02	1405	11.1	62.4	47.2	96.6	53.0	94.9	43.5	20.0	94.0	59.4	47.7
10/04	0708	14.4	61.1	49.0	99.2	44.9	94.9	41.7	41.4	97.3	61.5	52.1
10/06	0725	12.3	74.2	48.2	-	89.8	94.9	47.4	37.5	98.1	-	-
10/08	0730	11.7	86.9	45.1	99.9	74.4	94.9	44.1	20.0	62.2	59.3	48.3
10/10	0735	13.4	85.7	37.9	99.9	54.5	94.9	48.1	20.0	96.9	62.9	50.9
10/12	1240	10.5	87.4	37.7	99.9	80.8	94.9	55.0	20.0	89.8	64.7	51.0
10/14	1335	7.8	88.6	38.6	99.7	71.7	94.9	53.3	20.0	79.7	61.7	47.3
10/16	0735	13.9	76.5	39.9	99.9	92.5	94.9	55.0	20.0	94.0	66.0	53.8
10/18	0720	13.9	82.8	30.3	99.9	51.6	94.9	62.2	20.0	96.0	62.6	50.5
10/20	1340	12.6	82.8	29.4	100.0	84.4	94.9	64.7	20.0	99.1	66.3	52.6
10/22	1450	12.7	74.2	34.2	97.3	34.9	94.9	64.7	20.0	98.8	60.5	48.1
10/24	1720	21.9	85.7	45.1	96.0	52.5	94.9	63.5	20.0	96.3	65.5	56.5
10/26	0805	18.9	80.0	47.8	94.9	52.5	94.9	60.0	20.0	98.8	64.6	55.0
10/28	0640	24.6	85.7	50.9	96.0	57.2	94.9	64.7	20.0	97.0	67.1	58.8
10/30	0800	18.1	77.1	47.8	97.4	66.3	94.9	67.1	20.0	95.8	65.9	56.1
11/01	0745	12.7	80.0	48.3	90.9	53.6	94.9	65.9	20.0	85.8	61.7	50.9
11/03	1335	14.2	78.5	55.7	95.1	70.8	94.9	64.7	20.0	96.9	66.4	55.2
11/05	0910	19.3	86.9	60.2	94.9	65.4	94.9	55.0	38.8	87.5	67.2	59.8
11/07	1430	16.5	86.9	61.0	95.2	50.2	94.9	61.1	20.0	91.7	65.1	55.0
11/09	0805	14.4	88.2	64.1	94.6	98.9	94.9	48.1	41.4	88.3	70.2	59.9
11/11	0639	17.1	88.2	70.5	93.0	69.0	94.9	43.5	40.1	82.6	66.6	58.4
11/13	1355	8.1	90.0	57.1	93.4	62.7	94.9	22.2	20.0	89.0	61.3	46.1
11/15	1340	8.5	89.4	46.7	93.5	42.1	94.9	5.0	20.0	87.3	56.6	38.7
11/17	1115	9.0	88.2	60.2	93.6	77.2	94.9	5.0	20.0	93.7	62.5	43.0
11/19	0640	11.4	87.6	60.2	90.9	94.4	94.9	5.0	20.0	95.6	64.5	45.4
11/21	1115	14.6	88.8	66.1	90.1	82.6	94.9	5.0	20.0	95.0	64.4	46.9
11/23	1245	12.6	89.4	78.8	91.9	57.2	94.9	5.0	20.0	96.5	63.3	45.3
11/25	0825	12.0	89.4	60.2	94.3	86.2	94.9	27.2	47.1	94.2	68.1	55.9
11/27	1335	16.8	85.7	83.6	91.9	64.5	94.9	35.7	32.4	95.1	67.9	58.1
11/29	1305	15.7	84.3	77.9	92.9	71.7	94.9	25.3	20.0	97.0	66.3	54.2
12/02	1250	13.7	86.9	82.7	93.1	89.8	94.9	31.7	20.0	96.4	69.1	55.8
12/03	1120	13.5	80.0	83.6	91.7	79.0	94.9	42.9	32.4	94.3	68.6	57.7
12/05	1435	13.0	82.8	78.4	93.1	89.8	94.9	21.4	20.0	93.9	66.8	52.8
12/07	0710	13.5	82.8	82.7	93.4	92.5	94.9	39.4	42.8	92.3	70.6	59.6

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Table D-2. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT KANSAS CITY-7TH STREET

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0905	7.8	80.0	67.9	93.6	69.0	94.9	40.2	40.1	93.5	65.6	52.0
09/30	1052	9.4	66.9	58.7	97.7	65.4	94.9	44.7	20.0	96.4	62.7	49.4
10/04	0736	16.5	68.2	52.2	98.7	63.6	94.9	46.1	20.0	91.7	62.5	52.8
10/08	0755	15.9	80.0	42.3	99.9	79.0	94.9	47.4	20.0	87.6	63.9	53.4
10/12	1215	10.6	90.4	38.2	99.9	62.7	94.9	57.8	20.0	86.0	62.8	49.9
10/16	0805	15.2	80.0	40.3	99.9	71.7	94.9	58.9	20.0	97.0	65.4	54.1
10/20	1310	14.0	74.2	31.4	100.0	83.5	94.9	64.7	20.0	96.3	65.1	52.8
10/24	1655	15.9	82.8	45.6	96.0	53.6	94.9	61.1	20.0	97.8	64.5	53.8
10/28	0705	24.6	80.0	50.9	98.2	69.0	94.9	60.0	20.0	99.5	67.9	59.5
11/01	0815	14.4	78.5	50.9	95.8	70.8	94.9	60.0	20.0	95.2	65.4	54.4
11/05	0935	16.2	86.9	65.7	95.2	75.3	94.9	51.6	34.2	91.4	68.4	59.2
11/09	0850	15.0	85.7	68.9	95.4	75.3	94.9	41.7	48.3	92.8	69.0	59.5
11/13	1325	12.0	88.2	68.9	93.4	90.7	94.9	5.0	20.0	92.2	64.8	46.1
11/17	1050	11.9	88.2	66.1	93.8	77.2	94.9	5.0	20.0	92.7	63.3	45.1
11/21	1050	14.8	86.9	80.3	90.3	83.5	94.9	5.0	20.0	95.6	65.8	48.0
11/25	0845	13.6	86.9	76.0	91.6	62.7	94.9	24.6	35.9	94.8	66.0	54.5
11/29	1245	13.6	86.9	77.9	93.0	60.8	94.9	22.5	20.0	97.8	65.2	51.9
12/03	1055	15.7	80.0	86.5	91.8	85.3	94.9	42.3	20.0	93.4	68.7	57.2
12/07	0735	12.5	86.9	76.0	93.5	96.2	94.9	5.0	20.0	90.7	65.8	46.9

Table D-3. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT KANSAS CITY-TURNER STREET

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0945	12.5	80.0	75.2	93.9	67.2	94.9	28.5	20.0	92.8	64.2	51.7
09/28	1330	9.4	74.2	54.7	97.7	77.2	94.9	37.3	35.9	97.7	65.2	52.3
09/30	1020	9.4	71.3	58.7	96.8	54.5	94.9	46.1	35.9	93.8	63.0	51.1
10/02	1330	11.5	53.5	42.8	99.1	53.0	94.9	46.7	20.0	93.5	58.4	47.0
10/04	0808	14.4	59.7	47.5	98.8	51.9	94.9	46.7	20.0	98.1	60.6	50.8
10/06	0755	14.0	82.8	40.0	-	56.3	94.9	39.4	20.0	98.3	-	-
10/08	0820	14.2	80.0	35.7	99.9	70.8	94.9	46.1	20.0	96.8	63.6	51.8
10/10	0800	11.3	80.0	35.7	99.9	64.5	94.9	51.6	20.0	98.4	63.2	50.1
10/12	1155	13.9	86.3	37.7	99.9	80.8	94.9	57.8	20.0	92.6	65.7	53.6
10/14	1300	12.2	72.2	37.7	99.7	71.7	94.9	54.1	20.0	91.2	62.3	50.4
10/16	0830	11.8	81.4	40.3	100.0	94.4	94.9	64.7	20.0	98.4	68.0	54.1
10/18	0750	12.6	82.8	28.3	100.0	93.5	94.9	56.7	20.0	97.4	66.2	52.2
10/20	1235	14.4	77.1	39.5	97.9	88.0	94.9	65.9	20.0	99.3	67.2	55.0
10/22	1420	15.7	77.1	47.2	97.7	59.0	94.9	58.9	20.0	99.7	64.8	54.0
10/24	1625	18.5	85.7	52.0	94.0	52.2	94.9	55.8	20.0	99.3	65.3	55.4
10/26	0830	15.0	82.8	53.1	95.7	65.4	94.9	50.7	20.0	95.6	65.0	54.1
10/28	0735	18.5	74.2	50.9	97.7	64.5	94.9	52.5	20.0	99.5	65.2	55.5
10/30	0820	12.1	71.3	53.1	85.0	53.0	94.9	64.7	20.0	98.0	62.4	51.1
11/01	0840	13.5	77.1	47.2	97.8	77.2	94.9	55.0	20.0	95.7	65.3	53.6
11/03	1305	8.5	85.7	59.4	94.8	98.9	94.9	35.7	20.0	91.4	66.4	50.7
11/05	1000	19.8	82.8	63.4	95.0	88.9	94.9	45.4	20.0	93.6	68.3	58.5
11/07	1355	14.4	82.8	65.7	95.8	75.3	94.9	53.3	20.0	97.2	67.7	56.1
11/09	0920	16.5	85.7	62.6	95.4	78.1	94.9	34.5	20.0	94.0	66.2	55.2
11/11	0705	12.4	86.9	72.0	94.1	61.8	94.9	33.9	20.0	92.4	64.6	52.2
11/13	1300	13.6	87.6	57.8	93.7	88.0	94.9	5.0	20.0	91.0	63.5	45.9
11/15	1310	7.5	90.7	46.7	93.5	53.0	94.9	5.0	20.0	89.0	58.0	39.1
11/17	1020	10.9	85.7	64.1	93.8	58.1	94.9	5.0	20.0	94.4	61.1	43.2
11/19	0710	12.4	86.3	62.6	91.0	85.3	94.9	5.0	20.0	95.6	63.9	45.6
11/21	1025	13.4	86.9	70.5	90.6	59.0	94.9	5.0	20.0	95.3	62.1	45.0
11/23	1215	11.3	88.2	76.0	92.2	62.7	94.9	5.0	20.0	97.0	63.3	44.8
11/25	0900	17.7	86.9	83.6	91.8	65.4	94.9	35.1	53.5	96.7	70.2	61.3
11/27	1305	14.0	85.7	83.6	91.9	74.4	94.9	39.4	20.0	96.4	68.0	55.8
11/29	1220	14.4	82.8	79.8	93.0	73.5	94.9	38.7	38.8	98.1	69.1	58.6
12/02	1225	13.9	82.8	75.2	93.2	93.5	94.9	39.4	35.9	96.6	70.2	58.9
12/03	1025	14.0	77.1	87.9	92.1	78.1	94.9	44.7	32.4	94.0	68.8	58.1
12/05	1410	12.1	85.7	81.3	93.2	88.0	94.9	46.1	40.1	95.6	71.0	59.2
12/07	0800	19.8	82.8	86.7	93.5	96.2	94.9	52.5	57.4	98.9	75.6	67.4

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Table D-4. QUALITY RATINGS AND WQI FOR MILL CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1040	16.8	85.7	67.9	84.7	35.6	94.9	49.0	20.0	74.6	59.3	50.4
10/04	0903	24.6	88.2	76.0	80.2	25.5	94.9	49.8	20.0	72.7	59.9	51.9
10/12	1115	20.8	88.2	67.3	78.3	31.7	94.9	47.4	20.0	65.5	57.5	49.9
10/20	1200	31.6	86.9	64.1	78.5	20.6	94.9	65.9	20.0	86.0	62.5	54.4
10/28	0805	39.1	90.7	71.2	86.7	28.2	94.9	58.9	35.9	80.0	66.0	61.0
11/05	1030	34.8	86.9	64.9	87.4	35.2	94.9	57.8	37.5	88.7	66.6	61.6
11/13	1230	14.4	87.6	36.4	91.2	97.1	94.9	5.0	20.0	88.6	61.7	44.3
11/21	1005	43.3	85.7	64.9	86.3	30.8	94.9	73.2	32.4	89.6	68.2	63.2
11/29	1145	57.6	86.3	64.1	86.3	26.3	94.9	73.2	34.2	95.9	71.0	65.9
12/07	0840	59.6	85.7	72.8	86.6	20.5	94.9	78.0	20.0	96.7	71.0	63.1

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Table D-5. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT BONNER SPRINGS

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1120	10.3	77.1	70.5	94.2	70.8	94.9	42.9	35.9	94.9	66.3	54.2
09/28	1255	8.3	71.3	52.4	97.7	69.0	94.9	41.7	35.9	96.3	63.8	50.6
09/30	0948	9.4	74.2	58.2	96.2	81.7	94.9	46.7	37.5	96.8	66.6	53.9
10/02	1255	18.5	53.5	46.8	99.2	82.6	94.9	42.3	20.0	79.0	59.9	51.3
10/04	0922	14.8	65.1	47.8	99.0	52.2	94.9	51.6	34.2	97.0	62.8	53.4
10/06	0825	13.9	77.1	40.7	-	59.0	94.9	49.8	20.0	93.2	-	-
10/08	0850	10.5	77.1	38.2	99.9	62.7	94.9	55.0	32.4	96.1	63.7	51.5
10/10	0825	20.3	78.5	39.0	99.9	89.8	94.9	57.8	20.0	93.2	66.9	56.9
10/12	1055	13.4	77.1	36.8	99.9	60.8	94.9	61.1	20.0	95.6	63.3	51.5
10/14	1230	14.8	59.3	37.3	99.8	79.9	94.9	56.7	20.0	50.0	55.2	46.4
10/16	0900	20.3	75.9	41.6	98.6	72.6	94.9	67.1	20.0	98.8	66.7	57.0
10/18	0815	11.1	77.1	37.7	99.3	64.5	94.9	63.5	20.0	96.0	63.6	50.7
10/20	1145	25.9	74.2	36.4	98.2	81.7	94.9	71.6	20.0	98.3	68.0	59.1
10/22	1350	20.8	77.1	48.3	95.1	58.1	94.9	67.1	20.0	94.0	65.0	56.3
10/24	1600	-	82.8	45.1	97.2	62.7	94.9	52.5	20.0	94.4	-	-
10/26	0900	21.9	82.8	47.8	97.8	59.9	94.9	53.3	20.0	96.0	65.4	56.6
10/28	0820	19.3	82.8	50.4	97.0	32.2	94.9	67.1	20.0	92.5	63.0	53.1
10/30	0850	19.3	77.1	47.8	96.3	59.9	94.9	71.6	20.0	99.1	66.2	56.6
11/01	0905	11.2	80.0	50.4	93.2	73.5	94.9	68.3	20.0	92.8	65.3	52.8
11/03	1240	9.6	84.3	48.3	95.6	98.0	94.9	23.2	20.0	97.1	65.2	49.3
11/05	1045	22.5	82.8	61.8	95.2	95.3	94.9	47.4	20.0	97.1	69.9	60.5
11/07	1330	18.5	82.8	61.0	95.2	82.6	94.9	46.1	20.0	97.9	68.0	57.7
11/09	0940	15.4	86.9	61.0	94.9	98.9	94.9	16.6	20.0	94.7	66.7	52.3
11/11	0725	15.0	86.3	73.6	94.1	70.8	94.9	37.3	20.0	93.3	66.4	55.0
11/13	1215	13.9	85.7	56.3	94.1	96.2	94.9	5.0	20.0	93.7	64.4	46.4
11/15	1240	7.5	90.7	44.6	93.8	69.0	94.9	5.0	20.0	90.5	59.6	40.1
11/17	0955	10.9	86.9	62.6	93.6	77.2	94.9	5.0	20.0	95.4	63.1	44.5
11/19	0735	11.1	86.9	67.3	90.5	60.8	94.9	5.0	20.0	93.1	61.3	43.5
11/21	0950	13.7	86.9	79.8	91.8	87.1	94.9	5.0	20.0	95.9	66.2	47.7
11/23	1150	14.2	88.2	76.0	92.2	79.0	94.9	5.0	20.0	96.3	65.3	47.4
11/25	0930	13.5	86.9	85.5	91.9	69.0	94.9	35.1	47.1	97.1	69.7	58.7
11/27	1240	15.2	84.3	80.7	91.6	72.6	94.9	39.4	20.0	96.9	67.6	56.0
11/29	1130	13.6	82.8	76.9	92.9	75.3	94.9	42.3	40.1	97.6	69.2	58.6
12/02	1200	16.2	85.7	86.2	93.0	85.3	94.9	44.1	37.5	97.7	71.8	61.7
12/03	1000	12.5	90.7	83.1	91.6	73.5	94.9	46.1	32.4	94.0	69.3	57.7
12/05	1345	10.8	82.8	83.8	93.3	88.0	94.9	47.4	40.1	96.4	70.9	58.4
12/07	0900	15.2	85.7	83.3	93.8	97.1	94.9	52.5	47.1	98.3	74.1	63.9

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Table D-6. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT DESOTO

Date, 1972	Time	Fecal Coli	pH	BOD_5	$NO_2 + NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1210	8.7	77.1	73.6	95.0	97.1	94.9	39.4	37.5	97.7	69.4	55.0
09/30	0912	7.8	82.8	61.0	96.0	86.2	94.9	46.1	20.0	93.9	66.2	50.6
10/04	0952	11.1	69.6	47.8	98.7	57.2	94.9	52.5	20.0	98.5	62.4	50.0
10/08	0920	12.4	82.8	42.3	99.9	63.6	94.9	56.7	20.0	97.2	64.5	52.1
10/12	1025	10.7	74.5	37.7	99.8	87.1	94.9	63.5	20.0	88.4	64.2	51.0
10/16	0930	19.3	74.2	39.5	100.0	72.6	94.9	67.1	20.0	97.5	66.0	56.1
10/20	1125	17.7	82.8	36.4	98.0	78.1	94.9	73.2	20.0	98.0	67.4	56.4
10/24	1530	12.8	88.2	51.5	95.7	54.5	94.9	48.1	20.0	99.5	64.5	52.3
10/28	0840	13.7	82.8	52.0	97.7	52.2	94.9	65.9	20.0	93.1	64.4	53.1
11/01	0935	8.7	80.0	56.3	95.6	72.6	94.9	62.2	20.0	95.7	65.7	51.4
11/05	1115	15.7	82.8	56.3	96.2	98.0	94.9	54.1	20.0	98.3	69.5	57.7
11/09	1010	10.3	88.2	55.2	93.8	98.9	94.9	5.0	20.0	92.1	64.1	44.4
11/13	1155	11.7	85.7	61.8	93.9	98.9	94.9	5.0	20.0	91.3	64.5	45.6
11/17	0930	11.9	86.9	62.2	94.1	62.7	94.9	5.0	20.0	96.0	61.9	44.2
11/21	0920	15.9	85.7	75.2	90.8	68.1	94.9	5.0	20.0	96.7	64.0	47.2
11/25	0950	15.9	85.7	79.3	91.8	74.4	94.9	40.2	45.7	96.2	69.9	60.5
11/29	1105	18.9	85.7	77.9	93.2	78.1	94.9	45.4	41.4	97.7	71.1	62.6
12/03	0930	12.4	82.8	90.3	92.7	92.5	94.9	46.7	37.5	93.1	71.4	59.6
12/07	0920	15.4	82.8	85.7	93.8	79.0	94.9	53.3	52.1	98.4	72.8	63.2

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Table D-7. QUALITY RATINGS AND WQI FOR STRANGER CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1240	43.2	80.0	71.6	97.2	88.9	94.9	57.8	45.7	97.5	76.2	72.8
10/04	1013	29.9	86.9	79.5	96.0	75.3	94.9	71.6	56.1	88.2	74.7	70.3
10/12	1010	26.3	86.1	78.8	98.8	84.4	94.9	74.8	44.2	94.0	75.5	69.5
10/20	1105	43.2	82.8	76.0	99.1	90.7	94.9	76.4	58.8	97.0	79.8	77.0
10/28	0900	29.5	89.4	72.8	92.1	76.2	94.9	49.0	45.7	89.6	71.6	66.5
11/05	1130	15.0	85.7	69.7	91.5	88.9	94.9	32.8	47.1	93.3	69.3	59.1
11/13	1140	16.8	90.7	46.7	92.4	90.7	94.9	5.0	20.0	84.9	62.3	46.1
11/21	0905	20.8	85.7	79.8	88.4	90.7	94.9	49.0	45.7	95.5	72.6	65.0
11/29	1050	34.8	86.9	77.9	89.8	78.1	94.9	46.1	48.3	1.3	57.5	33.2
12/07	0945	49.3	82.8	89.5	89.9	93.5	94.9	81.1	48.3	95.3	80.7	78.2

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Table D-8. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT EUDORA

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1315	8.0	74.2	80.0	95.7	74.4	94.9	42.9	35.9	98.8	67.7	53.3
09/28	1215	6.9	77.1	51.9	96.1	75.3	94.9	43.5	37.5	99.0	65.4	50.6
09/30	0842	7.3	80.0	58.2	96.0	63.6	94.9	49.0	20.0	92.3	63.2	48.3
10/02	1210	11.0	66.9	52.3	96.0	51.9	94.9	49.0	20.0	93.4	60.6	48.8
10/04	1058	7.0	71.6	44.0	98.8	49.7	94.9	50.7	20.0	96.4	60.4	45.6
10/06	0907	6.2	77.1	44.2	-	86.2	94.9	55.0	20.0	88.0	-	-
10/08	0947	8.3	85.7	39.7	97.7	80.8	94.9	61.1	20.0	96.8	65.8	50.3
10/10	0900	7.6	77.1	40.8	98.0	62.7	94.9	61.1	20.0	91.3	62.0	47.5
10/12	0955	5.4	82.6	37.7	99.9	60.8	94.9	63.5	20.0	83.2	60.9	44.5
10/14	1150	9.4	78.2	36.8	98.6	55.4	94.9	55.8	20.0	96.2	61.8	48.1
10/16	0950	10.7	82.3	40.8	97.9	66.3	94.9	73.2	20.0	96.8	65.4	51.9
10/18	0855	4.1	85.7	36.8	95.0	70.8	94.9	63.5	20.0	90.0	62.6	43.9
10/20	1055	5.1	82.8	34.7	96.6	53.6	94.9	70.0	20.0	95.3	62.1	44.3
10/22	1315	12.7	80.0	53.1	94.9	84.4	94.9	62.2	20.0	99.1	67.7	55.1
10/24	1510	11.6	86.9	54.1	95.8	57.2	94.9	55.8	20.0	97.5	65.0	52.4
10/26	0935	8.1	86.9	52.5	96.6	59.0	94.9	56.7	20.0	94.2	64.1	49.5
10/28	0915	6.7	85.7	53.1	62.7	57.2	94.9	70.0	20.0	94.2	61.3	46.7
10/30	0925	9.3	82.8	52.5	97.7	59.0	94.9	70.0	20.0	97.6	65.5	51.4
11/01	1005	5.7	81.4	57.8	96.9	75.3	94.9	65.9	20.0	87.5	64.9	48.2
11/03	1205	8.3	85.7	65.7	96.5	98.9	94.9	39.4	20.0	96.7	68.3	52.1
11/05	1150	18.5	80.0	60.2	96.7	88.0	94.9	58.9	20.0	99.3	69.5	59.2
11/07	1250	15.0	82.8	64.9	96.0	68.1	94.9	49.8	20.0	99.1	67.0	55.8
11/09	1030	10.5	86.9	64.1	93.8	69.9	94.9	24.6	20.0	95.2	64.1	49.9
11/11	0800	10.0	86.9	66.5	95.4	69.9	94.9	40.9	20.0	95.0	65.6	51.8
11/13	1130	8.9	86.9	57.1	91.3	51.6	94.9	5.0	20.0	94.5	59.3	40.9
11/15	1200	7.0	89.4	47.2	94.6	85.3	94.9	5.0	20.0	92.7	61.8	40.9
11/17	0910	11.9	86.9	66.1	94.1	65.4	94.9	5.0	20.0	97.1	62.8	44.7
11/19	0805	11.1	86.3	57.8	90.8	84.4	94.9	5.0	20.0	96.3	63.2	44.6
11/21	0850	13.7	86.9	68.9	90.5	84.4	94.9	5.0	20.0	97.1	64.9	46.9
11/23	1115	15.4	89.4	82.7	95.7	71.7	94.9	5.0	20.0	98.1	66.2	48.3
11/25	1010	16.2	86.9	81.7	91.6	78.1	94.9	44.7	47.1	96.9	71.3	62.0
11/27	1200	18.5	85.7	81.7	92.7	73.5	94.9	36.2	20.0	97.6	68.4	57.7
11/29	1035	16.5	85.7	79.8	93.0	79.9	94.9	48.1	20.0	98.8	69.8	58.5
12/02	1130	16.8	86.9	86.0	92.7	90.7	94.9	47.4	40.1	96.6	72.8	63.1
12/03	0905	16.2	80.0	88.4	92.2	89.8	94.9	47.4	34.2	97.3	71.6	61.5
12/05	1305	12.0	81.4	84.8	93.8	81.7	94.9	49.8	44.2	97.0	71.1	59.6
12/07	1020	13.7	85.7	82.2	92.7	92.5	94.9	55.8	48.3	97.8	73.5	62.8

KANSAS RIVER STUDY

Table D-9. QUALITY RATINGS AND WQI FOR WAKARUSA RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1340	43.2	80.0	69.8	95.9	90.7	94.9	62.2	20.0	88.3	72.8	67.3
10/04	1105	29.9	87.6	64.9	97.5	71.7	94.9	65.9	47.1	79.8	70.5	66.1
10/12	0945	24.3	86.8	54.7	99.9	77.2	94.9	73.2	38.8	96.8	72.1	65.2
10/20	1040	49.3	88.2	67.3	98.2	91.6	94.9	62.2	57.4	26.7	67.3	61.7
10/28	0920	36.1	88.2	75.2	97.4	79.0	94.9	54.1	42.8	50.0	66.9	62.9
11/05	1200	41.0	86.9	74.4	97.4	94.4	94.9	49.0	42.8	87.5	74.9	71.1
11/13	1120	15.9	86.9	53.6	96.3	64.5	94.9	5.0	20.0	85.4	60.3	44.8
11/21	0840	17.7	85.7	76.0	90.2	94.4	94.9	50.7	45.7	95.5	72.4	63.6
11/29	1025	16.5	82.8	80.7	92.1	92.5	94.9	61.1	45.7	96.0	73.3	64.1
12/07	1035	47.5	81.4	90.8	92.5	88.0	94.9	67.1	44.2	96.7	78.9	76.0

KANSAS RIVER STUDY

Table D-10. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT LAWRENCE

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1430	23.4	77.1	76.0	96.5	77.2	94.9	43.5	38.8	99.7	70.7	63.5
09/30	0800	13.5	77.1	62.2	97.7	66.3	94.9	47.4	37.5	90.5	65.6	55.8
10/04	1138	14.6	68.7	47.5	99.8	47.4	94.9	45.4	20.0	98.3	61.3	50.5
10/08	1018	23.4	80.0	42.0	99.9	67.2	94.9	60.0	20.0	98.1	66.6	57.7
10/12	0920	20.8	80.3	37.3	100.0	88.9	94.9	57.8	20.0	92.6	66.8	57.0
10/16	1020	13.0	81.4	42.4	100.0	72.6	94.9	65.9	20.0	97.7	66.2	53.8
10/20	1010	45.9	80.0	48.8	99.9	62.7	94.9	63.5	20.0	94.3	69.8	64.2
10/24	1445	13.1	86.9	59.4	99.1	61.8	94.9	55.8	20.0	96.7	66.4	54.4
10/28	0955	29.1	85.7	52.5	99.8	67.2	94.9	62.2	20.0	95.3	68.9	61.4
11/01	1030	11.9	82.8	62.6	99.2	68.1	94.9	60.0	20.0	91.1	66.1	53.8
11/05	1230	25.5	80.0	68.1	97.1	85.3	94.9	62.2	20.0	99.4	71.4	63.0
11/09	1055	16.2	87.6	71.2	95.4	79.0	94.9	35.1	34.2	91.8	68.1	58.2
11/13	1055	17.1	85.7	68.1	94.5	70.8	94.9	5.0	20.0	92.6	63.4	47.3
11/17	0845	16.5	85.7	61.8	93.5	57.2	94.9	5.0	20.0	93.9	61.5	45.7
11/21	0810	13.0	86.9	66.5	92.8	90.7	94.9	5.0	20.0	96.0	65.2	46.7
11/25	1040	20.8	85.7	63.0	93.5	74.4	94.9	38.7	61.5	94.8	70.1	62.8
11/29	0955	18.1	86.9	76.0	94.9	85.3	94.9	52.5	52.1	97.4	73.2	64.7
12/03	0835	18.1	82.8	80.7	94.4	91.6	94.9	50.7	20.0	93.4	70.4	59.8
12/07	1100	12.2	82.8	78.5	93.5	94.4	94.9	26.8	20.0	96.9	68.1	53.8

KANSAS RIVER STUDY

Table D-11. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT LECOMPTON

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1525	20.2	74.2	62.7	96.2	68.1	94.9	48.1	20.0	94.9	65.7	56.8
09/28	1120	8.5	80.0	48.8	96.4	78.1	94.9	42.3	20.0	98.9	64.5	49.6
09/30	0726	8.1	80.0	67.2	97.2	55.4	94.9	46.7	20.0	90.9	63.1	48.9
10/02	1120	10.1	62.4	53.0	99.2	66.3	94.9	48.1	20.0	93.5	61.7	49.2
10/04	1212	15.4	68.7	41.7	99.8	49.1	94.9	49.0	20.0	50.0	53.1	45.2
10/06	0955	16.5	88.2	45.0	-	87.1	94.9	49.0	32.4	90.8	-	-
10/08	1053	6.8	80.0	40.9	99.9	66.3	94.9	56.7	20.0	96.0	63.3	47.4
10/10	0945	16.8	72.8	42.1	99.9	58.1	94.9	55.8	20.0	99.7	63.8	53.4
10/12	0855	16.2	87.2	37.3	100.0	59.0	94.9	56.7	20.0	89.4	63.4	52.8
10/14	1100	12.4	80.5	37.3	99.8	53.6	94.9	65.9	20.0	93.0	62.8	50.7
10/16	1100	25.3	82.6	42.2	100.0	59.9	94.9	71.6	20.0	97.0	67.2	58.7
10/18	0950	23.4	85.7	40.8	100.0	59.0	94.9	65.9	20.0	93.6	66.1	57.3
10/20	0940	27.3	80.0	48.3	99.9	72.6	94.9	79.5	20.0	95.3	69.4	61.5
10/22	1230	12.1	82.8	53.6	99.4	68.1	94.9	74.8	20.0	98.2	67.6	54.8
10/24	1415	9.6	88.2	53.1	99.3	60.8	94.9	56.7	20.0	94.4	65.0	51.2
10/26	1025	15.9	86.9	59.4	98.9	64.5	94.9	60.0	20.0	97.7	67.6	56.7
10/28	1035	12.3	86.9	52.5	99.6	56.3	94.9	70.0	20.0	95.5	66.1	53.6
10/30	1030	20.3	82.8	59.4	99.8	67.2	94.9	73.2	20.0	99.4	69.5	59.8
11/01	1120	6.9	85.7	58.6	99.3	59.0	94.9	67.1	20.0	98.4	66.2	49.9
11/03	1120	8.0	82.8	55.2	95.6	91.6	94.9	26.4	20.0	93.9	64.5	48.4
11/05	1340	9.7	82.8	53.6	96.3	79.0	94.9	52.5	20.0	98.6	66.3	52.2
11/07	1205	9.3	86.9	56.3	96.6	70.8	94.9	40.9	20.0	97.0	65.1	50.7
11/09	1145	12.2	86.9	62.6	95.6	69.9	94.9	37.3	20.0	94.7	65.2	52.6
11/11	0845	12.0	90.0	49.9	93.8	98.9	94.9	5.0	79.6	87.7	68.0	50.0
11/13	1010	12.8	82.8	62.6	94.6	60.8	94.9	5.0	20.0	94.2	61.2	44.2
11/15	1120	9.4	89.4	54.1	94.5	98.9	94.9	5.0	20.0	91.7	64.0	43.8
11/17	0820	9.6	86.9	48.0	90.7	52.5	94.9	5.0	20.0	92.3	58.2	40.5
11/19	0905	10.1	88.2	63.4	91.0	50.5	94.9	5.0	20.0	92.6	59.8	41.9
11/21	0740	18.5	85.7	56.3	93.6	84.4	94.9	5.0	45.7	96.7	66.5	51.4
11/23	1035	14.2	89.4	79.8	94.2	56.3	94.9	16.6	20.0	95.3	64.5	50.7
11/25	1110	13.2	85.7	72.0	91.8	98.9	94.9	39.4	41.4	95.3	70.7	59.3
11/27	1120	12.1	88.2	80.7	92.3	70.8	94.9	40.2	20.0	95.3	67.3	54.3
11/29	0925	17.4	86.9	78.8	94.7	86.2	94.9	55.0	53.5	98.3	73.9	65.1
12/02	1050	9.5	85.7	86.0	93.0	66.3	94.9	47.4	34.2	94.9	68.4	55.1
12/03	0805	36.8	77.1	88.8	96.7	98.0	94.9	64.7	57.4	97.6	79.0	75.0
12/05	1220	8.9	85.7	86.8	93.2	89.8	94.9	48.1	34.2	96.7	71.1	56.7
12/07	1120	14.2	82.8	88.8	93.2	98.0	94.9	55.0	42.8	97.2	73.9	63.0

Table D-12. QUALITY RATINGS AND WQI FOR DELAWARE RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1550	43.2	80.0	81.4	96.8	89.8	94.9	65.9	61.5	98.0	79.2	76.5
09/30	0700	44.5	80.0	89.0	97.0	87.1	94.9	65.9	65.7	95.6	79.8	77.4
10/04	1230	34.8	88.7	84.4	96.8	82.6	94.9	73.2	61.5	88.9	77.6	74.0
10/08	1125	44.5	89.4	81.9	97.1	88.9	94.9	78.0	69.4	92.5	81.2	78.9
10/12	0840	54.2	86.0	72.0	98.2	85.3	94.9	74.8	58.8	98.7	81.0	79.2
10/16	1120	70.7	89.5	74.6	97.7	94.4	94.9	74.8	62.8	93.2	84.4	83.5
10/20	0930	62.0	85.7	82.7	97.6	95.3	94.9	79.5	62.8	88.8	83.1	82.1
10/24	1405	22.6	90.7	85.5	97.7	96.2	94.9	58.9	64.2	78.3	74.9	68.3
10/28	1055	43.2	88.2	88.4	97.0	90.7	94.9	70.0	62.8	92.9	80.6	77.9
11/01	1135	16.8	87.0	84.6	97.0	98.9	94.9	60.0	62.8	89.5	75.5	66.5
11/05	1355	70.7	82.8	82.7	97.1	98.9	94.9	73.2	67.2	98.0	85.8	84.9
11/09	1200	70.7	85.7	86.5	97.0	98.9	94.9	74.8	75.9	97.6	87.3	86.6
11/13	1000	14.6	85.7	75.2	96.4	98.0	94.9	5.0	42.8	93.3	68.6	51.4
11/17	0800	62.0	82.8	83.6	96.9	92.5	94.9	71.6	69.4	98.4	84.0	82.9
11/21	0725	43.3	80.0	35.3	96.7	93.5	94.9	71.6	70.7	99.3	76.4	72.1
11/25	1120	69.7	86.9	93.1	96.5	90.7	94.9	44.7	74.8	98.6	84.7	83.0
11/29	0910	70.7	85.7	71.2	96.8	93.5	94.9	67.1	69.4	99.6	84.4	83.4
12/03	0745	76.5	80.0	90.8	96.9	92.5	94.9	73.2	61.5	98.9	86.2	85.3
12/07	1140	51.5	80.0	83.3	96.6	96.2	94.9	76.4	73.6	98.7	83.2	81.4

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Table D-13. QUALITY RATINGS AND WQI FOR SHUNGANUNGA CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0742	22.5	86.9	48.0	96.8	57.2	94.9	55.0	37.5	62.0	61.4	55.7
10/04	0723	6.6	88.4	37.6	92.5	42.1	94.9	55.0	20.0	50.9	53.0	40.2
10/12	1400	8.7	86.5	42.5	94.4	51.4	94.9	56.7	20.0	80.3	59.8	46.9
10/20	1410	34.8	86.9	54.1	88.7	42.4	94.9	62.2	20.0	82.0	64.2	58.3
10/28	0730	25.3	90.7	67.3	93.0	47.2	94.9	51.6	20.0	69.8	62.5	55.6
11/05	0720	19.8	91.9	55.2	91.7	59.0	94.9	48.1	37.5	79.0	64.4	57.3
11/13	1440	5.7	90.7	36.4	92.8	44.4	94.9	5.0	20.0	85.8	55.2	35.7
11/21	1425	24.6	85.7	69.3	89.9	51.6	94.9	57.8	20.0	97.7	67.4	59.2
11/29	1355	69.7	86.3	76.0	88.8	51.9	94.9	71.6	34.2	97.9	77.1	74.2
12/07	0730	43.2	86.9	73.0	92.2	56.3	94.9	73.2	20.0	95.3	72.2	66.6

KANSAS RIVER STUDY

Table D-14. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT TOPEKA

Date, 1972	Time	Fecal Coli	pH	BOD_5	$NO_2 + NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0812	22.5	74.2	49.5	96.6	73.5	94.9	43.5	20.0	91.7	64.4	56.0
09/28	1030	3.4	77.1	37.1	96.5	59.0	94.9	42.3	20.0	94.9	59.6	40.4
09/30	1320	12.0	66.9	58.9	97.1	69.0	94.9	45.4	20.0	98.3	63.8	51.7
10/02	1030	11.2	62.4	55.8	98.9	66.3	94.9	49.0	20.0	99.5	63.2	50.8
10/04	0743	6.1	80.5	39.7	99.8	60.8	94.9	47.4	20.0	91.3	61.0	45.1
10/06	1038	11.6	80.0	47.7	-	72.6	94.9	48.1	32.4	90.3	-	-
10/08	0745	5.3	77.1	41.0	99.8	70.8	94.9	49.8	20.0	93.1	62.1	45.1
10/10	1030	15.4	74.2	42.4	99.9	72.6	94.9	53.3	20.0	98.7	64.9	53.8
10/12	1340	5.5	86.7	53.6	99.9	65.4	94.9	55.0	20.0	95.2	64.8	47.4
10/14	1015	12.2	75.9	44.6	99.8	71.7	94.9	58.9	20.0	98.3	65.1	52.6
10/16	0715	12.3	76.8	43.7	99.9	81.7	94.9	61.1	20.0	91.2	65.1	52.8
10/18	1030	11.1	80.0	48.8	100.0	72.6	94.9	63.5	20.0	96.3	66.0	52.9
10/20	1355	13.1	74.2	50.9	100.0	69.0	94.9	62.2	20.0	97.4	65.5	53.7
10/22	1140	2.0	85.7	25.7	98.9	86.2	94.9	49.0	20.0	88.5	61.7	37.9
10/24	1230	9.9	82.8	58.6	98.5	70.8	94.9	58.9	20.0	99.5	66.9	52.9
10/26	1105	12.8	80.0	63.4	99.2	69.0	94.9	58.9	20.0	97.7	67.1	54.9
10/28	0735	10.4	71.3	55.7	99.9	72.6	94.9	56.7	20.0	91.6	64.1	51.4
10/30	1105	8.9	74.2	62.6	99.9	71.7	94.9	64.7	20.0	99.7	66.9	52.3
11/01	0700	7.5	77.1	33.8	98.5	98.0	94.9	37.3	20.0	91.7	63.1	46.8
11/03	1030	10.0	74.2	62.6	97.0	77.2	94.9	48.1	20.0	96.0	65.3	51.9
11/05	0745	20.8	80.0	61.8	96.0	81.7	94.9	50.7	20.0	93.1	67.6	58.6
11/07	1035	8.3	84.3	43.5	95.2	46.1	94.9	5.0	20.0	88.7	56.4	38.5
11/09	0720	22.5	78.5	67.3	96.3	72.6	94.9	48.1	20.0	92.2	67.0	58.6
11/11	0920	10.0	86.9	62.6	94.1	68.1	94.9	5.0	20.0	91.8	61.5	43.1
11/13	1420	6.6	80.0	45.1	94.6	79.0	94.9	16.6	20.0	94.2	60.9	43.6
11/15	1040	8.1	85.7	55.7	94.3	71.7	94.9	5.0	20.0	92.1	60.8	41.5
11/17	1245	10.5	89.4	47.2	89.6	42.7	94.9	5.0	20.0	93.7	57.7	40.4
11/19	0950	12.6	85.7	61.0	91.3	85.3	94.9	5.0	20.0	93.1	63.3	45.4
11/21	1410	11.4	77.1	68.9	90.8	82.6	94.9	5.0	20.0	96.5	63.1	44.8
11/23	0950	14.2	85.7	78.8	94.6	38.6	94.9	20.2	20.0	97.0	62.8	49.5
11/25	0720	19.3	82.8	89.3	92.0	94.4	94.9	40.2	44.2	95.3	72.9	64.0
11/27	1040	9.1	82.8	81.7	92.7	75.3	94.9	44.7	20.0	96.6	67.4	52.6
11/29	1335	14.2	80.0	76.9	48.0	71.7	94.9	38.7	32.4	96.9	63.0	53.3
12/02	1015	21.6	82.8	87.9	93.0	89.8	94.9	47.4	35.9	97.9	73.1	64.8
12/03	1250	22.5	77.1	89.3	93.2	89.8	94.9	46.1	20.0	94.6	70.7	61.3
12/05	1115	11.4	82.8	83.2	93.5	91.6	94.9	50.7	37.5	96.3	71.4	59.0
12/07	0755	32.1	82.8	89.0	93.3	86.2	94.9	55.8	20.0	98.4	73.9	66.4

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Table D-15. QUALITY RATINGS AND WQI FOR SOLDIER CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0853	43.3	77.1	67.3	96.7	95.3	94.9	73.2	-	95.8	-	-
10/04	0810	7.6	86.1	79.3	99.6	86.2	94.9	81.1	37.5	89.5	72.2	57.0
10/12	1310	7.8	81.4	79.8	99.9	86.2	94.9	71.6	32.4	96.8	71.8	56.4
10/20	1330	62.0	74.2	85.5	99.9	91.6	94.9	82.6	44.2	98.1	82.2	80.2
10/28	0823	24.6	80.0	80.7	99.4	89.8	94.9	68.3	20.0	89.9	72.1	63.6
11/05	0810	20.8	85.7	68.1	95.9	98.9	94.9	31.3	20.0	92.3	69.0	58.4
11/13	1350	9.9	89.4	45.6	93.9	91.6	94.9	5.0	20.0	84.5	61.2	42.5
11/21	1340	27.5	80.0	83.1	90.5	76.2	94.9	40.2	20.0	97.2	69.5	61.4
11/29	1310	26.0	80.0	85.5	91.9	91.6	94.9	42.9	35.9	99.3	73.1	65.9

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Table D-16. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT WILLARD

