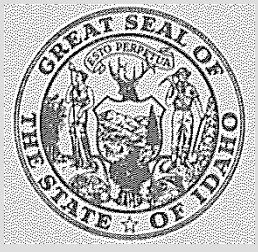
WATER QUALITY STATUS REPORT ● REPORT NO. 74

BIG ELK CREEK
Idaho County, Idaho
1986

Prepared by
Mark P. Von Lindern
George M. Dekan

Lewiston Field Office
1118 F. Street
Lewiston, Idaho 83501



Department of Health & Welfare
Division of Environment
Boise, Idaho

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TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

ABSTRACT

Big Elk Creek serves as a receiving stream for Elk City, Idaho's wastewater lagoons. Elk City is a small remote community of about 315 residents which is located approximately 130 miles southeast of Lewiston, Idaho. The economic base for the community is primarily derived from logging and outdoor recreation activities in the area. During 1986 the Elk City Water & Sewer Association applied for a State/EPA grant to upgrade their wastewater treatment lagoons. The purpose of the summer 1986 study was to review the water quality of Big Elk Creek in order to recommend discharge limits for the pending facility upgrade and subsequent NPDES permit. Additionally, the study attempted to evaluate possible leakage from the lagoons, and the associated effect on the water quality of Big Elk Creek. Since the effluent currently meanders through a marshy area the study also tried to assess the degree of treatment that was being offered by the marsh.

The study determined that the water quality of Big Elk Creek supports the uses designated by the Idaho water quality standards for: domestic water supply, agricultural water supply, cold water biota, salmonid spawning and secondary contact recreation. The standards also identify the stream for primary contact use, however, the bacteria counts above and below the treatment lagoons are high. Further investigation will be conducted to identify the sources of contamination with the appropriate corrective action to follow.

The lagoons by design were to discharge directly into Big Elk Creek but currently the effluent flows into a marshy area adjacent to the creek. The Elk City Water and Sewer Association apparently altered the flow of discharge in an effort to avoid NPDES monitoring requirements. The study, however, showed that the effluent water is continuing through the marsh and entering Big Elk Creek.

Except for high fecal coliform counts, the quality of the effluent sampled was within equivalent-to-secondary treatment standards. Accordingly, disinfection should be included within the treatment process. Unfortunately, the limited study did not supply sufficient information to determine if the lagoons are capable of accepting the imposed hydraulic flows. The facility plan being prepared under contract by Anderson & Perry Engineers should address the hydraulic limitations of the facility.

River samples did not indicate that leakage, if any, from the lagoons was effecting the water quality of Big Elk Creek. The effluent flows through a marshy area and then enters Big Elk Creek. The effluent quality was not significantly improved as it passed through this area.

Aesthetic and health problems within the marsh can be reduced if the effluent flow is directed immediately towards Big Elk Creek. Accordingly, the discharge flow should be reestablished as originally designed for the facility.

INTRODUCTION

Big Elk Creek is a major tributary of the American River (Figure 1) and enters the river approximately one mile west of Elk City. Big Elk Creek and the American River are identified in the Idaho Water Quality Standards and Wastewater Treatment Requirements (1985) as stream segment C.B. 1311 and C.B. 131, respectively. Protected uses for Big Elk Creek from the source to the mouth are: domestic water supply, agricultural water supply, cold water biota, salmonid spawning, primary contact recreation, and secondary contact recreation. The American River is protected for all of the aforementioned uses, and is also designated as a special resource water.

General Idaho water quality standards also apply to both drainage systems. These standards indicate that waters of the state must not contain: hazardous, deleterious, and radioactive materials; floating, suspended, and submerged matter; excess nutrients and suspended sediment in excess of the limits described within the Idaho water quality standards.

Elk City, Idaho, utilizes a two-celled lagoon system which is located adjacent to Big Elk Creek. It should be noted that the Elk City Water and Sewer Association redirected the discharge flow from the lagoons in 1979. The outfall originally flowed directly into Big Elk Creek from the west side of cell #2. In an attempt to eliminate NPDES permit monitoring requirements, the discharge flow was redirected to a marshy area where it now drains for several hundred feet before entering Big Elk Creek. The District has contended that no discharge reaches Big Elk Creek, and therefore no NPDES permit is required. As such, no monitoring has been conducted for several years, and no Discharge Monitoring Reports have been submitted since June 30, 1977.

The Division of Environment inspection reports on the facility indicate that:

1) The wastewater lagoons periodically overflow the discharge control boards.

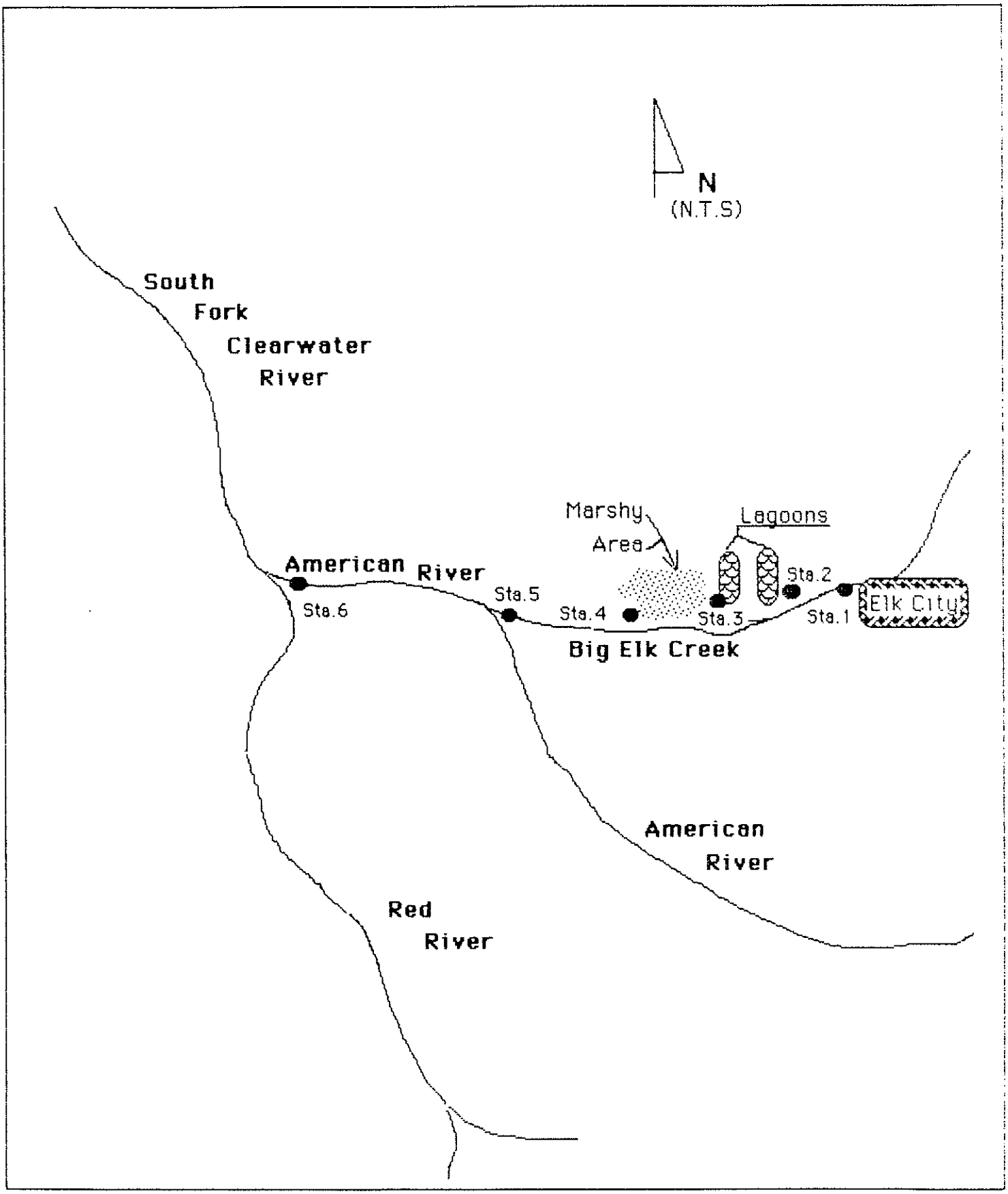
2) Flow from the lagoons could visually be traced through the marshy area to a point of discharge into Big Elk Creek.