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	0933	17.4	77.1	65.5	95.7	78.1	94.9	48.1	20.0	95.0	66.9	56.8
09/28	0945	14.2	77.1	55.6	96.0	75.3	94.9	45.4	20.0	95.8	65.1	53.8
09/30	1235	12.4	71.3	65.0	96.3	67.2	94.9	47.4	20.0	97.9	64.8	52.9
10/02	0945	11.9	71.3	53.8	98.6	70.8	94.9	53.3	20.0	99.5	64.9	52.5
10/04	0845	10.5	77.1	49.5	99.9	64.5	94.9	54.1	20.0	96.0	63.9	51.0
10/06	1129	23.4	71.3	49.9	-	67.2	94.9	55.0	32.4	98.3	-	-
10/08	0820	4.7	74.2	49.7	99.9	69.0	94.9	56.7	20.0	93.2	62.9	45.3
10/10	1055	32.6	62.4	42.4	99.9	72.6	94.9	61.1	20.0	92.1	65.5	58.9
10/12	1240	6.8	76.5	42.5	99.9	73.5	94.9	61.1	20.0	97.2	64.3	48.2
10/14	0930	32.1	72.5	54.1	99.8	86.2	94.9	67.1	20.0	94.1	70.0	63.0
10/16	0800	54.2	73.1	49.4	100.0	93.5	94.9	67.1	20.0	95.2	73.8	68.3
10/18	1115	54.2	74.2	50.4	100.0	76.2	94.9	70.0	20.0	98.1	73.1	67.8
10/20	1255	57.6	71.3	70.5	99.9	77.2	94.9	78.0	20.0	97.8	75.9	71.0
10/22	1100	19.3	80.0	66.5	99.0	73.5	94.9	73.2	20.0	95.5	69.6	59.9
10/24	1150	23.4	82.8	64.1	98.5	76.2	94.9	65.9	20.0	99.6	70.6	61.8
10/26	1200	37.5	77.1	61.8	98.9	74.4	94.9	64.7	20.0	98.2	71.3	65.1
10/28	0900	43.2	71.3	61.8	99.9	77.2	94.9	68.3	20.0	92.8	71.3	65.9
10/30	1145	36.8	74.2	61.8	99.4	73.5	94.9	74.8	20.0	97.3	71.5	65.2
11/01	0745	23.9	77.1	69.7	98.0	82.6	94.9	67.1	20.0	94.3	70.4	61.9
11/03	0950	10.5	77.1	61.0	97.2	79.9	94.9	40.2	20.0	95.6	65.2	51.8
11/05	0835	23.0	77.1	68.1	95.5	80.8	94.9	49.8	20.0	95.1	68.4	59.8
11/07	1000	12.6	86.3	58.6	95.3	76.2	94.9	21.0	20.0	92.8	63.8	50.4
11/09	0805	20.3	85.7	69.7	95.7	79.0	94.9	55.8	20.0	93.2	69.2	59.8
11/11	1005	-	86.9	54.1	94.9	57.2	94.9	5.0	20.0	89.8	-	-
11/13	1315	9.9	82.8	64.1	94.3	78.1	94.9	5.0	20.0	91.8	62.2	43.5
11/15	0950	10.0	89.4	62.6	94.3	51.6	94.9	5.0	20.0	94.4	60.6	42.3
11/17	1200	13.0	89.4	55.2	89.9	45.8	94.9	5.0	20.0	92.7	59.0	42.6
11/19	1035	13.9	85.7	68.9	91.9	70.8	94.9	5.0	20.0	93.3	62.9	45.8
11/21	1310	18.1	82.8	79.3	91.1	60.8	94.9	5.0	20.0	95.6	63.5	47.6
11/23	0920	14.8	88.2	81.7	94.6	55.4	94.9	25.7	32.4	95.9	66.4	55.0
11/25	0800	18.5	82.8	90.3	91.9	94.4	94.9	44.7	58.8	90.5	73.5	65.1
11/27	0950	19.3	82.8	85.5	92.6	74.4	94.9	47.4	20.0	95.3	69.2	59.2
11/29	1235	23.4	81.4	85.5	92.6	79.0	94.9	46.7	40.1	97.0	71.9	64.8
12/02	0915	18.9	86.3	85.5	93.0	94.4	94.9	53.3	40.1	96.0	73.8	64.9
12/03	1210	22.6	78.5	90.8	93.2	90.7	94.9	49.8	20.0	95.6	71.6	62.1
12/05	1020	25.9	82.8	88.5	93.2	79.9	94.9	55.0	41.4	96.7	73.6	67.3
12/07	0900	24.4	86.3	90.3	93.2	81.7	94.9	57.8	45.7	97.3	74.9	68.2

Table D-17. QUALITY RATINGS AND WQI FOR MILL CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1005	43.3	80.0	68.6	99.8	90.7	94.9	63.5	38.8	91.4	75.2	71.7
10/04	0905	12.0	85.7	79.1	99.9	82.6	94.9	71.6	34.2	83.2	70.3	59.0
10/12	1215	7.5	86.0	72.8	99.9	85.3	94.9	67.1	37.5	82.3	69.1	54.7
10/20	1225	62.0	77.1	76.0	100.0	91.6	94.9	79.5	38.8	91.2	79.8	77.6
10/28	0920	70.7	82.8	76.0	99.9	90.7	94.9	67.1	20.0	83.0	77.8	73.4
11/05	0855	43.2	85.7	70.5	99.9	98.9	94.9	76.4	20.0	84.5	75.3	69.4
11/13	1245	9.9	89.4	55.2	95.1	79.0	94.9	5.0	38.8	62.8	58.8	42.8
11/21	1240	34.8	77.1	89.8	95.1	91.6	94.9	63.5	50.7	97.1	77.3	73.0
11/29	1215	70.7	80.0	90.3	96.1	90.7	94.9	78.0	47.1	99.2	84.3	82.7
12/07	0925	69.7	80.0	93.1	97.7	95.3	94.9	79.5	40.1	98.4	84.5	82.3

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Table D-18. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT PAXICO

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1100	15.2	77.1	68.1	95.2	95.3	94.9	42.9	20.0	97.0	68.4	56.6
09/30	1200	11.7	80.0	66.8	96.3	65.4	94.9	44.7	20.0	99.1	65.7	53.0
10/04	0937	11.1	73.9	55.7	99.9	59.0	94.9	54.1	-	99.4	-	-
10/08	0845	6.9	74.2	58.2	98.8	88.9	94.9	57.8	20.0	95.9	66.6	50.2
10/12	1140	7.0	66.0	54.1	99.9	88.0	94.9	65.9	20.0	95.6	65.8	49.8
10/16	0830	18.9	72.2	51.8	100.0	74.4	94.9	68.3	20.0	95.4	66.9	57.3
10/20	1150	18.1	77.1	68.1	98.8	86.2	94.9	78.0	20.0	95.5	70.8	60.4
10/24	1120	12.5	85.7	67.3	98.2	68.1	94.9	62.2	20.0	98.9	68.4	55.8
10/28	1000	18.1	74.2	61.0	99.1	72.6	94.9	71.6	20.0	94.2	67.7	57.9
11/01	0823	11.7	77.1	60.2	97.4	74.4	94.9	64.7	20.0	93.0	66.3	53.9
11/05	0930	24.3	77.1	66.5	96.0	97.1	94.9	55.0	20.0	96.8	70.8	62.0
11/09	0840	20.3	80.0	73.6	95.4	84.4	94.9	56.7	32.4	94.4	70.7	62.6
11/13	1215	7.4	86.9	41.7	94.6	98.9	94.9	5.0	20.0	86.6	61.3	40.7
11/17	1130	8.7	89.4	54.1	90.2	50.0	94.9	5.0	20.0	90.8	58.4	40.2
11/21	1205	17.7	80.0	76.9	91.4	98.9	94.9	28.5	37.5	95.0	69.9	59.7
11/25	0835	15.0	86.9	88.4	92.1	93.5	94.9	50.7	49.4	95.6	73.8	63.6
11/29	1140	16.5	81.4	80.7	92.7	79.0	94.9	49.8	44.2	96.8	71.0	61.9
12/03	1135	20.3	82.8	90.3	93.4	85.3	94.9	53.3	32.4	94.8	72.3	63.8
12/07	0955	22.8	80.0	90.3	93.3	94.4	94.9	62.2	50.7	97.3	75.9	68.8

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Table D-19. QUALITY RATINGS AND WQI FOR VERMILLION RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1130	34.8	80.0	70.6	95.2	84.4	94.9	62.2	20.0	95.0	72.1	65.5
10/04	1000	11.6	86.2	74.6	97.7	75.3	94.9	65.9	35.9	92.4	70.2	58.6
10/12	1121	15.7	82.3	76.9	98.8	79.9	94.9	68.3	40.1	92.8	71.7	62.3
10/20	1135	24.6	80.0	84.6	98.6	94.4	94.9	71.6	41.4	94.0	75.5	68.8
10/28	1020	43.2	88.2	77.9	98.3	82.6	94.9	60.0	32.4	78.2	73.1	69.4
11/05	0950	20.3	85.7	68.1	96.3	87.1	94.9	37.3	20.0	87.9	67.5	57.8
11/13	1150	6.1	89.4	38.6	93.8	96.2	94.9	5.0	20.0	77.1	59.1	38.4
11/21	1145	19.8	80.0	83.6	92.4	88.0	94.9	52.5	41.4	95.3	72.2	64.1
11/29	1125	24.8	80.0	86.5	93.8	88.0	94.9	61.1	48.3	95.5	74.6	68.4
12/07	1020	51.5	80.0	94.6	93.0	96.2	94.9	79.5	41.4	97.2	81.4	78.5

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Table D-20. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT WAMEGO

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1155	7.4	80.0	71.0	94.5	76.2	94.9	45.4	20.0	96.0	65.9	50.2
09/28	0855	7.3	80.0	47.0	94.7	82.6	94.9	42.3	20.0	94.9	63.7	48.1
09/30	1125	10.9	80.0	66.7	95.3	62.7	94.9	48.1	20.0	98.8	65.4	52.4
10/02	0905	6.8	74.2	51.7	96.8	58.1	94.9	53.3	20.0	95.4	62.2	47.0
10/04	1015	10.7	76.2	58.2	96.3	54.5	94.9	55.0	20.0	98.2	63.8	51.1
10/06	1213	7.6	74.2	59.6	-	66.3	94.9	58.9	20.0	99.2	-	-
10/08	0910	7.6	82.8	62.6	96.8	69.9	94.9	58.9	20.0	95.3	66.0	50.7
10/10	1140	10.6	66.9	58.1	97.9	69.9	94.9	62.2	20.0	93.7	64.2	51.7
10/12	1105	5.7	74.8	58.6	99.0	78.1	94.9	62.2	20.0	93.1	65.3	48.3
10/14	0845	18.5	81.4	58.6	99.0	69.9	94.9	67.1	20.0	94.1	67.7	58.0
10/16	0900	23.9	77.4	66.5	99.8	92.5	94.9	71.6	20.0	95.4	71.8	62.9
10/18	1150	17.1	74.2	57.1	99.6	78.1	94.9	68.3	20.0	99.7	68.4	57.8
10/20	1115	35.4	80.0	65.7	98.5	71.7	94.9	76.4	20.0	95.7	72.0	65.5
10/22	0915	15.2	86.9	62.6	97.7	71.7	94.9	65.9	20.0	92.9	68.1	57.0
10/24	1055	14.8	85.7	68.9	97.5	66.3	94.9	67.1	20.0	97.7	68.8	57.3
10/26	1235	24.9	77.1	63.4	97.8	65.4	94.9	62.2	20.0	96.9	68.2	60.2
10/28	1030	14.8	80.0	64.9	97.8	71.7	94.9	67.1	20.0	95.8	68.0	56.8
10/30	1220	14.0	80.0	62.6	97.4	67.2	94.9	71.6	20.0	96.0	67.5	56.1
11/01	0845	10.0	82.8	68.1	97.1	74.4	94.9	56.7	20.0	91.9	66.7	53.1
11/03	0907	9.5	78.5	69.7	95.1	75.3	94.9	50.7	20.0	94.5	66.1	52.2
11/05	1000	14.8	77.1	68.9	95.2	77.2	94.9	51.6	20.0	95.8	67.1	56.0
11/07	0910	11.2	82.8	72.8	95.2	85.3	94.9	55.0	20.0	94.8	68.6	55.2
11/09	0910	10.6	85.7	73.6	94.6	88.9	94.9	47.4	53.5	93.6	71.1	58.9
11/11	1035	11.1	86.3	82.7	94.1	79.0	94.9	49.8	32.4	94.4	69.7	57.3
11/13	1130	10.3	86.9	56.3	94.1	81.7	94.9	5.0	20.0	92.3	62.4	43.6
11/15	0910	10.5	86.9	55.2	93.1	48.8	94.9	5.0	20.0	91.4	58.8	41.4
11/17	1100	10.3	88.8	90.8	91.0	48.0	94.9	5.0	20.0	93.1	62.5	43.4
11/19	1115	13.6	85.7	73.6	92.2	75.3	94.9	5.0	20.0	93.9	63.9	46.3
11/21	1125	17.7	85.7	76.0	91.6	77.2	94.9	30.8	44.2	95.7	69.2	59.9
11/23	0840	13.6	89.4	79.8	94.5	63.6	94.9	32.2	34.2	95.2	67.5	56.2
11/25	0910	14.2	86.9	92.2	92.3	82.6	94.9	51.6	61.5	95.5	74.0	63.8
11/27	0905	19.3	85.7	82.7	92.7	78.1	94.9	54.1	40.1	95.0	71.7	63.6
11/29	1100	15.0	85.7	84.6	92.8	76.2	94.9	54.1	50.7	96.7	72.2	62.6
12/02	0840	16.2	88.2	88.4	93.0	91.6	94.9	54.1	45.7	95.4	74.0	64.3
12/03	1110	23.4	85.7	89.3	93.3	90.7	94.9	54.1	40.1	95.1	74.3	67.0
12/05	0925	16.2	81.4	84.8	93.2	84.4	94.9	57.8	48.3	95.4	72.6	63.5
12/07	1045	18.5	82.8	89.3	92.9	83.5	94.9	62.2	56.1	97.8	74.9	66.6

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Table D-21. QUALITY RATINGS AND WQI FOR BIG BLUE RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1240	43.3	82.8	78.8	91.7	94.4	94.9	55.8	60.1	97.0	78.2	75.3
09/30	1050	21.6	82.8	78.7	92.4	86.2	94.9	55.8	65.7	97.8	74.8	67.8
10/04	1050	12.6	88.4	85.8	97.3	59.0	94.9	55.8	68.3	98.7	72.9	61.8
10/08	0950	8.5	82.8	87.2	92.1	82.6	94.9	58.9	69.4	95.6	73.4	59.6
10/12	1030	7.1	86.8	86.5	93.5	83.5	94.9	57.8	61.5	95.9	73.2	57.8
10/16	0935	51.5	86.5	86.1	92.0	81.7	94.9	55.8	65.7	95.0	79.4	77.5
10/20	1040	47.5	82.8	86.5	92.5	84.4	94.9	57.8	61.5	92.4	78.1	75.9
10/24	1015	54.2	86.9	90.3	93.5	81.7	94.9	54.1	64.2	96.5	80.5	78.5
10/28	1115	57.6	85.7	92.2	92.7	82.6	94.9	55.0	56.1	95.9	80.3	78.5
11/01	0915	7.6	85.7	85.5	92.3	98.9	94.9	54.1	60.1	95.7	74.0	58.8
11/05	1035	54.2	82.8	84.6	92.7	98.9	94.9	56.7	68.3	97.8	81.8	79.9
11/09	0945	62.0	85.7	90.3	92.7	82.6	94.9	58.9	81.7	97.6	83.5	82.3
11/13	1050	11.2	77.1	85.5	93.5	80.8	94.9	20.2	52.1	95.9	68.5	55.1
11/17	1020	62.0	88.2	62.6	93.0	79.0	94.9	53.3	62.8	97.6	78.7	77.0
11/21	1045	69.7	86.9	86.5	91.9	91.6	94.9	54.1	65.7	98.0	83.6	82.4
11/25	0945	23.0	85.7	91.2	92.2	79.0	94.9	64.7	79.6	97.1	77.5	71.0
11/29	1130	70.7	77.1	87.4	92.7	80.8	94.9	63.5	64.2	99.7	82.6	81.6
12/03	1030	76.5	77.1	94.1	92.9	90.7	94.9	56.7	56.1	99.0	83.8	82.4
12/07	1245	76.5	85.7	95.0	92.7	83.5	94.9	65.9	68.3	98.7	85.9	85.2

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Table D-22. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT MANHATTAN

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1320	8.1	74.2	68.6	96.2	60.8	94.9	42.3	20.0	98.9	64.0	49.3
09/30	1010	11.6	80.0	68.8	97.9	63.6	94.9	44.1	20.0	96.5	65.4	52.7
10/04	1110	12.9	73.6	50.6	96.3	59.9	94.9	55.0	20.0	97.3	63.5	52.0
10/08	1005	8.9	74.2	61.8	99.9	74.4	94.9	62.2	34.2	98.8	67.9	54.5
10/12	1005	6.3	77.4	59.4	99.9	72.6	94.9	67.1	20.0	92.8	65.7	49.2
10/16	1000	23.6	75.1	63.7	100.0	88.9	94.9	73.2	20.0	98.0	71.4	62.5
10/20	1015	31.1	77.1	65.7	99.9	73.5	94.9	78.0	20.0	95.5	71.4	64.3
10/24	0955	20.8	80.0	61.8	100.0	69.9	94.9	70.0	20.0	96.9	69.1	59.8
10/28	1140	23.3	74.2	55.7	99.9	69.9	94.9	73.2	20.0	99.5	68.8	60.2
11/01	0940	13.9	78.5	64.9	99.6	82.6	94.9	78.0	20.0	96.7	70.0	57.8
11/05	1055	15.9	74.2	57.1	98.5	77.2	94.9	67.1	20.0	97.6	67.6	56.8
11/09	1015	20.3	85.7	72.8	96.3	98.9	94.9	57.8	20.0	95.4	72.1	61.9
11/13	1020	11.9	82.8	63.4	95.2	98.9	94.9	18.4	20.0	91.9	65.7	50.8
11/17	0955	13.0	88.2	48.3	89.1	48.0	94.9	5.0	20.0	94.6	58.7	42.2
11/21	1020	15.4	82.8	68.1	90.7	98.0	94.9	5.0	20.0	95.2	65.6	48.0
11/25	1010	11.1	82.8	87.4	92.4	79.0	94.9	49.0	32.4	95.5	69.7	57.3
11/29	1005	12.1	85.7	83.6	93.2	79.0	94.9	55.8	20.0	97.1	69.8	56.6
12/03	1005	11.9	77.1	90.3	94.5	92.5	94.9	54.1	20.0	95.3	70.4	56.8
12/07	1305	22.9	80.0	88.6	94.8	88.9	94.9	57.8	20.0	95.8	72.3	63.0

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Table D-23. QUALITY RATINGS AND WQI FOR CLARK CREEK

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1405	43.2	80.0	71.2	97.7	86.2	94.9	65.9	50.7	94.1	76.4	73.6
10/04	1145	12.8	86.8	75.2	97.8	70.8	94.9	67.1	57.4	87.1	71.0	60.9
10/12	0930	6.6	82.8	74.4	99.0	84.4	94.9	64.7	49.4	77.9	68.6	54.0
10/20	0940	54.2	80.0	75.2	99.1	88.0	94.9	74.8	54.8	90.6	79.2	77.5
10/28	1220	57.6	86.9	78.8	99.3	86.2	94.9	68.3	42.8	80.7	77.6	75.6
11/05	1125	35.4	85.7	73.6	99.2	92.5	94.9	73.2	54.8	88.9	77.0	73.2
11/13	0940	17.7	82.8	70.5	98.6	93.5	94.9	64.7	52.1	81.3	71.5	63.6
11/21	0940	27.5	80.0	77.4	93.3	95.3	94.9	55.0	57.4	92.1	74.5	69.1
11/29	0930	39.1	81.4	87.4	95.4	91.6	94.9	78.7	54.8	93.4	79.1	75.8

KANSAS RIVER STUDY

Table D-24. QUALITY RATINGS AND WQI FOR KANSAS RIVER AT FORT RILEY

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1430	14.8	74.2	72.0	96.2	87.1	94.9	29.9	20.0	97.0	66.6	54.4
09/28	0750	8.3	80.0	36.8	96.8	73.5	94.9	37.3	20.0	90.7	61.1	46.6
09/30	0930	5.9	80.0	64.1	97.9	61.8	94.9	45.4	20.0	94.5	63.6	47.1
10/02	0805	2.0	80.0	40.8	99.9	67.2	94.9	46.1	20.0	90.2	60.8	38.4
10/04	1210	11.0	82.0	49.9	96.4	64.5	94.9	54.1	20.0	96.7	64.4	51.6
10/06	1300	7.1	77.1	58.4	-	73.5	94.9	62.2	20.0	96.1	-	-
10/08	1035	7.3	82.8	59.4	98.8	78.1	94.9	64.7	20.0	97.0	67.4	51.3
10/10	1220	10.7	77.1	57.4	98.8	77.2	94.9	65.9	20.0	98.5	67.3	53.9
10/12	0903	4.7	82.8	59.4	99.4	72.6	94.9	63.5	20.0	87.1	64.8	46.8
10/14	0755	5.7	82.3	53.6	99.1	74.4	94.9	62.2	20.0	84.6	63.9	47.4
10/16	1042	11.3	79.1	59.1	99.3	74.4	94.9	65.9	20.0	96.6	67.3	54.3
10/18	1235	7.5	80.0	57.8	99.3	76.2	94.9	67.1	20.0	97.5	67.1	51.3
10/20	0915	7.8	74.2	56.3	99.6	86.2	94.9	70.0	20.0	92.0	66.6	51.3
10/22	0815	6.4	80.0	55.7	99.6	88.0	94.9	65.9	20.0	89.0	66.4	49.8
10/24	0910	10.7	82.8	63.4	99.7	81.7	94.9	67.1	20.0	93.5	68.4	54.8
10/26	1315	20.8	77.1	57.1	99.6	69.0	94.9	64.7	20.0	96.9	67.7	58.6
10/28	1240	11.1	80.0	63.4	99.6	79.9	94.9	64.7	20.0	99.3	68.7	55.1
10/30	1310	11.3	77.1	57.1	99.7	72.6	94.9	74.8	20.0	97.3	67.5	54.4
11/01	1024	9.7	77.1	60.2	99.6	81.7	94.9	70.0	20.0	95.0	67.7	53.6
11/03	0815	11.3	75.6	65.7	98.6	86.2	94.9	76.4	20.0	93.5	68.9	55.7
11/05	1145	22.3	75.6	59.4	97.4	90.7	94.9	67.1	82.8	98.1	75.3	68.5
11/07	0815	16.2	82.8	69.7	96.5	74.4	94.9	64.7	20.0	90.9	68.1	57.7
11/09	1120	13.6	80.0	64.9	96.0	82.6	94.9	60.0	20.0	95.2	68.1	56.2
11/11	1125	13.9	85.7	57.1	94.1	77.2	94.9	35.7	20.0	91.2	64.6	53.0
11/13	0920	11.6	80.0	70.5	95.2	77.2	94.9	16.6	20.0	90.7	63.4	49.2
11/15	0815	7.4	89.4	38.2	89.0	49.1	94.9	5.0	20.0	80.2	54.6	37.0
11/17	0910	14.4	89.4	48.6	90.2	52.2	94.9	5.0	20.0	94.0	59.5	43.3
11/19	1200	10.8	88.2	53.1	86.6	50.5	94.9	5.0	20.0	93.9	58.7	41.5
11/21	0915	20.3	82.8	78.4	93.0	79.0	94.9	35.7	37.5	97.7	70.0	61.4
11/23	0750	13.7	88.2	82.7	94.5	84.4	94.9	35.1	20.0	96.0	69.0	56.0
11/25	1045	13.9	80.0	90.3	92.9	88.0	94.9	56.7	47.1	96.6	73.0	62.5
11/27	0815	15.9	86.3	82.7	91.0	69.9	94.9	46.7	20.0	93.9	67.9	56.9
11/29	0905	13.0	84.3	82.7	94.6	87.1	94.9	64.7	34.2	98.1	72.6	61.0
12/02	0750	17.4	85.7	87.4	93.4	76.2	94.9	56.7	20.0	95.6	70.5	59.7
12/03	0920	20.8	80.0	89.3	93.3	92.5	94.9	55.8	20.0	94.6	71.9	62.0
12/05	0820	18.9	82.8	89.8	94.3	94.4	94.9	64.7	20.0	97.6	73.5	62.6
12/07	1345	13.1	80.0	82.7	94.3	87.1	94.9	71.6	20.0	95.6	71.0	58.4

Table D-25. QUALITY RATINGS AND WQI FOR REPUBLICAN RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1507	9.4	77.1	48.3	97.5	61.8	94.9	74.8	44.2	86.6	65.1	53.4
09/30	0850	5.3	85.7	68.5	98.2	69.0	94.9	74.8	49.4	88.7	69.2	52.7
10/04	1235	8.7	82.8	65.2	96.5	50.2	94.9	78.0	64.2	98.1	70.0	56.7
10/08	1100	13.4	80.0	76.2	97.1	83.5	94.9	70.0	57.4	95.9	73.3	63.0
10/12	0830	3.4	83.1	71.2	97.7	71.7	94.9	68.3	47.1	89.4	68.5	49.1
10/16	1120	5.5	79.7	70.5	97.3	69.9	94.9	70.0	53.5	94.1	69.5	53.2
10/20	0845	4.8	80.0	72.8	97.7	88.9	94.9	76.4	45.7	87.5	70.4	52.7
10/24	0840	5.9	88.2	74.4	98.4	63.6	94.9	73.2	48.3	82.1	68.3	52.9
10/28	1305	3.5	74.2	64.1	98.7	61.8	94.9	73.2	42.8	98.5	67.4	48.1
11/01	1045	5.5	85.7	55.7	99.3	70.8	94.9	70.0	52.1	93.3	68.8	52.5
11/05	1215	10.3	77.1	64.1	97.2	81.7	94.9	73.2	52.1	98.6	71.4	59.2
11/09	1155	4.3	85.7	61.8	96.5	82.6	94.9	64.7	65.7	92.5	70.7	52.4
11/13	0850	7.4	77.1	73.6	96.3	95.3	94.9	58.9	52.1	91.4	70.8	56.2
11/17	0835	10.0	82.8	76.9	96.3	84.4	94.9	61.1	45.7	97.6	71.8	59.1
11/21	0845	15.9	80.0	77.9	95.7	85.3	94.9	57.8	50.7	99.3	72.9	63.6
11/25	1120	6.5	77.1	89.3	95.7	95.3	94.9	68.3	56.1	98.4	74.4	57.9
11/29	0835	21.6	82.8	81.7	95.6	88.0	94.9	73.2	49.4	98.4	75.7	68.4
12/03	0845	14.2	77.1	91.2	96.0	87.1	94.9	67.1	48.3	96.9	74.0	63.6
12/07	1420	6.8	82.8	74.0	96.2	81.7	94.9	73.2	52.1	95.7	71.9	56.6

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Table D-26. QUALITY RATINGS AND WQI FOR SMOKY HILL RIVER

Date, 1972	Time	Fecal Coli	pH	BOD_5	NO_2 $+NO_3$	TPO_4	Temp	Turb	Total Solids	%D.O. Sat	WQI(A)	WQI(M)
09/26	1540	17.1	77.1	68.5	96.0	69.0	94.9	27.2	20.0	97.7	65.0	53.9
09/30	0820	6.9	80.0	52.8	97.7	51.6	94.9	39.4	20.0	93.8	61.0	45.9
10/04	1300	10.8	73.1	41.7	96.3	62.7	94.9	47.4	20.0	88.9	60.5	48.5
10/08	1120	8.0	80.0	42.8	99.9	73.5	94.9	61.1	20.0	97.9	65.0	49.7
10/12	0805	4.8	85.1	45.1	99.9	71.7	94.9	58.9	20.0	90.4	63.8	45.8
10/16	1150	54.2	72.8	54.8	100.0	75.3	94.9	64.7	20.0	98.6	72.9	67.7
10/20	0815	43.2	74.2	45.6	100.0	71.7	94.9	71.6	20.0	93.8	69.9	64.1
10/24	0815	35.4	84.3	65.7	100.0	69.9	94.9	65.9	20.0	95.6	71.6	65.1
10/28	1335	54.2	77.1	61.0	99.3	70.8	94.9	68.3	20.0	98.7	73.8	68.8
11/01	1105	29.5	77.1	62.6	99.3	80.8	94.9	71.6	20.0	96.7	71.2	63.8
11/05	1230	41.0	75.6	56.3	96.9	98.9	94.9	62.2	20.0	97.3	73.0	66.7
11/09	1230	16.2	85.7	68.9	96.2	85.3	94.9	68.3	20.0	94.8	70.4	59.3
11/13	0820	17.1	80.0	61.8	94.5	65.4	94.9	5.0	20.0	89.3	61.0	45.8
11/17	0810	11.2	90.7	42.5	88.1	64.5	94.9	5.0	20.0	91.4	59.1	41.9
11/21	0820	17.4	87.6	62.2	86.3	93.5	94.9	5.0	20.0	93.4	64.7	48.1
11/25	1145	17.7	82.8	84.6	89.7	61.8	94.9	38.7	20.0	94.9	66.5	56.2
11/29	0810	13.7	80.0	74.4	90.5	64.5	94.9	43.5	20.0	92.2	64.9	53.7
12/03	0820	20.8	80.0	87.4	92.3	89.8	94.9	51.6	20.0	93.0	70.7	61.0
12/07	1445	43.3	82.8	91.2	92.6	84.4	94.9	67.1	20.0	94.9	75.9	70.0

Table E-4.01. SUMMARY STATISTICS FOR KANSAS CITY-JAMES STREET

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI (A)	36	64.7	3.2	0.5	56.6	70.6
Fecal Coli, x 10^3	37	4.83	3.86	0.64	0.60	16.0
pH	37	8.0	0.3	0.04	7.7	8.7
BOD_5	37	5.4	2.5	0.4	1.7	10.9
NO_3+NO_2	36	0.64	0.41	0.07	0.	1.35
PO_4	37	0.36	0.27	0.04	0.	1.34
Turbidity	37	68.	86.	14.	16.	460.
Total Solids	37	599.	205.	34.	400.	1660.
Temperature (°C)	37	10.6	6.0	1.0	0.	22.0
DO (% Sat.)	37	89.8	10.1	1.7	62.4	115.0
DO (mg/l)	37	10.2	1.7	0.3	6.1	12.6
Conductivity	37	698.	187.	31.	320.	1047.
NH_3	36	0.25	0.16	0.03	0.03	0.69
Cl	37	68.	35.	6.	23.	130.
Suspended Solids	37	142.	160.	26.	25.	840.
Total Coli, x 10^4	36	8.1	6.9	1.1	1.3	30.0
Fecal Strep, x 10^3	37	5.2	8.9	1.5	0.2	48.0
COD	9	37.8	21.1	7.0	17.0	85.0
TOC	11	11.6	5.1	1.6	7.0	21.0
Flow	0	-	-	-	-	-

Table E-4.02. SUMMARY STATISTICS FOR KANSAS CITY-7TH STREET

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	19	65.4	2.0	0.5	62.5	69.0
Fecal Coli, x 10^3	19	4.21	3.45	0.79	0.60	16.0
pH	19	8.1	0.3	0.06	7.6	8.6
BOD_5	19	4.9	2.5	0.6	1.4	10.2
NO_3+NO_2	19	0.59	0.43	0.10	0.	1.30
PO_4	19	0.28	0.12	0.03	0.03	0.50
Turbidity	19	68.	65.	15.	18.	230.
Total Solids	19	581.	108.	25.	390.	790.
Temperature (°C)	19	10.3	6.3	1.4	0.	23.0
DO (% Sat.)	19	90.4	8.0	1.8	78.8	110.2
DO (mg/l)	19	10.4	1.8	0.4	7.5	13.0
Conductivity	19	694.	192.	44.	344.	1066.
NH_3	19	0.20	0.17	0.04	0.03	0.77
Cl	19	66.	37.	8.	21.	128.
Suspended Solids	19	127.	104.	24.	39.	400.
Total Coli, x 10^4	19	5.8	5.3	1.2	1.6	26.0
Fecal Strep, x 10^3	19	4.8	8.7	2.0	0.4	37.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.03. SUMMARY STATISTICS FOR KANSAS CITY-TURNER STREET

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	36	65.4	3.6	0.6	58.0	75.6
Fecal Coli, x 10^3	37	4.50	3.21	0.53	1.20	18.0
pH	37	8.1	0.3	0.04	7.6	8.9
BOD_5	37	5.2	2.6	0.4	1.3	11.3
NO_3+NO_2	36	0.64	0.46	0.08	0.	2.04
PO_4	37	0.30	0.16	0.03	0.	0.56
Turbidity	37	70.	94.	15.	17.	520.
Total Solids	37	612.	224.	37.	320.	1760.
Temperature (°C)	37	10.1	5.9	1.0	0.	22.0
DO (% Sat.)	37	94.7	8.3	1.4	82.0	120.5
DO (mg/l)	37	10.9	1.4	0.2	7.7	14.4
Conductivity	37	691.	188.	31.	290.	1009.
NH_3	36	0.19	0.20	0.03	0.02	1.00
Cl	37	69.	36.	6.	20.	131.
Suspended Solids	37	157.	231.	38.	36.	1350.
Total Coli, x 10^4	36	8.2	7.2	1.2	0.1	28.0
Fecal Strep, x 10^3	37	4.0	6.6	1.1	0.1	28.0
COD	9	37.7	23.7	7.9	19.0	92.0
TOC	11	11.0	4.9	1.5	6.0	19.6
Flow	0	-	-	-	-	-

Table E-4.04. SUMMARY STATISTICS FOR MILL CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	10	64.4	4.9	1.5	57.5	71.0
Fecal Coli, x 10^3	10	0.74	1.01	0.32	0.03	3.0
pH	10	7.9	0.1	0.04	7.6	8.0
BOD_5	10	4.0	1.8	0.6	2.5	9.0
NO_3+NO_2	10	2.09	0.58	0.18	1.2	2.96
PO_4	10	1.73	0.78	0.25	0.02	2.73
Turbidity	10	44.	68.	22.	9.	235.
Total Solids	10	597.	121.	38.	470.	820.
Temperature (°C)	10	9.2	6.4	2.0	0.	20.0
DO (% Sat.)	10	78.8	9.5	3.0	64.4	93.5
DO (mg/l)	10	9.4	2.5	0.8	6.3	13.7
Conductivity	10	789.	192.	61.	517.	1108.
NH_3	10	0.55	0.57	0.18	0.03	1.73
Cl	10	50.	17.	5.	29.	76.
Suspended Solids	10	67.	98.	31.	10.	336.
Total Coli, x 10^4	10	1.4	2.2	0.7	0.1	7.5
Fecal Strep, x 10^3	10	2.8	6.1	1.9	0.1	20.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.05. SUMMARY STATISTICS FOR BONNER SPRINGS

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	35	65.7	3.7	0.6	55.2	74.1
Fecal Coli, x 10^3	36	4.22	3.67	0.61	0.50	18.0
pH	37	8.2	0.3	0.05	7.6	8.9
BOD_5	37	5.2	2.5	0.04	1.4	9.0
NO_3+NO_2	36	0.61	0.39	0.06	0.01	1.29
PO_4	37	0.29	0.25	0.04	0.	1.54
Turbidity	37	70.	99.	16.	13.	530.
Total Solids	37	612.	212.	35.	400.	1720.
Temperature (°C)	37	10.0	5.6	0.9	0.	20.0
DO (% Sat.)	37	97.1	14.5	2.4	84.0	158.4
DO (mg/l)	37	11.1	1.6	0.3	8.3	15.1
Conductivity	37	716.	199.	33.	266.	1063.
NH_3	36	0.17	0.13	0.02	0.03	0.69
Cl	37	72.	39.	6.	17.	140.
Suspended Solids	37	158.	222.	37.	35.	1320.
Total Coli, x 10^4	35	8.5	7.6	1.3	0.8	42.0
Fecal Strep, x 10^3	36	4.8	8.3	1.4	0.1	37.0
COD	9	41.2	23.1	7.7	23.0	95.0
TOC	11	13.5	7.1	2.2	6.0	27.5
Flow	35	4687.	4356.	736.	1200.	23000.

Table E-4.06. SUMMARY STATISTICS FOR DESOTO

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI (A)	19	66.5	3.2	0.7	61.9	72.8
Fecal Coli, x 10^3	19	5.24	3.88	0.89	1.30	16.0
pH	19	8.1	0.2	0.04	7.8	8.5
BOD_5	19	4.9	2.4	0.6	1.0	9.0
NO_3+NO_2	19	0.60	0.38	0.09	0.	1.25
PO_4	19	0.24	0.17	0.04	0.	0.55
Turbidity	19	57.	59.	14.	12.	205.
Total Solids	19	572.	114.	26.	360.	830.
Temperature (°C)	19	9.8	5.6	1.3	0.	20.0
DO (% Sat.)	19	92.6	5.6	1.3	81.3	103.7
DO (mg/l)	19	10.7	1.5	0.4	7.8	14.2
Conductivity	19	715.	191.	44.	440.	1048.
NH_3	19	0.18	0.14	0.03	0.03	0.61
Cl	19	70.	38.	9.	26.	141.
Suspended Solids	19	125.	103.	24.	35.	355.
Total Coli, x 10^4	19	13.2	11.4	2.6	2.3	42.0
Fecal Strep, x 10^3	19	3.1	3.6	0.8	0.3	11.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.07. SUMMARY STATISTICS FOR STRANGER CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI(A)	10	72.0	7.3	2.3	57.5	80.7
Fecal Coli, x 10^3	10	0.72	0.91	0.29	0.06	2.70
pH	10	7.9	0.2	0.06	7.6	8.2
BOD_5	10	2.8	1.5	0.5	1.1	6.8
NO_3+NO_2	10	0.88	0.54	0.17	0.12	1.58
PO_4	10	0.15	0.07	0.02	0.06	0.26
Turbidity	10	73.	151.	48.	7.	500.
Total Solids	10	530.	458.	145.	310.	1830.
Temperature (°C)	10	9.8	7.0	2.2	0.	22.0
DO (% Sat.)	10	80.0	29.2	9.2	0.	106.8
DO (mg/l)	9	10.1	1.7	0.6	8.1	13.2
Conductivity	10	497.	84.	27.	314.	593.
NH_3	10	0.11	0.09	0.03	0.03	0.34
Cl	10	9.	2.	1.	6.	12.
Suspended Solids	10	203.	489.	155.	9.	1590.
Total Coli, x 10^4	10	2.0	3.6	1.1	0.1	12.0
Fecal Strep, x 10^3	10	10.6	22.8	7.2	0.2	72.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	7	414.	750.	284.	25.	2100.

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Table E-4.08. SUMMARY STATISTICS FOR EUDORA

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI (A)	36	65.5	3.8	0.6	59.3	73.5
Fecal Coli, x 10^3	37	13.94	14.97	2.46	1.50	68.0
pH	37	8.1	0.2	0.03	7.7	8.6
BOD_5	37	4.9	2.4	0.4	1.2	9.4
NO_3+NO_2	36	0.78	0.82	0.14	0.01	5.20
PO_4	37	0.30	0.16	0.03	0.	0.64
Turbidity	37	67.	105.	17.	12.	560.
Total Solids	37	644.	245.	40.	390.	1930.
Temperature (°C)	37	10.2	5.8	0.9	0.	22.0
DO (% Sat.)	37	94.2	8.5	1.4	76.7	116.3
DO (mg/l)	37	10.8	1.6	0.3	7.3	14.0
Conductivity	37	742.	217.	36.	280.	1117.
NH_3	36	0.39	0.83	0.14	0.04	5.12
Cl	37	78.	42.	7.	15.	150.
Suspended Solids	37	140.	208.	34.	26.	1210.
Total Coli, x 10^4	36	24.8	23.5	3.9	1.6	92.0
Fecal Strep, x 10^3	37	5.9	13.2	2.2	0.5	79.0
COD	9	36.5	25.9	8.6	17.0	99.0
TOC	11	11.8	6.4	1.9	7.3	30.0
Flow	0	-	-	-	-	-

Table E-4.09. SUMMARY STATISTICS FOR WAKARUSA RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	10	71.5	4.9	1.6	60.3	78.9
Fecal Coli, x 10^3	10	0.76	0.91	0.29	0.06	2.30
pH	10	8.0	0.1	0.05	7.8	8.2
BOD_5	10	3.2	1.4	0.4	1.0	5.5
NO_3+NO_2	10	0.58	0.42	0.13	0.02	1.33
PO_4	10	0.16	0.12	0.04	0.05	0.38
Turbidity	10	36.	43.	13.	12.	155.
Total Solids	10	468.	141.	45.	320.	830.
Temperature (°C)	10	9.7	6.9	2.2	0.	21.0
DO (% Sat.)	10	81.1	18.9	6.0	36.2	108.8
DO (mg/l)	10	9.5	2.9	0.9	4.2	13.7
Conductivity	10	556.	45.	14.	491.	625.
NH_3	10	0.11	0.10	0.03	0.04	0.37
Cl	10	20.	25.	8.	8.	90.
Suspended Solids	10	57.	59.	19.	20.	220.
Total Coli, x 10^4	10	0.9	1.0	0.3	0.1	3.4
Fecal Strep, x 10^3	10	3.4	6.2	2.0	0.04	20.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	7	216.	332.	126.	9.	950.

Table E-4.10. SUMMARY STATISTICS FOR LAWRENCE

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	19	67.4	3.2	0.7	61.3	73.2
Fecal Coli, x 10^3	19	2.22	1.61	0.37	0.08	5.20
pH	19	8.1	0.2	0.04	7.9	8.6
BOD_5	19	4.6	2.0	0.5	2.0	8.8
NO_3+NO_2	19	0.42	0.37	0.09	0.	0.98
PO_4	19	0.28	0.16	0.04	0.05	0.72
Turbidity	19	51.	46.	11.	17.	160.
Total Solids	19	577.	123.	28.	290.	750.
Temperature (°C)	19	10.3	5.8	1.3	0.	21.0
DO (% Sat.)	19	91.4	5.1	1.2	84.0	100.9
DO (mg/l)	19	10.4	1.4	0.3	8.2	13.7
Conductivity	19	746.	210.	48.	440.	1077.
NH_3	19	0.13	0.16	0.04	0.03	0.65
Cl	19	80.	43.	10.	22.	151.
Suspended Solids	19	99.	75.	17.	27.	310.
Total Coli, x 10^4	19	3.0	3.0	0.7	0.1	13.0
Fecal Strep, x 10^3	19	3.5	6.5	1.5	0.01	24.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.11. SUMMARY STATISTICS FOR LECOMPTON

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	36	65.9	4.6	0.8	53.1	79.0
Fecal Coli, x 10^3	37	6.15	5.72	0.94	0.17	24.0
pH	37	8.0	0.2	0.04	7.7	8.7
BOD_5	37	5.0	2.2	0.4	1.2	8.8
NO_3+NO_2	36	0.47	0.41	0.07	0.	1.26
PO_4	37	0.31	0.18	0.30	0.	0.66
Turbidity	37	69.	100.	16.	8.	470.
Total Solids	37	634.	226.	37.	150.	1510.
Temperature (°C)	37	10.2	5.8	1.0	0.	22.0
DO (% Sat.)	37	964.	12.2	2.0	80.3	140.4
DO (mg/l)	37	11.0	1.4	0.2	7.8	13.8
Conductivity	37	796.	240.	39.	288.	1195.
NH_3	36	0.14	0.12	0.02	0.02	0.60
Cl	37	89.	48.	8.	10.	167.
Suspended Solids	37	165.	262.	43.	10.	1124.
Total Coli, x 10^4	36	8.3	10.3	1.7	0.3	55.0
Fecal Strep, x 10^3	37	6.2	14.2	0.2	0.06	71.0
COD	9	41.3	23.3	7.8	18.1	78.0
TOC	11	12.7	6.4	1.9	6.8	25.7
Flow	37	4372.	3240.	533.	1300.	12000.