3) Algae and duckweed problems occur during certain periods of the year.

4) Frequently the sewer line feeding the lagoon becomes plugged.

5) An NPDES permit is appropriate since a discharge is being utilized.

FIGURE 1: Schematic of Big Elk Creek



STUDY DESIGN AND SAMPLE STATIONS

The historically low flow period was selected for this limited study of Big Elk Creek. The primary objectives of the study were to: 1) Determine if the effluent from the Elk City wastewater lagoons was entering Big Elk Creek. 2) Determine if significant treatment is gained by meandering the effluent through the adjoining marsh. 3) Establish if the effluent was capable of meeting equivalent to secondary standards. 4) Ascertain if the effluent will adversely effect the water quality within Big Elk Creek.

Six sample stations were selected (Figure 2). They included stations number: 1) Big Elk Creek above the Elk City lagoons, 2) Influent lift station for the wastewater lagoons, 3) Discharge weir at Elk City lagoon, 4) Discharge weir within the marsh, just prior to flowing into Big Elk Creek, 5) Big Elk Creek, below the lagoons at the mouth, 6) American River at the confluence with the South Fork of the Clearwater River. STORET numbers were assigned to each station (Table 1).

All stations, except the influent lift station, were sampled approximately once every three weeks between May 7, 1986 and September 24, 1986 for a total of eight sample sets. The influent flow at Station #2 was sampled three times during the high flow period in May and June.

MATERIALS AND METHODS

On-site and laboratory analyses were used to determine water quality (Table 2). All sample collections and test procedures conformed to Standard Methods (APHA, 1985), EPA guidelines (1979), or U. S. Geological Survey (U.S.G.S, 1977). Dissolved oxygen was determined with a YSI Model 54 meter, electrical conductivity with a YSI Model 33 SCT meter, pH with a Corning Model M-103 meter, and stream velocity with a Marsh McBirney Model 201 meter. Estimates of the municipal influent flow were determined by test pumping the lift station which feeds the lagoons. The wastewater effluent flowing from the lagoon (St.#3) and from the marshy area (St.#4) were measured through V-notch weirs.

RESULTS

During the survey Big Elk Creek exhibited a flow regime typical of most creeks in North Idaho. Flows ranged from a maximum discharge of 86.0 cfs to a minimum flow of 2.2 cfs with the mean being 22.1 cfs (Figure 3). On 5/7/86 high flows made it necessary to estimate the flow at Station #5. The flow value obtained at Station #1 which was also on Big Elk Creek was used to approximate the flow at Station #5. Big Elk Creek discharges into the American River about one mile downstream from the wastewater lagoons. The peak flow observed within the American River during the study period was 400 cfs with the mean discharge being 105 cfs. The minimum instream flows for both drainages occurred during the August 28, 1986 site visit.

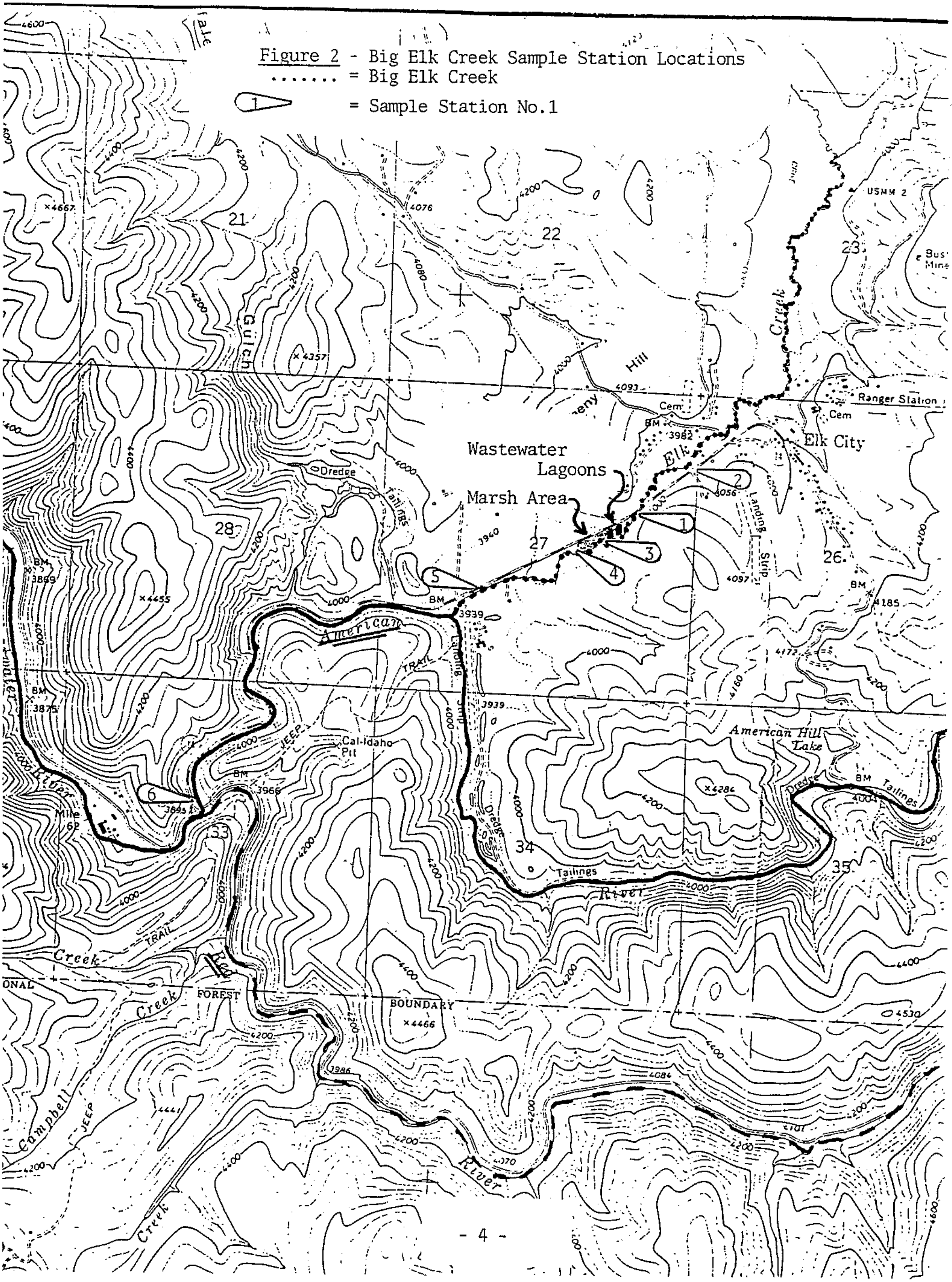


Figure 2 - Big Elk Creek Sample Station Locations
.... = Big Elk Creek
(1) = Sample Station No.1