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Table E-4.12. SUMMARY STATISTICS FOR DELAWARE RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI (A)	19	80.9	4.7	1.1	68.6	87.3
Fecal Coli, x 10^3	19	0.34	0.78	0.18	0.01	2.90
pH	19	8.0	0.2	0.04	7.6	8.2
BOD_5	19	2.2	1.8	0.4	0.7	9.3
NO_3+NO_2	19	0.40	0.06	0.01	0.24	0.49
PO_4	19	0.07	0.05	0.01	0.	0.18
Turbidity	19	22.	30.	7.	8.	140.
Total Solids	19	263.	55.	13.	180.	430.
Temperature (°C)	19	11.5	5.5	1.3	2.0	22.0
DO (% Sat.)	19	92.0	8.5	2.0	73.0	105.1
DO (mg/l)	19	10.2	1.8	0.4	7.7	13.5
Conductivity	19	375.	30.	7.	306.	412.
NH_3	19	0.08	0.08	0.02	0.01	0.33
Cl	19	11.	13.	3.	5.	65.
Suspended Solids	19	31.	35.	8.	11.	172.
Total Coli, x 10^4	19	0.5	0.9	0.2	0.01	3.6
Fecal Strep, x 10^3	19	1.8	4.7	1.1	0.01	20.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	19	745.	840.	193.	25.	2500.

Table E-4.13. SUMMARY STATISTICS FOR SHUNGANUNGA CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range: Minimum	Range: Maximum
WQI (A)	10	63.7	7.3	2.3	53.0	77.1
Fecal Coli, x 10^3	10	7.75	13.20	4.18	0.01	37.0
pH	10	7.8	0.2	0.06	7.5	8.0
BOD_5	10	5.5	2.4	0.8	2.5	9.0
NO_3+NO_2	10	1.08	0.34	0.11	0.44	1.54
PO_4	10	0.65	0.18	0.06	0.44	0.91
Turbidity	10	48.	77.	24.	12.	265.
Total Solids	10	598.	126.	40.	470.	890.
Temperature (°C)	10	9.1	5.8	1.8	0.	19.0
DO (% Sat.)	10	77.9	15.4	4.9	55.3	105.3
DO (mg/l)	10	9.3	2.9	0.9	5.7	13.8
Conductivity	10	763.	196.	62.	300.	926.
NH_3	10	0.39	0.42	0.13	0.05	1.43
Cl	10	69.	32.	10.	11.	120.
Suspended Solids	10	106.	194.	61.	13.	655.
Total Coli, x 10^4	10	9.0	15.1	4.8	0.1	43.0
Fecal Strep, x 10^3	10	2.5	6.2	1.9	0.04	20.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.14. SUMMARY STATISTICS FOR TOPEKA

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	36	64.8	4.0	0.7	56.4	73.9
Fecal Coli, x 10^3	37	14.34	25.25	4.15	0.25	125.0
pH	37	8.2	0.2	0.03	7.7	8.7
BOD_5	37	5.2	2.6	0.4	1.1	12.2
NO_3+NO_2	36	0.78	1.80	0.30	0.	10.98
PO_4	37	0.30	0.21	0.03	0.01	1.07
Turbidity	37	69.	76.	13.	18.	260.
Total Solids	37	686.	215.	35.	420.	1340.
Temperature (°C)	37	9.5	5.6	0.9	0.	20.0
DO (% Sat.)	37	91.1	5.9	1.0	81.3	104.3
DO (mg/l)	37	10.6	1.6	0.3	8.0	14.2
Conductivity	37	796.	224.	37.	289.	1263.
NH_3	36	0.13	0.15	0.03	0.02	0.58
Cl	37	96.	47.	8.	30.	190.
Suspended Solids	36	160.	185.	31.	31.	724.
Total Coli, x 10^4	36	19.3	30.0	5.0	0.4	140.0
Fecal Strep, x 10^3	37	9.6	16.9	2.8	0.3	69.0
COD	9	32.3	14.4	4.8	13.0	52.0
TOC	11	13.6	6.1	1.8	8.8	30.8
Flow	33	3577.	2230.	388.	1200.	8000.

Table E-4.15. SUMMARY STATISTICS FOR SOLDIER CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	8	71.4	5.8	2.0	61.2	82.2
Fecal Coli, x 10^3	9	4.85	7.07	2.36	0.02	17.0
pH	9	8.1	0.2	0.07	7.7	8.4
BOD_5	9	2.8	1.8	0.6	1.5	7.0
NO_3+NO_2	9	0.49	0.50	0.17	0.01	1.30
PO_4	9	0.10	0.07	0.02	0.	0.25
Turbidity	9	118.	279.	93.	6.	860.
Total Solids	8	904.	1159.	410.	420.	3770.
Temperature (°C)	9	9.6	5.0	1.7	4.0	18.0
DO (% Sat.)	9	90.4	8.7	2.9	77.7	104.9
DO (mg/l)	9	10.5	1.7	0.6	8.6	13.0
Conductivity	9	611.	146.	49.	272.	721.
NH_3	9	0.07	0.07	0.02	0.02	0.26
Cl	9	26.	33.	11.	6.	113.
Suspended Solids	9	440.	1186.	395.	11.	3600.
Total Coli, x 10^4	9	6.8	10.5	3.5	0.1	28.0
Fecal Strep, x 10^3	9	11.8	30.1	10.0	0.1	92.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	9	402.	979.	326.	11.	3000.

Table E-4.16. SUMMARY STATISTICS FOR WILLARD

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	35	68.2	4.5	0.8	59.0	75.9
Fecal Coli, x 10^3	36	4.21	9.57	1.60	0.03	54.0
pH	37	8.2	0.2	0.04	7.7	8.7
BOD_5	37	4.0	1.9	0.3	1.0	7.6
NO_3+NO_2	36	0.51	0.43	0.07	0.	1.37
PO_4	37	0.28	0.14	0.02	0.05	0.78
Turbidity	37	61.	78.	13.	9.	320.
Total Solids	37	654.	175.	29.	310.	1070.
Temperature (°C)	37	9.4	5.3	0.9	0.	19.0
DO (% Sat.)	37	92.9	7.2	1.2	83.0	119.1
DO (mg/l)	37	10.8	1.3	0.2	8.5	13.9
Conductivity	37	813.	261.	43.	296.	1278.
NH_3	36	0.09	0.11	0.02	0.02	0.49
Cl	37	103.	55.	9.	30.	220.
Suspended Solids	37	127.	159.	26.	18.	695.
Total Coli, x 10^4	35	7.1	11.1	1.9	0.1	57.0
Fecal Strep, x 10^3	37	4.3	8.6	1.4	0.01	42.0
COD	9	30.8	14.1	4.7	14.0	50.0
TOC	11	11.1	2.8	0.9	6.7	17.3
Flow	0	-	-	-	-	-

Table E-4.17. SUMMARY STATISTICS FOR MILL CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	10	75.2	7.7	2.4	58.8	84.5
Fecal Coli, x 10^3	10	3.15	5.91	1.87	0.01	18.0
pH	10	8.1	0.2	0.06	7.7	8.3
BOD_5	10	2.5	1.4	0.4	0.7	5.2
NO_3+NO_2	10	0.23	0.29	0.09	0.	0.67
PO_4	10	0.10	0.06	0.02	0.	0.22
Turbidity	10	25.	37.	12.	8.	130.
Total Solids	10	467.	58.	18.	370.	560.
Temperature (°C)	10	9.4	6.0	1.9	0.5	19.0
DO (% Sat.)	10	83.0	11.4	3.6	62.7	98.9
DO (mg/l)	10	9.8	2.5	0.8	7.6	14.0
Conductivity	10	639.	84.	26.	430.	730.
NH_3	10	0.07	0.10	0.03	0.02	0.35
Cl	10	44.	61.	19.	10.	194.
Suspended Solids	10	30.	35.	11.	7.	122.
Total Coli, x 10^4	10	3.3	6.6	2.1	0.4	20.0
Fecal Strep, x 10^3	10	1.5	3.4	1.1	0.1	11.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	10	64.	99.	31.	5.	330.

Table E-4.18. SUMMARY STATISTICS FOR PAXICO

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI(A)	18	68.4	4.2	1.0	58.4	75.9
Fecal Coli, x 10^3	19	6.00	7.31	1.68	0.62	23.0
pH	19	8.2	0.2	0.05	7.7	8.6
BOD_5	19	3.8	1.8	0.4	1.0	7.8
NO_3+NO_2	19	0.55	0.43	0.10	0.	1.33
PO_4	19	0.19	0.17	0.04	0.	0.63
Turbidity	19	74.	163.	37.	9.	720.
Total Solids	18	733.	510.	120.	370.	2660.
Temperature (°C)	19	9.6	5.3	1.2	0.	19.5
DO (% Sat.)	19	91.6	5.3	1.2	79.4	101.9
DO (mg/l)	19	10.6	1.3	0.3	8.8	13.9
Conductivity	19	827.	288.	66.	369.	1377.
NH_3	19	0.10	0.14	0.03	0.01	0.57
Cl	19	108.	63.	15.	18.	214.
Suspended Solids	19	193.	458.	105.	23.	2020.
Total Coli, x 10^4	19	8.5	8.6	2.0	1.1	32.0
Fecal Strep, x 10^3	19	8.3	22.5	5.2	0.2	91.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.19. SUMMARY STATISTICS FOR VERMILLION RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI(A)	10	71.7	5.8	1.8	59.1	81.4
Fecal Coli, x 10^3	10	4.37	9.84	3.11	0.05	32.0
pH	10	8.1	0.2	0.06	7.7	8.2
BOD_5	10	2.8	2.2	0.7	0.6	8.5
NO_3+NO_2	10	0.57	0.34	0.11	0.16	1.04
PO_4	10	0.13	0.08	0.02	0.03	0.26
Turbidity	10	120.	310.	98.	8.	1000.
Total Solids	10	767.	954.	302.	390.	3480.
Temperature (°C)	10	9.2	6.3	2.0	0.	19.5
DO (% Sat.)	10	85.3	7.6	2.4	72.1	94.5
DO (mg/l)	10	10.1	1.9	0.6	8.4	13.8
Conductivity	10	630.	150.	48.	250.	762.
NH_3	10	0.11	0.10	0.03	0.04	0.37
Cl	10	20.	32.	10.	4.	111.
Suspended Solids	10	351.	984.	311.	8.	3150.
Total Coli, x 10^4	10	7.2	13.7	43.4	0.1	42.0
Fecal Strep, x 10^3	10	16.3	47.0	14.9	0.04	150.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table 4.20. SUMMARY STATISTICS FOR WAMEGO

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	36	67.9	3.9	0.7	58.8	74.9
Fecal Coli, x 10^3	37	6.84	7.84	1.29	0.19	37.0
pH	37	8.1	0.2	0.03	7.7	8.6
BOD_5	37	3.4	1.5	0.2	0.8	6.8
NO_3+NO_2	36	0.63	0.33	0.06	0.03	1.22
PO_4	37	0.28	0.14	0.02	0.07	0.70
Turbidity	37	44.	51.	8.	10.	220.
Total Solids	37	605.	168.	28.	290.	910.
Temperature (°C)	37	9.9	5.2	0.9	0.	20.0
DO (% Sat.)	37	92.9	7.1	1.2	85.2	115.7
DO (mg/l)	37	10.7	1.3	0.2	8.3	14.0
Conductivity	37	837.	295.	48.	264.	1295.
NH_3	36	0.09	0.09	0.01	0.02	0.38
Cl	37	113.	64.	11.	28.	224.
Suspended Solids	37	81.	79.	13.	15.	384.
Total Coli, x 10^4	36	14.9	15.9	2.6	16.0	74.0
Fecal Strep, x 10^3	37	4.0	6.9	1.1	0.1	35.0
COD	9	28.3	11.7	3.9	13.0	45.0
TOC	11	11.2	4.8	1.4	4.0	20.7
Flow	37	2555.	1929.	317.	758.	6300.

KANSAS RIVER STUDY

Table E-4.21. SUMMARY STATISTICS FOR BIG BLUE RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	19	78.5	4.7	1.1	68.5	85.9
Fecal Coli, x 10^3	19	3.29	6.35	1.46	0.01	21.0
pH	19	8.0	0.2	0.04	7.8	8.3
BOD_5	19	1.5	0.8	0.2	0.5	4.2
NO_3+NO_2	19	0.97	0.16	0.04	0.37	1.13
PO_4	19	0.16	0.10	0.02	0.	0.44
Turbidity	19	28.	15.	4.	17.	90.
Total Solids	19	265.	56.	13.	130.	360.
Temperature (°C)	19	11.8	5.3	1.2	2.0	20.0
DO (% Sat.)	19	94.1	3.4	0.8	86.5	100.0
DO (mg/l)	19	10.4	1.5	0.3	8.7	13.5
Conductivity	19	398.	48.	11.	297.	514.
NH_3	19	0.13	0.25	0.06	0.02	1.06
Cl	19	21.	19.	4.	8.	72.
Suspended Solids	19	32.	17.	4.	13.	82.
Total Coli, x 10^4	19	3.1	7.1	1.6	0.01	26.0
Fecal Strep, x 10^3	19	2.7	6.5	1.5	0.03	20.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	19	1145.	979.	224.	171.	3000.

Table 4.22. SUMMARY STATISTICS FOR MANHATTAN

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	19	67.8	3.5	0.8	58.7	72.3
Fecal Coli, x 10^3	19	5.34	6.90	1.58	0.27	30.0
pH	19	8.2	0.2	0.04	7.8	8.4
BOD_5	19	3.7	1.5	0.4	1.0	6.5
NO_3+NO_2	19	0.47	0.47	0.11	0.	1.48
PO_4	19	0.24	0.18	0.04	0.	0.70
Turbidity	19	42.	53.	12.	9.	230.
Total Solids	19	846.	249.	57.	490.	1230.
Temperature (°C)	19	9.3	5.5	1.3	0.	20.0
DO (% Sat.)	19	94.1	5.9	1.3	85.8	107.4
DO (mg/l)	19	10.9	1.2	0.3	8.7	13.4
Conductivity	19	1230.	432.	99.	380.	1872.
NH_3	19	0.09	0.10	0.02	0.01	0.42
Cl	19	193.	111.	25.	30.	360.
Suspended Solids	19	98.	169.	39.	15.	760.
Total Coli, x 10^4	19	8.4	8.6	2.0	0.4	30.0
Fecal Strep, x 10^3	19	3.8	12.0	2.8	0.01	53.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.23. SUMMARY STATISTICS FOR CLARK CREEK

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI(A)	9	75.0	3.8	1.3	68.6	79.2
Fecal Coli, x 10^3	9	3.64	8.49	2.83	0.03	26.0
pH	9	8.1	0.12	0.04	7.9	8.2
BOD_5	9	2.5	0.6	0.2	1.3	3.2
NO_3+NO_2	9	0.31	0.28	0.09	0.10	0.91
PO_4	9	0.12	0.08	0.03	0.04	0.31
Turbidity	9	16.	5.	2.	8.	27.
Total Solids	9	356.	35.	12.	320.	430.
Temperature (°C)	9	10.3	6.2	2.1	2.0	19.5
DO (% Sat.)	9	81.2	5.9	2.0	72.7	88.7
DO (mg/l)	9	9.3	1.7	0.6	7.1	12.1
Conductivity	9	555.	30.	10.	506.	600.
NH_3	9	0.06	0.06	0.02	0.02	0.22
Cl	9	20.	35.	12.	6.	114.
Suspended Solids	9	19.	11.	4.	5.	40.
Total Coli, x 10^4	9	3.1	6.6	2.2	0.1	20.0
Fecal Strep, x 10^3	9	3.2	5.2	1.7	0.1	15.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

Table E-4.24. SUMMARY STATISTICS FOR FORT RILEY

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	36	66.9	4.3	0.7	54.6	75.3
Fecal Coli, x 10^3	37	19.86	60.37	9.92	0.82	370.0
pH	37	8.1	0.2	0.03	7.7	8.4
BOD_5	37	4.2	2.0	0.3	1.0	8.9
NO_3+NO_2	36	0.51	0.47	0.08	0.01	1.8
PO_4	37	0.25	0.14	0.02	0.05	0.66
Turbidity	37	55.	105.	17.	10.	570.
Total Solids	37	942.	308.	51.	120.	1830.
Temperature (°C)	37	9.9	5.6	0.9	0.5	20.0
DO (% Sat.)	37	90.5	7.2	1.2	74.4	109.0
DO (mg/l)	37	10.4	1.5	0.2	7.6	13.6
Conductivity	37	1356.	488.	80.	391.	2072.
NH_3	36	0.11	0.10	0.02	0.01	0.44
Cl	37	227.	111.	18.	31.	393.
Suspended Solids	34	115.	235.	40.	11.	1270.
Total Coli, x 10^4	36	19.1	28.2	4.7	0.7	151.0
Fecal Strep, x 10^3	37	3.8	10 9	1.8	0.2	64.0
COD	9	38.5	26.8	8.9	10.	99.0
TOC	11	15.4	10.9	3.3	7.9	41.3
Flow	37	1304.	1218.	200.	354.	5300.

Table E-4.25. SUMMARY STATISTICS FOR REPUBLICAN RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range Minimum	Range Maximum
WQI(A)	19	70.7	2.6	0.6	65.1	75.7
Fecal Coli, x 10^3	19	29.70	27.53	6.32	0.90	89.0
pH	19	8.2	0.1	0.03	7.8	8.4
BOD_5	19	3.1	1.3	0.3	0.9	6.5
NO_3+NO_2	19	0.40	0.15	0.03	0.10	0.60
PO_4	19	0.24	0.15	0.03	0.04	0.62
Turbidity	19	14.	4.	1.	9.	24.
Total Solids	19	366.	46.	11.	260.	430.
Temperature (°C)	19	10.7	5.3	1.2	1.0	20.5
DO (% Sat.)	19	90.5	8.4	1.9	75.9	105.0
DO (mg/l)	19	10.2	1.7	0.4	7.3	13.0
Conductivity	19	579.	51.	12.	440.	614.
NH_3	19	0.27	0.17	0.04	0.07	0.62
Cl	19	47.	22.	5.	33.	119.
Suspended Solids	18	21.	11.	3.	6.	49.
Total Coli, x 10^4	19	44.3	29.6	6.8	6.3	107.0
Fecal Strep, x 10^3	19	3.5	2.8	0.7	0.2	11.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	0	-	-	-	-	-

KANSAS RIVER STUDY

Table E-4.26. SUMMARY STATISTICS FOR SMOKY HILL RIVER

Variable	Number of Samples	Mean	Standard Deviation	Standard Error of Mean	Range	
					Minimum	Maximum
WQI (A)	19	67.4	5.1	1.2	59.1	75.9
Fecal Coli, x 10^3	19	6.23	12.77	2.93	0.04	53.0
pH	19	8.2	0.2	0.05	7.6	8.5
BOD_5	19	4.6	2.1	0.5	0.9	7.8
NO_3+NO_2	19	0.61	0.60	0.14	0.	1.87
PO_4	19	0.28	0.14	0.03	0.	0.57
Turbidity	19	56.	75.	17.	13.	290.
Total Solids	19	1172.	231.	53.	730.	1490.
Temperature (°C)	19	9.5	6.2	1.4	0.	20.5
DO (% Sat.)	19	93.7	10.4	2.4	82.4	123.7
DO (mg/l)	19	10.9	1.2	0.3	8.1	13.1
Conductivity	19	1689.	552.	127.	503.	2293.
NH_3	19	0.12	0.13	0.03	0.01	0.54
Cl	19	306.	134.	31.	65.	459.
Suspended Solids	19	103.	148.	34.	24.	680.
Total Coli, x 10^4	19	8.8	17.2	3.9	0.1	57.0
Fecal Strep, x 10^3	19	6.3	19.3	4.4	0.01	83.0
COD	0	-	-	-	-	-
TOC	0	-	-	-	-	-
Flow	19	475.	402.	92.	253.	2000.

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT KANSAS CITY-JAMES STREET

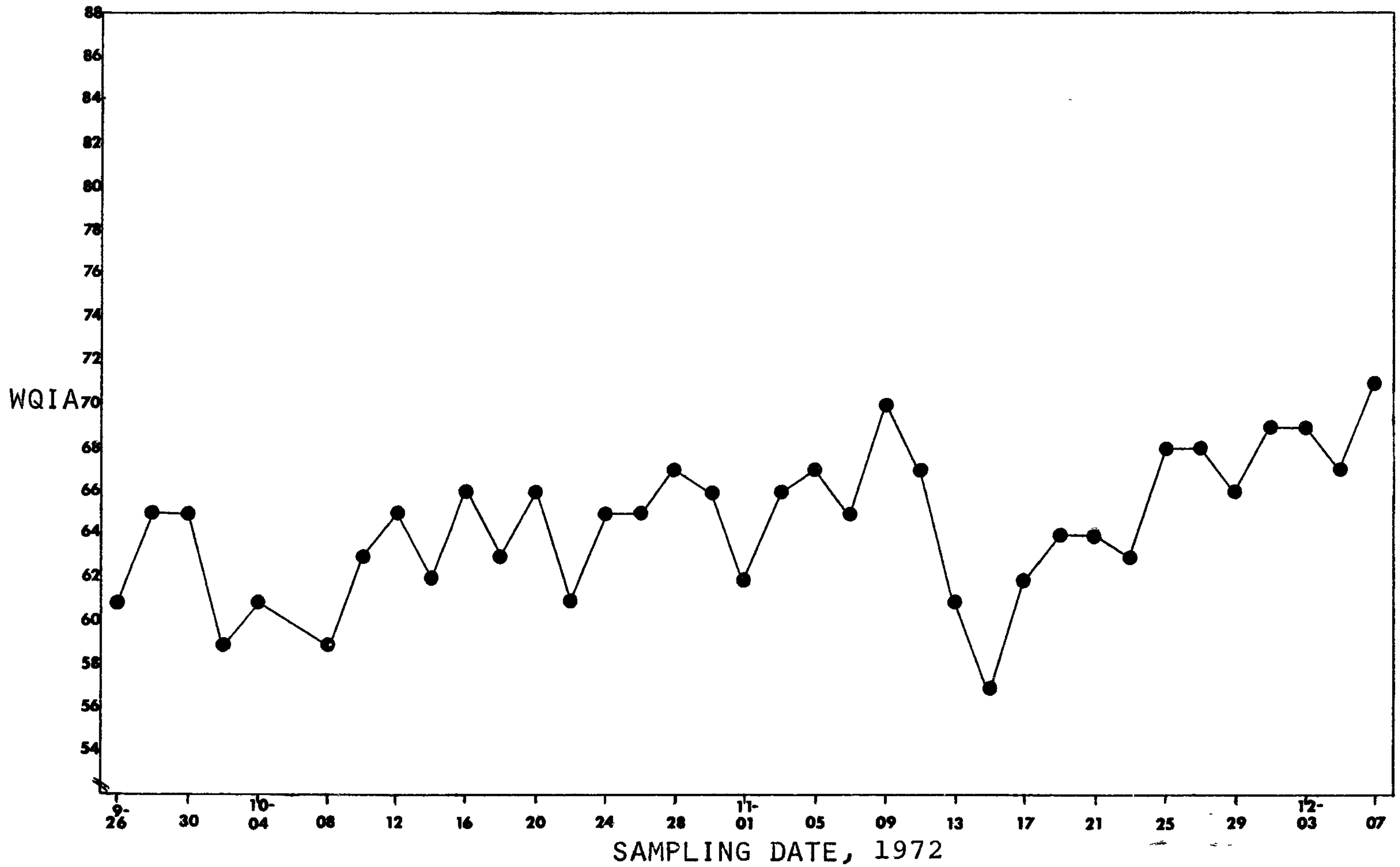

Figure F-1

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KANSAS RIVER STUDY

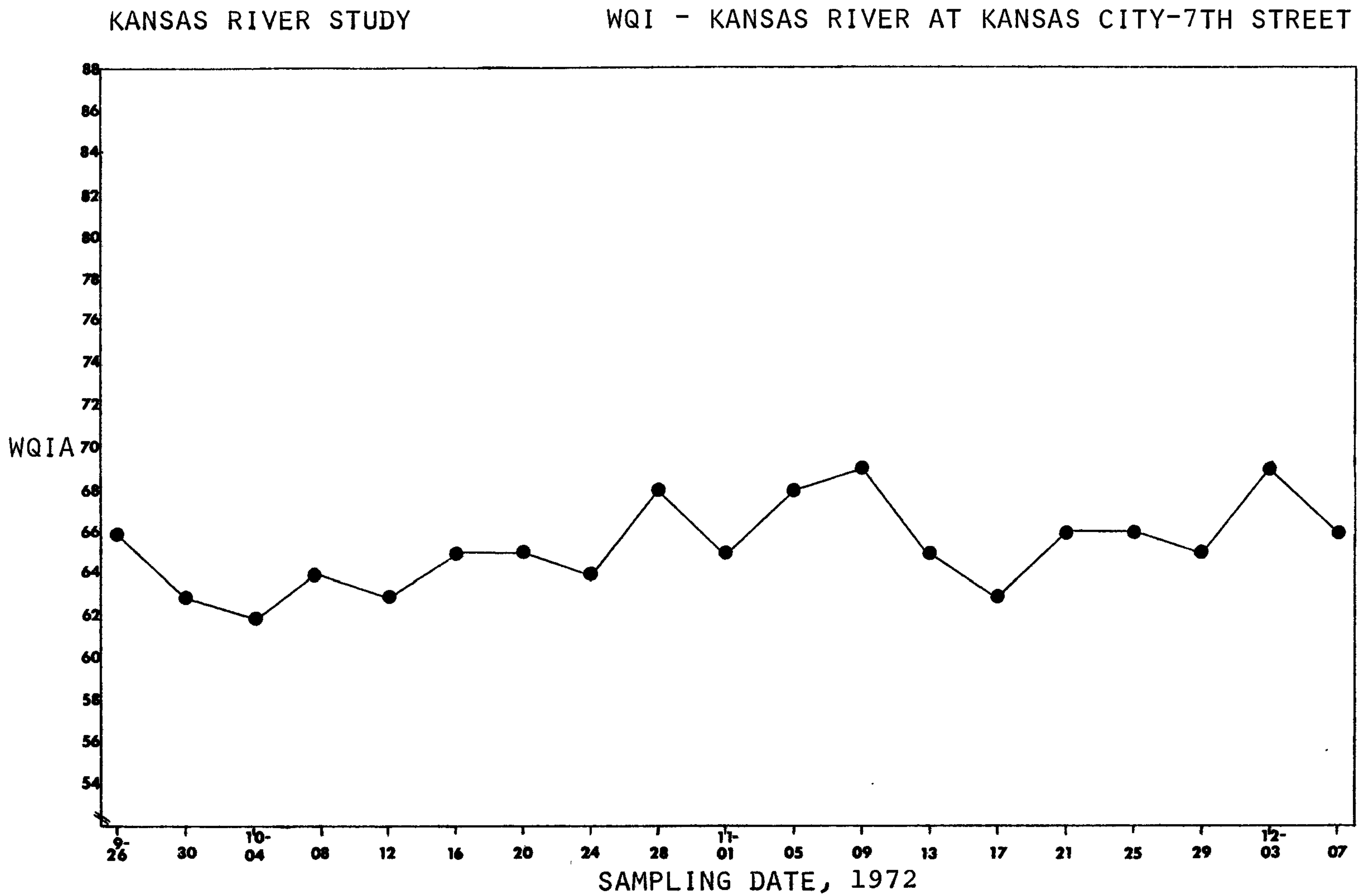


Figure F-2

KANSAS RIVER STUDY WQI - KANSAS RIVER AT KANSAS CITY-TURNER STREET

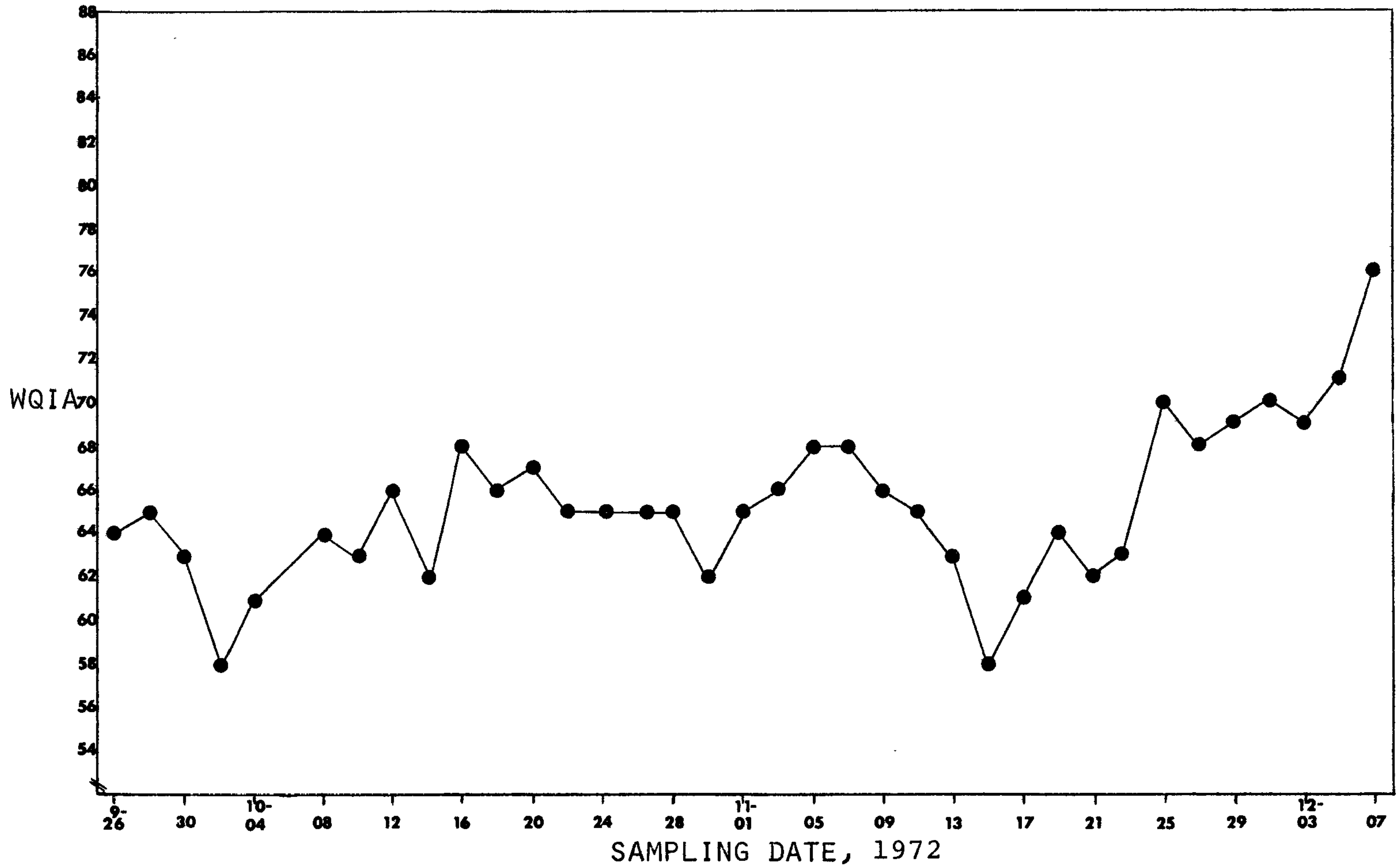
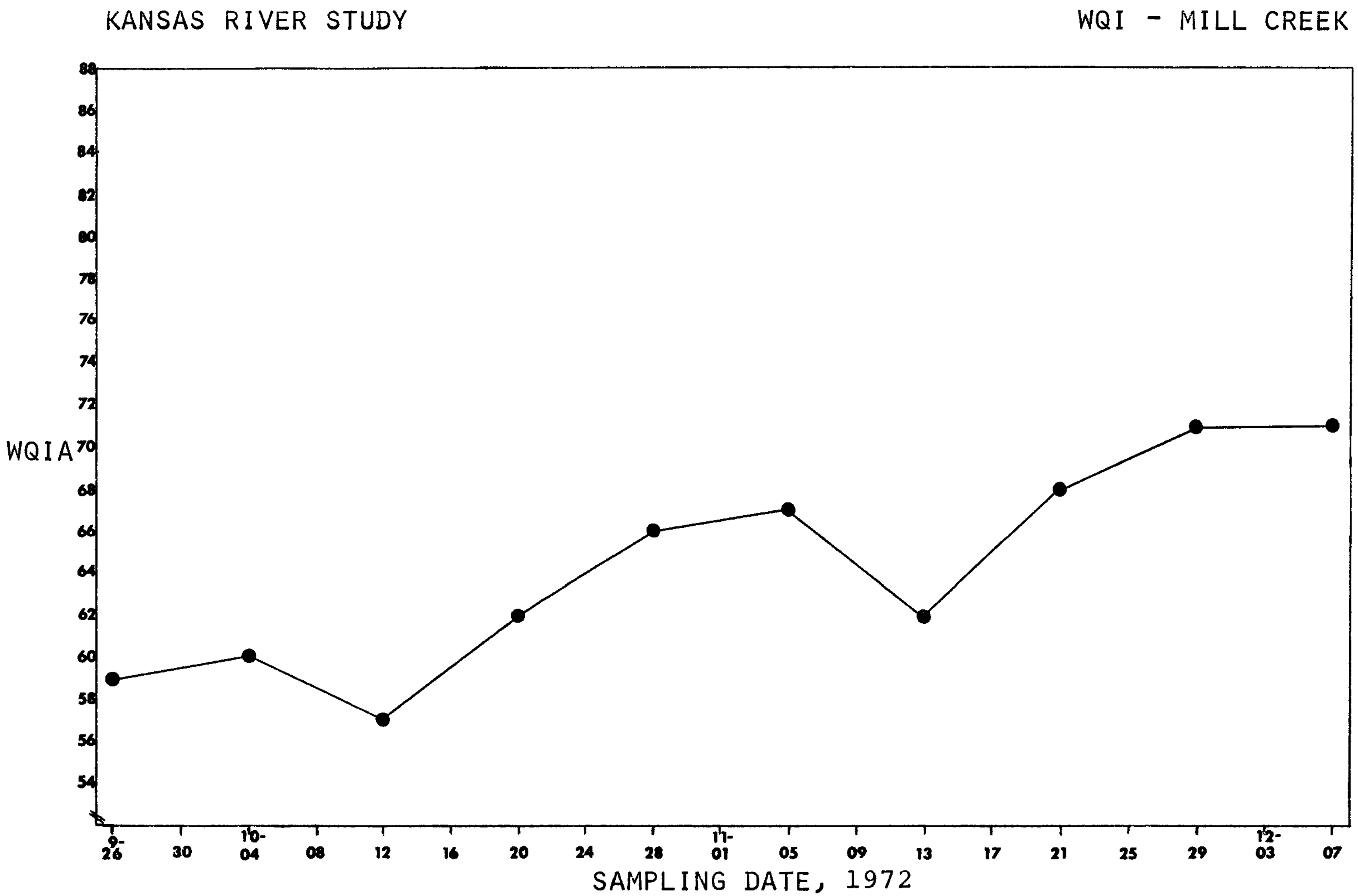


Figure F-3


KANSAS RIVER STUDY
WQI - MILL CREEK
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SAMPLING DATE, 1972

Figure F-4

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT BONNER SPRINGS

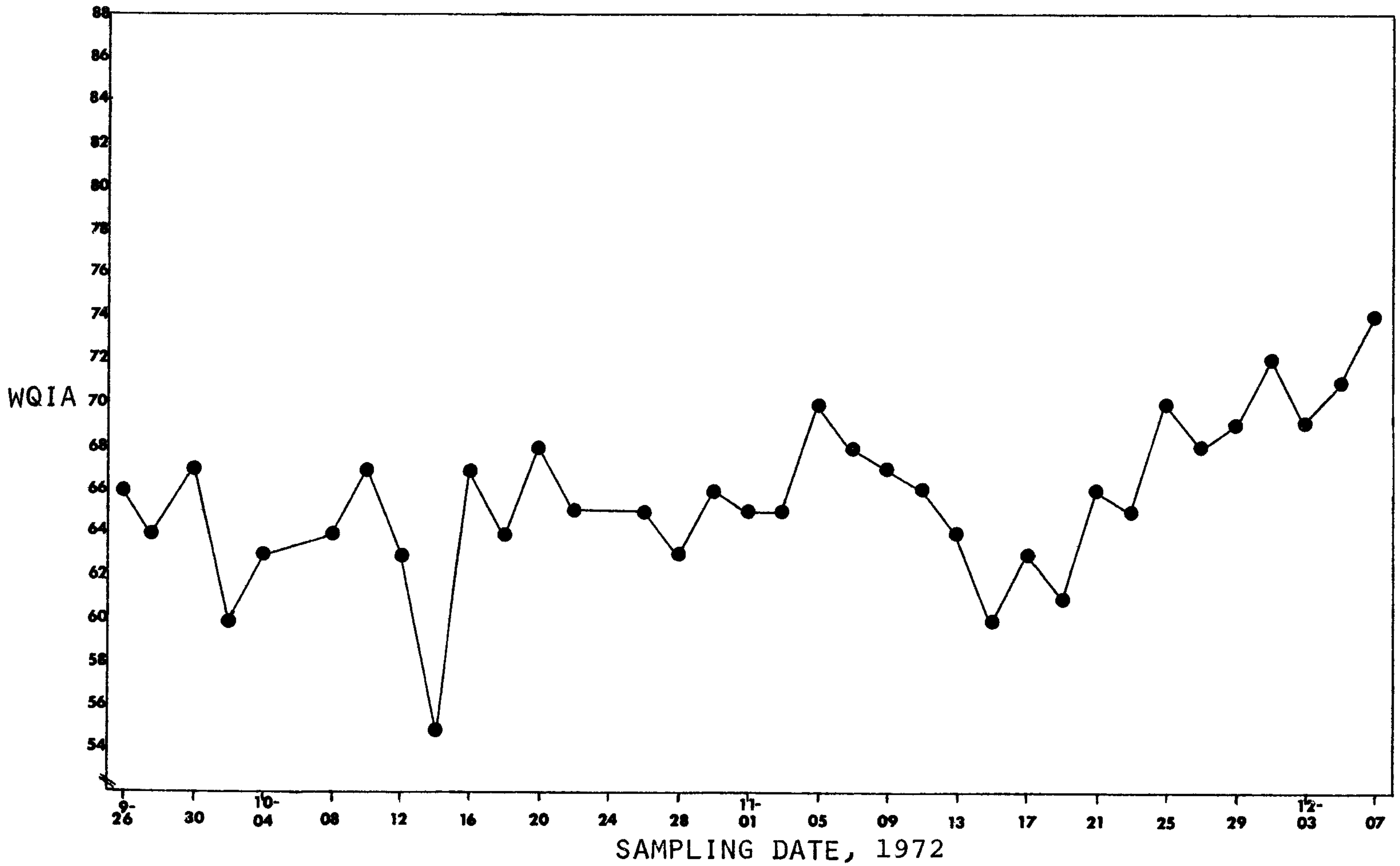


Figure F-5

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT DESOTO

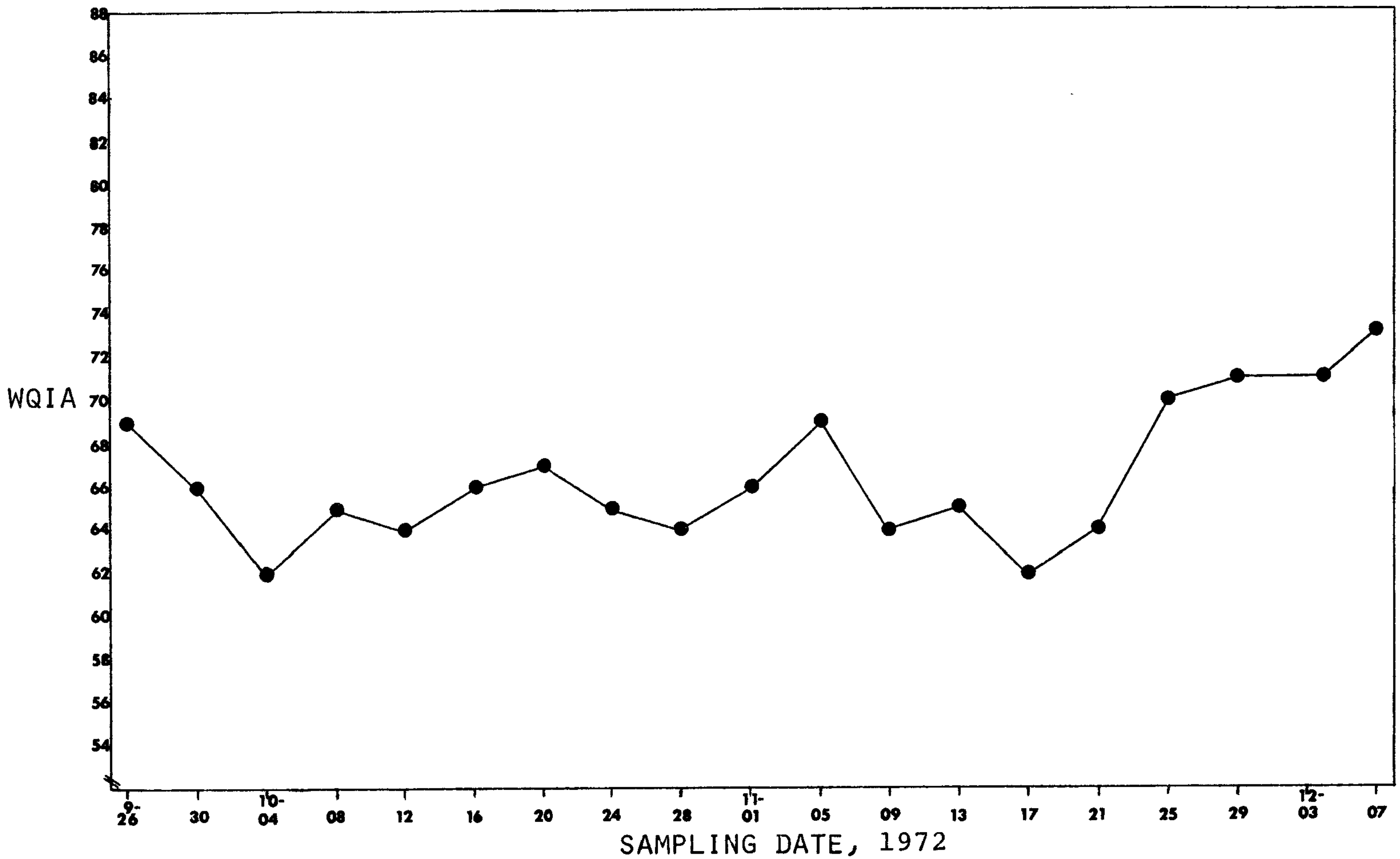


Figure F-6

KANSAS RIVER STUDY

WQI - STRANGER CREEK

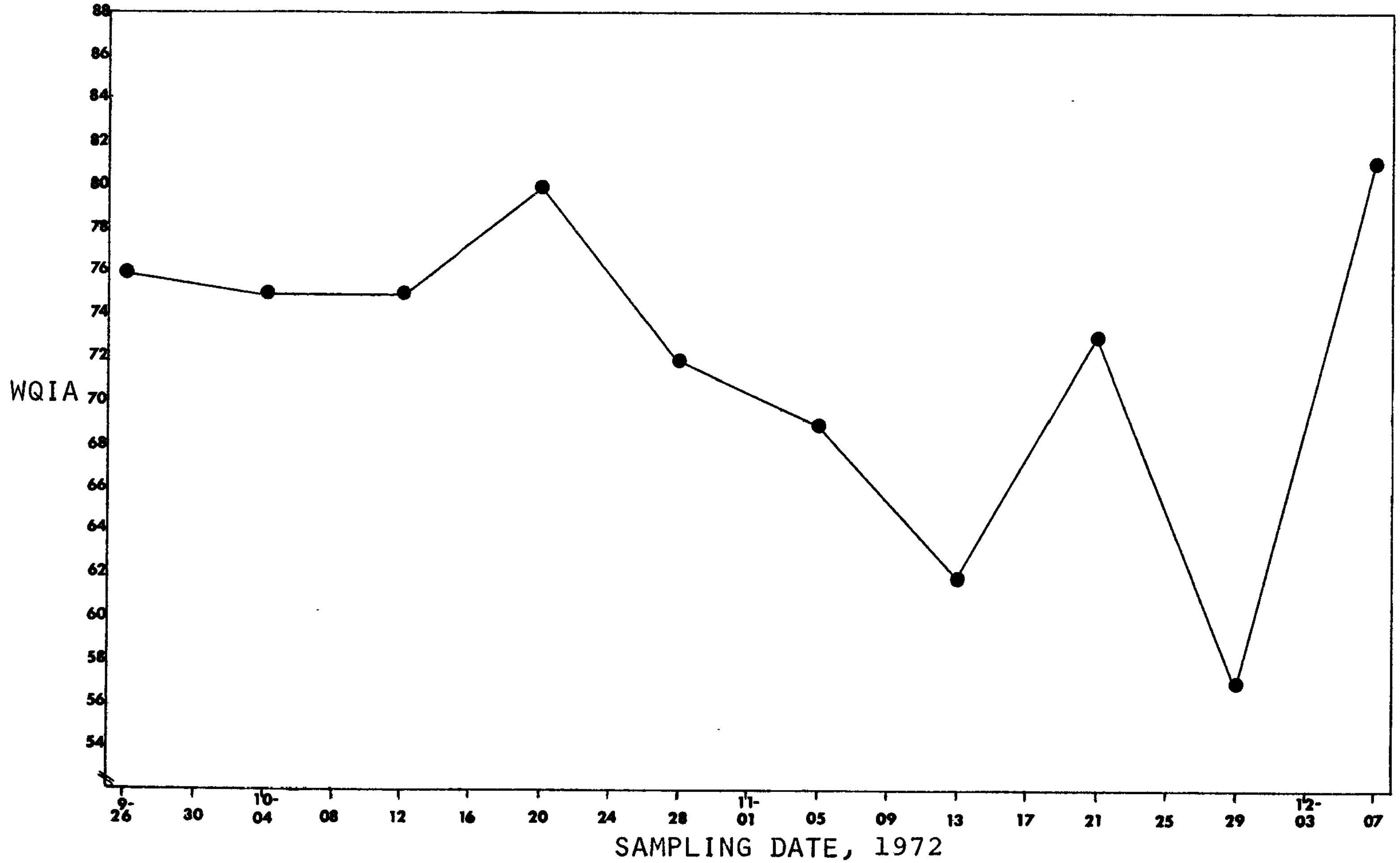


Figure F-7

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT EUDORA

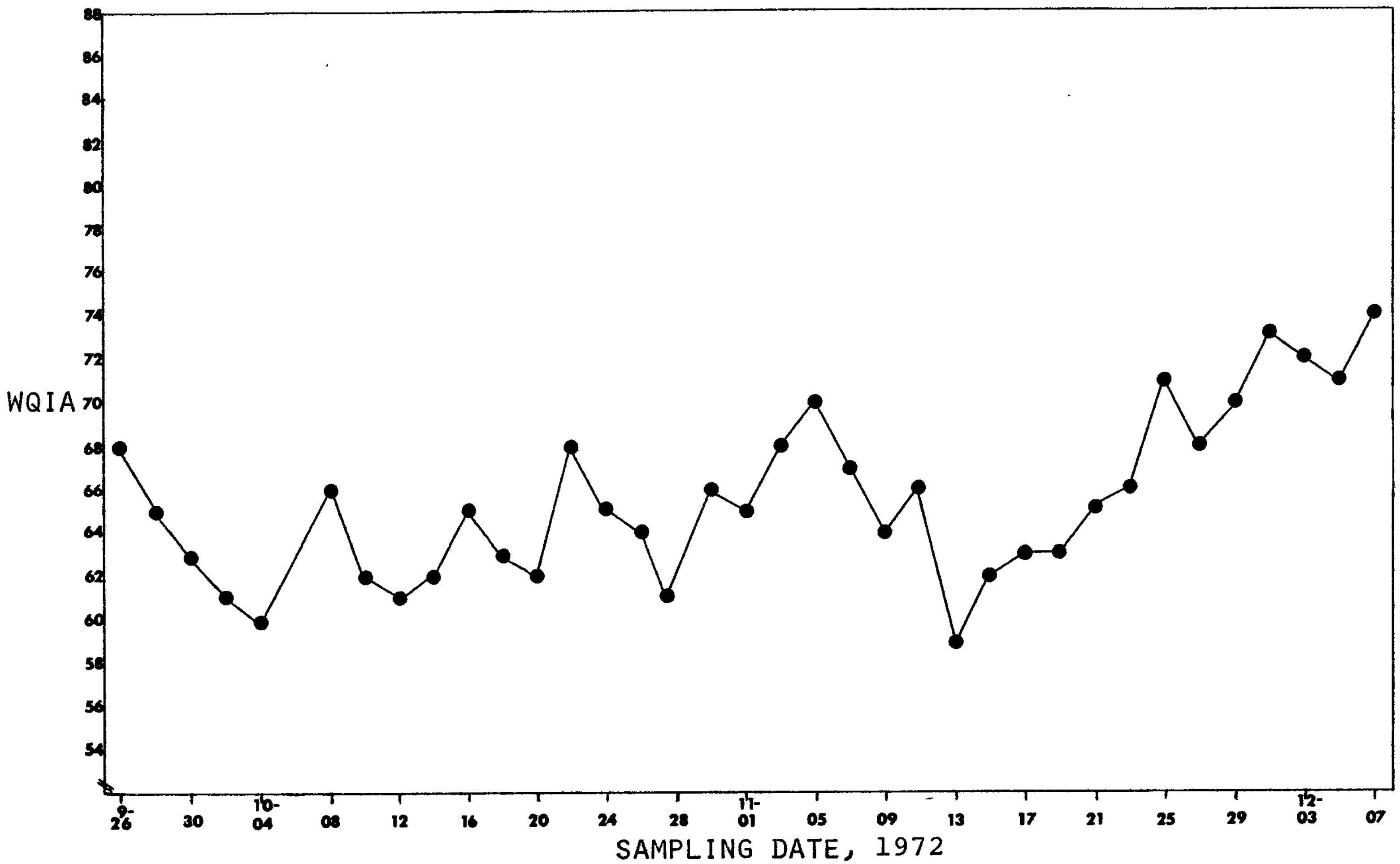


Figure F-8

KANSAS RIVER STUDY

WQI - WAKARUSA RIVER

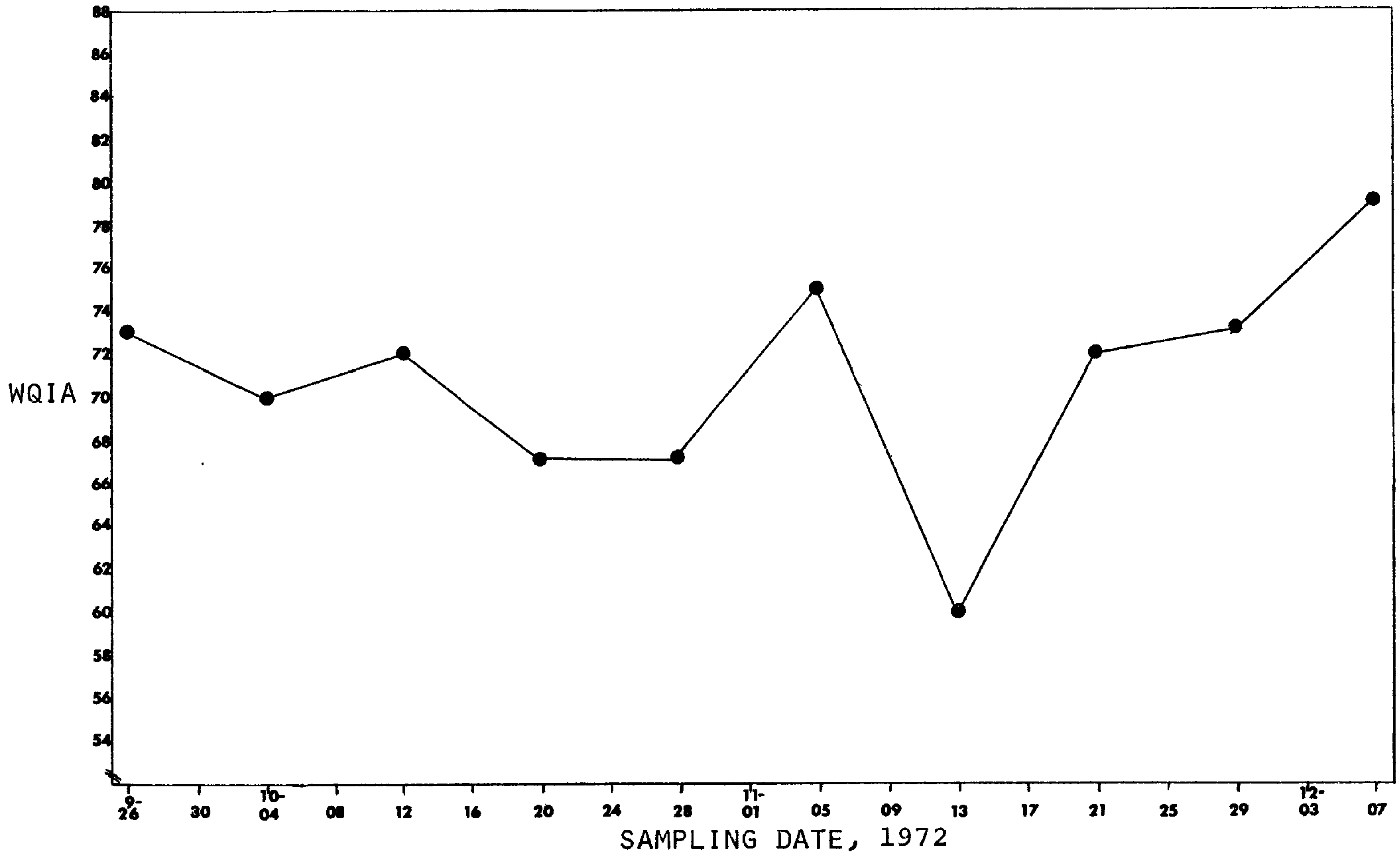


Figure F-9

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT LAWRENCE

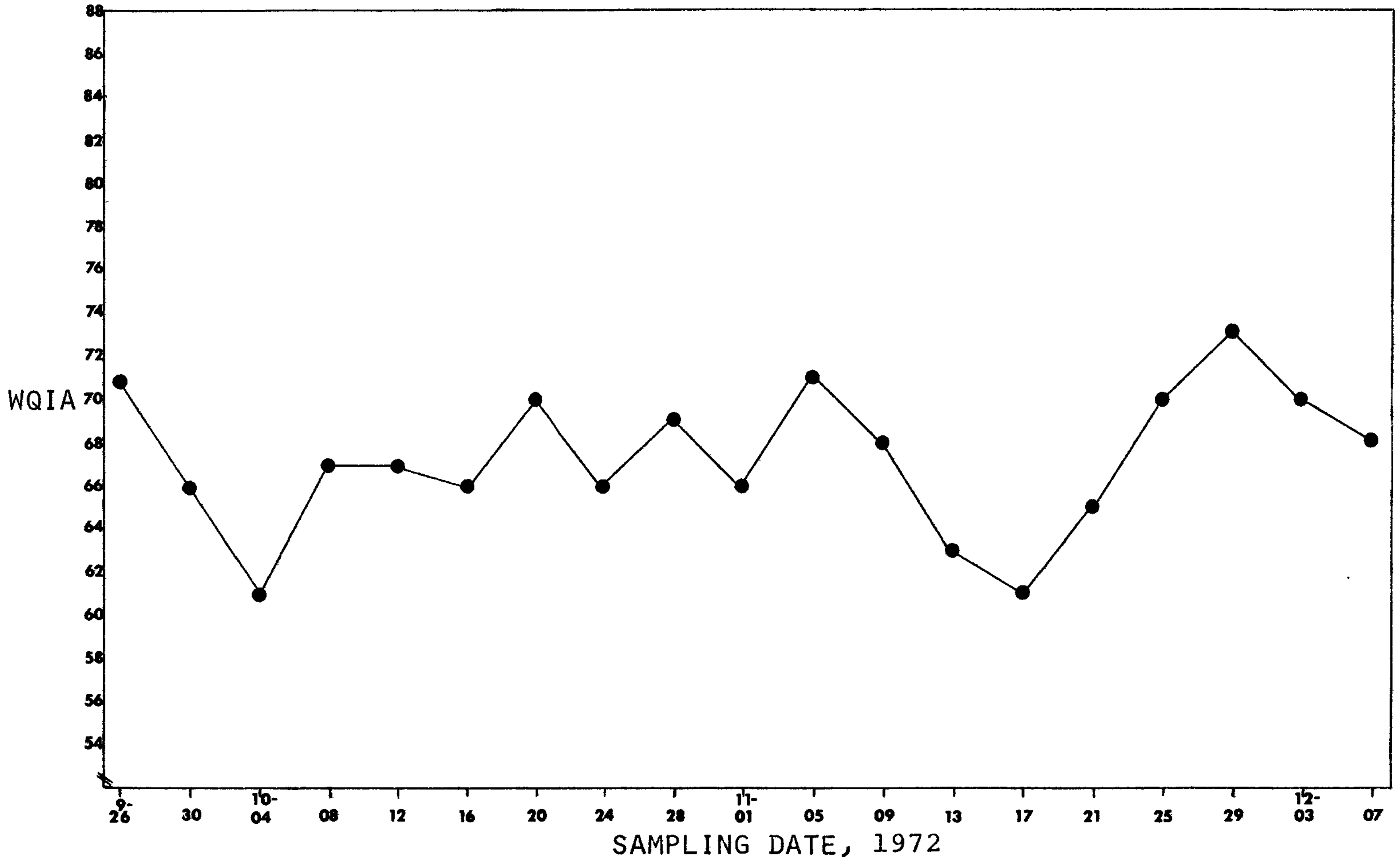


Figure F-10

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT LECOMPTON

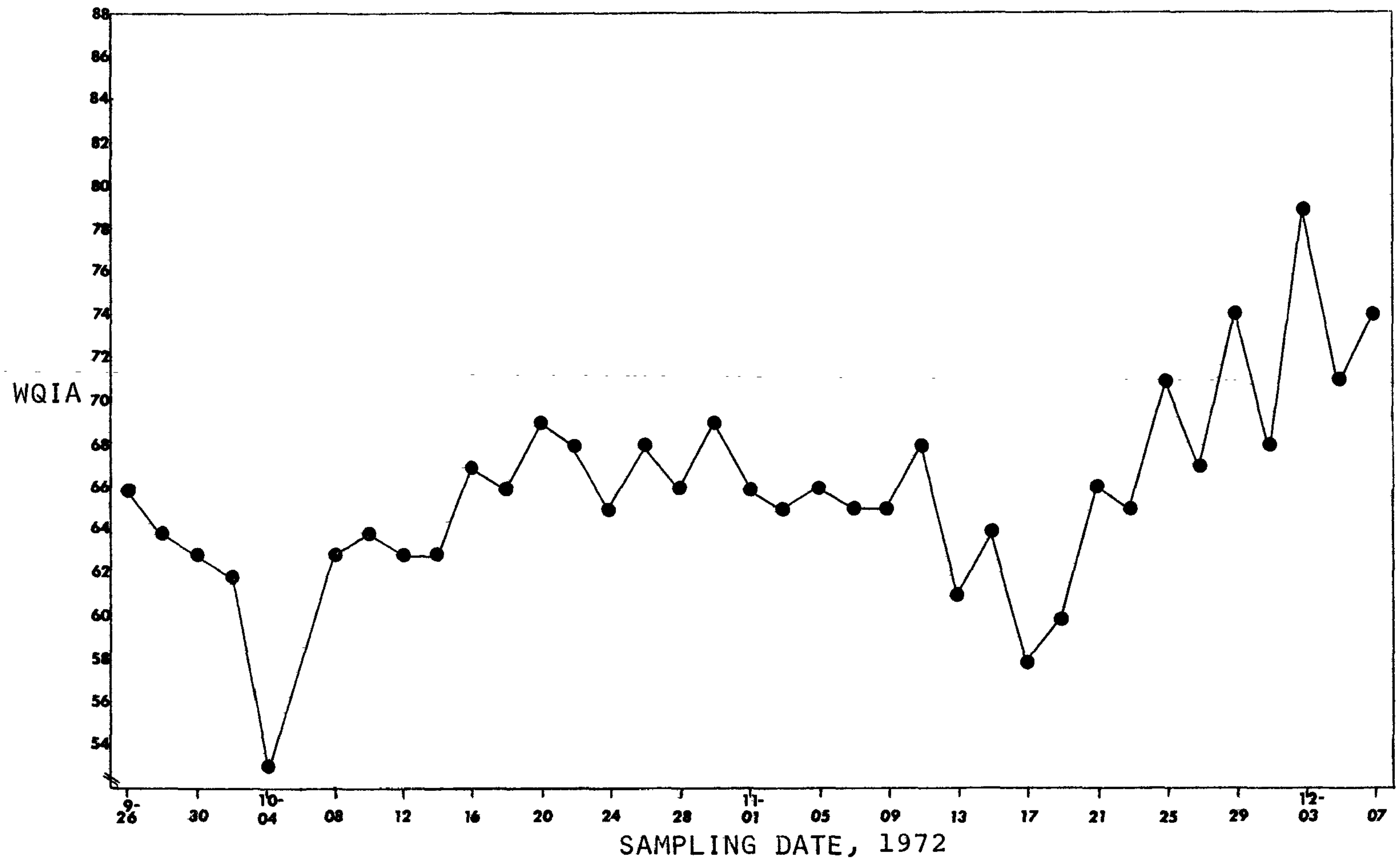
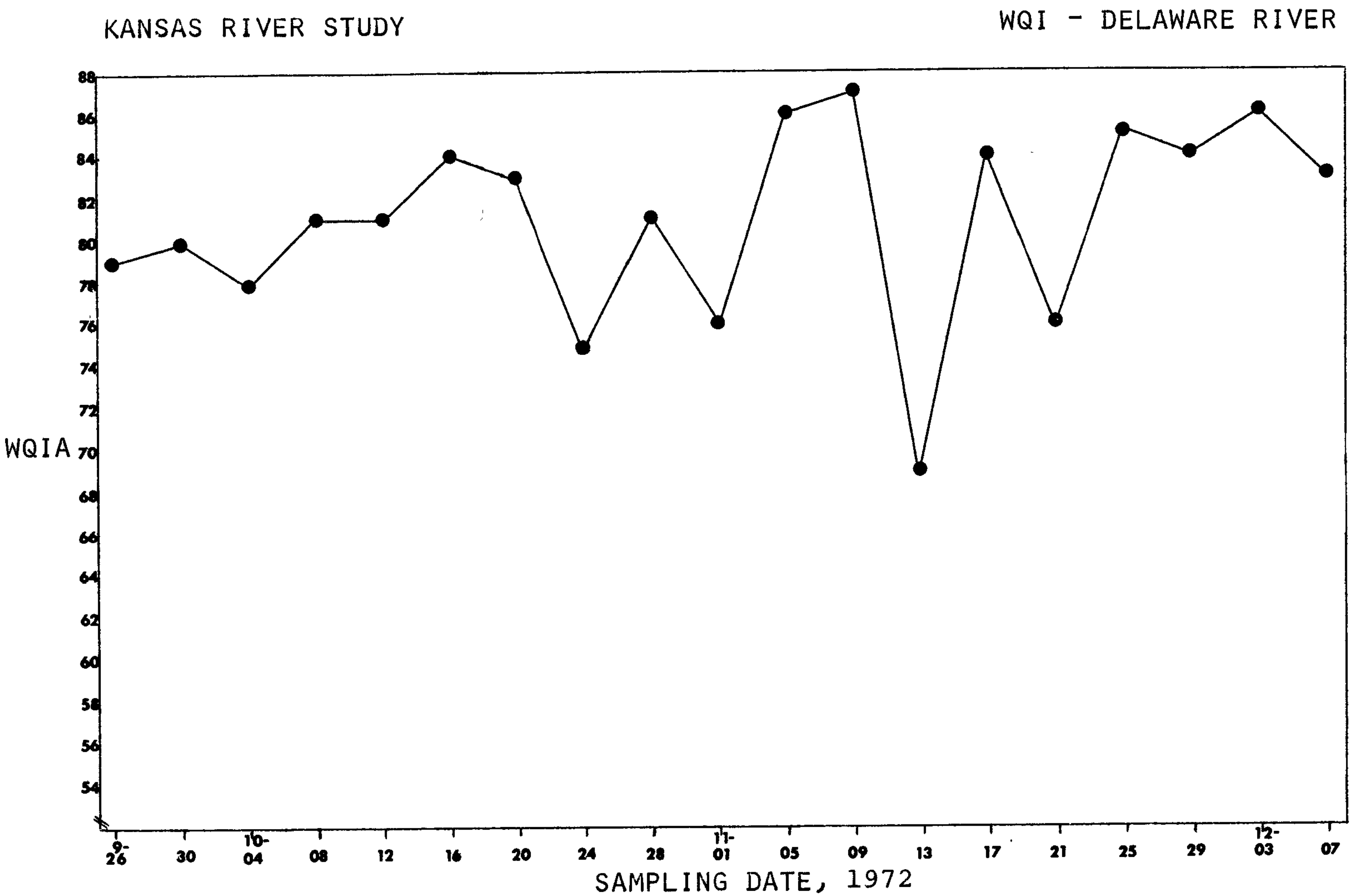


Figure F-11


KANSAS RIVER STUDY
WQI - DELAWARE RIVER
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SAMPLING DATE, 1972
Figure F-12

KANSAS RIVER STUDY

WQI - SHUNGANUNGA CREEK

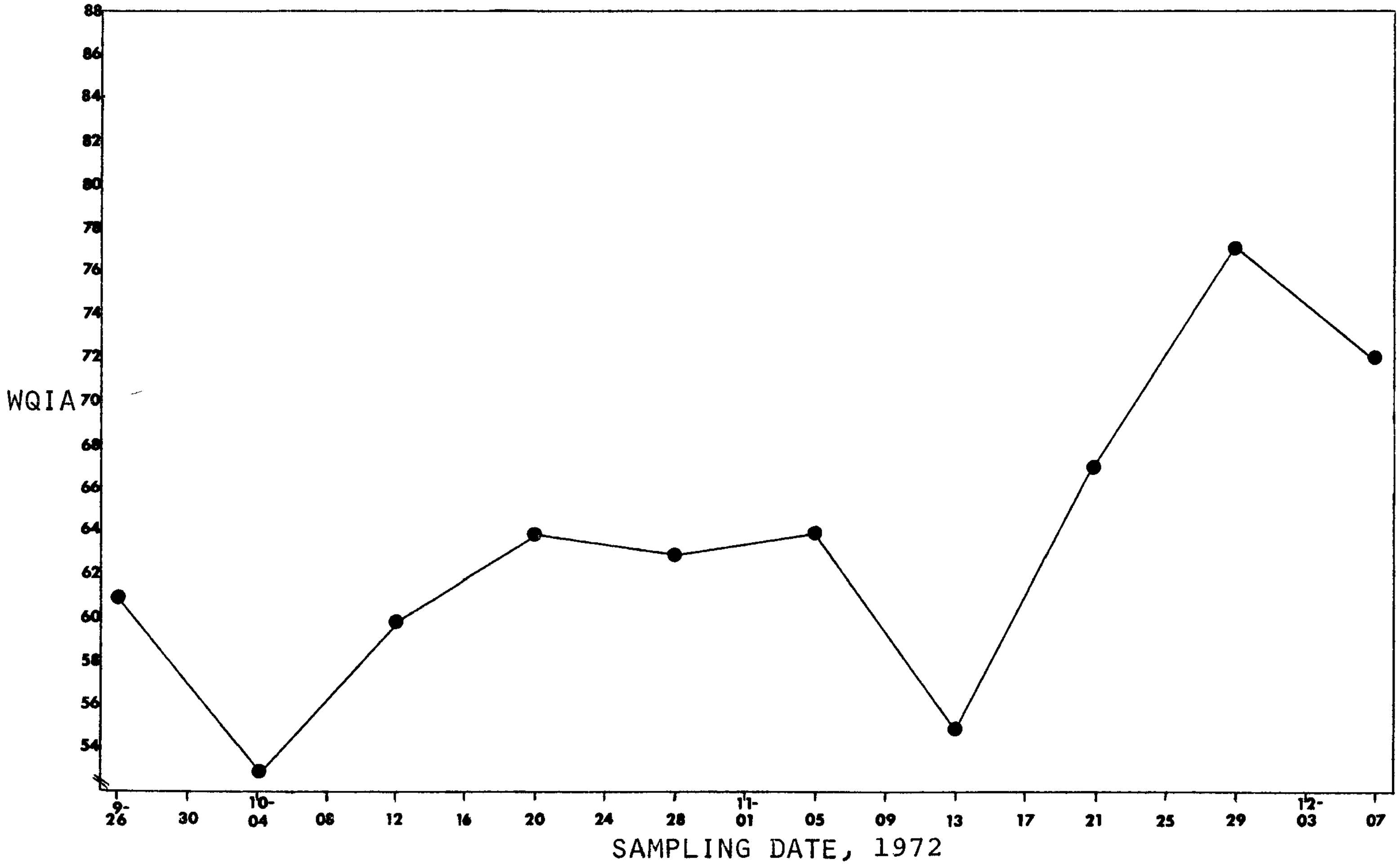


Figure F-13

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT TOPEKA

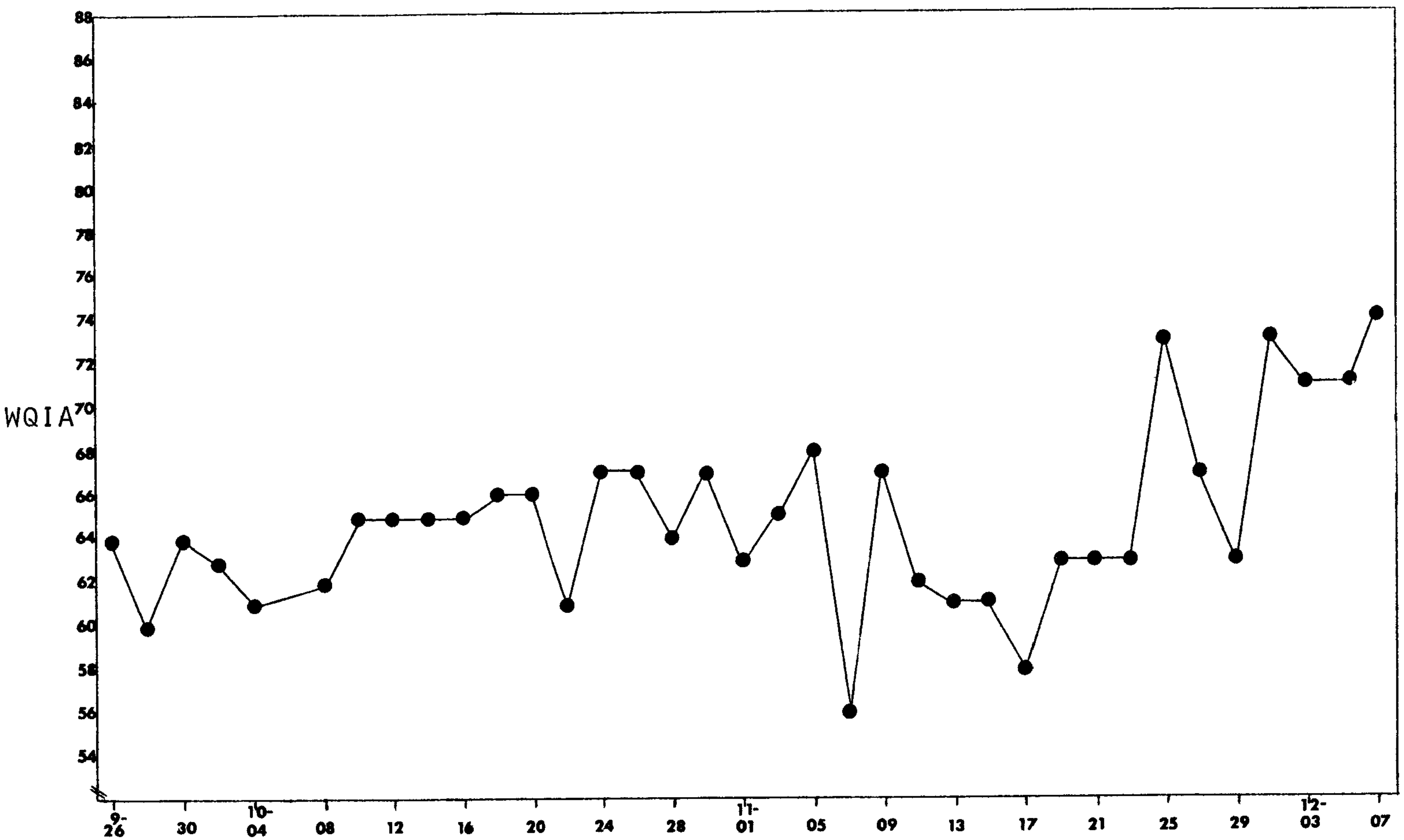
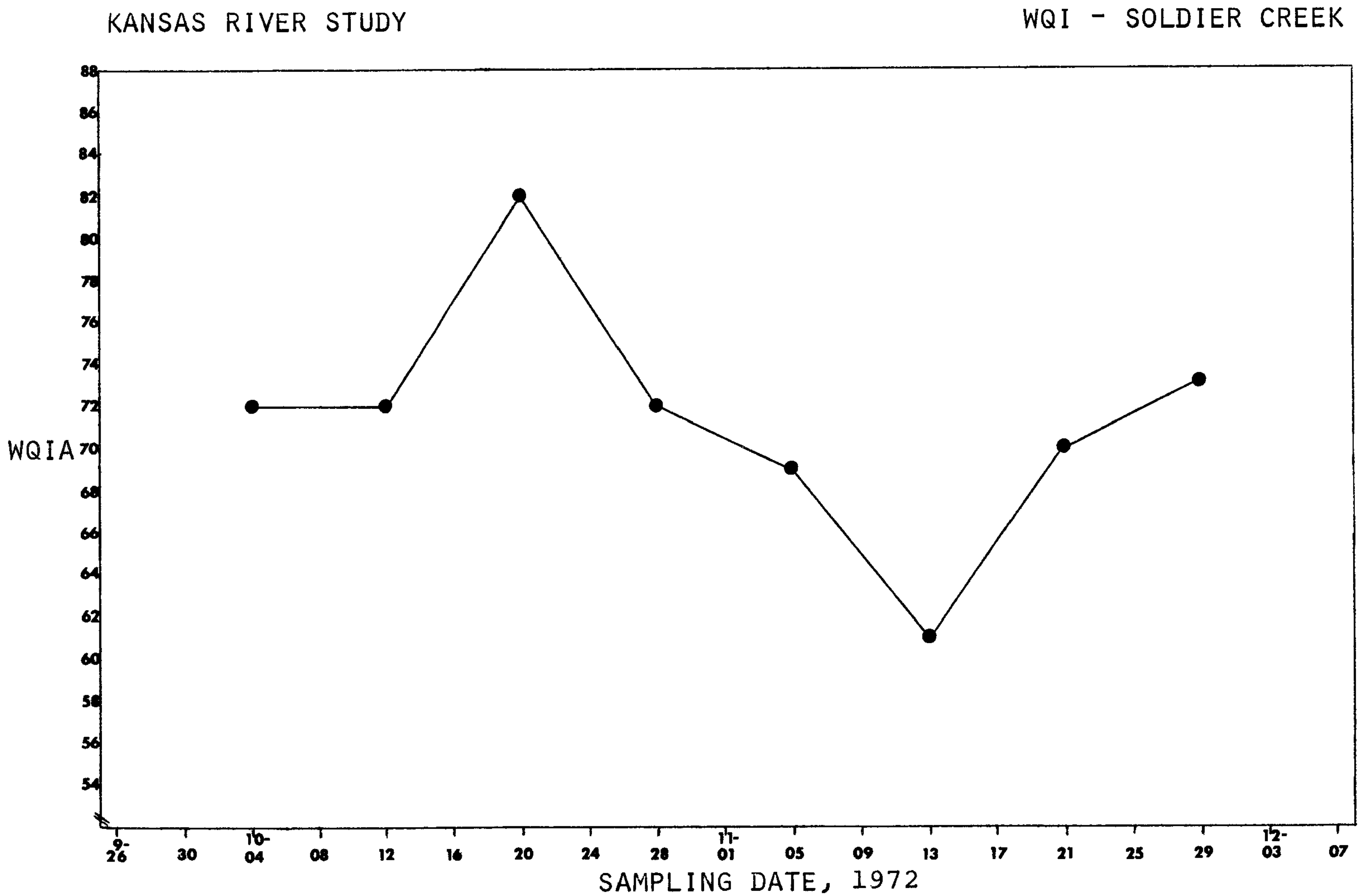


Figure F-14


KANSAS RIVER STUDY
WQI - SOLDIER CREEK
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SAMPLING DATE, 1972

Figure F-15

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT WILLARD

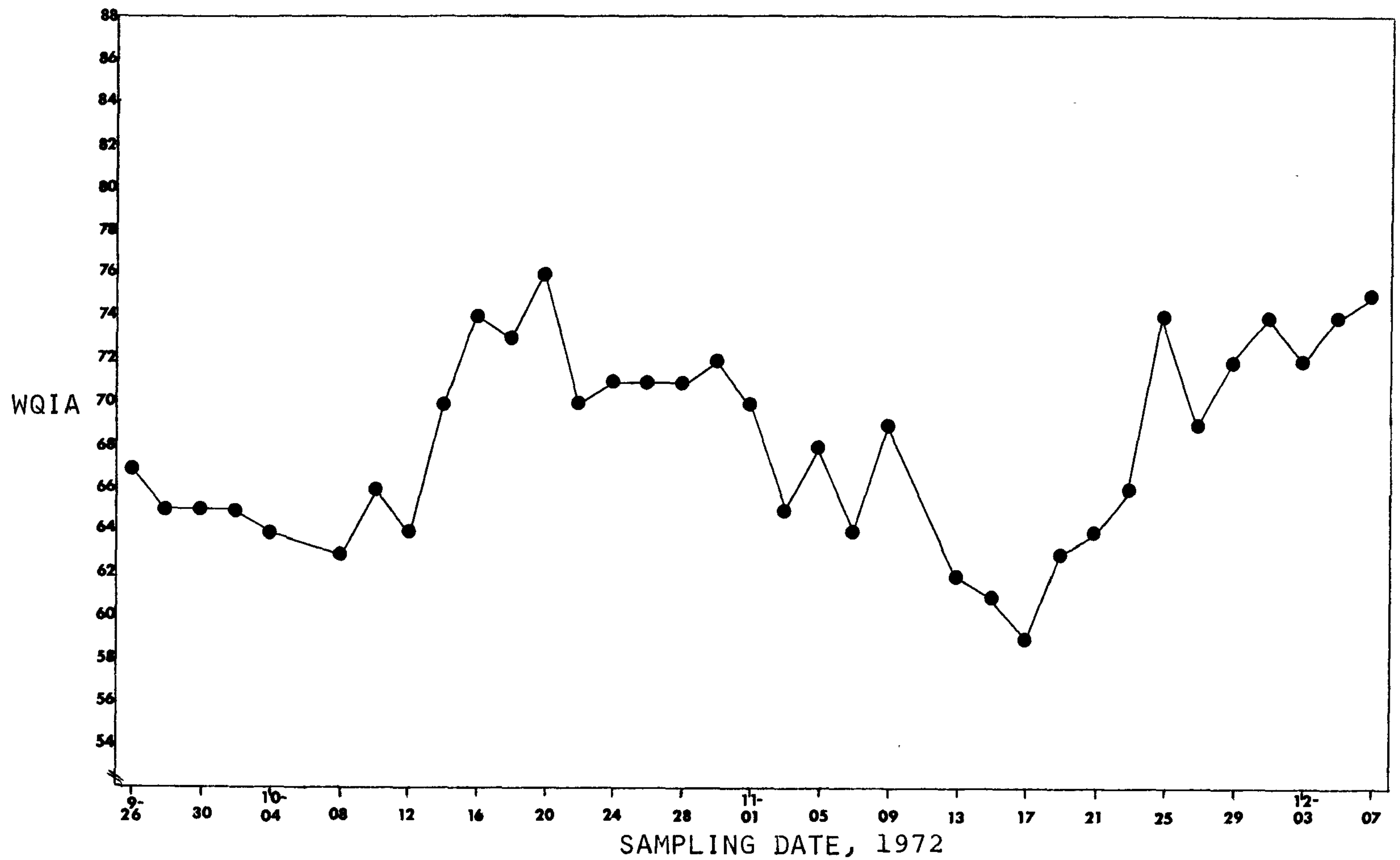


Figure F-16

KANSAS RIVER STUDY

WQI - MILL CREEK

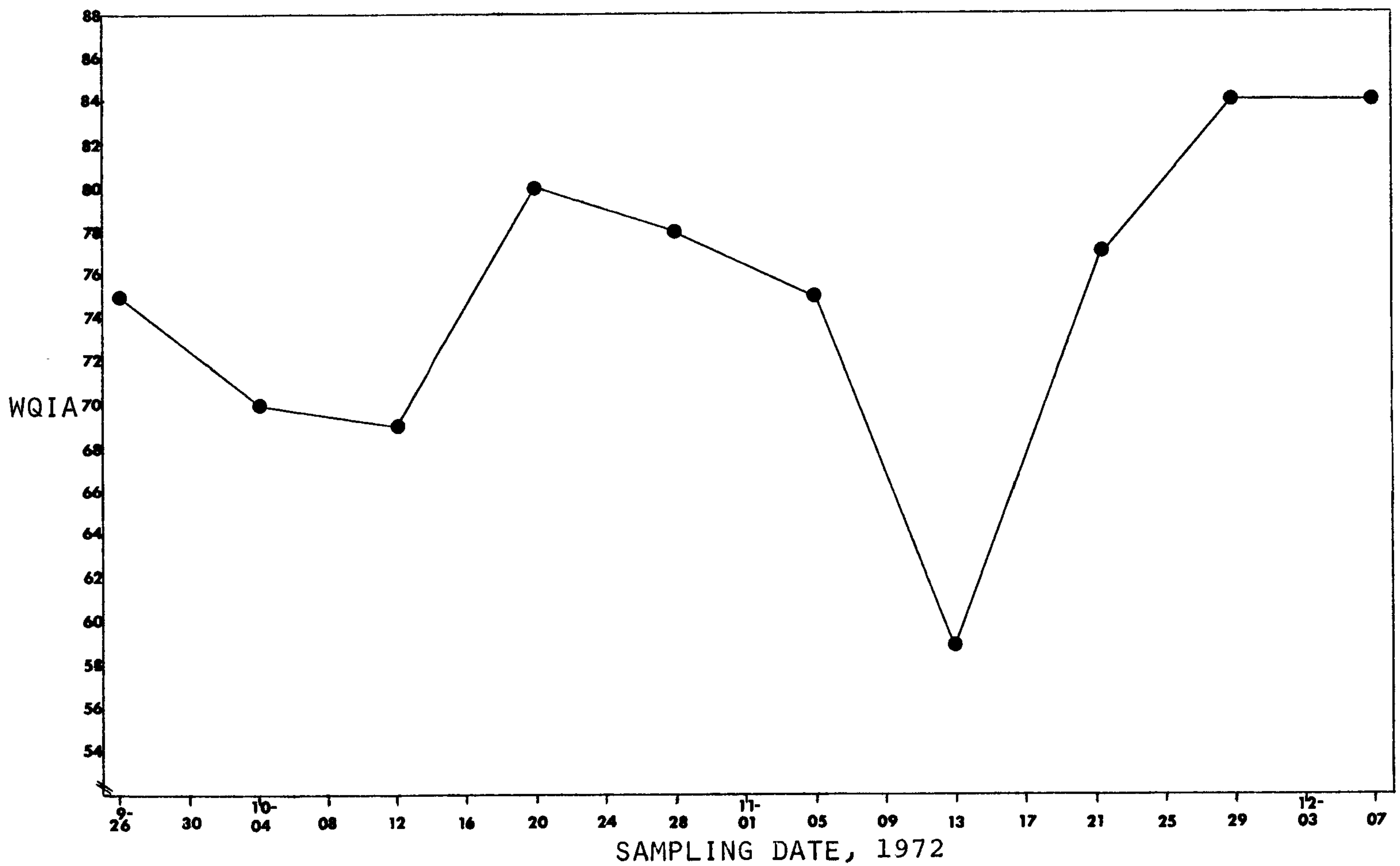


Figure F-17

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT PAXICO

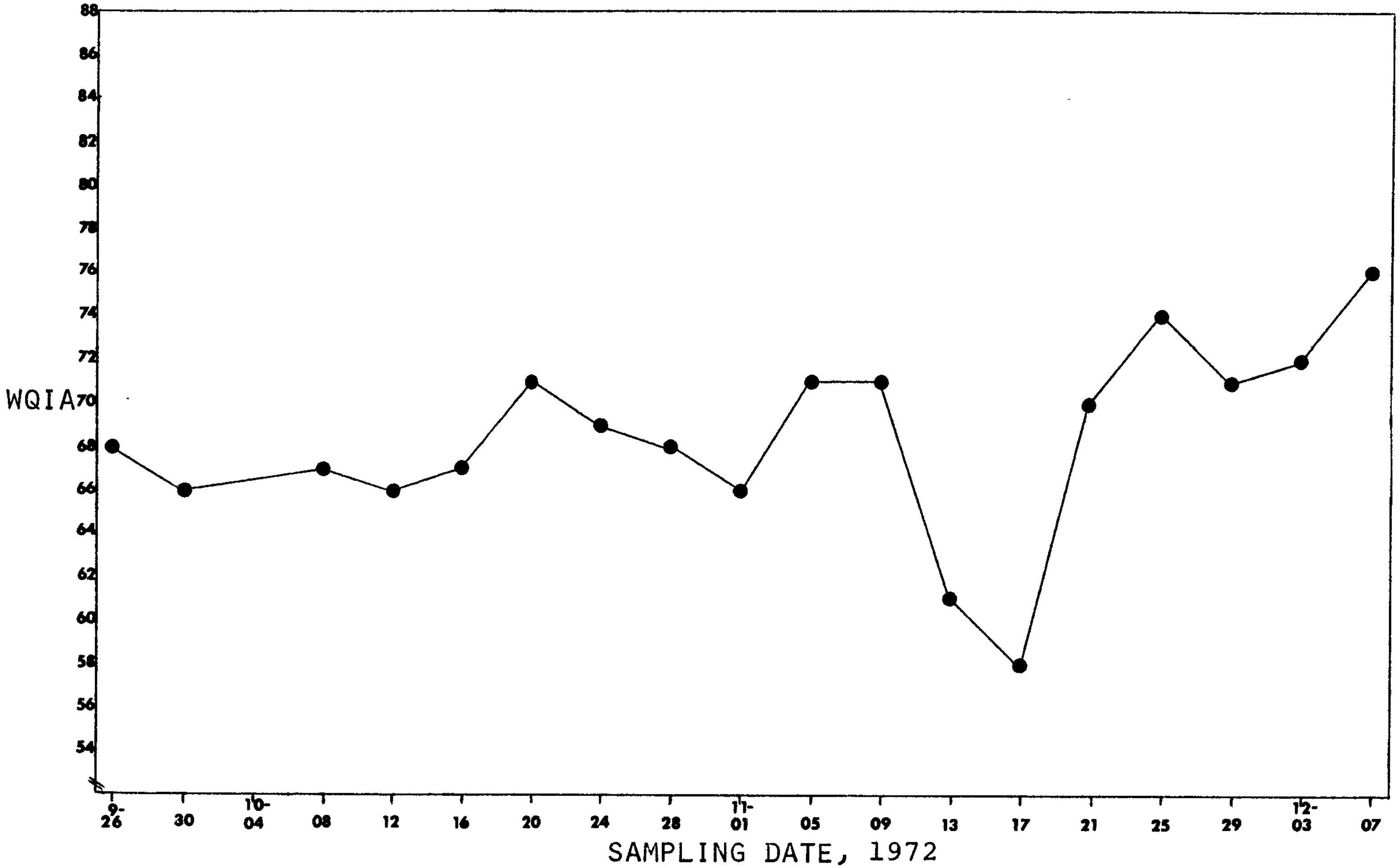
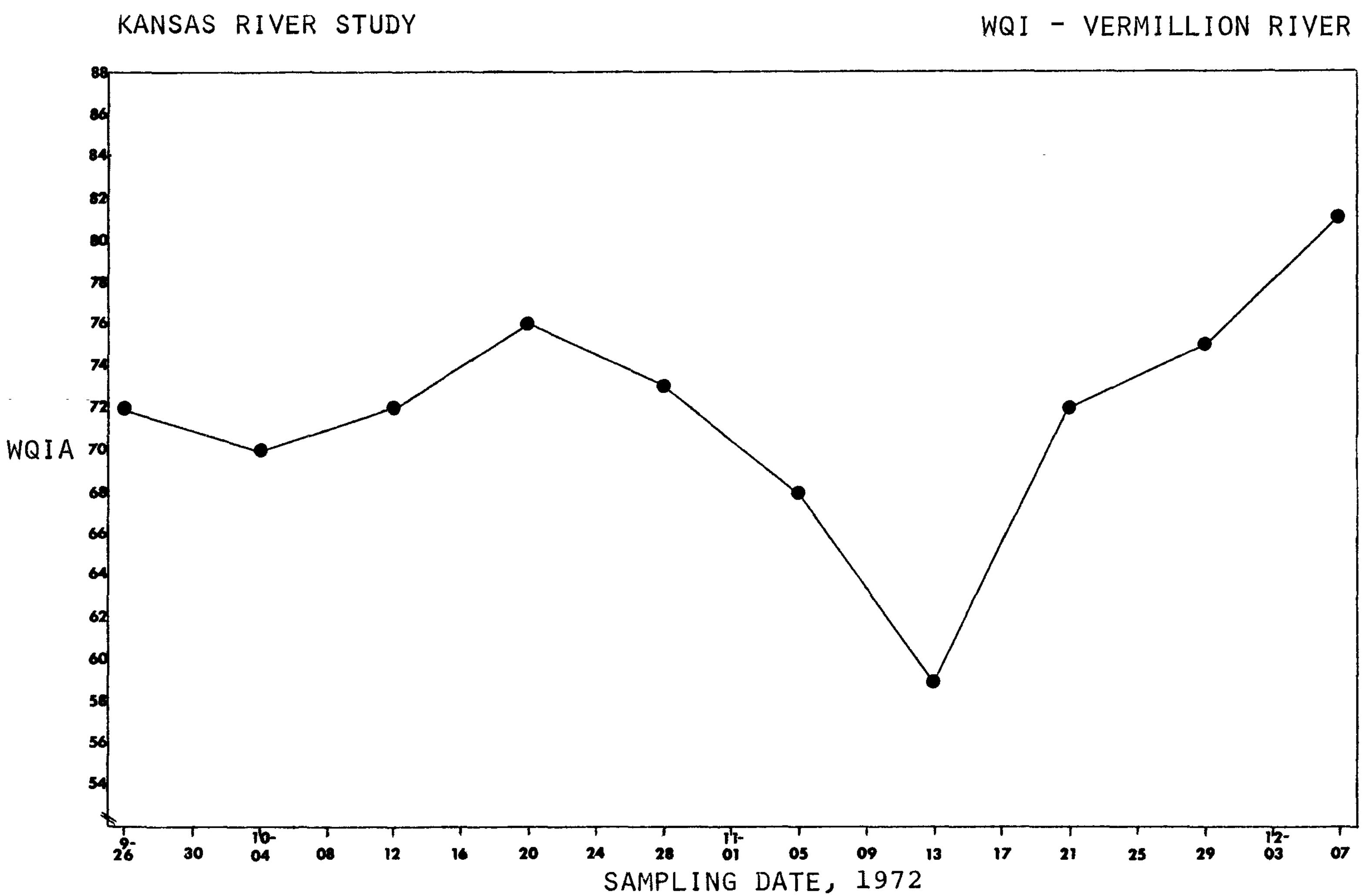