Table 1

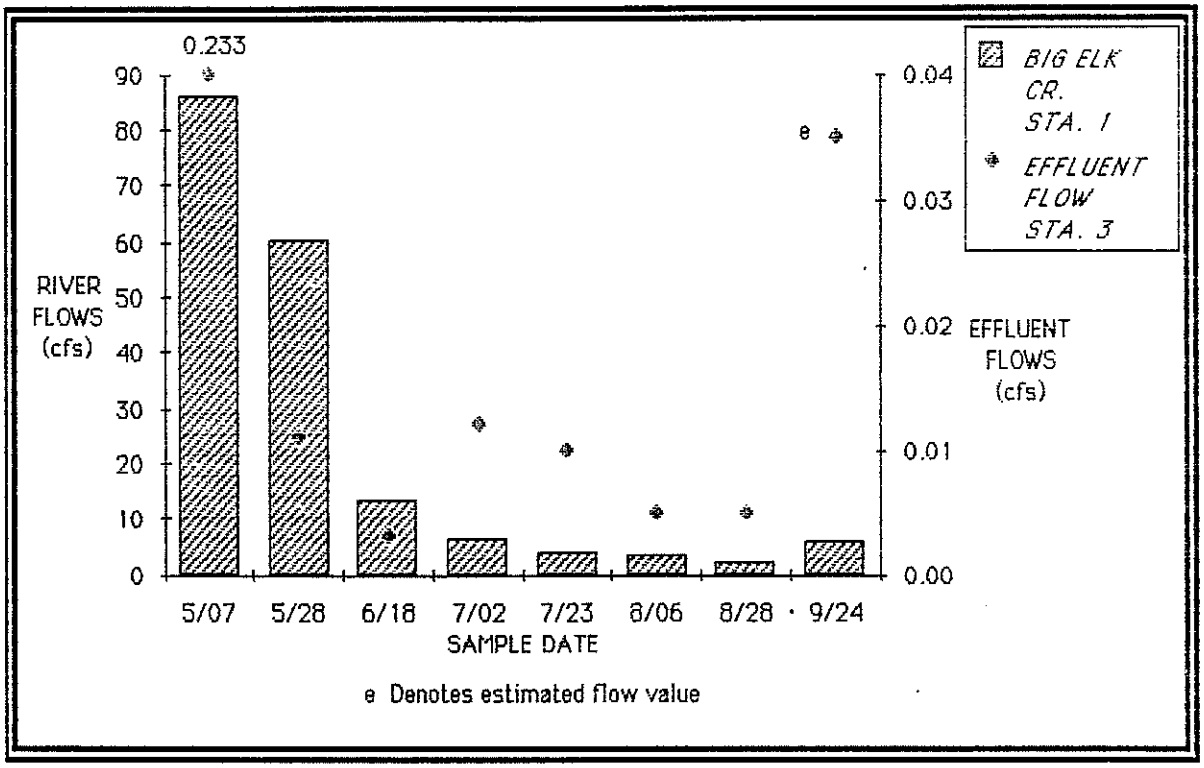
Sample Stations, Big Elk Creek, Elk City Effluent Limitation Study

Stn.	Description	River Mile	STORET
1	Big Elk Cr. above Elk City Outfall	324.3/139.3/74.7/62.5/1.5/1.0	2020185
2	Elk City Influent at Lift Station	324.3/139.3/74.7/62.5/1.5/1.2	2020191
3	Elk City Outfall at Lagoon	324.3/139.3/74.7/62.5/1.5/.8	2020186
4	Elk City Effluent at Marsh	324.3/139.3/74.7/62.4/1.5/.7	2020190
5	Big Elk Creek at Mouth	324.3/139.3/74.7/62.5/1.5/.1	2020187
6	American River at Mouth	324.3/139.3/74.7/62.5/.1	2020188

Table 2 Parameter List

Parameter	Units	STORET	Frequency
Physical			
1) Discharge	cfs	00061	1 per 3/weeks
2) Water Temperature	°C	00010	(all parameters)
3) Dissolved Oxygen (D.O.)	mg/l	00300	
4) Electrical Conductivity	µmhos/cm	00095	
5) pH	S.U.	00400	
Nutrients			
6) Biochemical oxygen demand (BOD)	mg/l	00310	
7) Suspended solids (S.S.)	mg/l	00530	
8) Total phosphorus (T.P.)	mg/l	00665	
9) Total Kjeldahl nitrogen (T.K.N.)	mg/l	00625	
10) Total ammonia	mg/l	00610	
Bacteria			
11) Fecal Coliform	#/100 ml	31616	

Figure 3 : Effluent and Big Elk Creek Flows During the Summer 1986 Study Period



Influent wastewater flows at Station #2 were established three times and fluctuated from 0.17 cfs (0.11 mgd) to 0.03 cfs (0.02 mgd) (Figure 4) with the mean being 0.07 cfs (0.05 mgd). Pump usage records were not kept prior to the study and little historical information was available on the system for estimating past influent flows.

After the initial site visit on May 7, 1986 when the lagoons were discharging 0.23 cfs (0.15 mgd), weir boards were added to increase the holding capacity within the second cell. Effluent discharges occurring after May 7, 1986 were due to leakage between these boards, which resulted in a relatively constant rate of discharge. Behind the boards the small pond increased elevation and then stabilized during the summer.

By September 24, 1986 the pond elevation had raised causing leakage from between the control boards to increase. Excluding the highest flow on May 7, 1986 the mean effluent flow during the remainder of the study was 0.01 cfs (0.006 mgd). After the effluent was discharged from the smaller lagoon (St. #3) it flowed to an adjacent marshy area where it continued through the marshy area and then into Big Elk Creek (Stn. #4).

The mean biochemical oxygen demand (BOD) averaged for all instream stations was 1.0 mg/l (Figure 5). BOD concentrations above and below the lagoons were comparable with the average gain being 0.1 mg/l. Within the effluent the BOD ranged from 8.0 mg/l to 30.3 mg/l which resulted in a mean of 22.0 mg/l. Once the effluent flowed through the marshy area, the mean BOD decreased from 22 mg/l to 13.8 mg/l (Figure 5).