Figure F-18



KANSAS RIVER STUDY
WQI - VERMILLION RIVER
WQIA
88
86
84
82
80
78
76
74
72
70
68
66
64
62
60
58
56
54
9-
26
30
10-
04
08
12
16
20
24
28
11-
01
05
09
13
17
21
25
29
12-
03
07
SAMPLING DATE, 1972

Figure F-19

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT WAMEGO

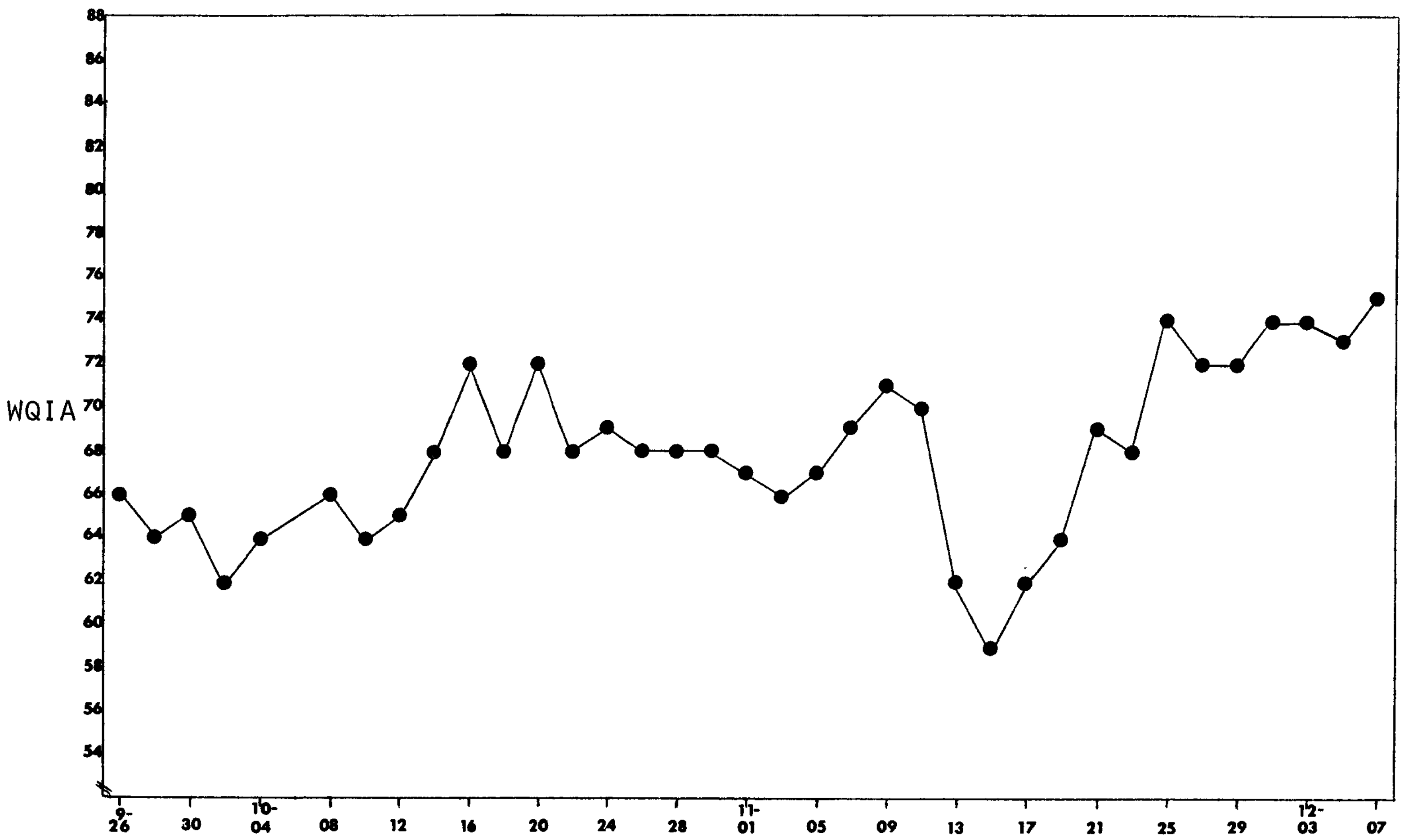


Figure F-20

KANSAS RIVER STUDY

WQI - BIG BLUE RIVER

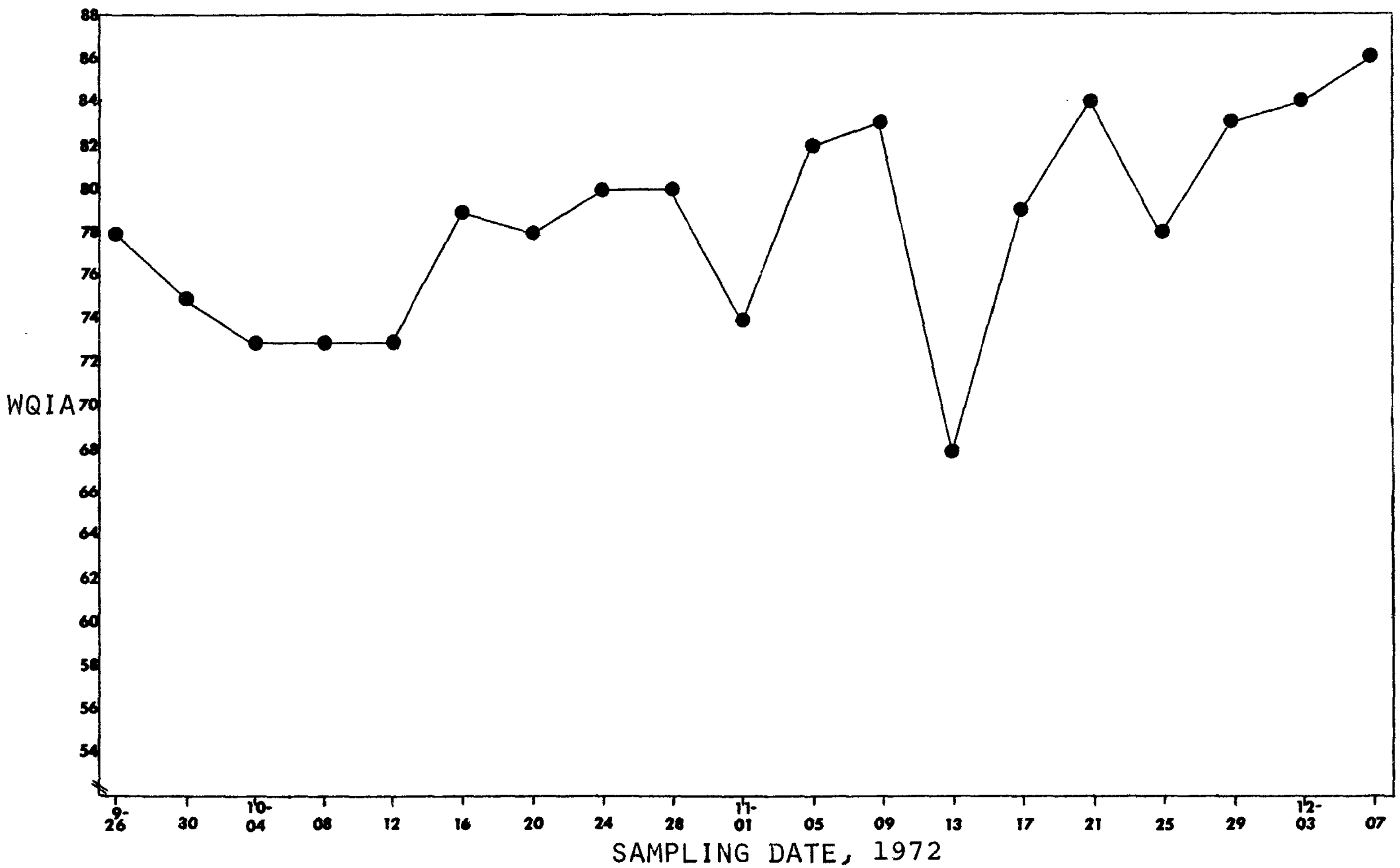


Figure F-21

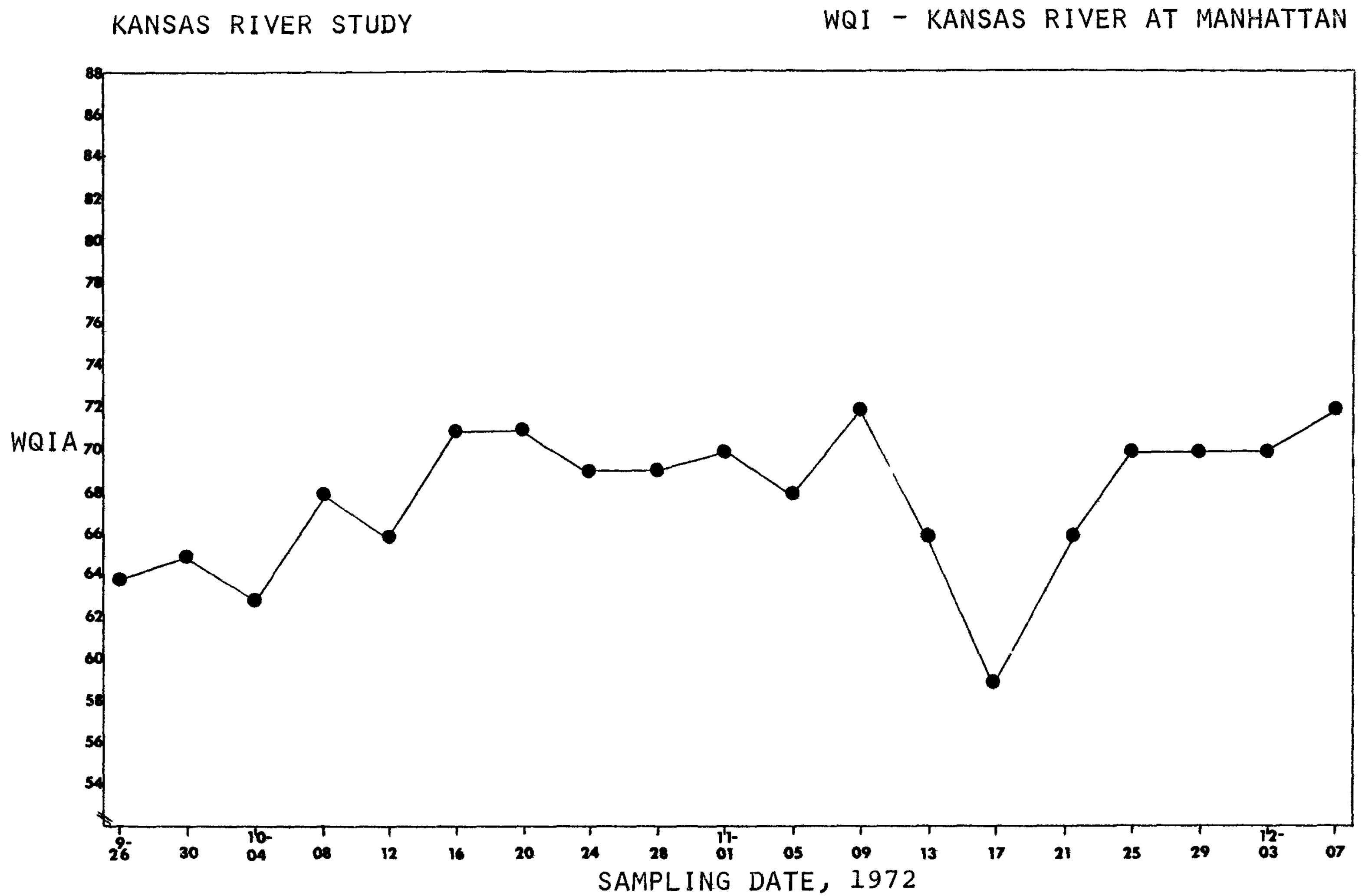

KANSAS RIVER STUDY
WQI - KANSAS RIVER AT MANHATTAN
WQIA
88
86
84
82
80
78
76
74
72
70
68
66
64
62
60
58
56
54
9-26
30
10-04
08
12
16
20
24
28
11-01
05
09
13
17
21
25
29
12-03
07
SAMPLING DATE, 1972

Figure F-22

KANSAS RIVER STUDY

WQI - CLARK CREEK

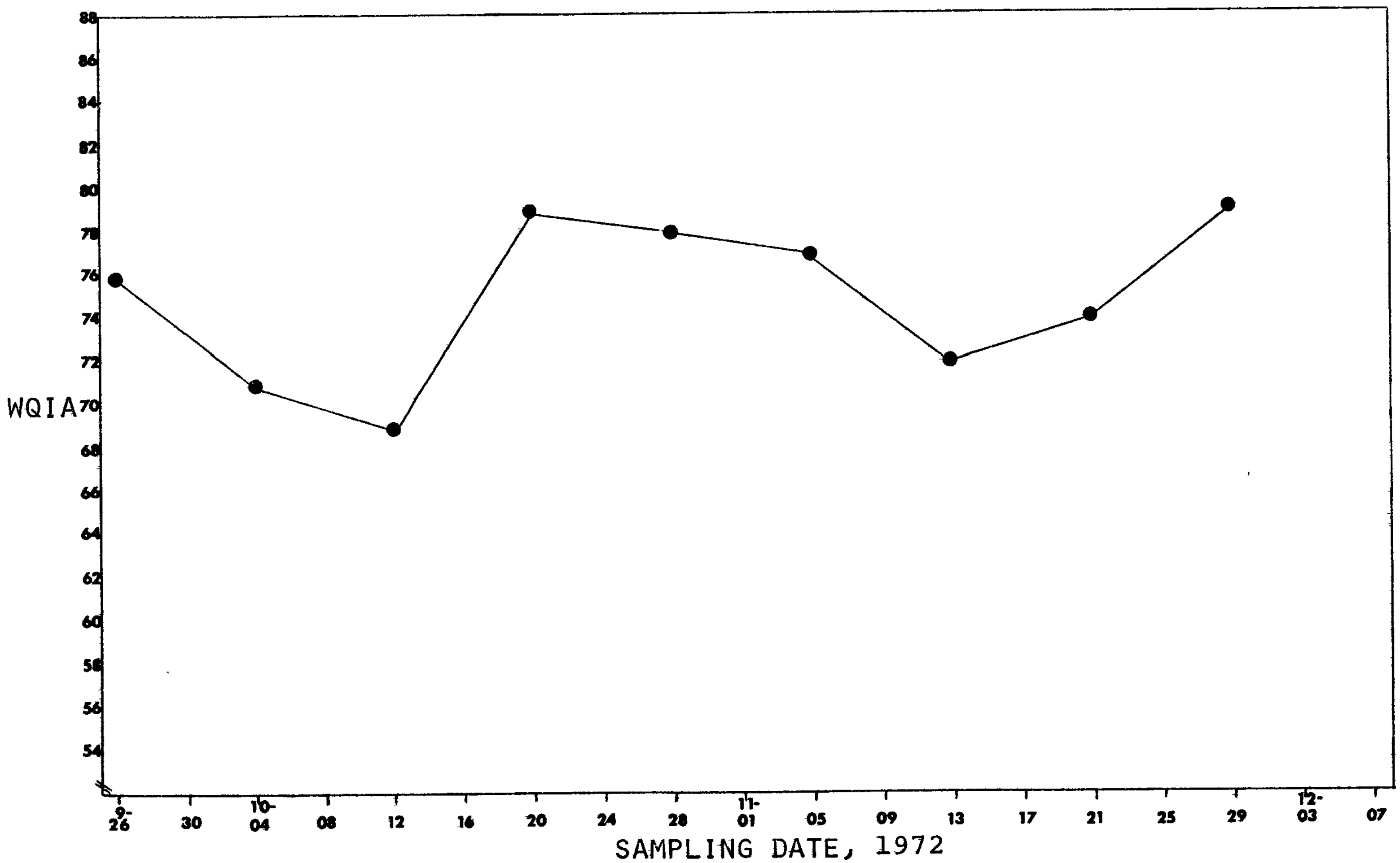


Figure F-23

KANSAS RIVER STUDY

WQI - KANSAS RIVER AT FORT RILEY

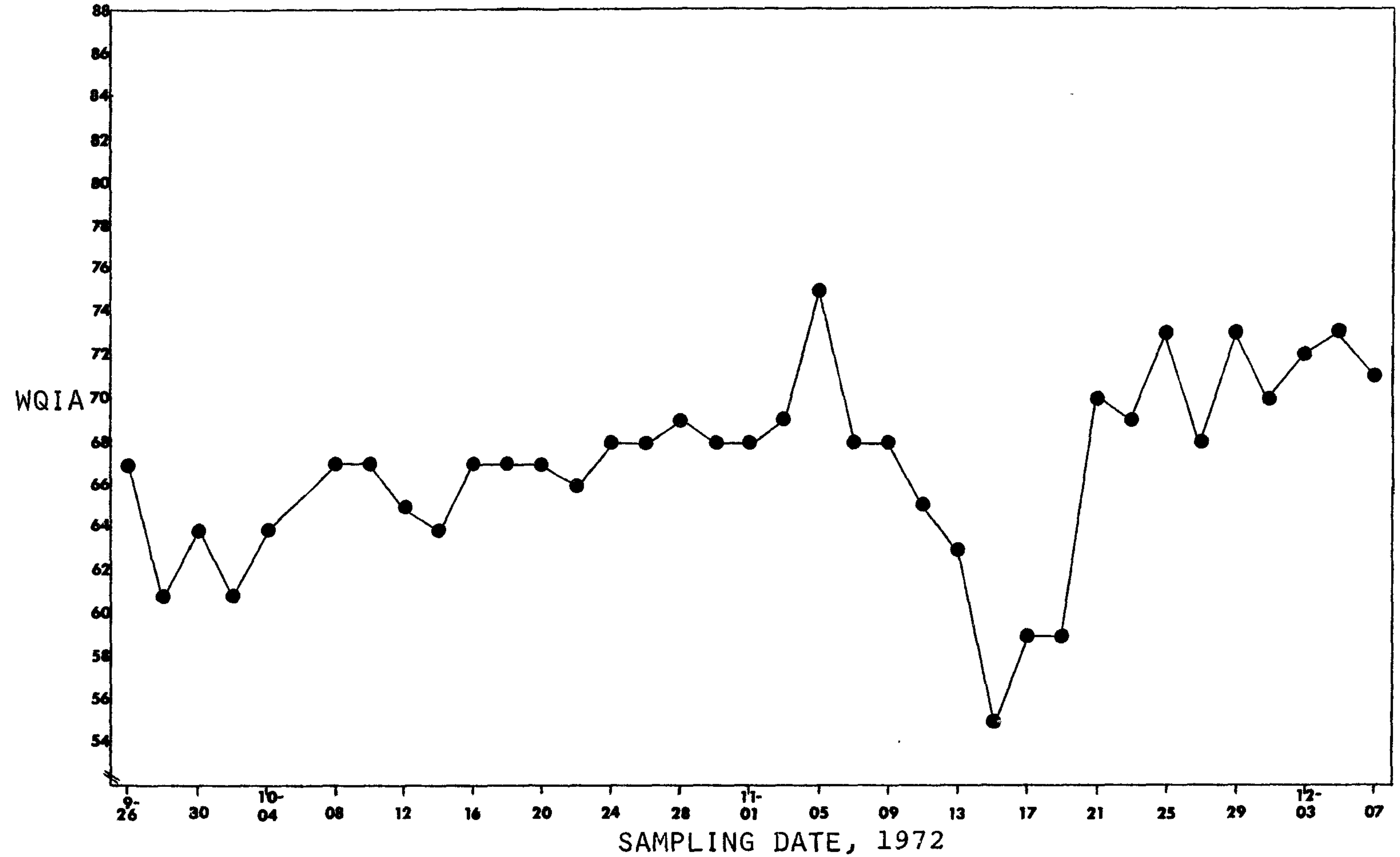


Figure F-24

KANSAS RIVER STUDY

WQI - REPUBLICAN RIVER

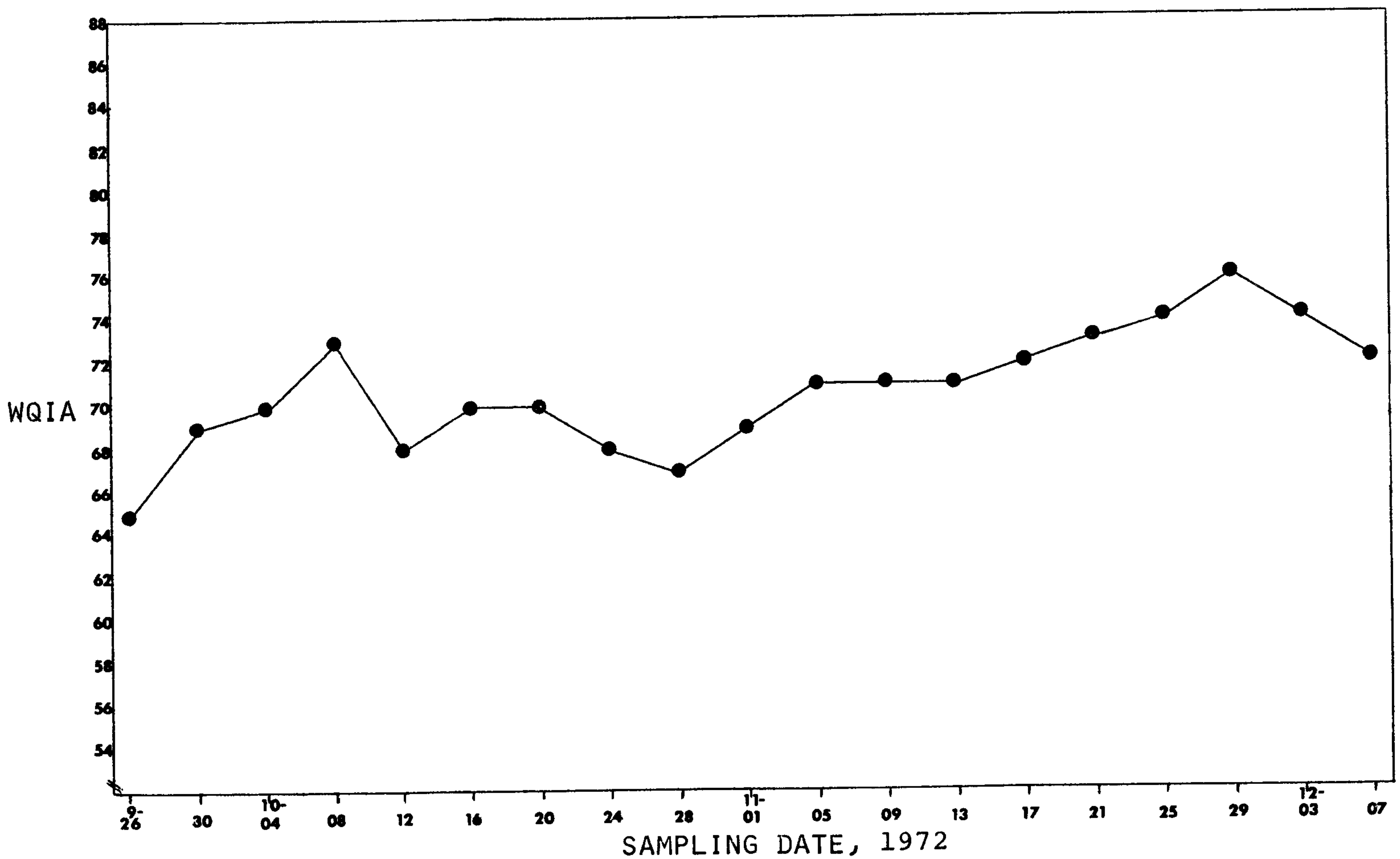


Figure F-25

183

KANSAS RIVER STUDY

WQI - SMOKY HILL RIVER

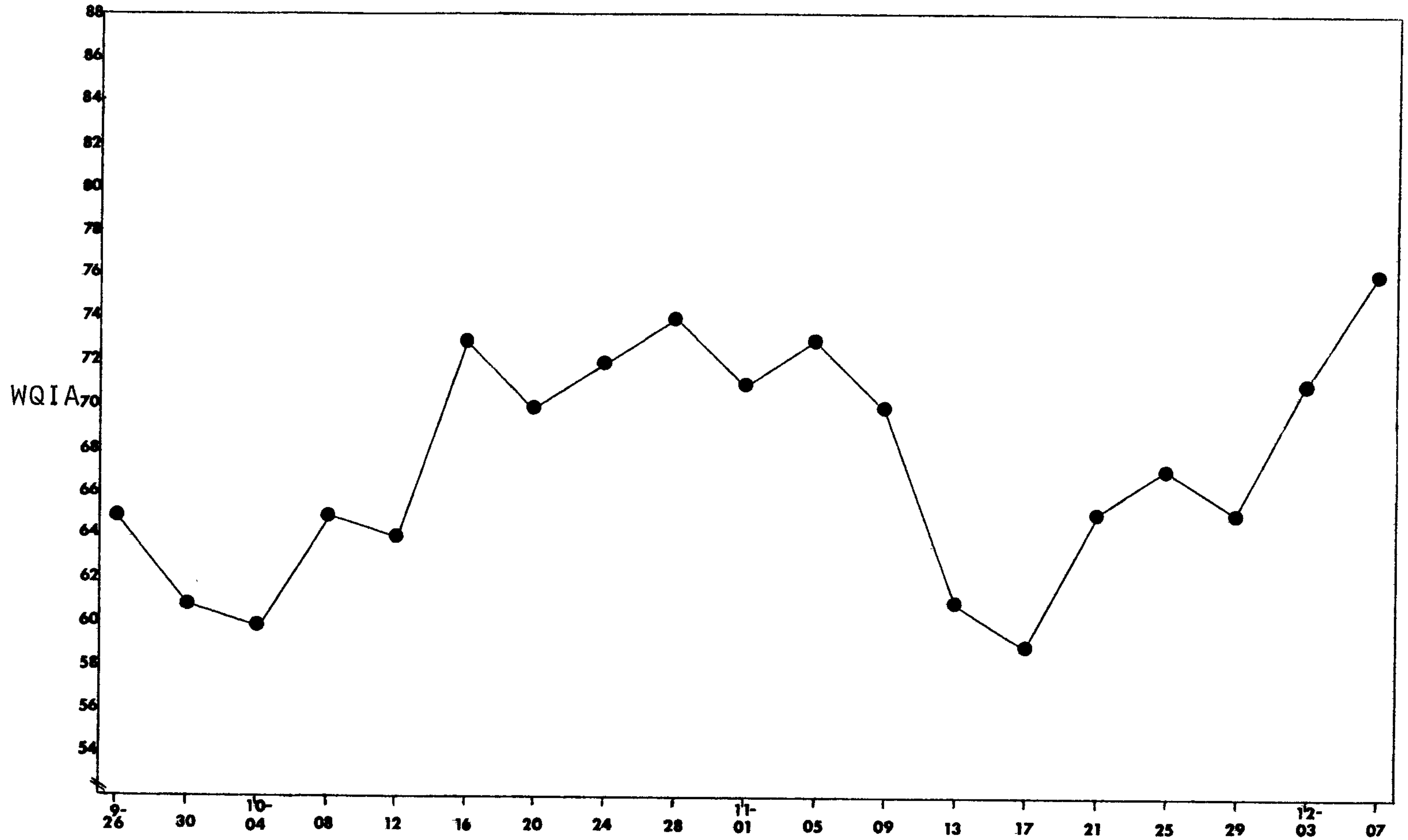


Figure F-26

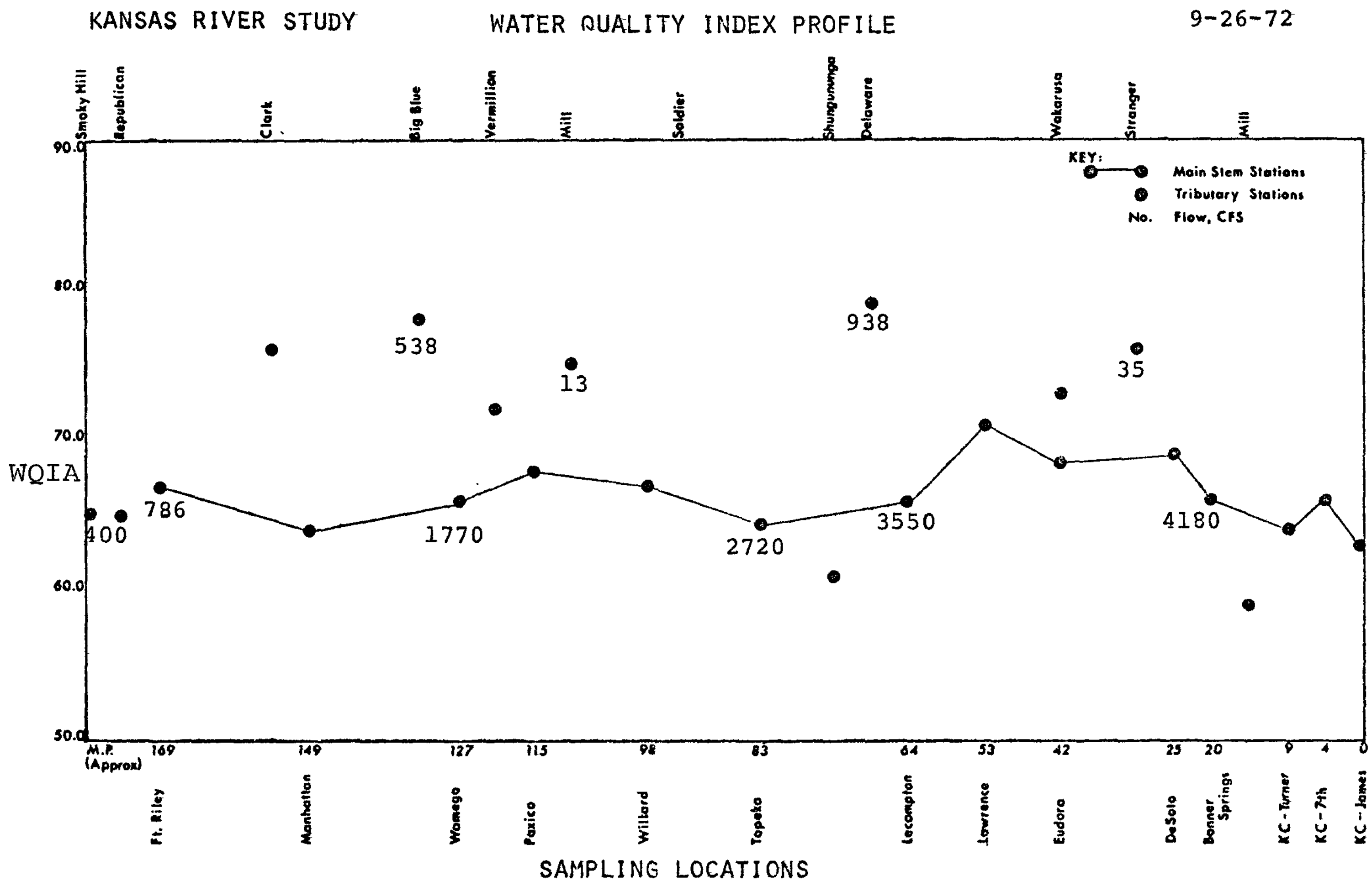

KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
9-26-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
538
938
13
35
786
400
1770
2720
3550
4180
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC-Turner
KC-7th
KC-James
SAMPLING LOCATIONS