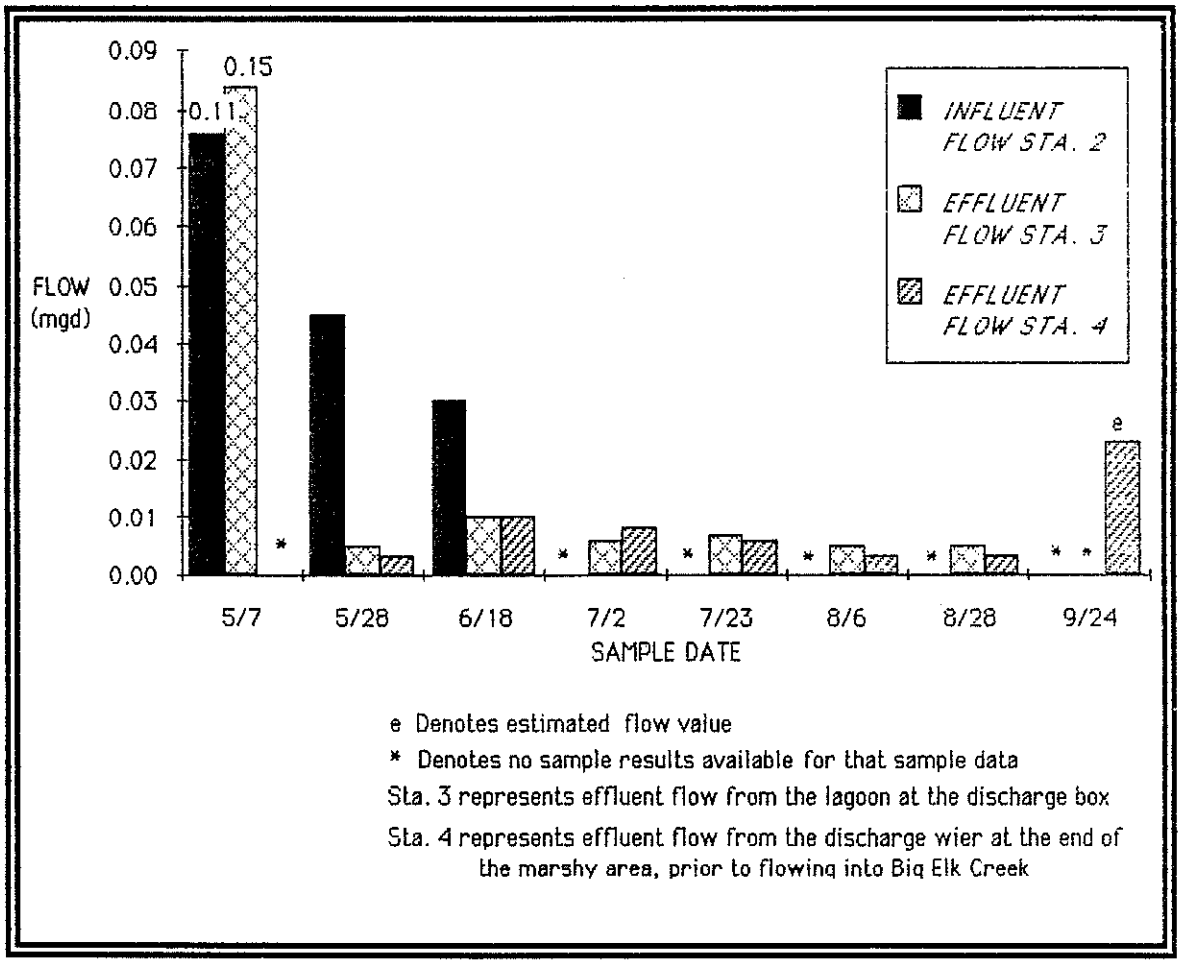
Suspended solid concentrations (S.S.) decreased 15% in Big Elk Creek between Station #1, above the lagoon and #5, below the lagoon. Combining all the river samples taken from Big Elk Creek resulted in a mean S.S. concentration of 18 mg/l with a range from 2 mg/l to 110 mg/l (Figure 5). Effluent samples varied from 2 mg/l to 80 mg/l with the average concentration being 45 mg/l. S.S. concentrations increased by 1 mg/l as the result of effluent moving through the marsh (Figure 5).

Instream B.O.D. loadings in Big Elk Creek ranged from 17 lbs/day to 298 lbs/day with a mean of 69 lbs/day. S.S. loadings varied from 37 lbs/day to 11,700 lbs/day with the mean being 2320 lbs/day. The larger stream flows in the American River resulted in higher mean BOD and S.S. loadings of 450 lbs/day and 6,991 lbs/day, respectively.

Effluent loadings varied from 0 lbs/day to 14 lbs/day for BOD with the mean being 3 lbs/day. S.S. loadings ranged from 1 to 13 lbs/day and the mean was 4 lbs/day. A true comparison of the influent and effluent loadings could only be determined on May 7, 1986 since the flow from the lagoons was being restricted during the remainder of the study period. On that date the percent removal was 48% for BOD and 62% for S.S.

The dissolved oxygen (D.O.) content within Big Elk Creek ranged from 7.8 mg/l to 11.8 mg/l with the mean being 9.3 mg/l (Figure 6). Effluent D.O. values varied from 0 mg/l to 2.9 mg/l which resulted in a mean concentration of 1.1 mg/l. Instream water temperatures as low as 3.6° C were recorded and the highest temperature was 16.5°C.

Figure 4 : Influent and Effluent Flows From Sta. 2,3, & 4 During the Summer 1986 Study Period



e Denotes estimated flow value

* Denotes no sample results available for that sample data

Sta. 3 represents effluent flow from the lagoon at the discharge box

Sta. 4 represents effluent flow from the discharge wier at the end of the marshy area, prior to flowing into Big Elk Creek

Figure 5 : Mean B.O.D. and S.S. Concentrations During the Summer 1986 Study Period