Figure G-1

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 9-28-72

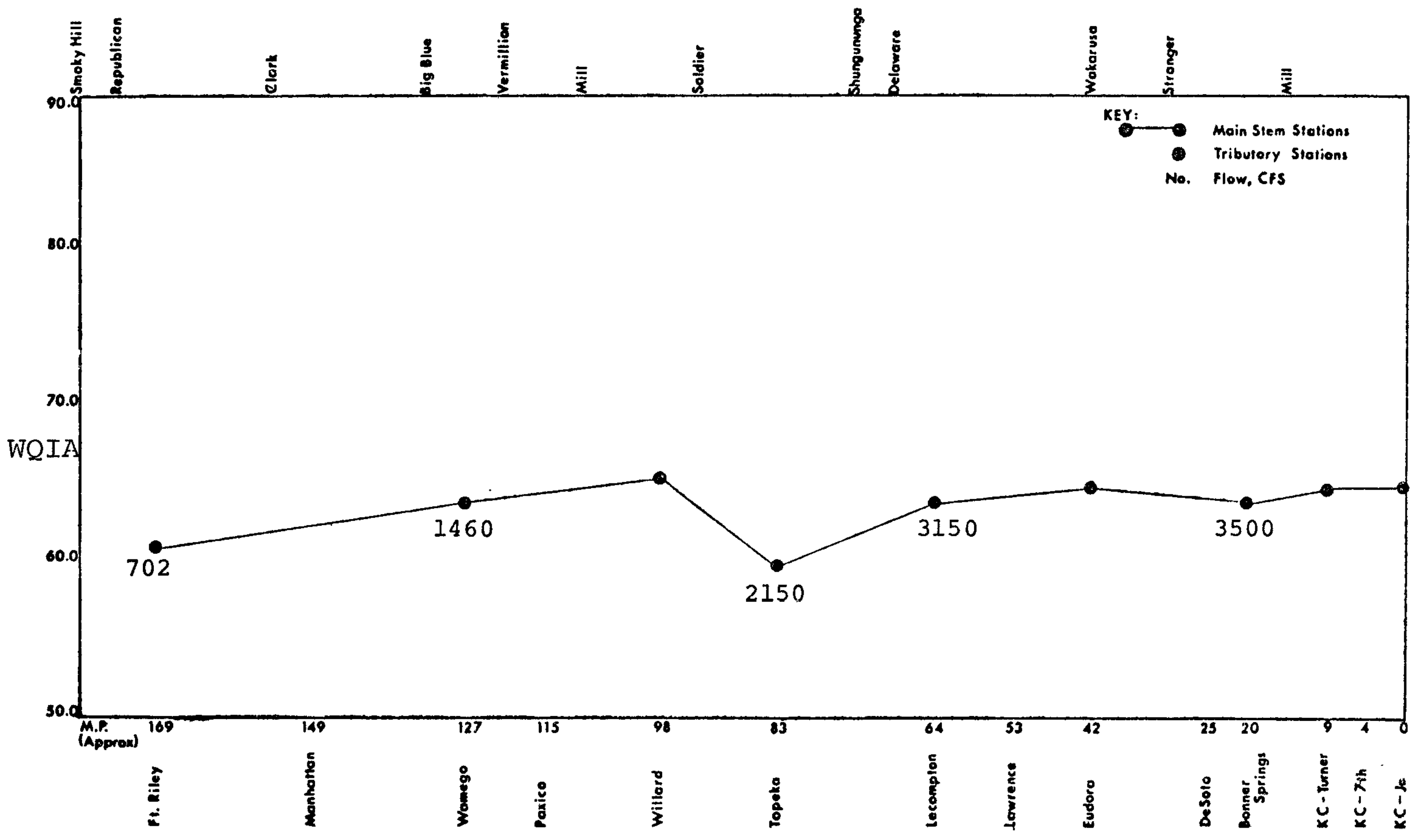


Figure G-2

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 9-30-72

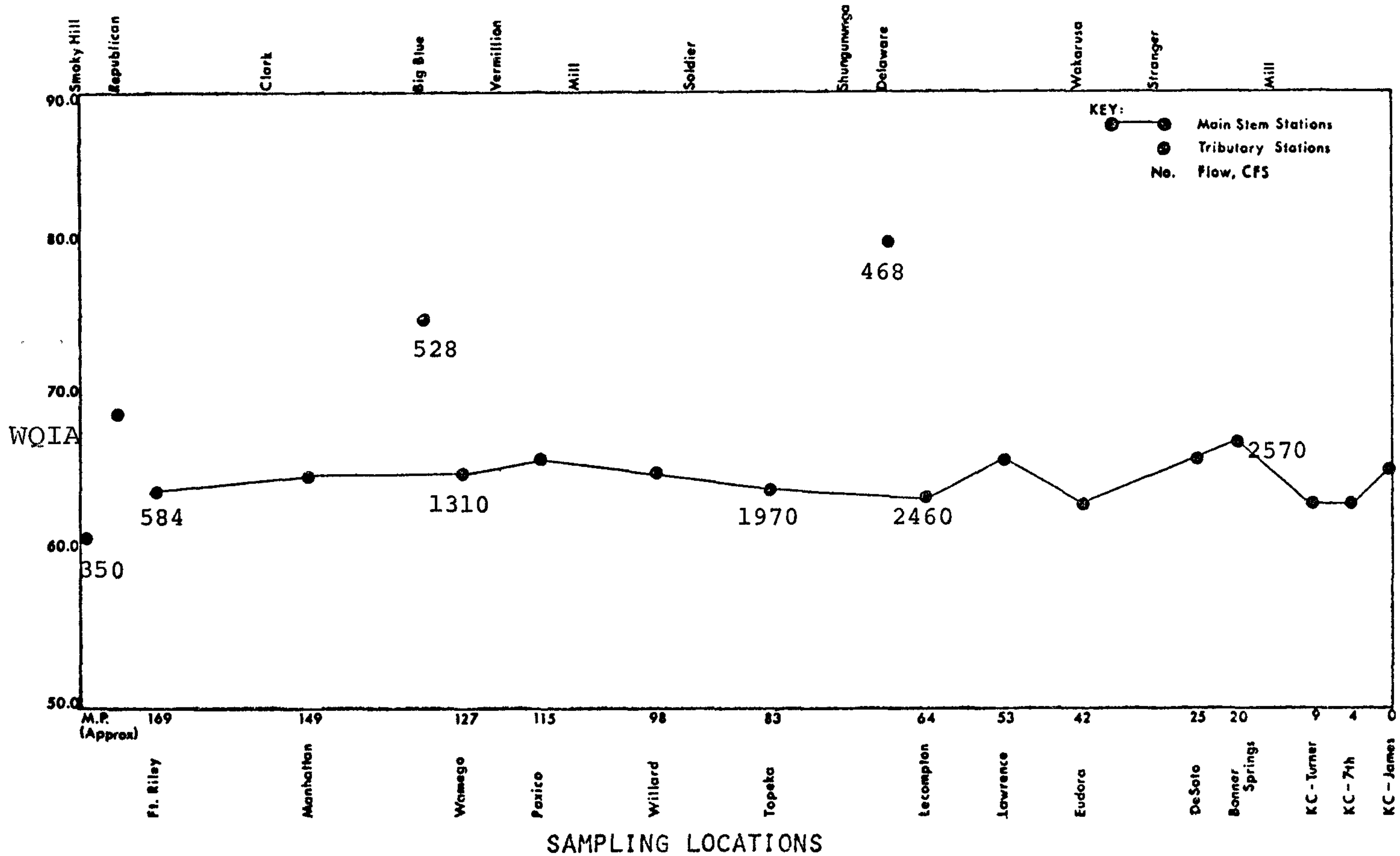


Figure G-3

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-02-72

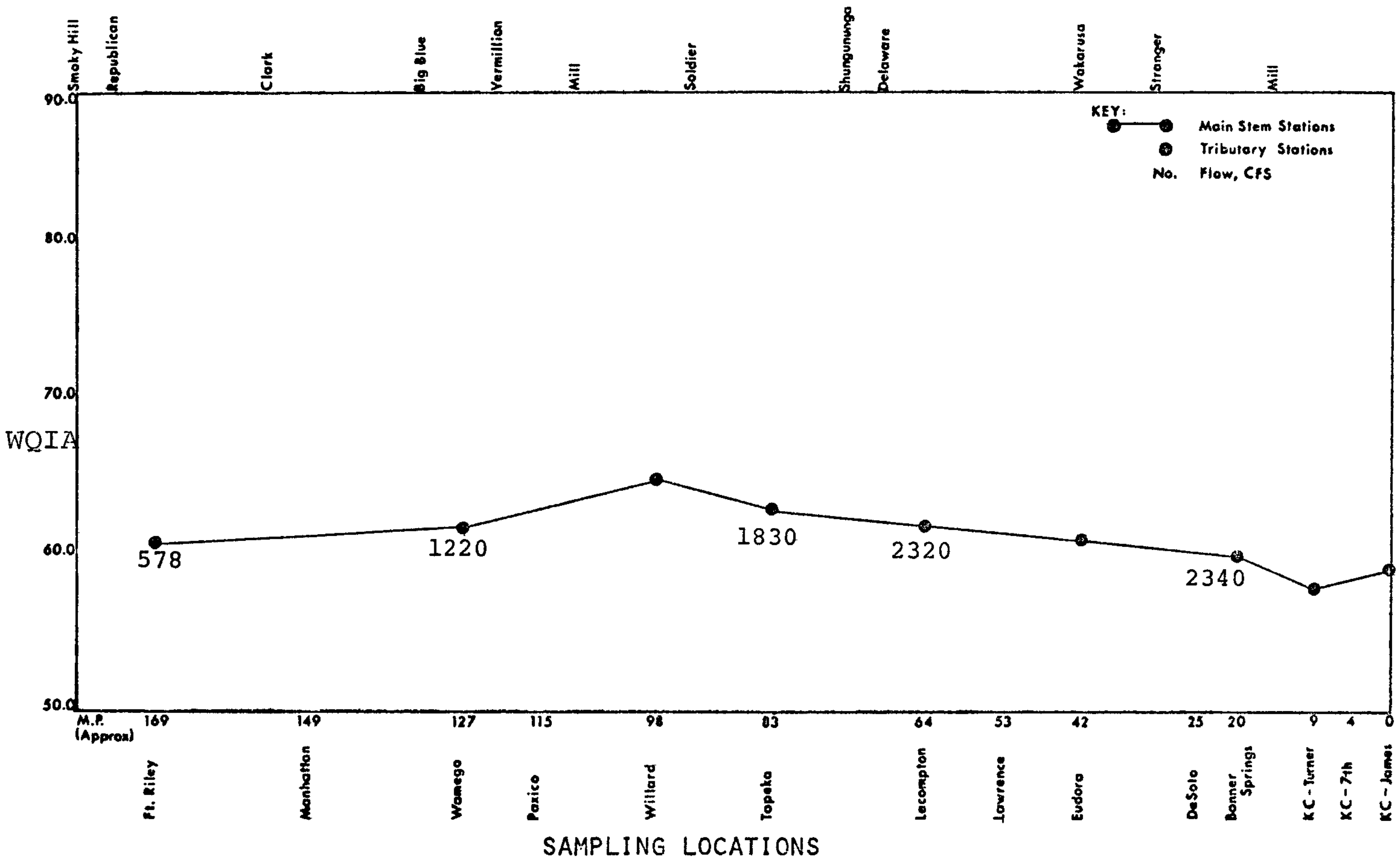


Figure G-4

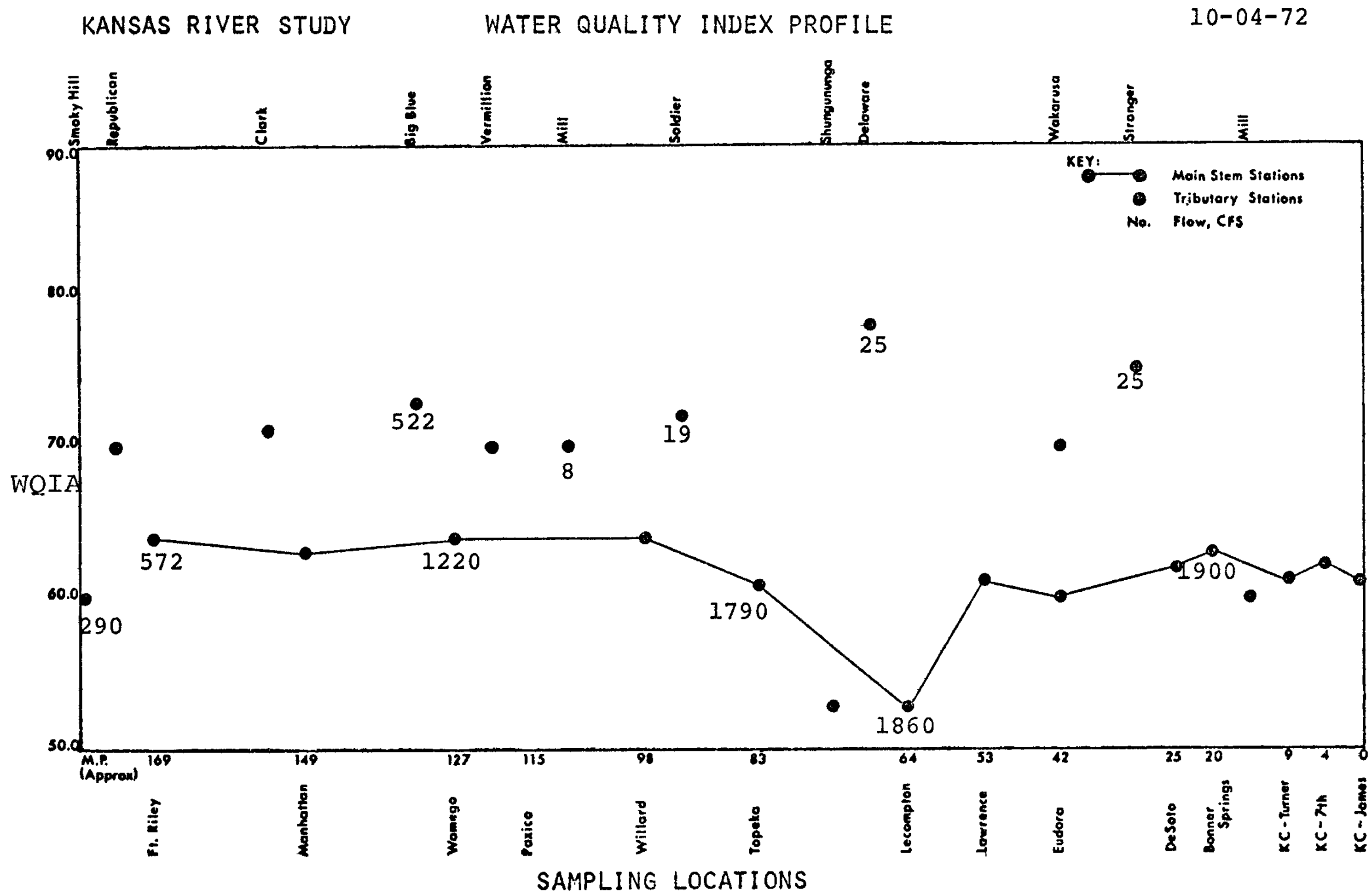

KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
10-04-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
290
572
1220
522
8
19
1790
25
1860
25
1900
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC - Turner
KC - 7th
KC - James
SAMPLING LOCATIONS

Figure G-5

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-08-72

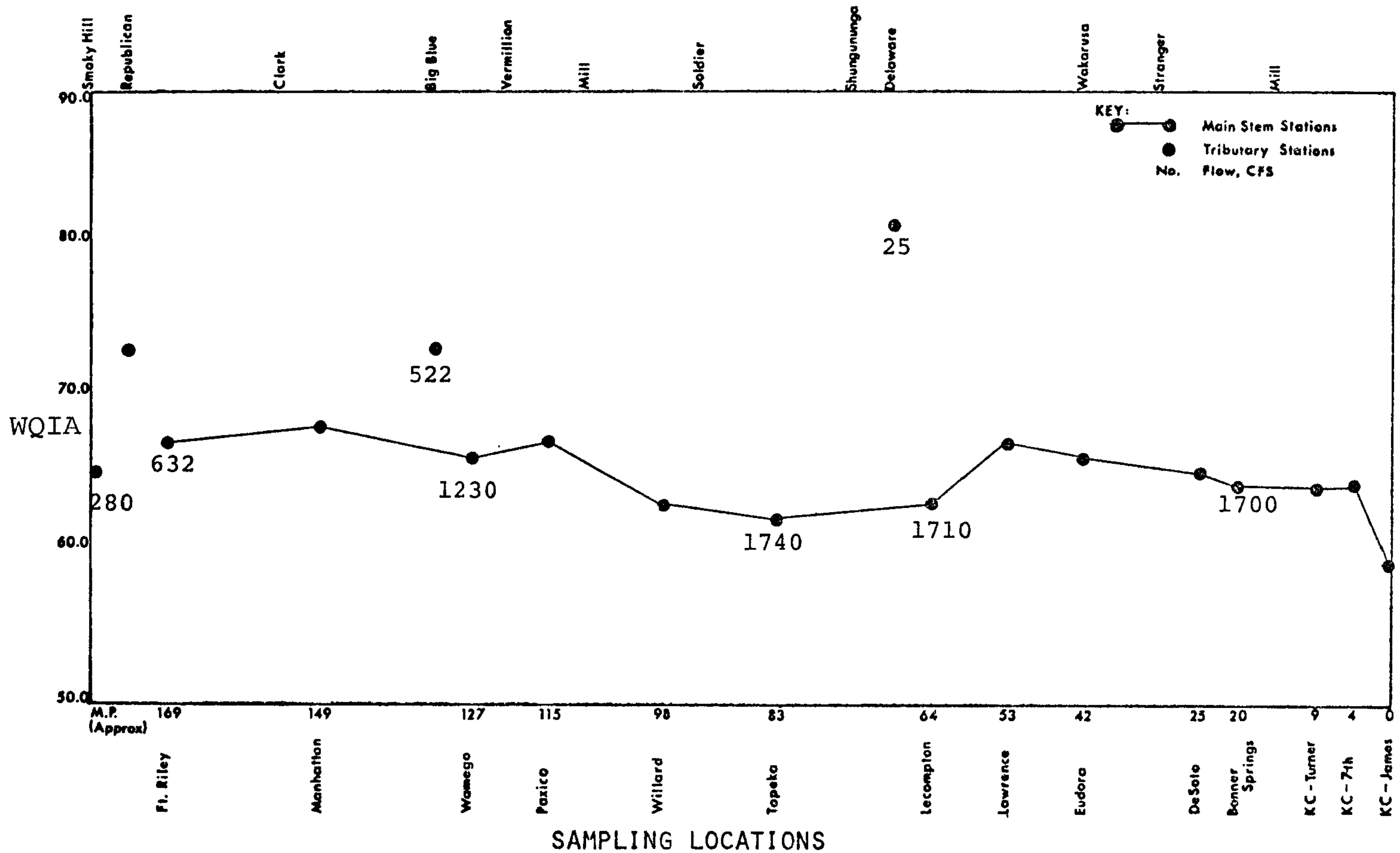


Figure G-6

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-10-72

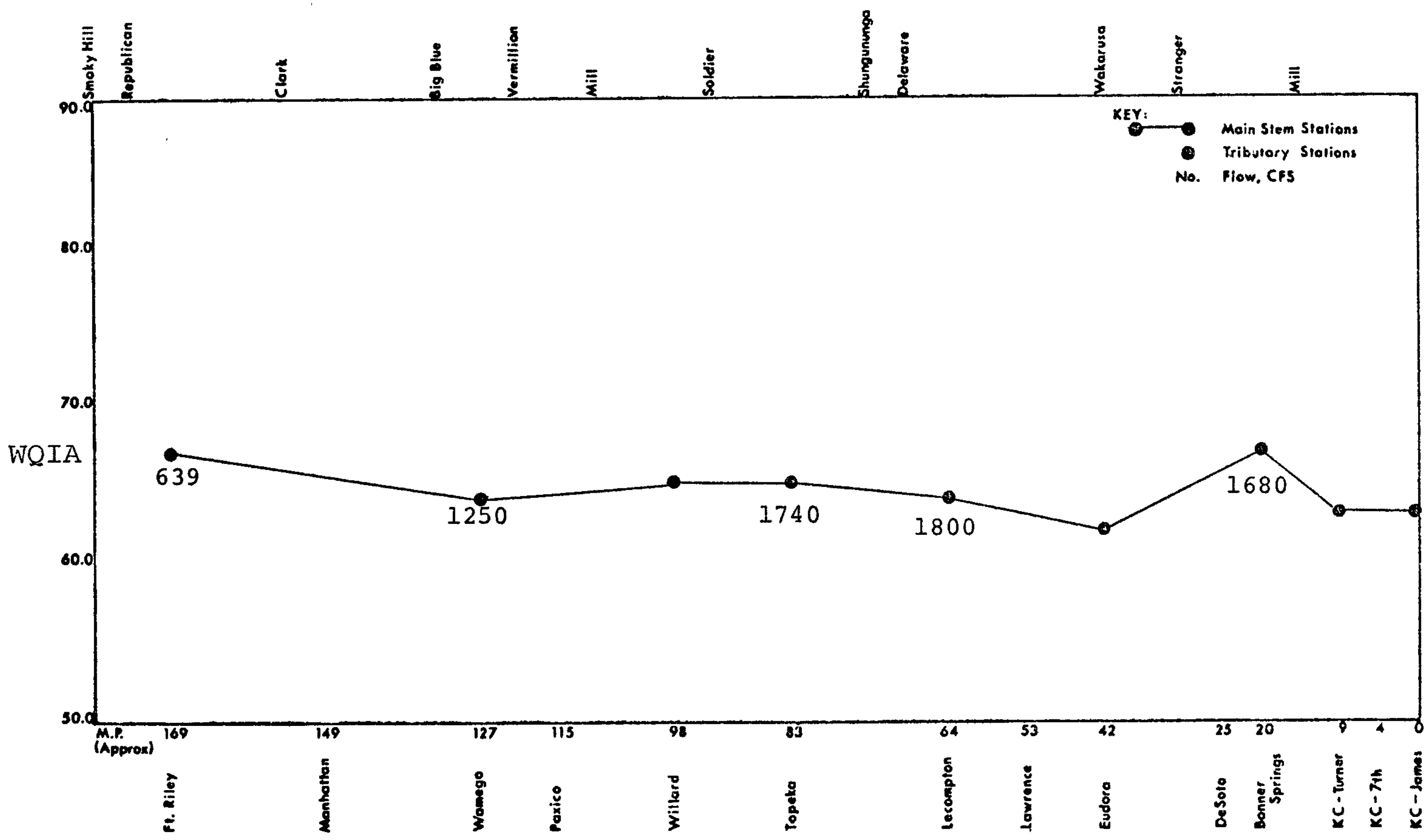


Figure G-7

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-12-72

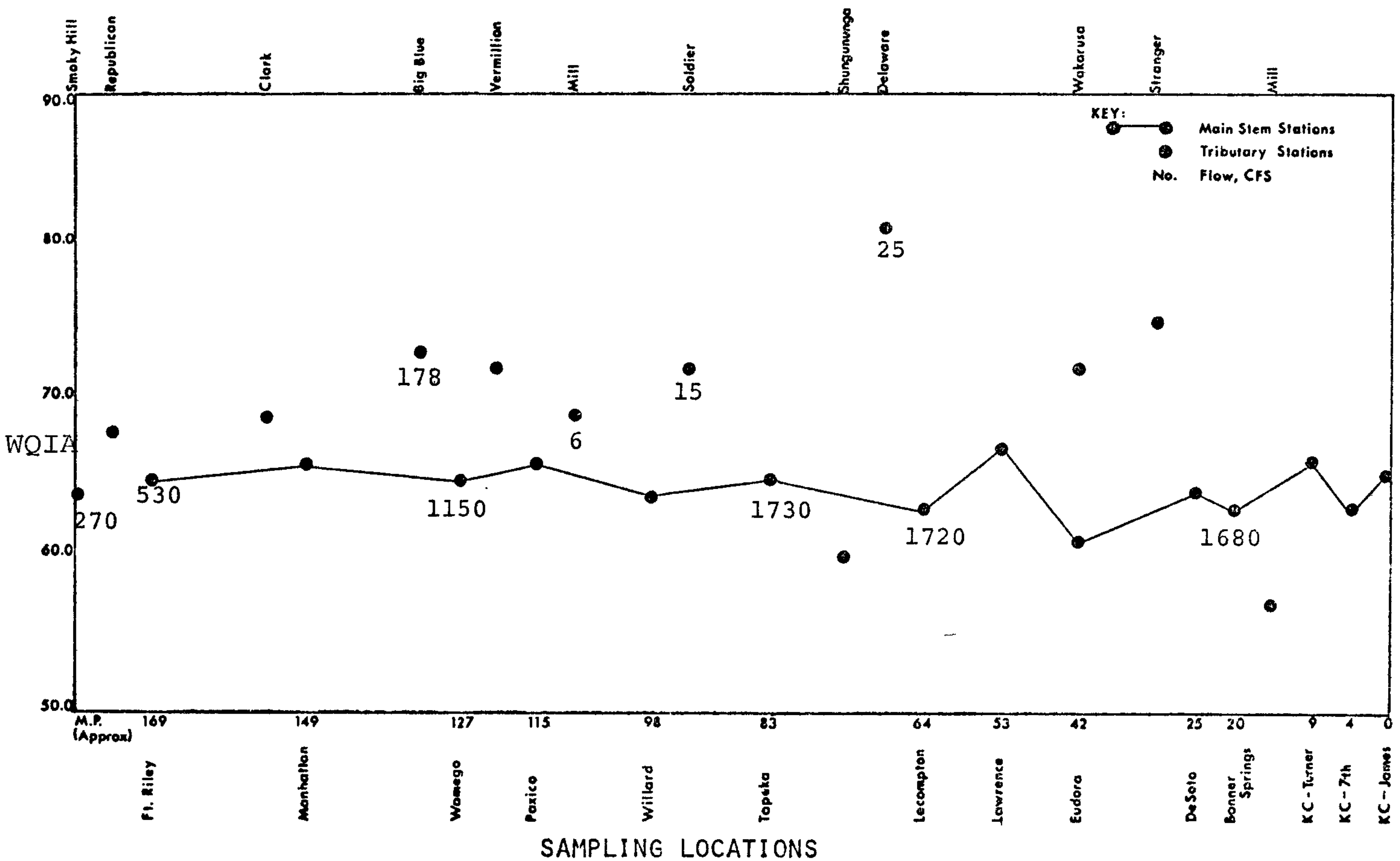


Figure G-8

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-14-72

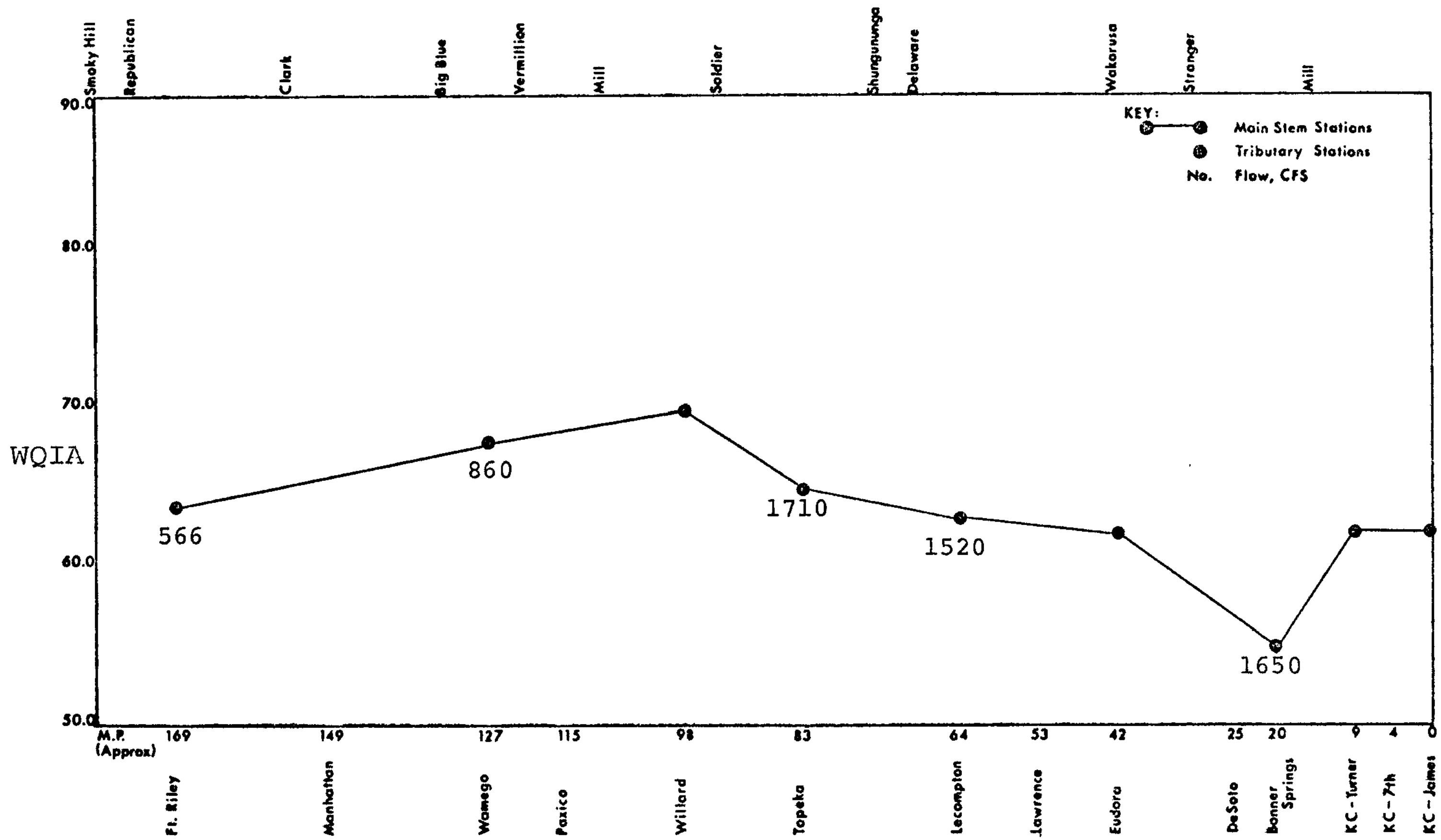


Figure G-9

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-16-72

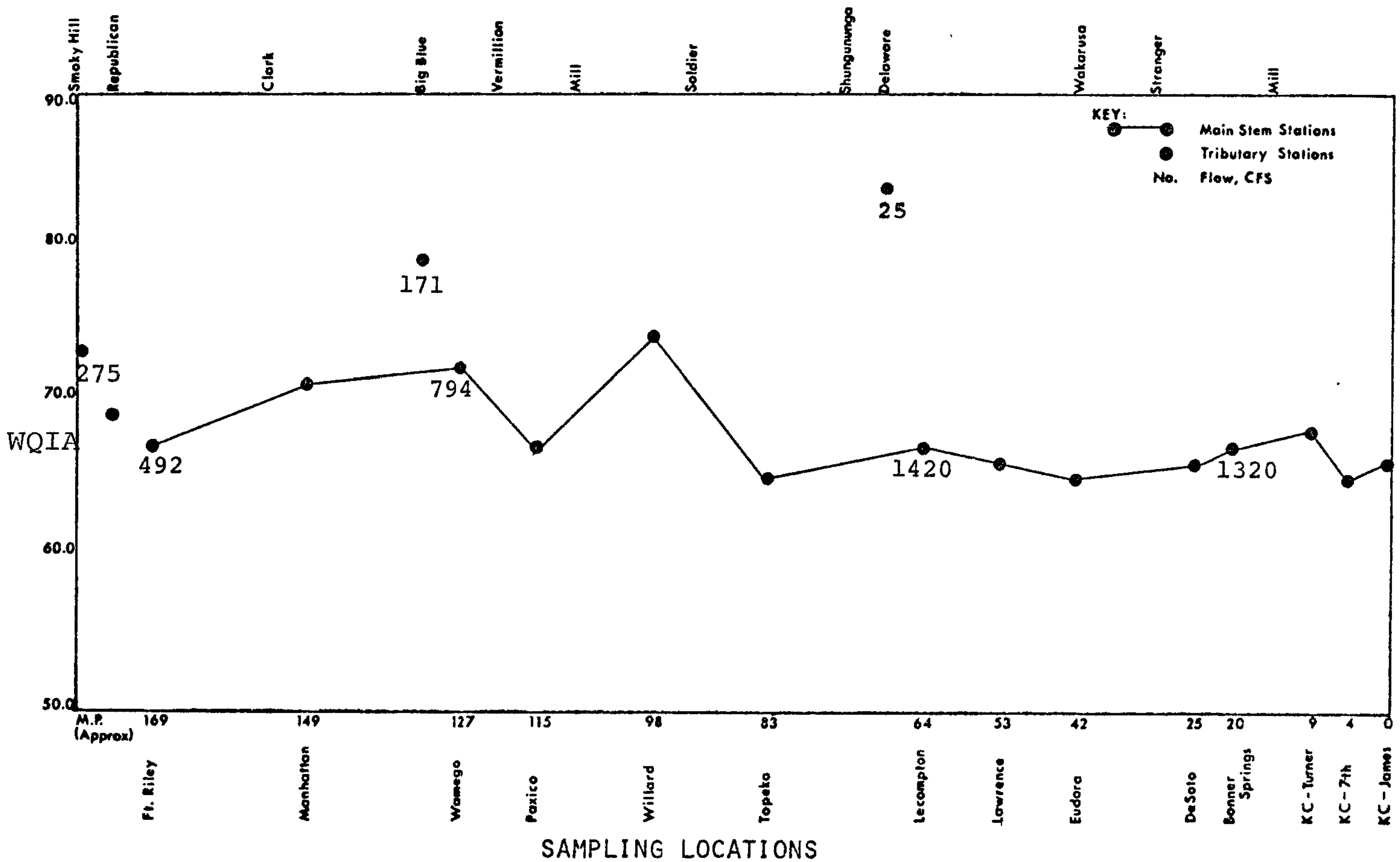


Figure G-10

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-18-72

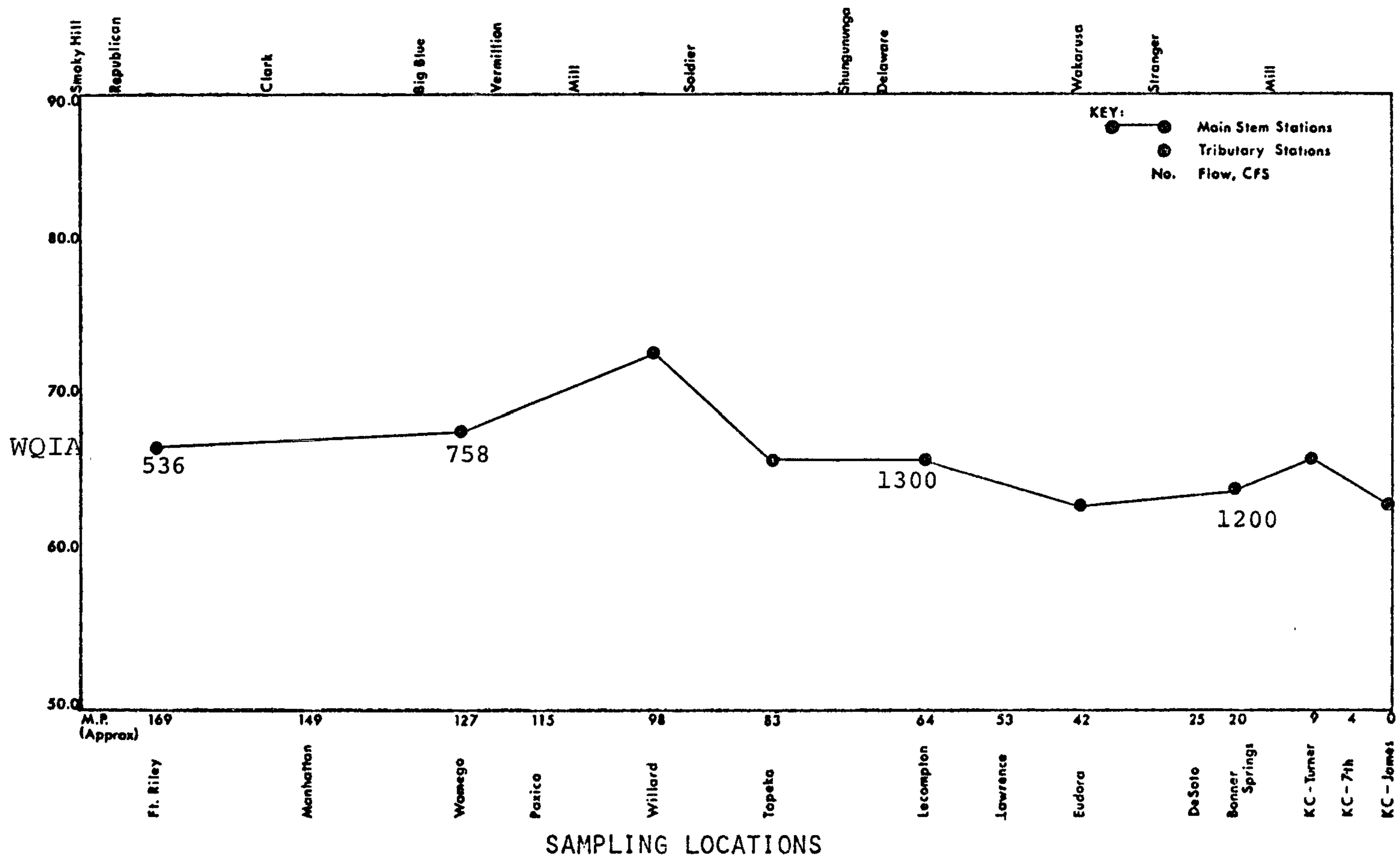
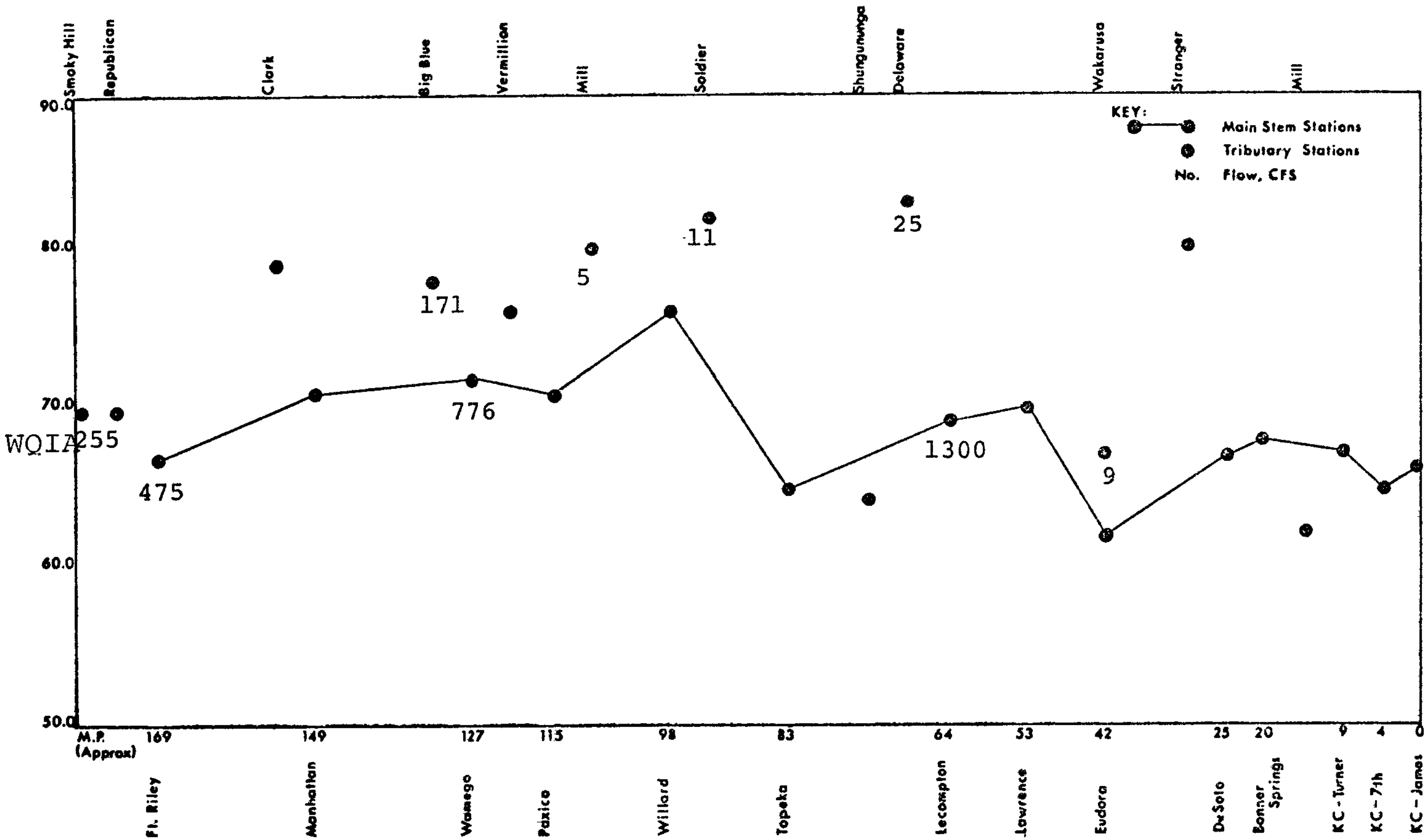


Figure G-11

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-20-72



SAMPLING LOCATIONS

Figure G-12

KANSAS RIVER STUDY   WATER QUALITY INDEX PROFILE   10-22-72

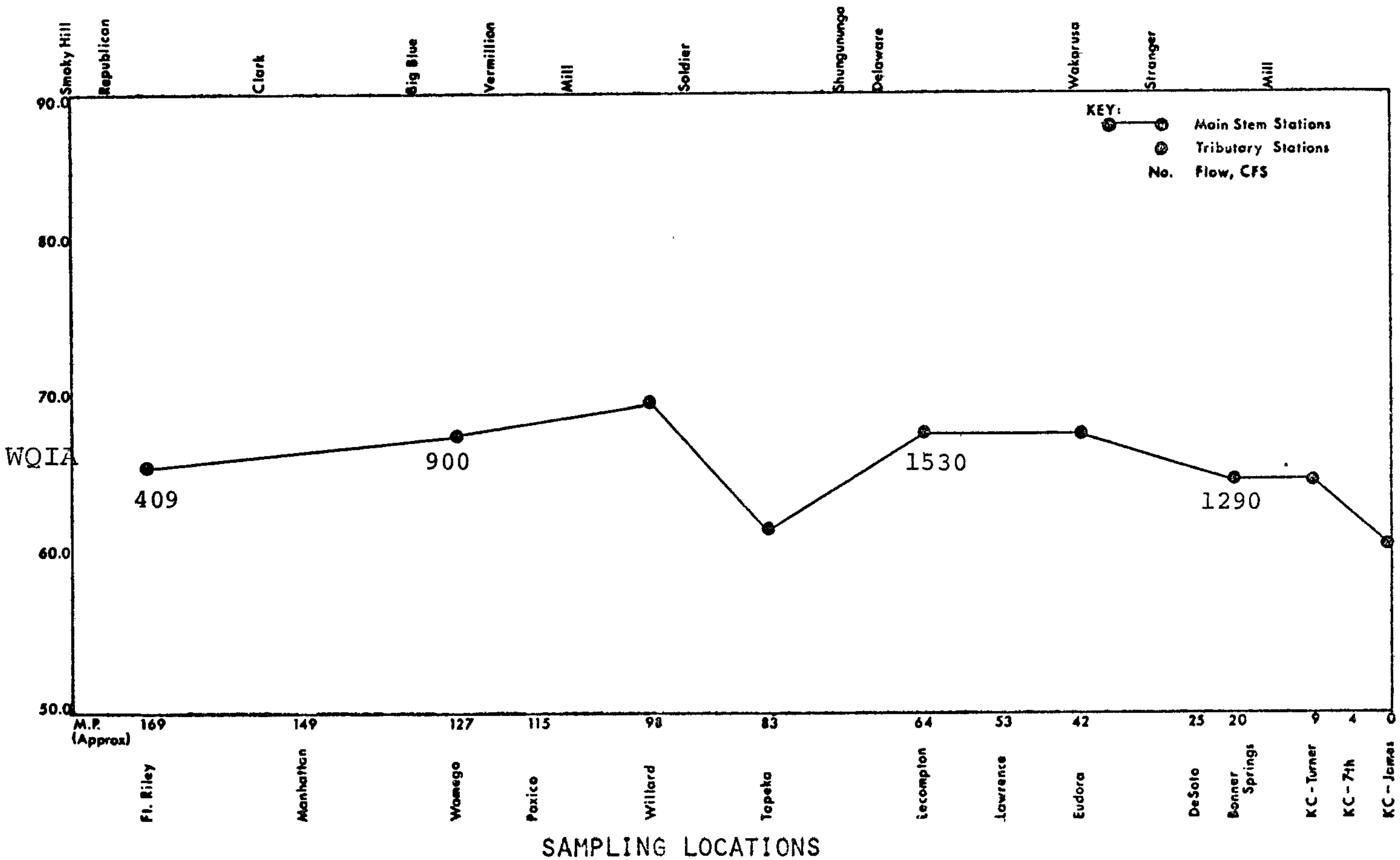


Figure G-13

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-24-72

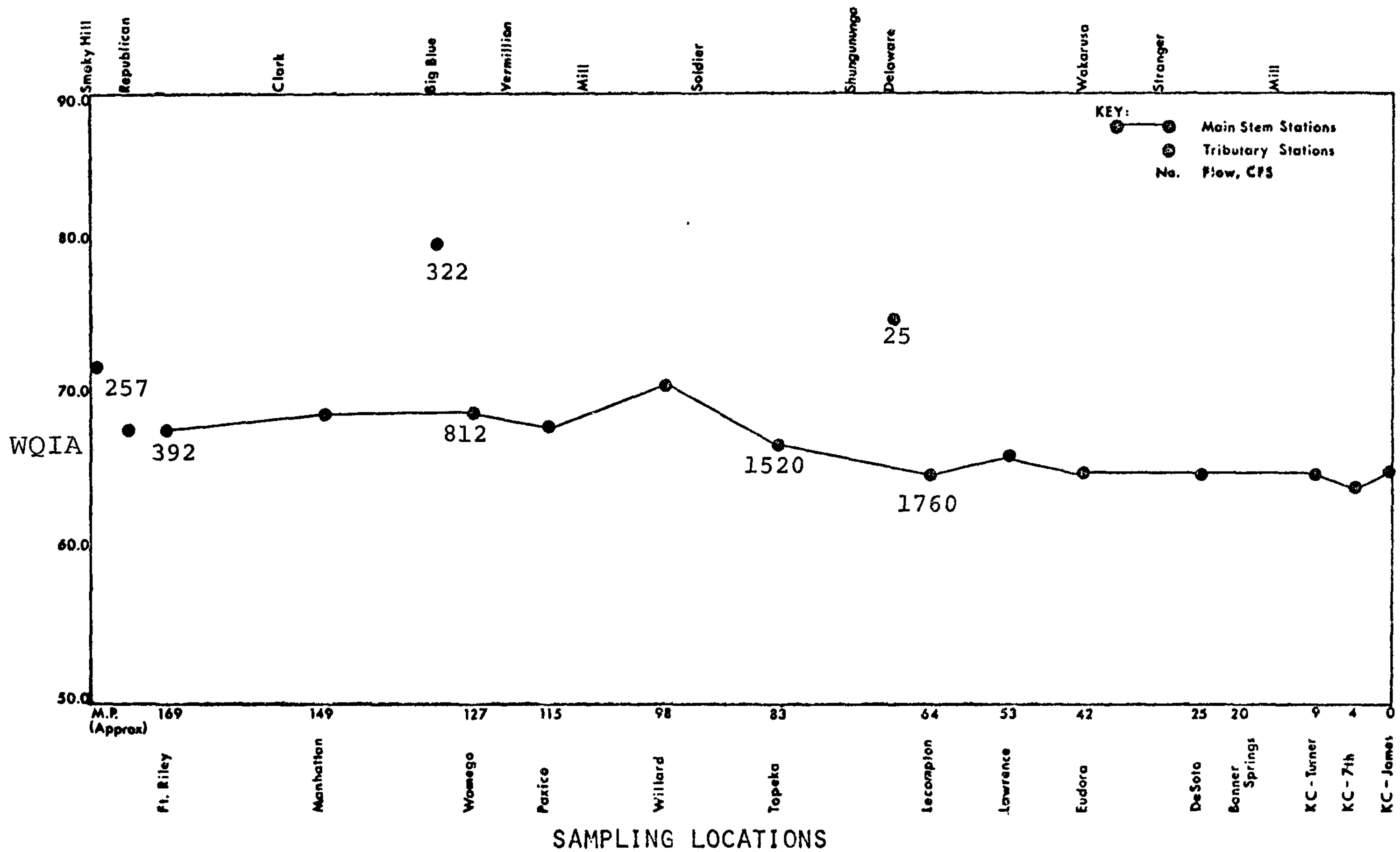


Figure G-14

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-26-72

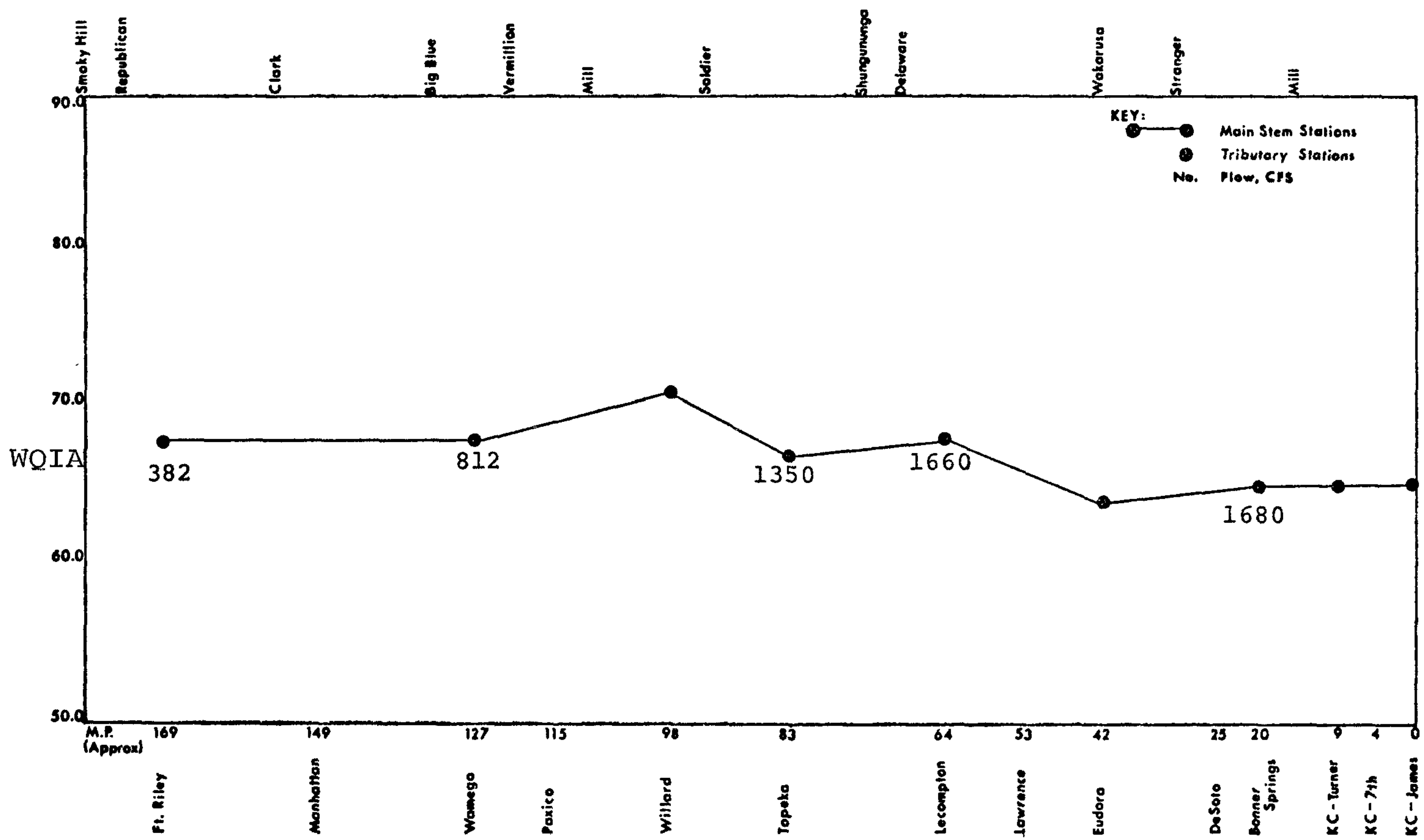


Figure G-15

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-28-72

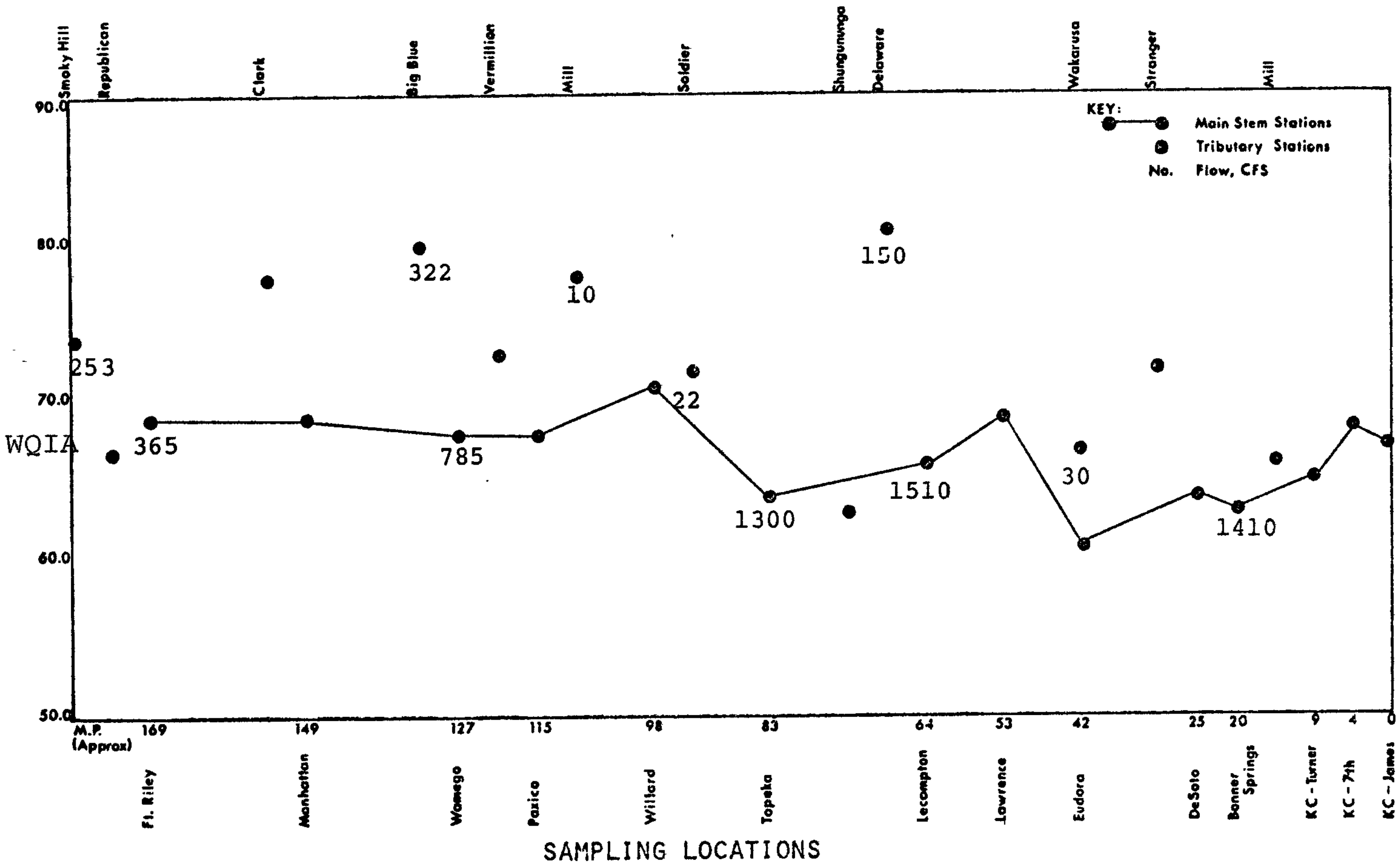


Figure G-16

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 10-30-72

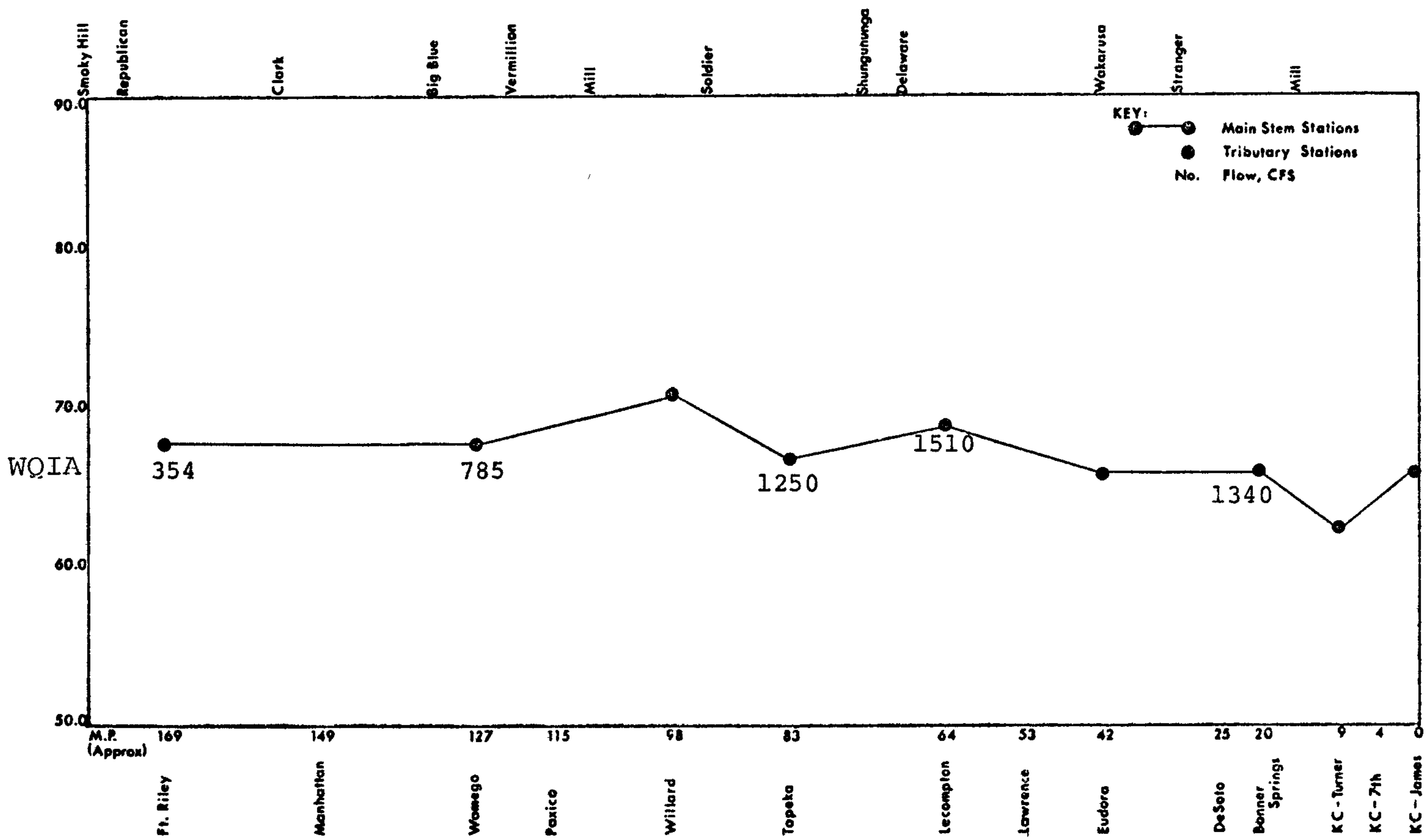
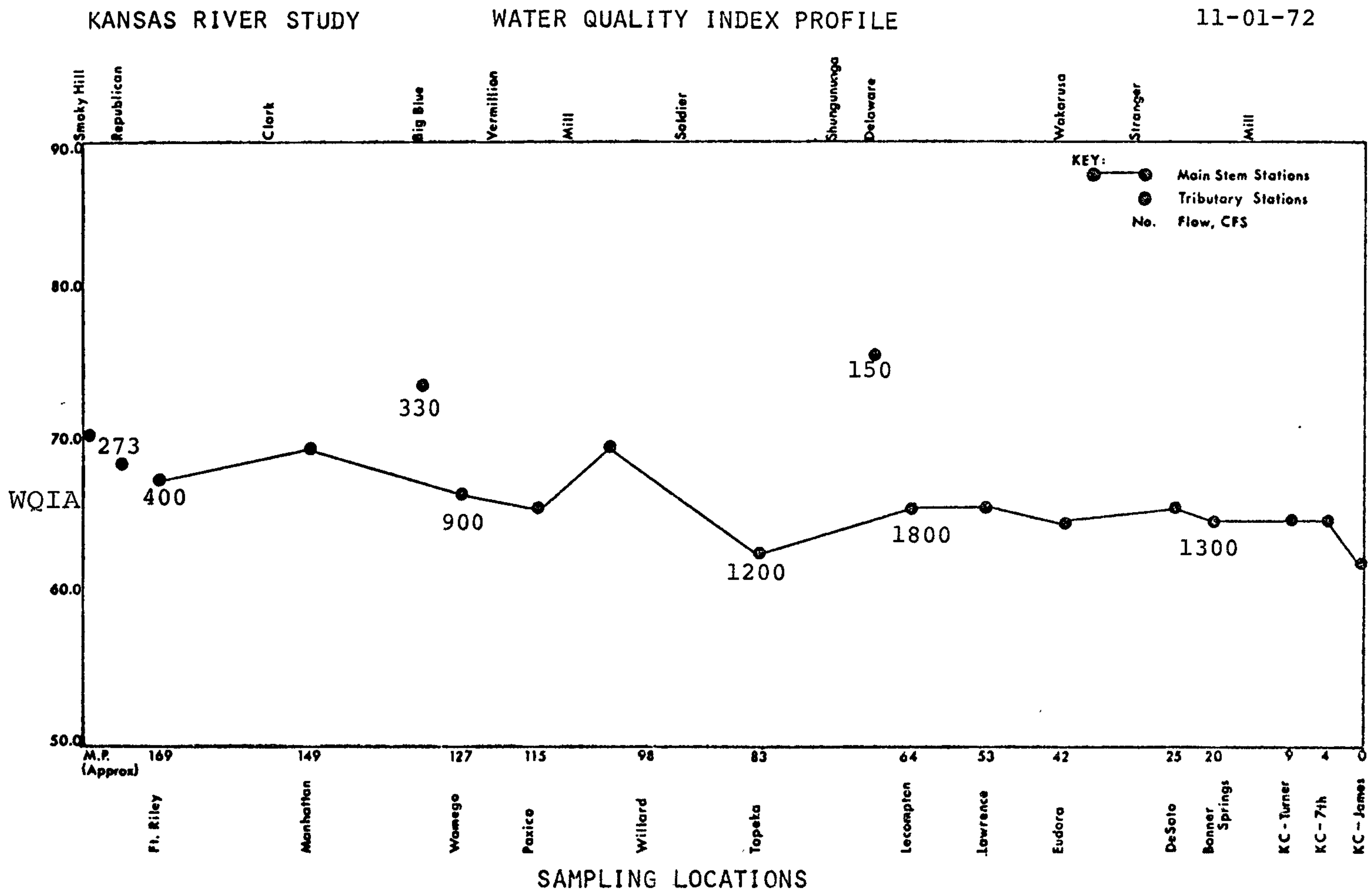


Figure G-17


KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
11-01-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
273
400
330
900
150
1200
1800
1300
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC-Turner
KC-7th
KC-James
SAMPLING LOCATIONS
Figure G-18

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-03-72

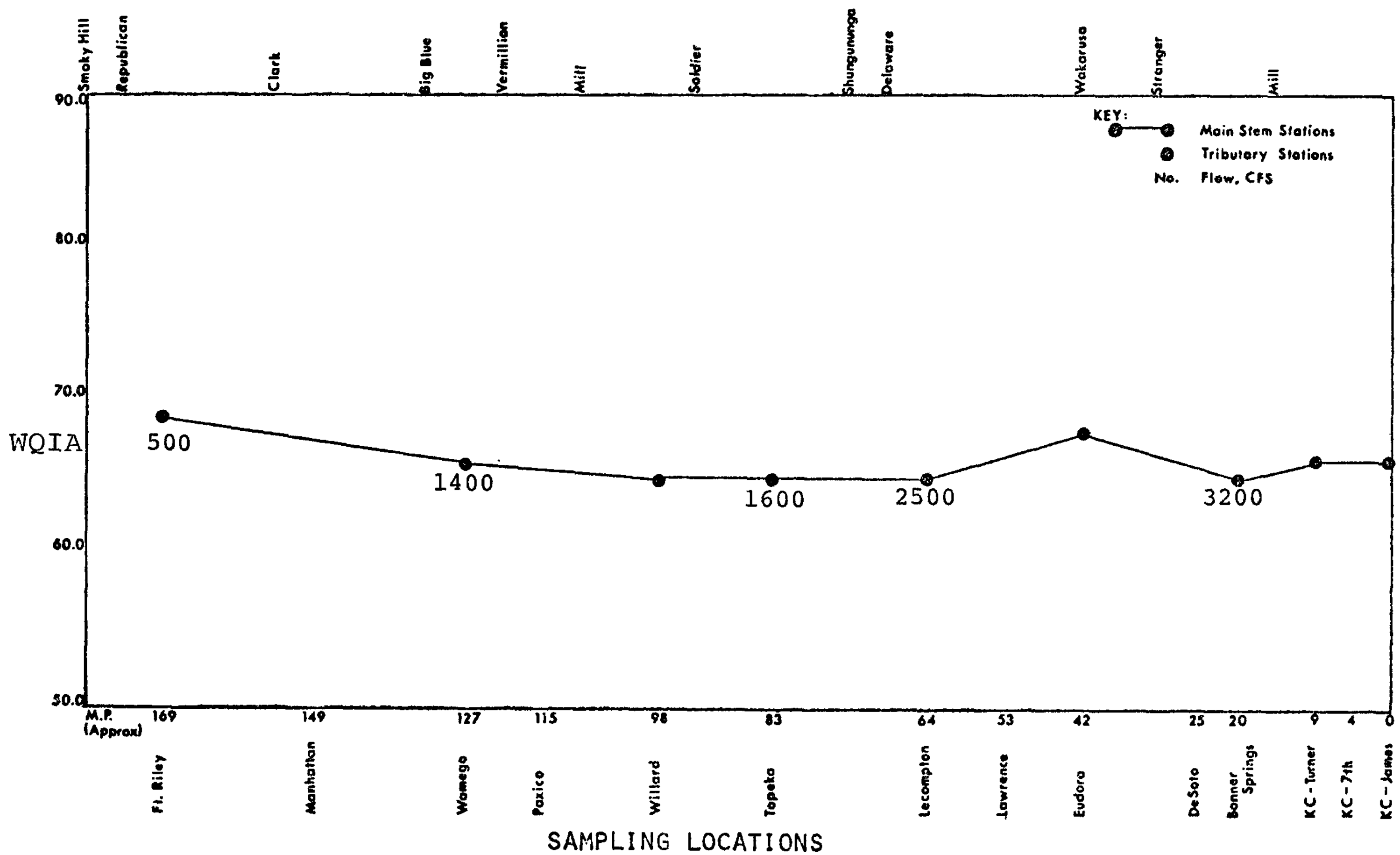


Figure G-19

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-05-72

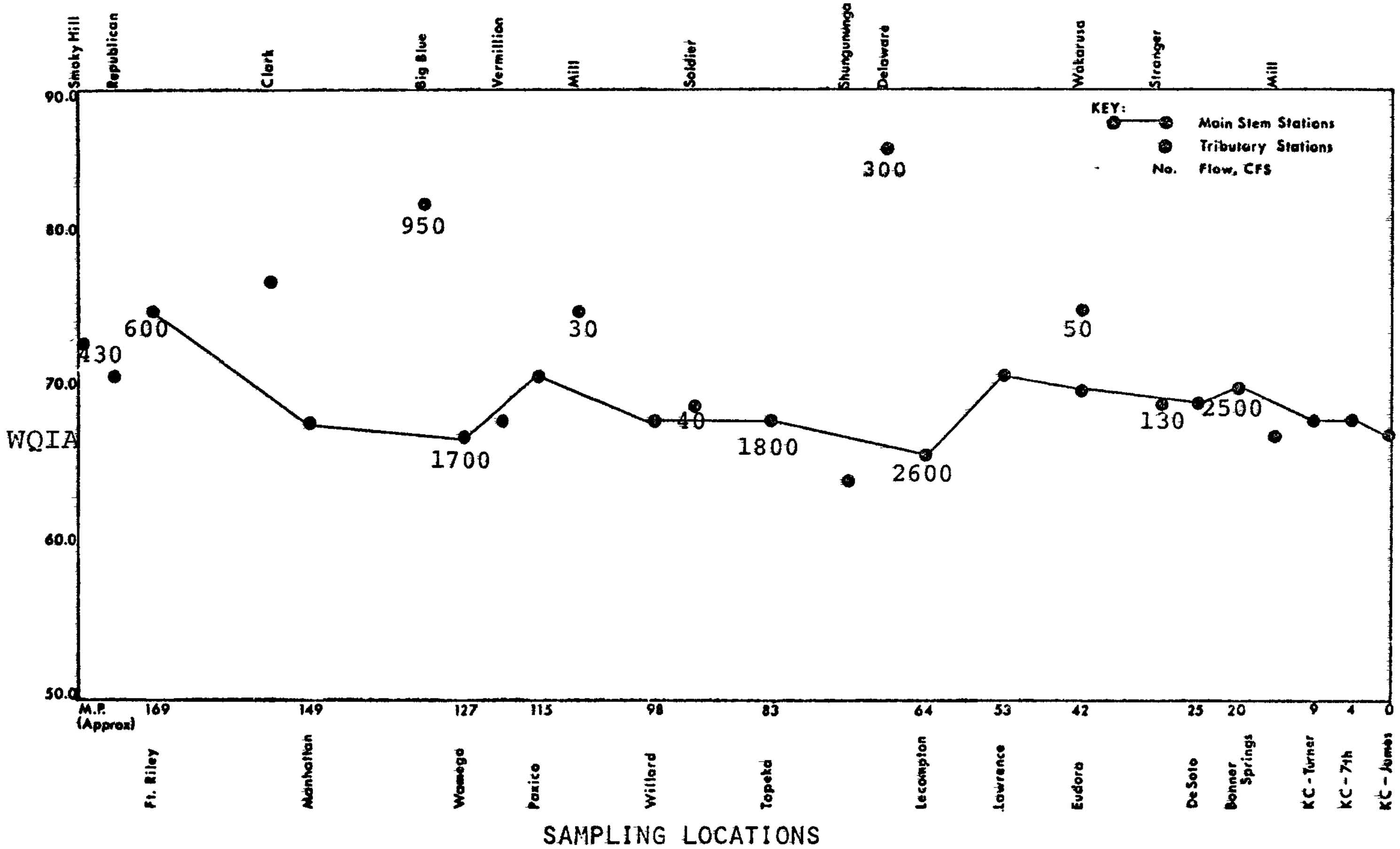


Figure G-20

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

August 12, 1974

To: Recipients of EPA Report 907/9-74-001, "Water Quality Index Application In The Kansas River Basin"

An omission has been found in the report "Water Quality Index Application In The Kansas River Basin", EPA-907/9-74-001, February 1974, which we recently sent to you. Please insert the following EPA Review Notice on the inside of the front cover of the subject report:

EPA Review Notice

This report has been reviewed by the Environmental Protection Agency and approved for publication. Approval does not signify that the contents necessarily reflect the views and policies of the Environmental Protection Agency, nor does mention of trade names or commercial products constitute endorsement or recommendation for use.

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-07-72

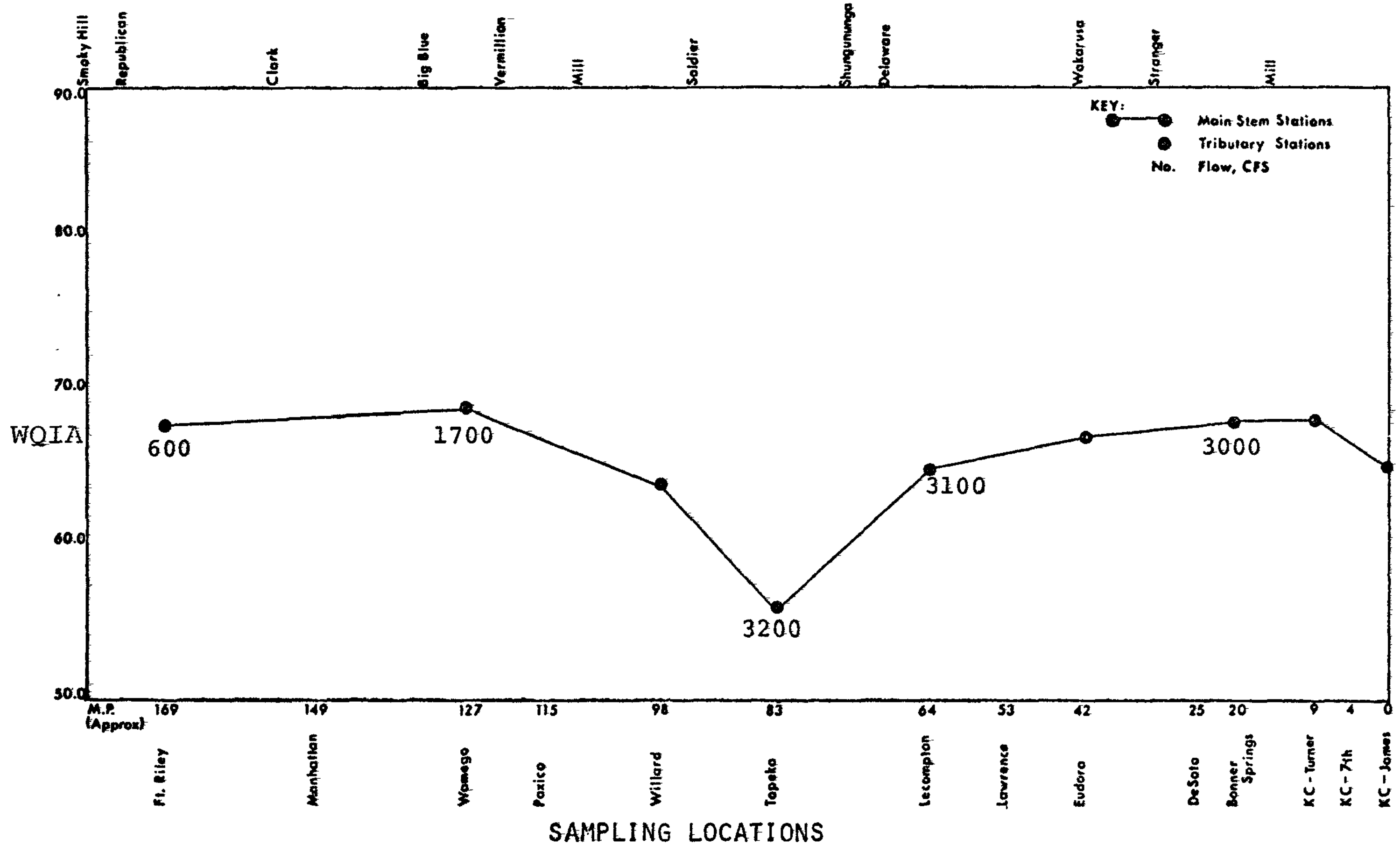


Figure G-21

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-09-72

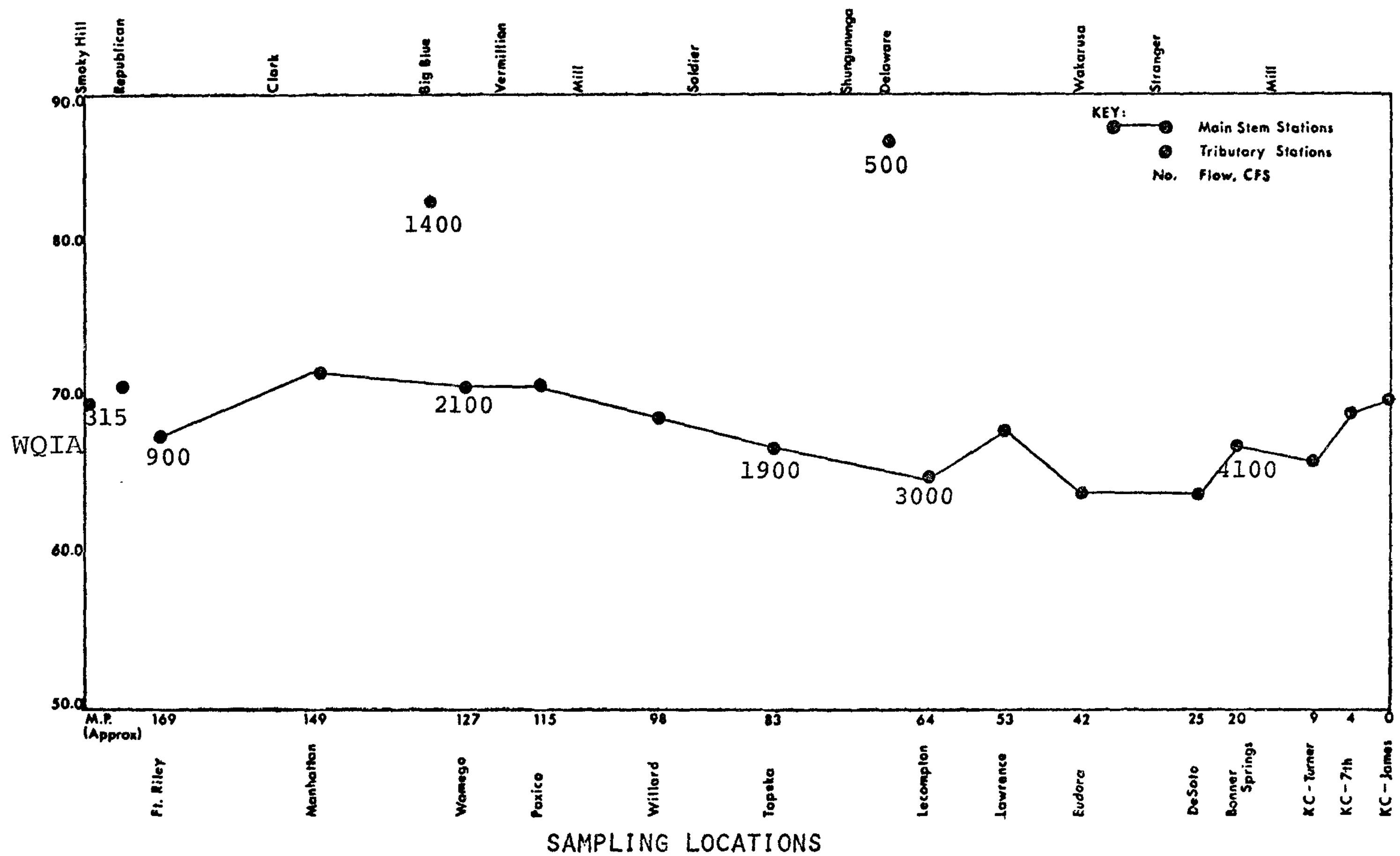


Figure G-22

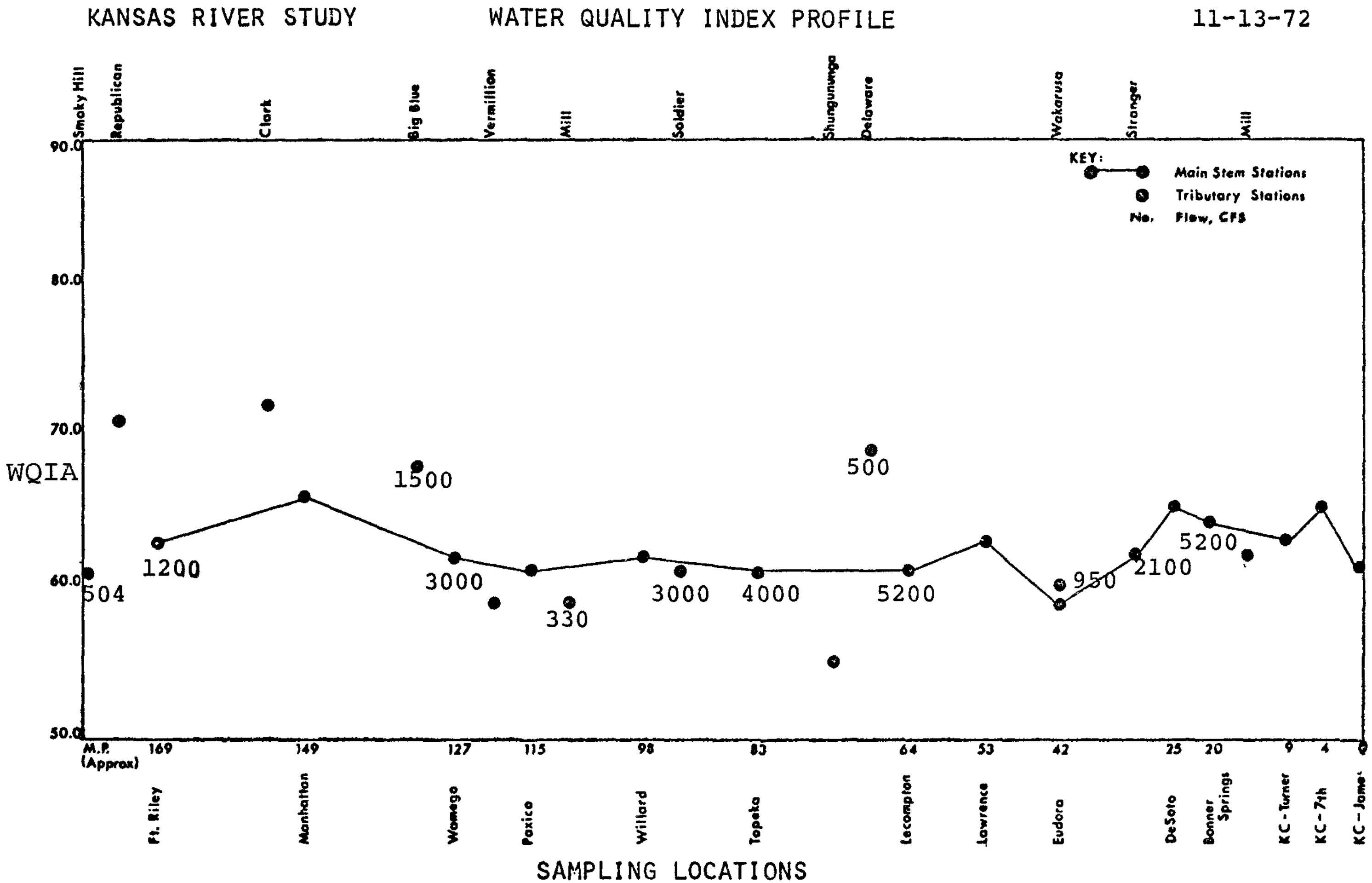

KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
11-13-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
504
1200
1500
3000
330
3000
4000
500
5200
950
2100
5200
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC - Turner
KC - 7th
KC - James
SAMPLING LOCATIONS

Figure G-23

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-13-72

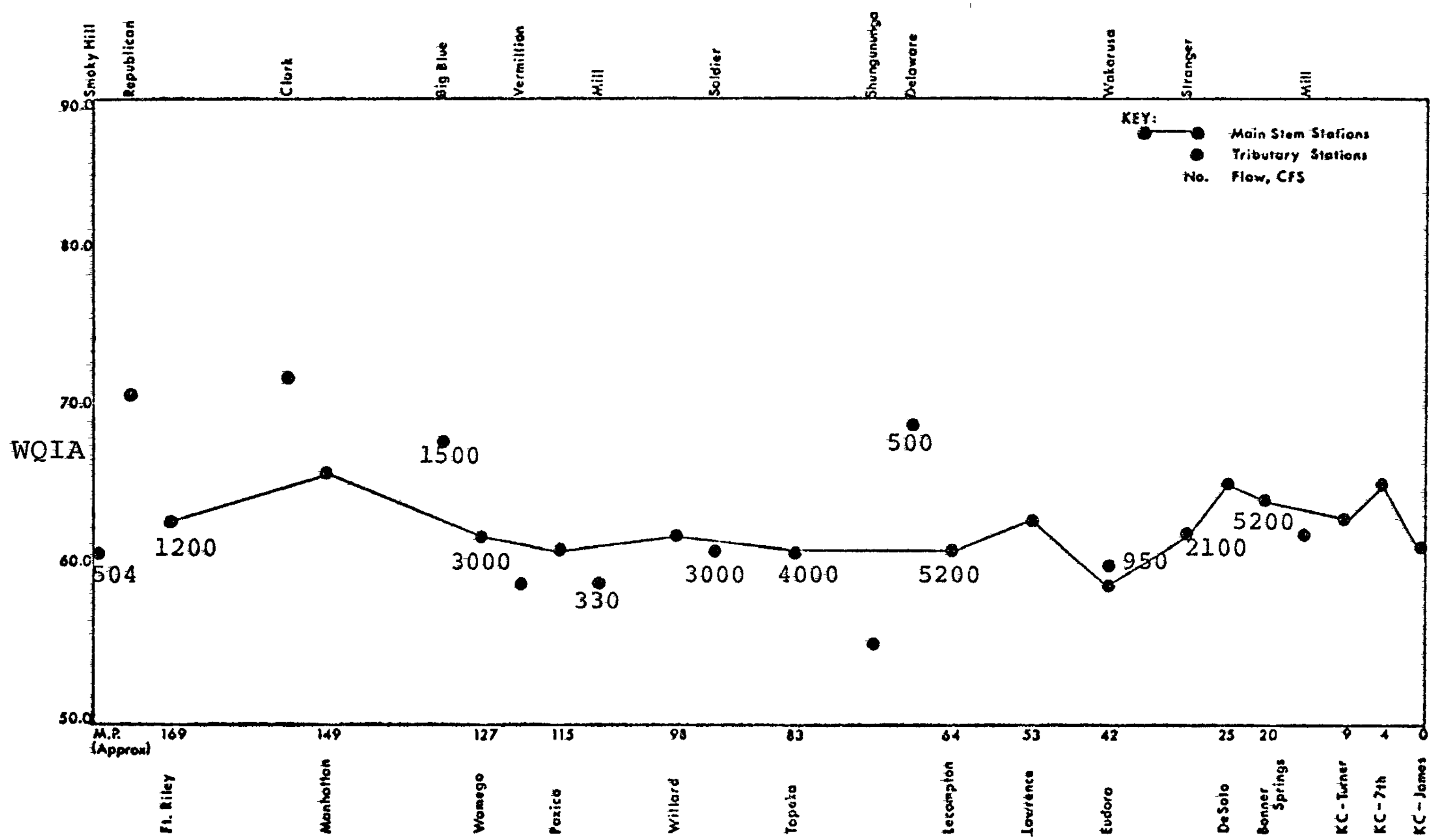


Figure G-24

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-15-72

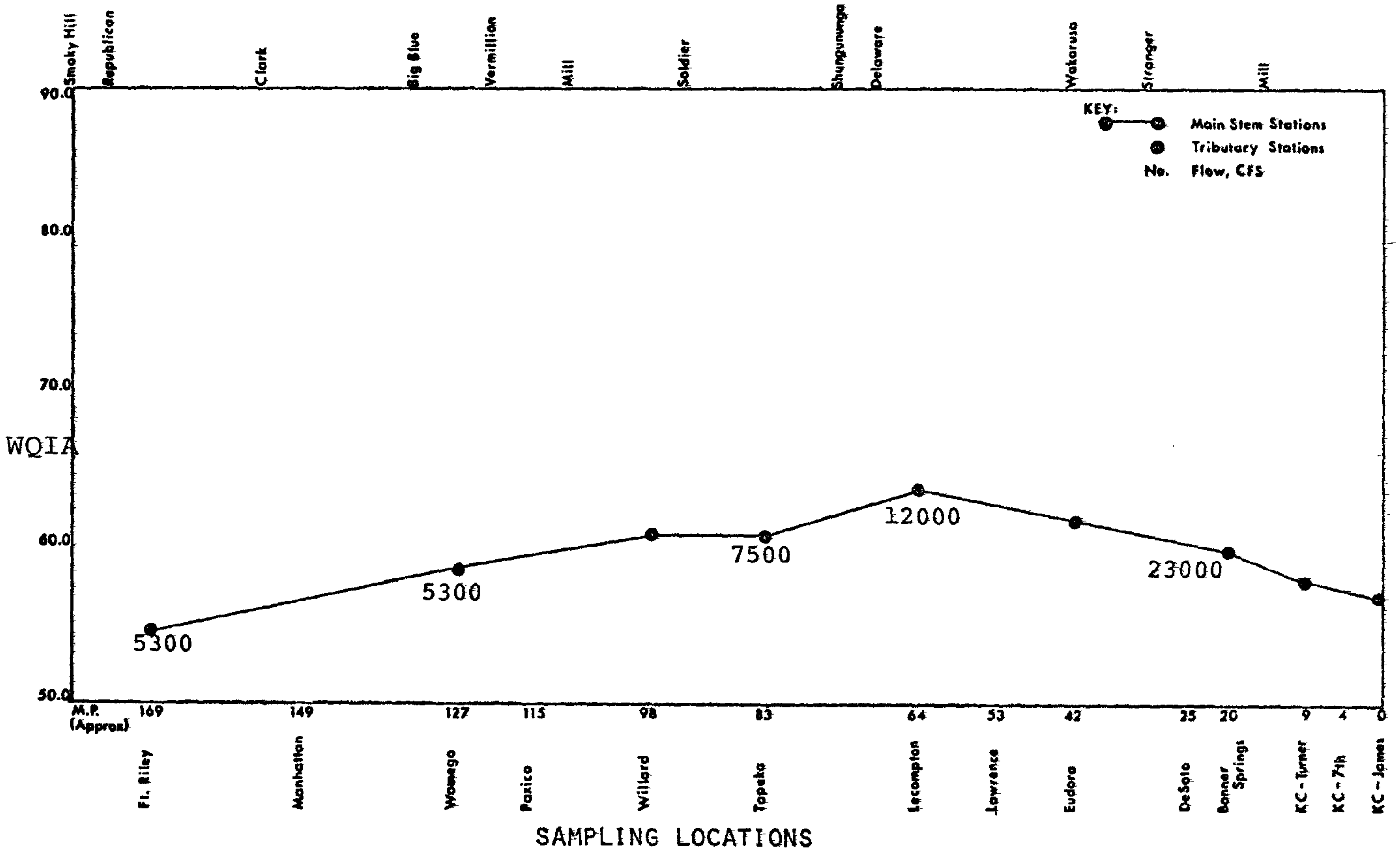


Figure G-25

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-17-72

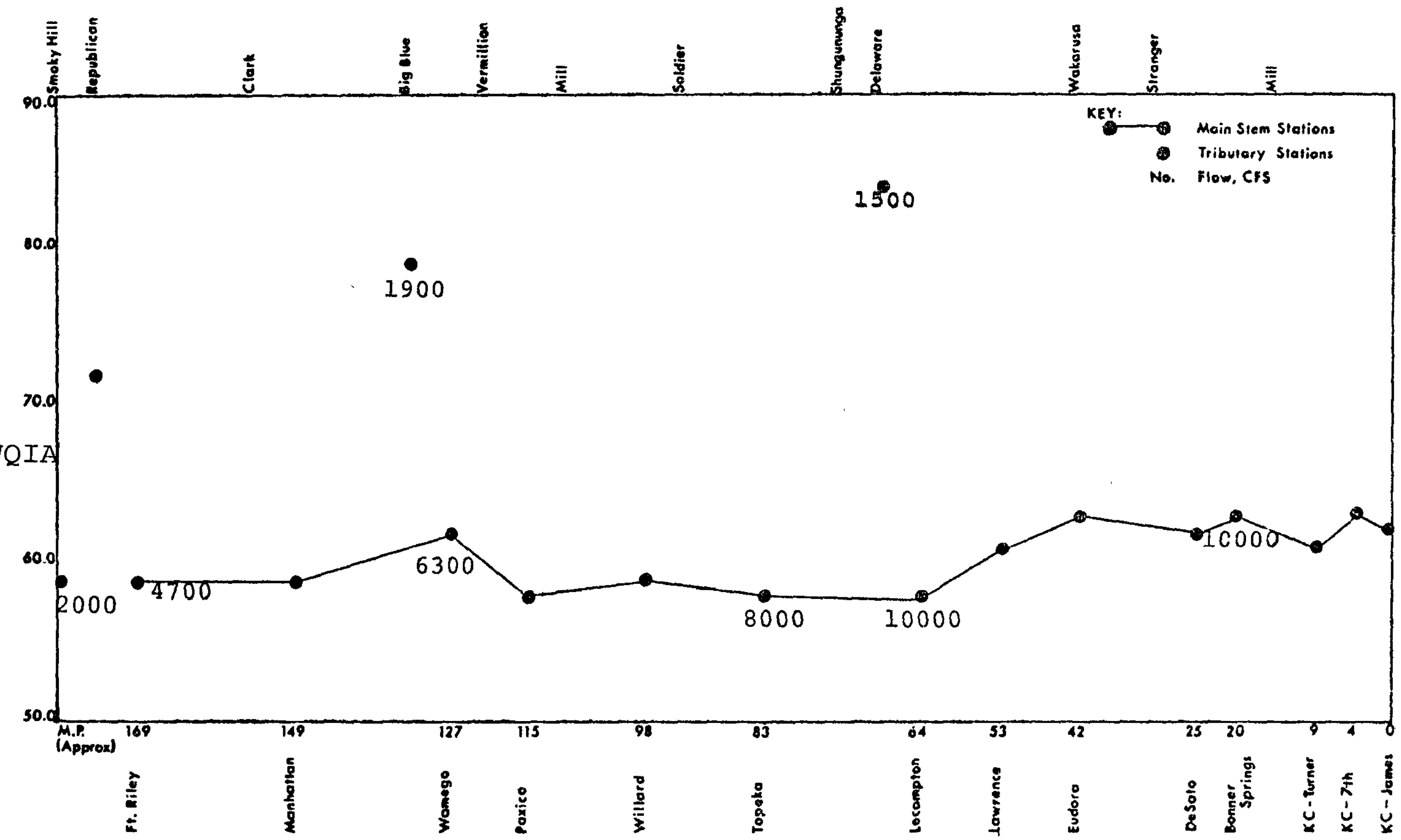
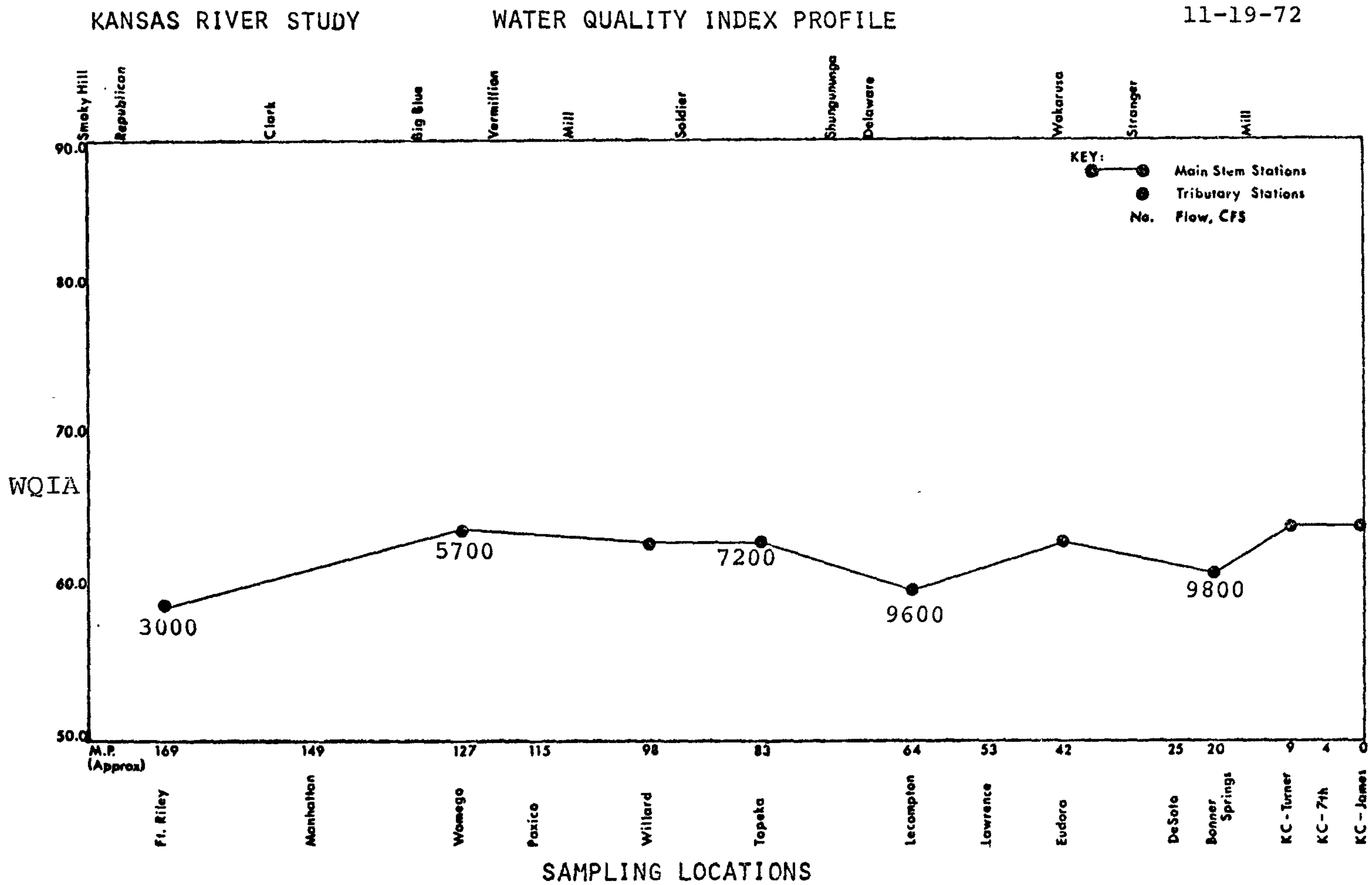