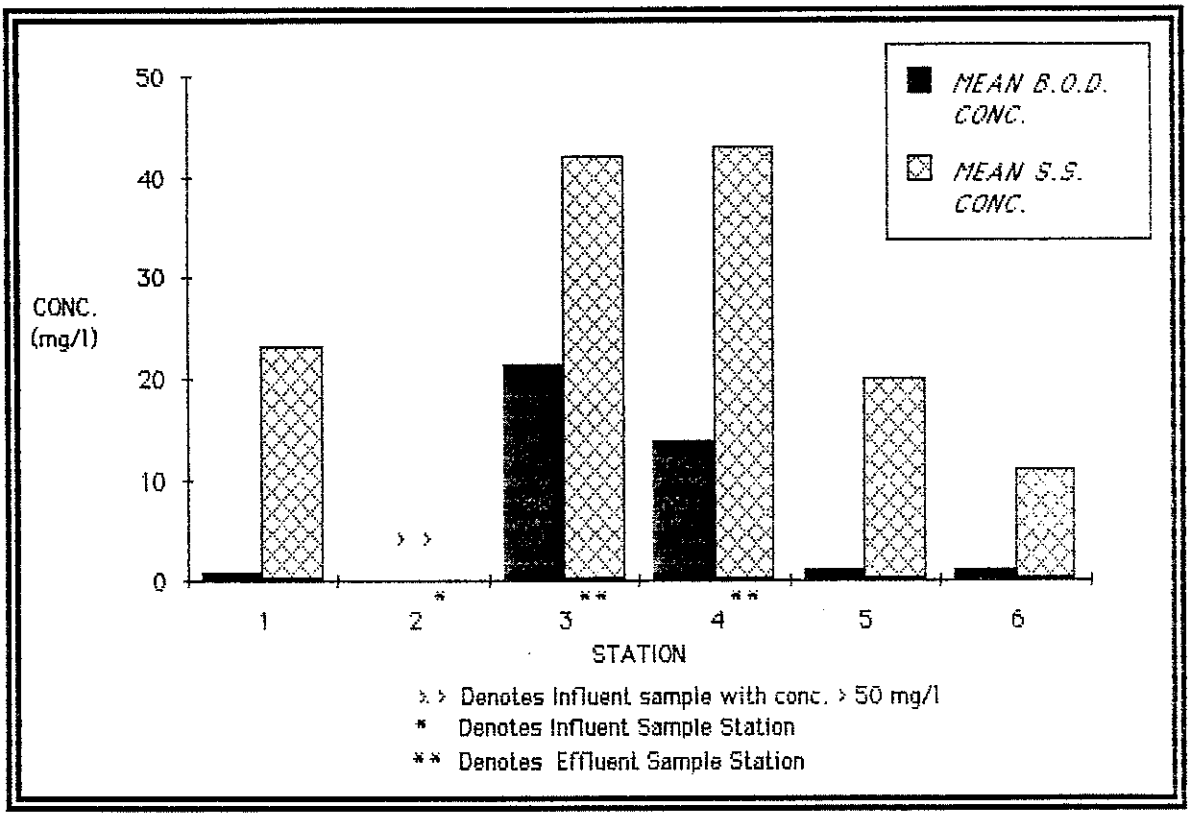
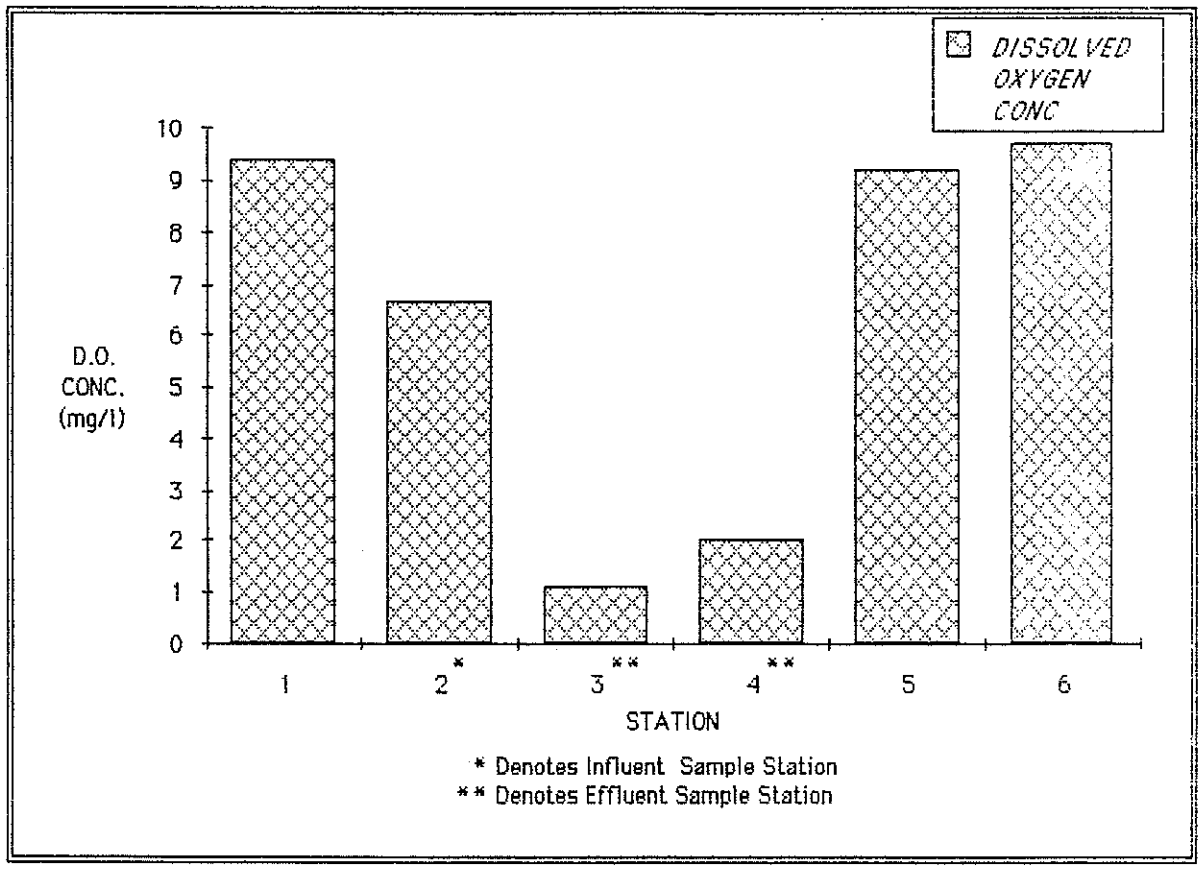


Figure 6 : Mean Dissolved Oxygen Concentrations During the Summer 1986 Study Period



The mean temperature within the wastewater effluent of 12.4°C was slightly lower than the 13°C average instream water temperature.

The instream monitoring stations on Big Elk Creek (1 and 5) showed similar water chemistry throughout the study. The mean phosphate concentration of <0.1 mg/l was consistent at both instream stations (Figure 7). The mean TKN values in the stream showed an increase from 0.23 mg/l above lagoons to 0.25 mg/l after receiving the effluent. Mean ammonia concentrations decreased from 0.048 mg/l above the lagoons to 0.041 mg/l at Station 5, below the wastewater discharge.

The mean phosphate level in the wastewater effluent was 3.0 mg/l at the lagoon outfall and remained constant through the marshy area. The mean TKN concentration decreased from 8.4 mg/l at Station #3 to 8.0 mg/l after flowing through the marshy area and discharging at Station #4 (Figure 7). The mean ammonia concentration was 3.9 mg/l at the lagoon discharge point and 4.0 at Station #4 (Figure 7).

Effluent from the Elk City lagoons averaged 0.4 lbs/day for total phosphorus and 1.4 lbs/day for TKN,of which 0.6 lbs/day was estimated to be total ammonia. As previously mentioned, due to the operation of the lagoons, establishing a representative loading for the effluent was not possible since the flows had been reduced at the discharge structure. Big Elk Creek samples resulted in means of 12 lbs/day, 34 lbs/day, 6 lbs/day for total phosphorus, TKN and total ammonia respectively (Figure 8).

Fecal coliform counts in the river samples varied from 10 colonies per 100 ml to TNTC (too numerous to count) and from 1,000 to 6,200 colonies per 100 ml in the wastewater effluent. The mean coliform densities were 2,376/100 ml and 226 colonies/100 ml for the wastewater effluent and the river stations, respectively (Figure 9). Densities at Station # 1, which is above the lagoon outfall point, showed a mean density of 223 colonies per 100 ml and ranged from 10 colonies per 100 ml to TNTC.

During the study period temperature was the only parameter that was consistently higher in Big Elk Creek below the lagoon than above the discharge point with the average difference being 0.9°C. The other parameters did not show consistent increases or decreases during the study period.

QUALITY ASSURANCE

Precision is a measure of the mutual agreement among individual analysis of the same property. The study used replicate samples for B.O.D., S.S., fecal coliform, T.P., ammonia and TKN at Station 6 to establish precision (Table 3). The average relative range on all replicate samples except of total ammonia were within recognized limits (Bauer 1985). Ammonia values did not show good mutual agreement but unfortunately such is usually the case for ammonia results.

Figure 7 : Mean Nutrient Concentrations During the Summer 1986 Study Period

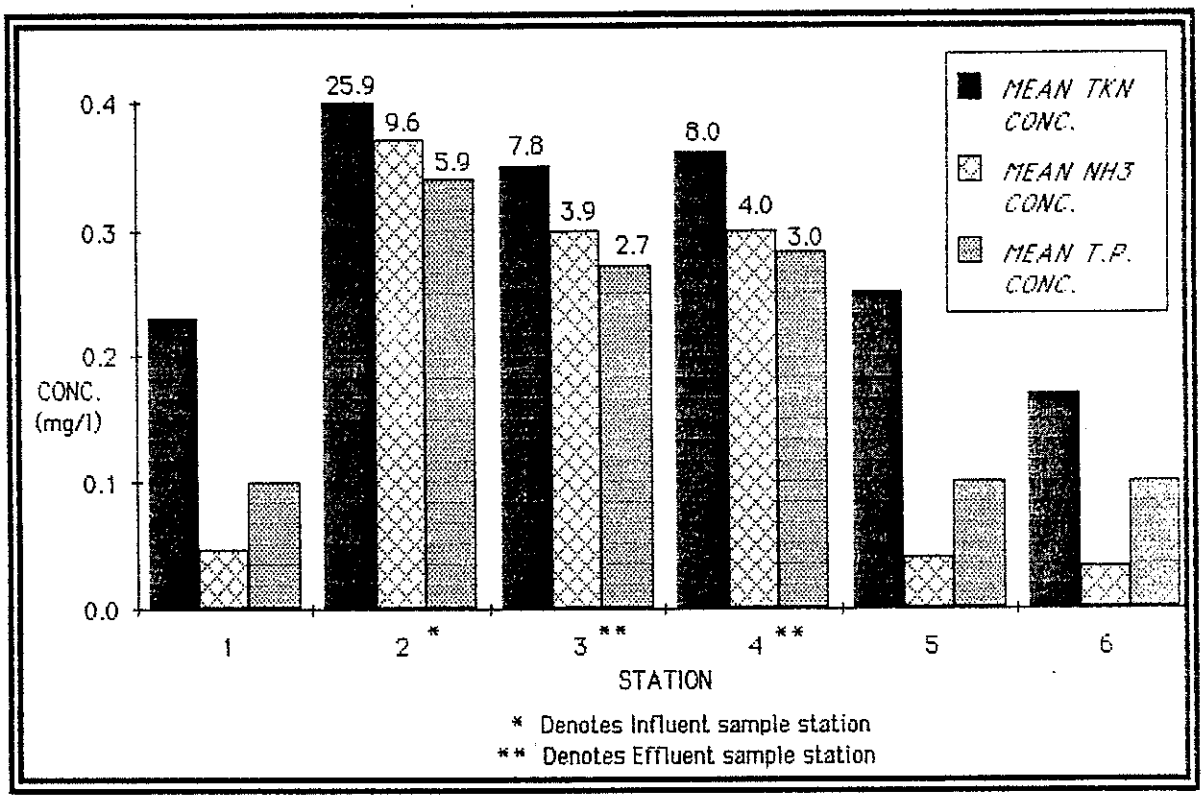


Figure 8 : Mean Nutrient Loads During the Summer 1986 Study Period

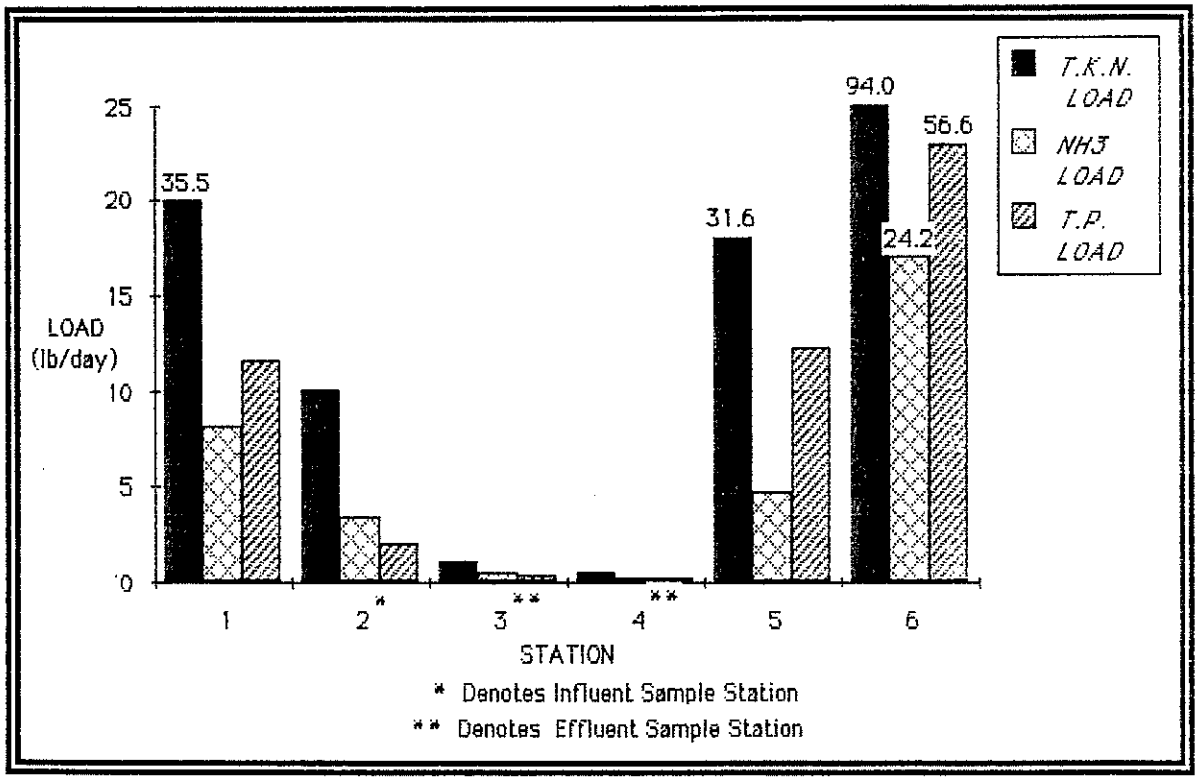


Figure 9 : Mean Fecal Coliform Densities During the Summer 1986 Study Period

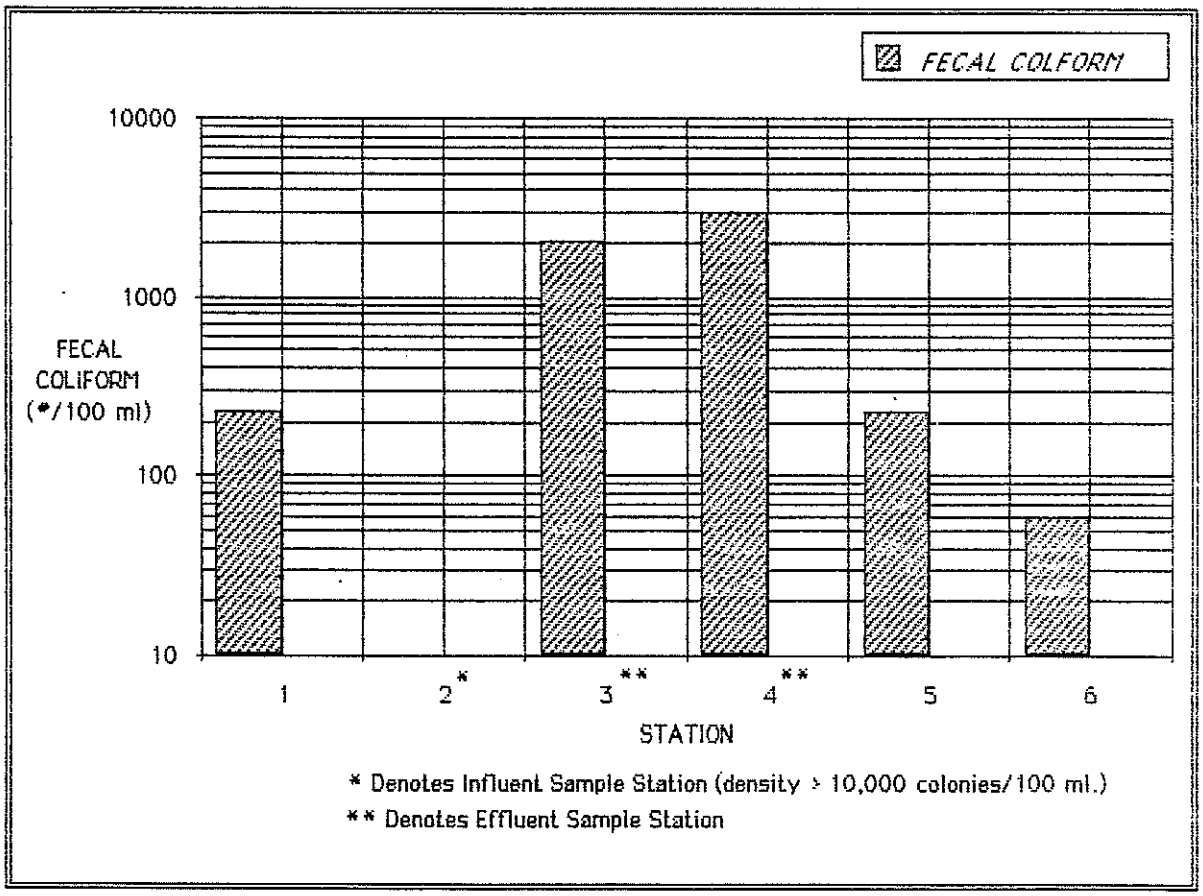


Table 3 Quality Assurance on Big Elk Creek - Summer 1986

Precision

Parameter	N	X	Relative Range
BOD	8	1.0	12.5%
SS	8	10.9	27%
Fecal Coliform	8	59.9	34.5%
T. Phosphorus	8	0.1	0%*
T. Ammonia	8	0.033	65.6%
T.K.N.	8	0.170	24%