Figure G-26


KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
11-19-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
3000
5700
7200
9600
9800
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC-Turner
KC-7th
KC-James
SAMPLING LOCATIONS
Figure G-27

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-21-72

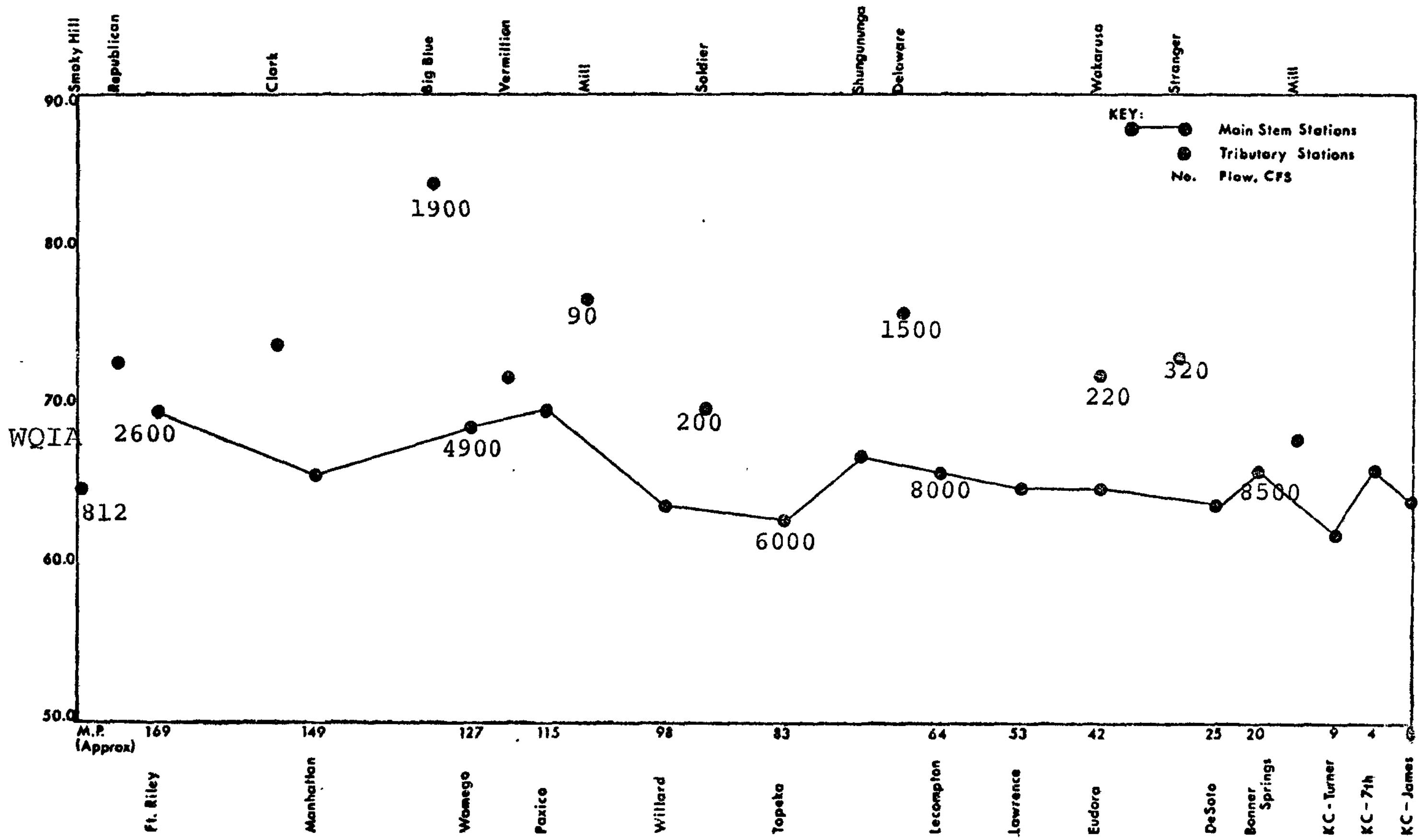


Figure G-28

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-23-72

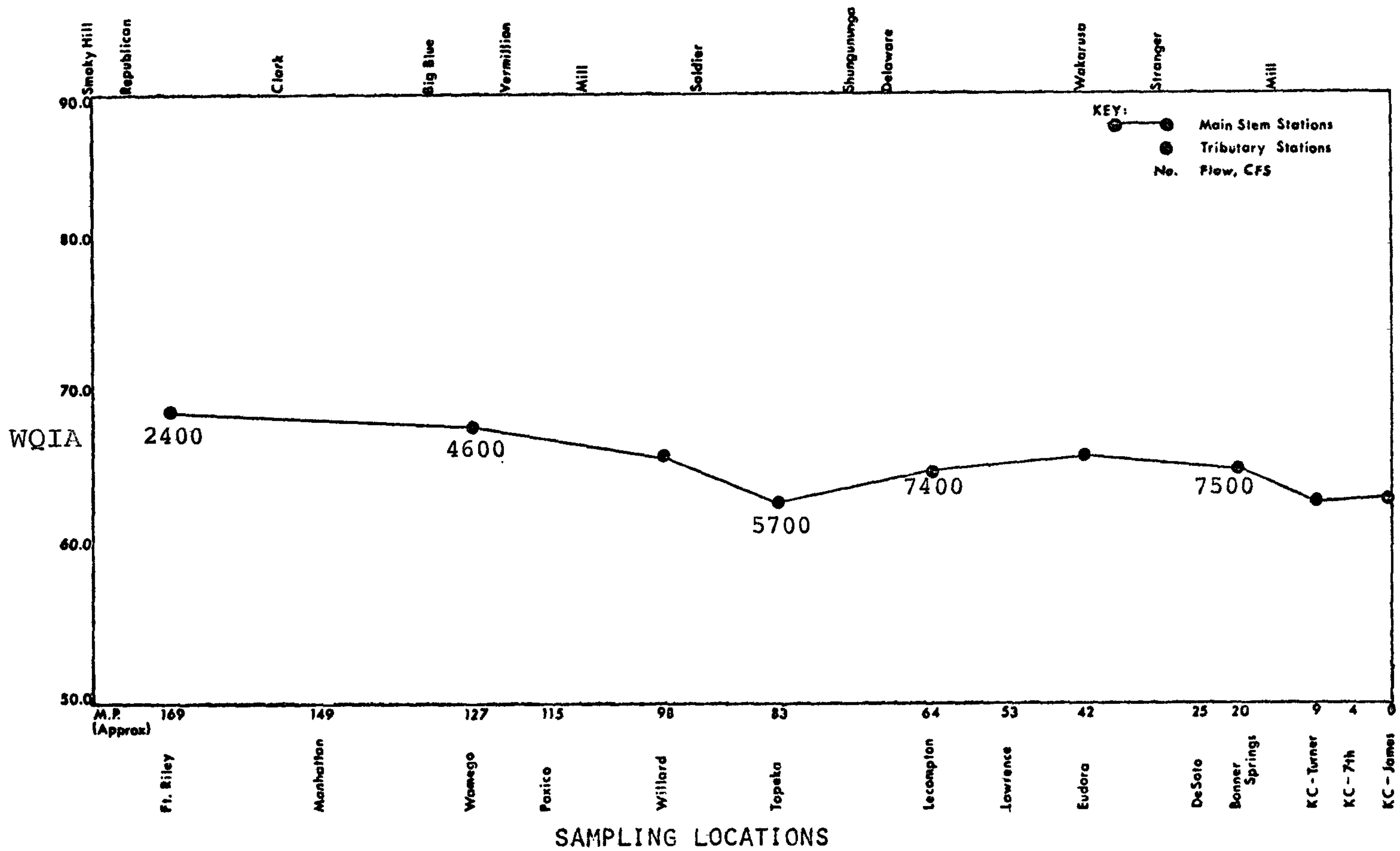
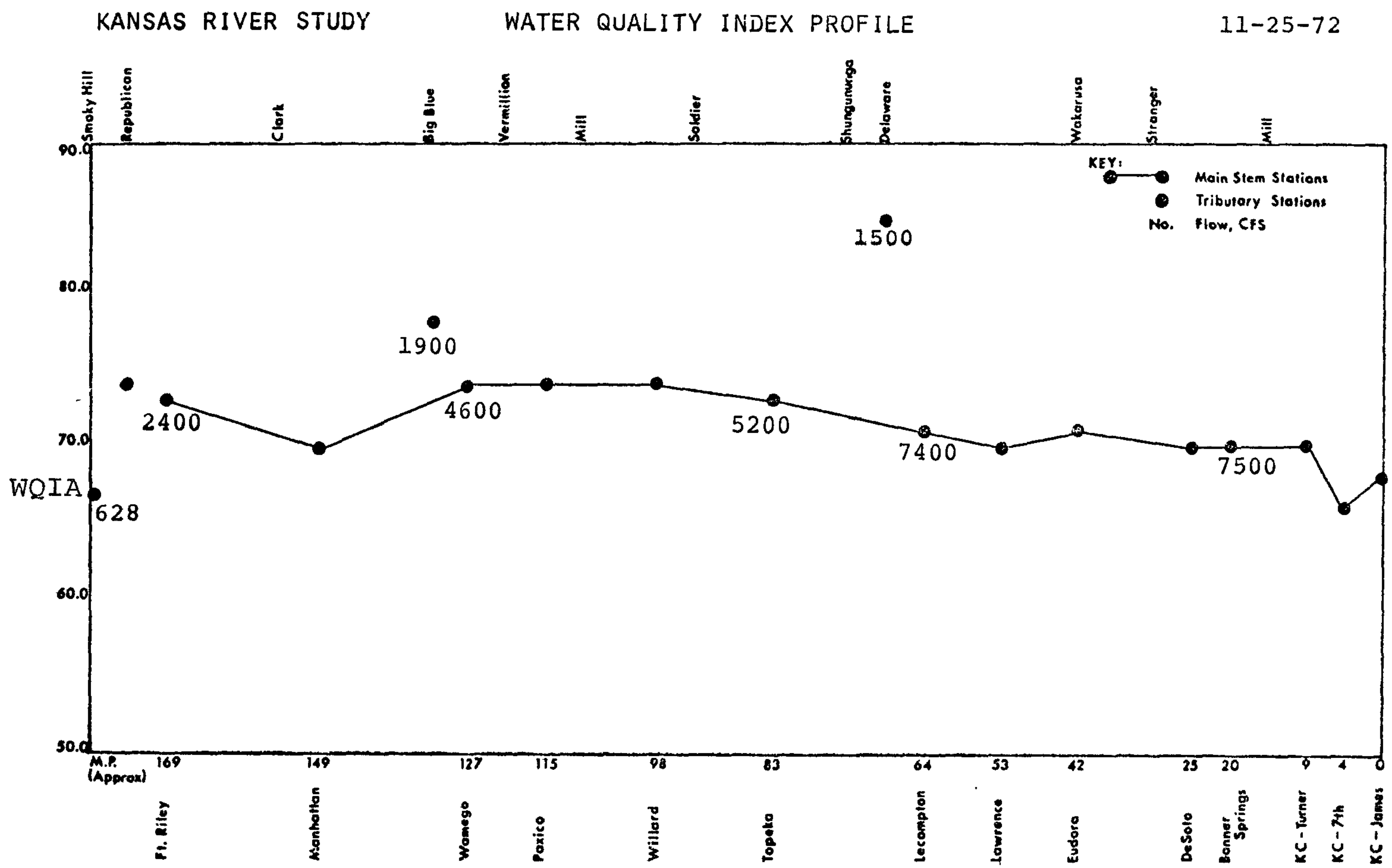


Figure G-29


KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
11-25-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
628
2400
1900
4600
5200
1500
7400
7500
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC-Turner
KC-7th
KC-James
SAMPLING LOCATIONS
Figure G-30

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 11-27-72

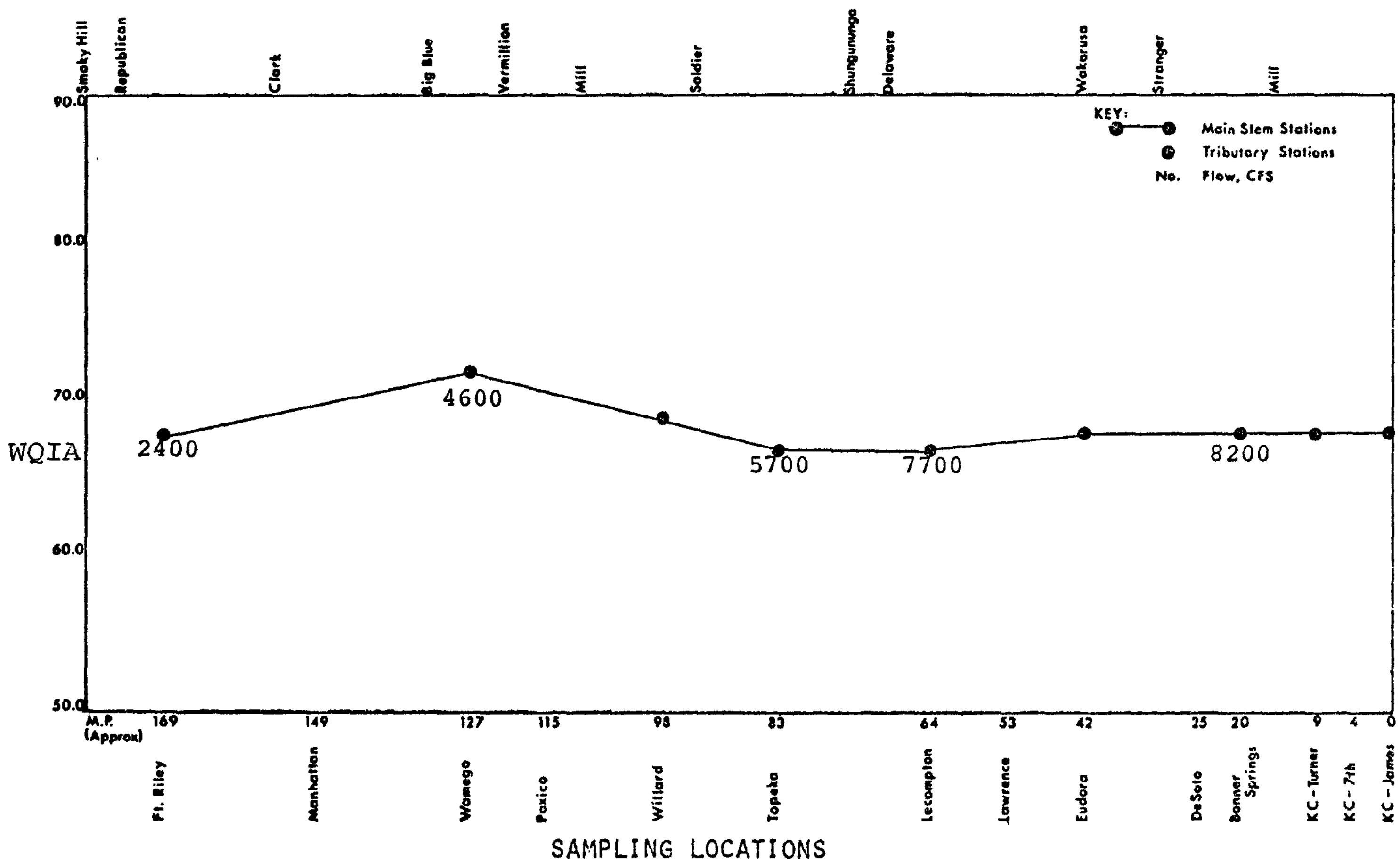


Figure G-31

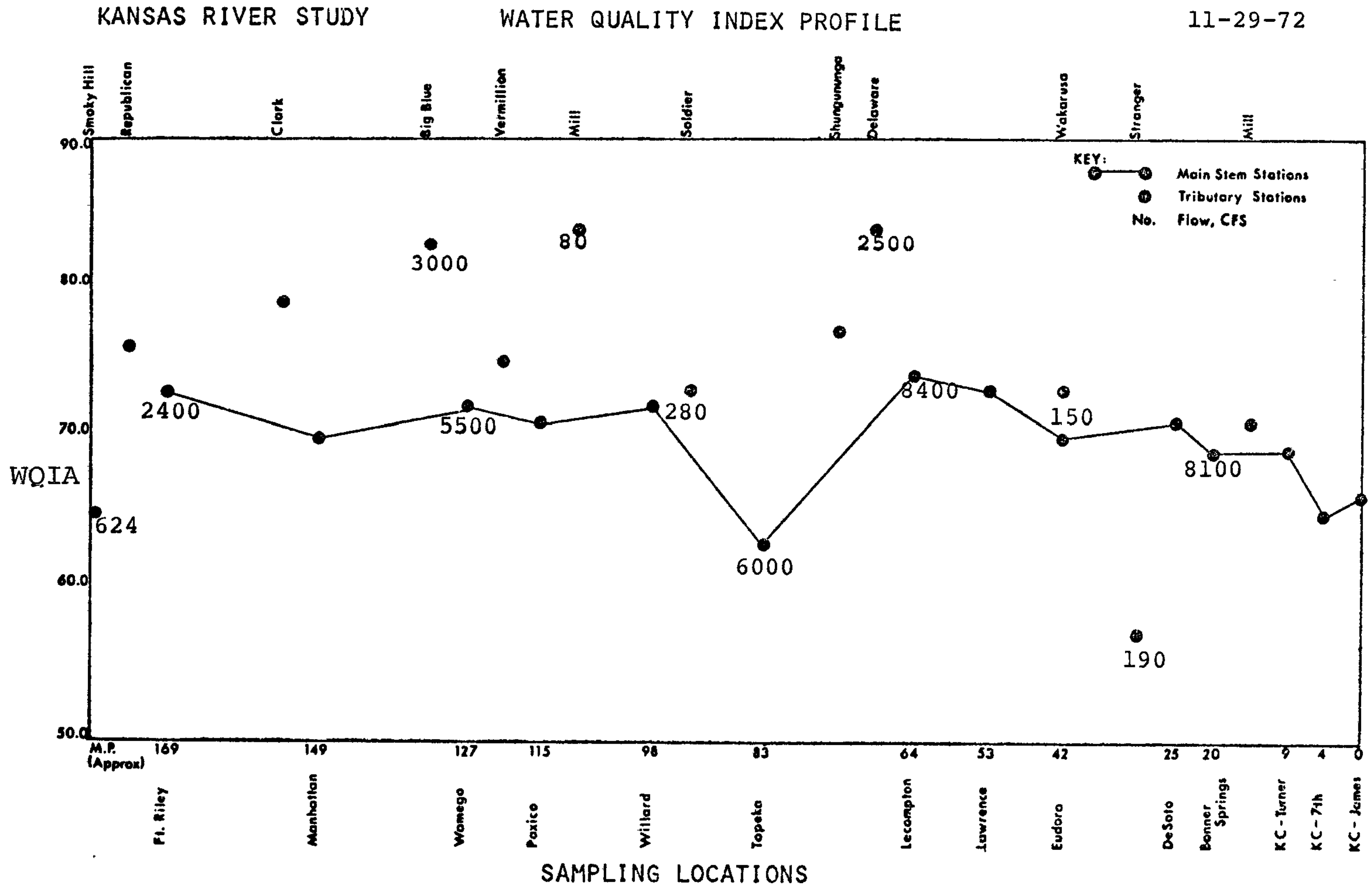

KANSAS RIVER STUDY
WATER QUALITY INDEX PROFILE
11-29-72
Smoky Hill
Republican
Clark
Big Blue
Vermillion
Mill
Soldier
Shunganunga
Delaware
Wakarusa
Stranger
Mill
KEY:
Main Stem Stations
Tributary Stations
No. Flow, CFS
90.0
80.0
70.0
60.0
50.0
WQIA
3000
80
2500
2400
5500
280
8400
150
8100
624
6000
190
M.P. (Approx)
169
149
127
115
98
83
64
53
42
25
20
9
4
0
Ft. Riley
Manhattan
Wamego
Paxico
Willard
Topeka
Lecompton
Lawrence
Eudora
DeSoto
Bonner Springs
KC-Turner
KC-7th
KC-James
SAMPLING LOCATIONS

Figure G-32

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 12-02-72

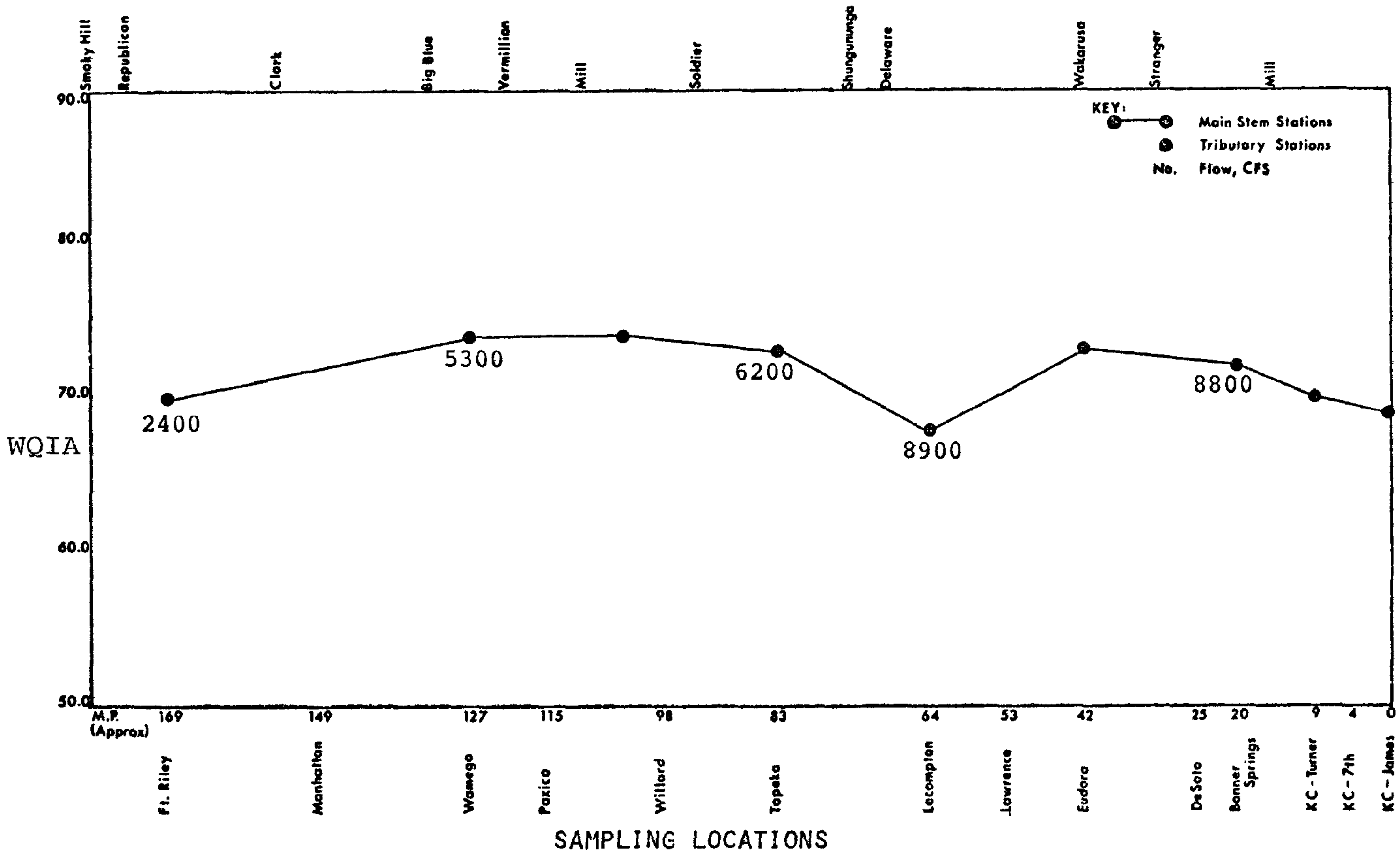


Figure G-33

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 12-03-72

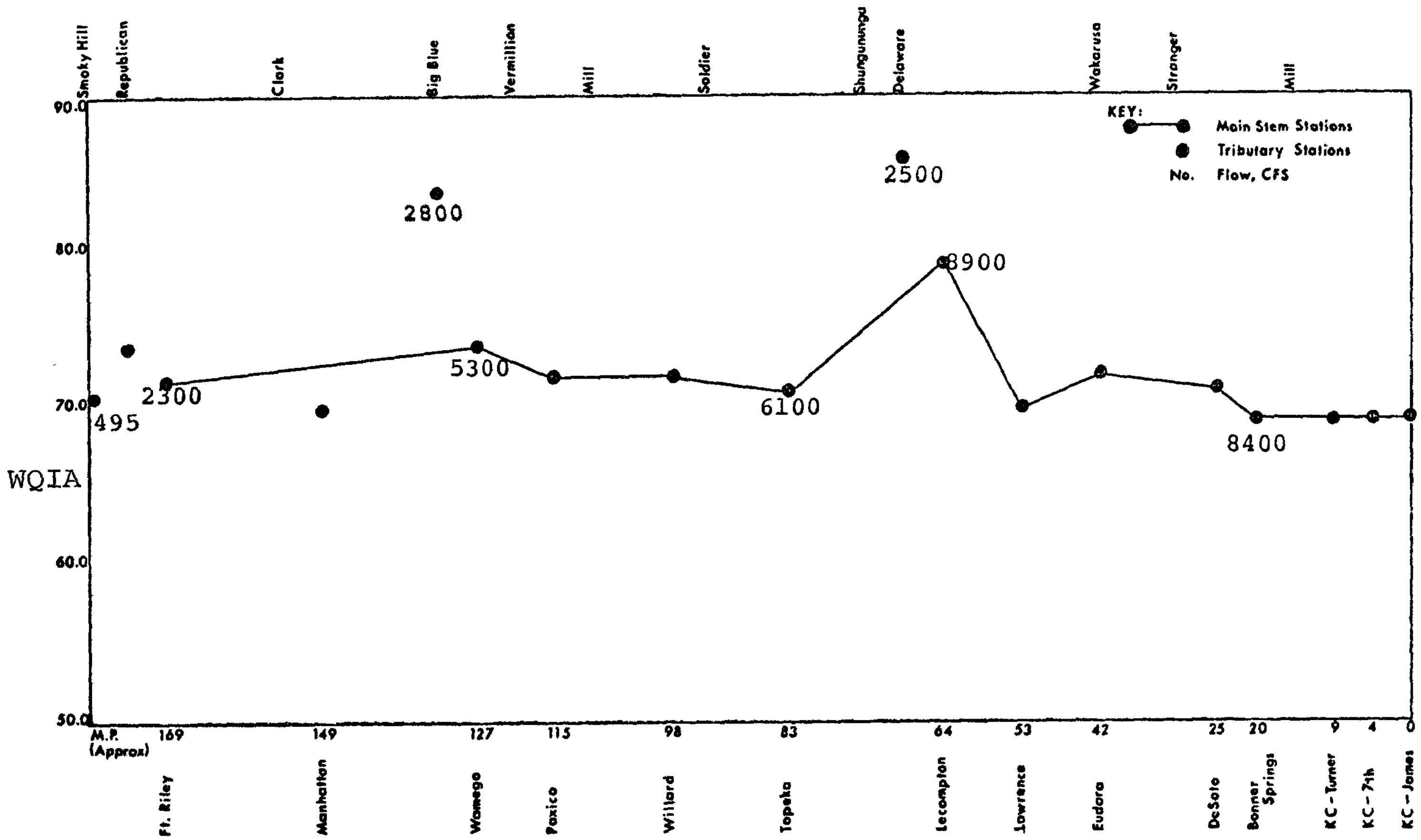


Figure G-34

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 12-05-72

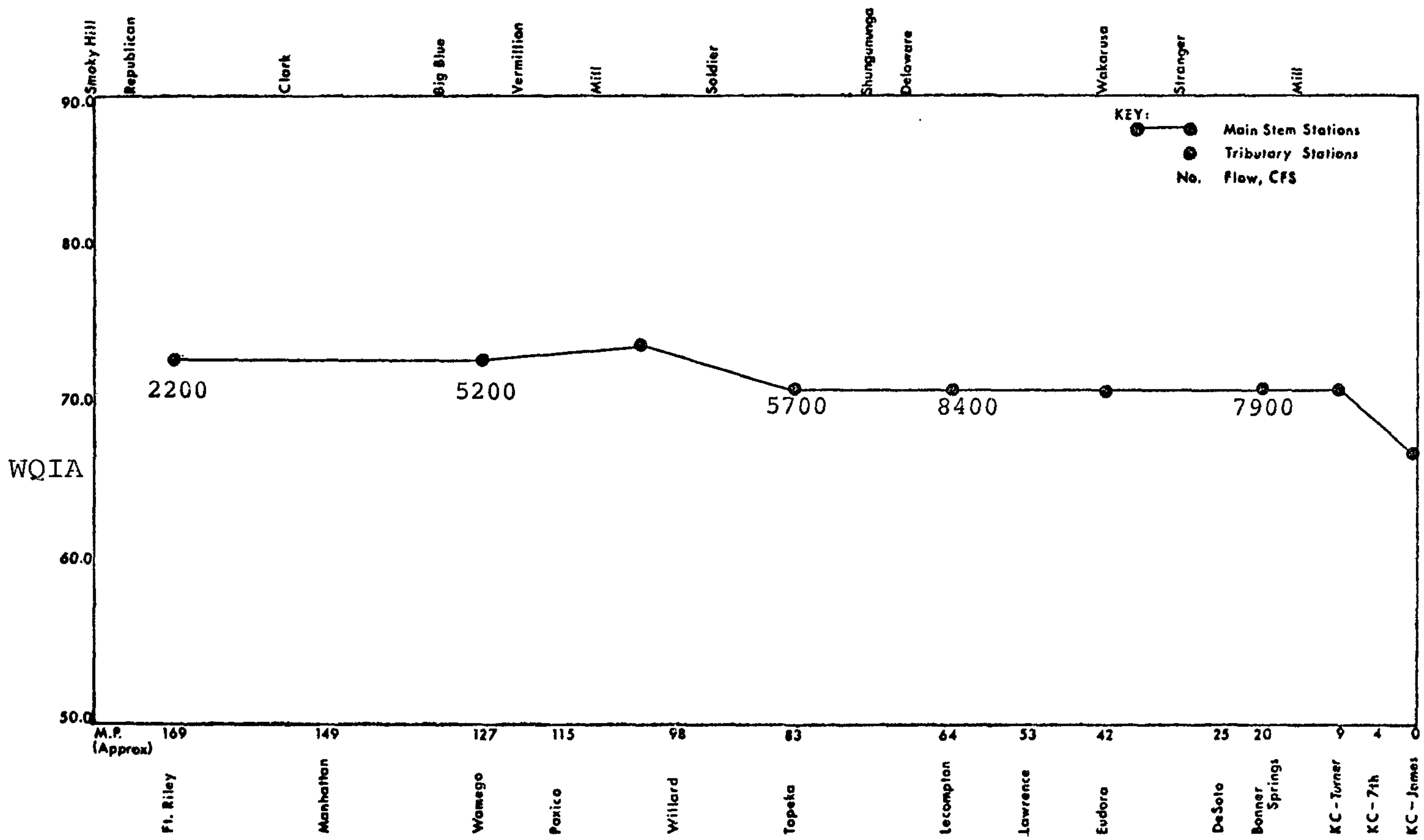


Figure G-35

KANSAS RIVER STUDY WATER QUALITY INDEX PROFILE 12-07-72

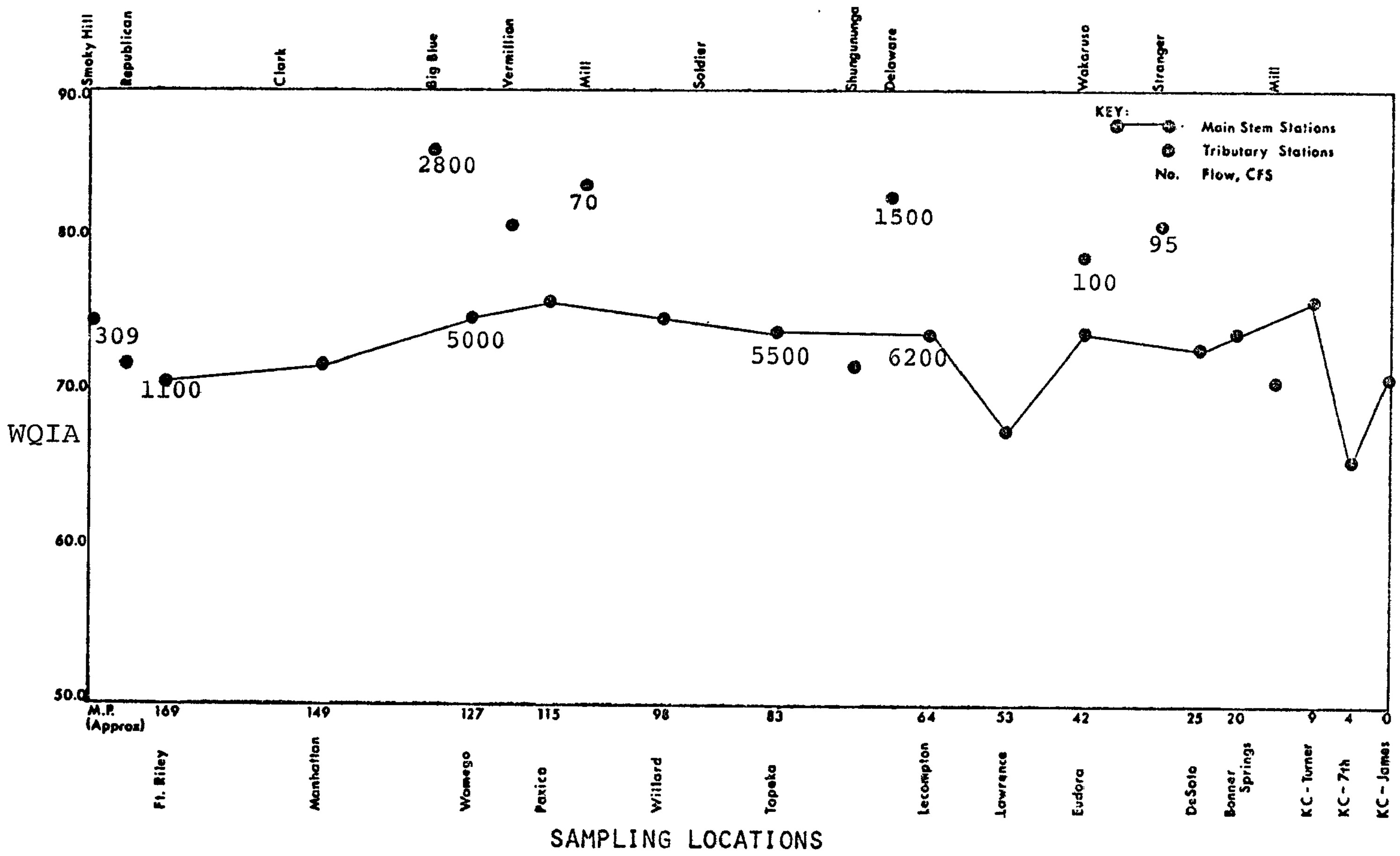


Figure G-36

APPENDIX H

KANSAS RIVER STUDY

Table H-1. PARAMETER CORRELATIONS - KANSAS RIVER STATIONS

Parameters	KC-James			KC-7th St.			KC-Turner			Bonner Springs			DeSoto			Eudora		
	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠
Total solids versus Conductivity			X			X			X			X			X			X
Total solids versus Suspended solids	X					X	X			X					X	X		
Turbidity versus Suspended solids	X			X			X			X			X			X		
Fecal Coliforms versus Total coliforms	X			X				X		X			X				X	
Fecal coliforms versus Fecal streptococci		X				X			X			X			X			X
BOD_5 versus COD			X						X			X						X
BOD_5 versus TOC			X						X			X						X
Fecal coliforms versus TOC		X							X			X						X

APPENDIX H

Table H-1. PARAMETER CORRELATIONS - KANSAS RIVER STATIONS CONT.

Parameter	Lawrence			Lecompton			Topeka			Willard			Paxico		
	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠
Total solids versus Conductivity		X				X			X			X			X
Total solids versus Suspended solids			X	X				X				X	X		
Turbidity versus Suspended solids	X			X			X			X			X		
Fecal coliforms versus Total coliforms			X			X	X					X	X		
Fecal coliforms versus Fecal streptococci			X			X			X			X			X
BOD_5 versus COD						X			X			X			
BOD_5 versus TOC						X			X			X			
Fecal coliforms versus TOC						X			X			X			

APPENDIX H

Table H-1. PARAMETER CORRELATIONS - KANSAS RIVER STATIONS CONT.

Parameters	Wamego			Manhattan			Ft. Riley		
	99	95	≠	99	95	≠	99	95	≠
Total solids versus Conductivity			X		X				X
Total solids versus Suspended solids			X			X			X
Turbidity versus Suspended solids	X			X			X		
Fecal coliforms versus Total coliforms	X			X				X	
Fecal coliforms versus Fecal streptococci			X			X			X
BOD_5 versus COD			X				X		
BOD_5 versus TOC			X					X	
Fecal coliforms versus TOC			X						X

APPENDIX H
KANSAS RIVER STUDY
Table H-2. PARAMETER CORRELATIONS - TRIBUTARY STATIONS

Parameters	Mill			Stranger			Wakarusa			Delaware			Shunganunga			Soldier		
	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠
Total solids versus Conductivity		X			X				X			X			X			X
Total solids versus Suspended solids			X	X			X			X			X			X		
Turbidity versus Suspended solids	X			X			X			X			X			X		
Fecal coliforms versus Total coliforms	X					X	X			X			X				X	
Fecal coliforms versus Fecal streptococci	X					X		X		X					X			X

APPENDIX H

Table H-2. PARAMETER CORRELATIONS - TRIBUTARY STATIONS

Parameters	Mill			Vermillion			Big Blue			Clark			Republican			Smoky Hill		
	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠	99	95	≠
Total solids versus Conductivity			X	X					X			X			X	X		
Total solids versus Suspended solids			X	X					X			X			X			X
Turbidity versus Suspended solids	X			X			X					X		X		X		
Fecal coliforms versus Total coliforms	X			X			X			X			X			X		
Fecal coliforms versus Fecal streptococci			X	X					X			X		X				X

APPENDIX I
BIOLOGICAL ORGANISMS
KANSAS RIVER STUDY

Organisms	Lecompton	Willard
Plecoptera		
Aeroneuria sp.		1
Capnia sp.		3
Isogenus sp.	2	15
Ephemeroptera		
Isonychia sp.		9
Paraleptophlebia sp.		2
Stenonema sp.	1	16
Odonata		
Agrion sedula		2
Trichoptera		
Cheumatopsyche sp.	12	14
Hydropsyche sp.	27	30
Smicridea fasciatella	10	8
Coleoptera		
Stenelmis sp.	1	
Diptera		
Ablabesmyia flavifrons		1
Orthocladius nivoriundus		2
Orthocladius sp.	3	23
Simulium vittatum	3	30
Smittia sp. 1		1
Smittia sp. 2		1
Tanytarsus sp.		4
Total number of organisms	59	166
Total number of species	8	17

BIBLIOGRAPHIC DATA SHEET	1. Report No. EPA-907/9-74-001	2.	3. Recipient's Accession No.
4. Title and Subtitle WATER QUALITY INDEX APPLICATION IN THE KANSAS RIVER BASIN			5. Report Date February 1974
			6.
7. Author(s) Nina I. McClelland, Ph. D.			8. Performing Organization Rept. No.
9. Performing Organization Name and Address National Sanitation Foundation NSF Building Ann Arbor, Michigan 48105			10. Project/Task/Work Unit No.
			11. Contract/Grant No. 68-01-0761
12. Sponsoring Organization Name and Address Environmental Protection Agency, Region VII 1735 Baltimore Kansas City, Missouri 64108			13. Type of Report & Period Covered Final Report
			14.

15. Supplementary Notes

The Superintendent of Documents Class No. is EP 1.2:W29/17

16. Abstracts

The National Sanitation Foundation's (NSF) Water Quality Index (WQI) is an empirical expression which integrates nine significant physical, chemical, and microbiological parameters of water quality into a single number to provide a uniform, consistent, and comprehensible term for measuring and reporting water quality.

To demonstrate the responsiveness of WQI to variations in water quality and to determine optimum frequencies for computing and reporting WQI, a comprehensive field sampling, laboratory analysis, and data management program was developed for applying WQI to selected sites on the Kansas River and its major tributaries. Seventeen parameters were measured (the nine in WQI and eight related parameters) on nearly 600 samples from 26 sites (14 main stem and 12 tributary). Parameters most responsible for quality variation in both main stem and tributary stations were identified by least squares regression. Results indicated that the NSF Water Quality Index (WQI) is an effective method for measuring and reporting overall quality variations in the Kansas River.

17. Key Words and Document Analysis. 17a. Descriptors

Water quality

Rivers - water quality

Surveys - water quality

17b. Identifiers/Open-Ended Terms

Kansas River Basin

National Sanitation Foundation Water Quality Index

Topeka, Kansas

Water Quality Index

17c. COSATI Field/Group

18. Availability Statement	19. Security Class (This Report)	21. No. of Pages
Release unlimited	UNCLASSIFIED	226
	20. Security Class (This Page) UNCLASSIFIED	22. Price