* Artifact in the data which is related to the minimum detection limits

DISCUSSION

DISCHARGE /FLOW

Stream flows in Big Elk Creek fluctuated from 2.6 cfs to 86 cfs during the study period. The flow decreased by 97% between May 28, 1986 and August 28, 1986. Flows within the American River were usually about five times greater than that of Big Elk Creek. During the study, flows from the lagoons peaked on May 7, 1986 at 0.23 cfs (0.15 mgd). The discharge was then restricted, which allowed only flow through the weir boards to be sampled and measured. Traditionally weir boards are pulled just before winter and replaced during early summer. Such operating procedures could, if not properly regulated, result in a low dilution ratio. Sufficient information could not be obtained from the limited study to determine the historical yearly flows entering or being discharged from the lagoons. However, during the study the minimum stream flow to effluent ratio was 370:1 which occurred on May 7,1986. In order to prevent aesthetic and health problems a minimum dilution factor should be established for the facility since flows as low as 2 cfs can be expected in Big Elk Creek. Under a state grant, Anderson and Perry Engineers are further investigating Elk City's wastewater flows in an effort to address the hydraulic limitations of the facility. The present discharge structure is a concrete box which uses various numbers and widths of boards to control flow. The discharge structure should be improved to reduce leaks and allow better control of effluent flow. Due to a lack of surface flow within the marshy area, the wastewater effluent is not adequately diluted and as such health and aesthetic problems may exist within the marshy area. Discharging directly into Big Elk Creek would eliminate the flow through the marsh and allow better control of the effluent being received by the creek.

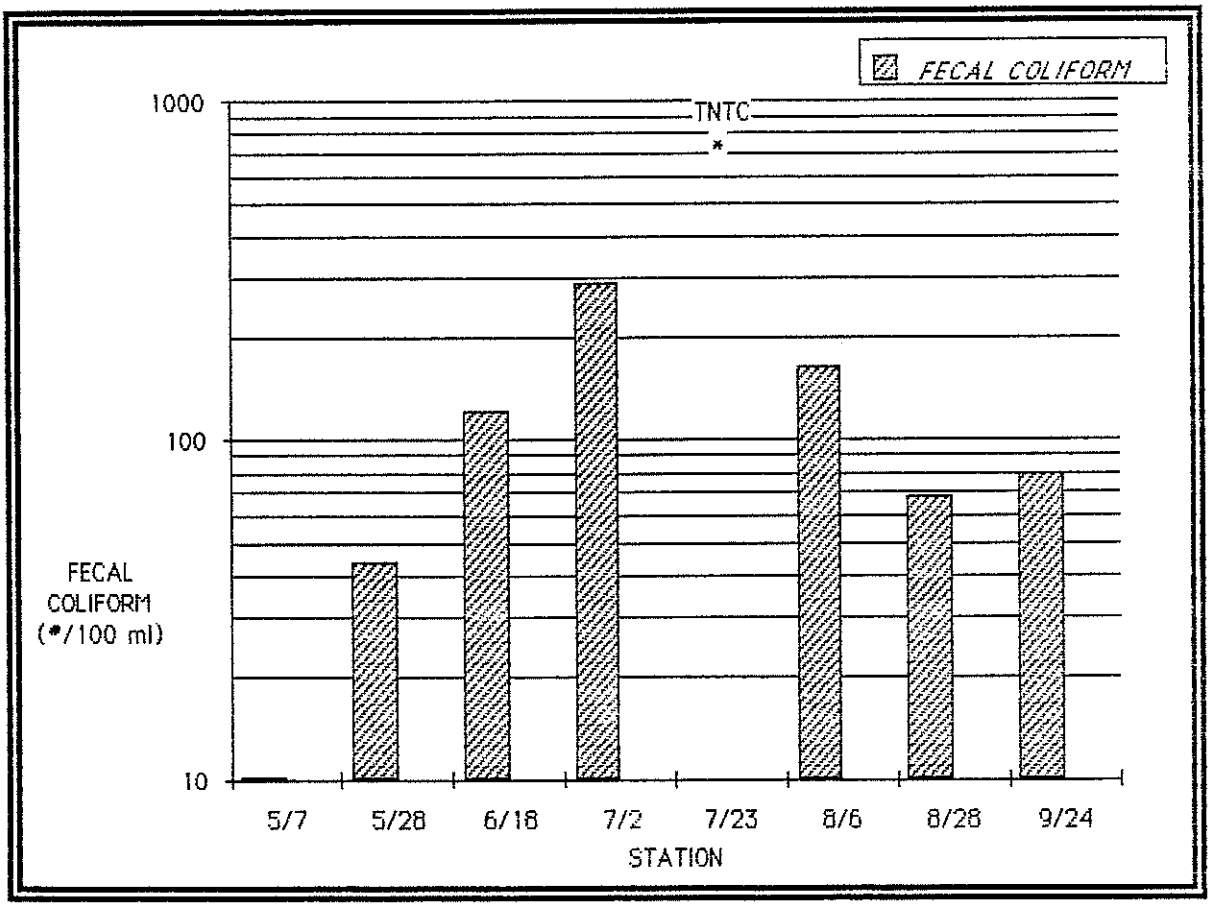
DESIGNATED USES

Big Elk Creek is considered a valuable recreational stream and is actively used as such. Approximately one mile downstream from the wastewater lagoon the creek discharges into the American River which is designated as a special resource water. The study indicated that the designated uses for Big Elk Creek are appropriate except for perhaps primary contact recreational purposes. During the study the average fecal coliform densities in Big Elk Creek at Stations 1 & 5 were 223 colonies/100 ml. (Fig.10) and 229 colonies/100 ml. During the study period two instream samples were reported as being T.N.T.C. (Fig. 9). On a given sampling day the results at Stations 1 & 5 were comparable with the fecal coliform counts at downstream sites usually being slightly higher. According to the "Idaho Water Quality Standards" primary contact waters should not exceed:

(a) 500/100 ml at any time; and

(b) 200/100 ml in more than 10 percent (10%) of the total samples taken over a thirty (30) day period; and

Figure 10 : Instream Fecal Coliform Densities At Sta. 1 During the Summer 1986 Study Period



(c) A geometric mean of 50/100 ml based on a minimum of five (5) samples taken over a thirty (30) day period.

Big Elk Creek flows through the municipal limits of Elk City. Some local restaurants, motels, laundry facilities and residential development exists along the stream which may be contributing to the fecal coliform densities. Additional investigation is necessary to identify the sources contributing to the high fecal coliform counts within Big Elk Creek. The appropriate corrective action will be taken to reduce the high coliform counts during 1987.

BOD/S.S.

Both the BOD and S.S. concentrations at Stations 1 & 5, which were the instream sampling locations on Big Elk Creek, showed similar results. The mean instream BOD and S.S. levels were 0.95 mg/l and 22 mg/l, respectively. The quality of the wastewater effluent was within equivalent to secondary treatment standards of 45 mg/l for BOD and 70 mg/l S.S. (7 of the 8 samples). A reduction by 37% in the mean BOD concentration occurred between the lagoon outfall at Station #3 and Station #4 which was at the discharge point after the marshy area. The mean SS concentration increased from 42 mg/l to 46 mg/l between the two stations. The effluent apparently gains a benefit from the marshy area when considering BOD, but S.S. concentration is not affected. Sample results in Big Elk Creek showed a 15% decrease in the S.S. concentration below the lagoon and an increase of 0.1 mg/l in the BOD concentration which is considered negligible.

During the study period, operation of the lagoon did not allow sufficient information to be gained to accurately estimate the mean reduction in BOD and suspended solid loadings. However, sufficient information was obtained during the May 7, 1986 sample date to determine that the BOD and S.S. loadings in the effluent were 11 lbs/day and 13 lbs/day, respectively. The removal rate was 48% for BOD and 62% for SS. Without sampling year-round and recording the flows, establishing a representative removal rate for the facility could not be calculated. Sixty-five percent removal is usually required for such lagoon treatment facilities.

Dissolved Oxygen and Temperature

The high mountain springs and winter snowpack which fed Big Elk Creek resulted in cool instream water temperatures. The temperature increase at Station #1 from 3.6°C to 15.7°C occurred within 21 days. Peak river flows also occurred during this period indicating that the cold water was the result of runoff from the snowpack.

Typically, colder water has higher D.O. concentrations. Such was the case on Big Elk Creek when the coldest water temperature coincided with the highest D.O. concentration reading of 11.7 mg/l. The introduction of wastewater effluent did not cause a significant sag in the stream's average D.O. concentration. A minimum instream D.O. concentration of 7.8 mg/l was recorded during the study, which is within the acceptable limits for the designated use of salmonid spawning.

pH and Conductivity

Monitoring within Big Elk Creek showed an average pH of 6.8 S.U. which ranged from 6.2 to 7.7 S.U. The wastewater effluent showed minimum and maximum pH values of 6.0 and 6.9 S.U. respectively. Both values are within the range of 6.0 to 9.0 S.U. usually set for equivalent to secondary treatment. Idaho water quality standards have similar established limits of 6.5 - 9.0 S. U.

Conductivity within the river averaged 40 µmhos/cm with the highest value being 109 µmhos/cm. A higher mean conductivity value of 191 µmhos/cm was present in the wastewater, but did not cause an increase to occur between instream Stations 1 and 5. Potable water within the United States generally ranges from 50 to 1,500 µmhos/cm. Instream conductivity measurements did not indicate the presence of high concentrations of aqueous inorganic acids, bases, or salts which are typically good conductors.

Fecal Coliform

The quality of wastewater effluent indicated that the treatment lagoons were capable during the study of meeting equivalent to secondary standards with the exception of satisfying fecal coliform limits.

Customarily, counts of 100 colonies/100 ml and 200 colonies/100 ml are required in NPDES permits for weekly and monthly averages, respectively. Bacteria counts within the effluent exceeded the usual limits on each sample date with the minimum count being 1,000 colonies/100 ml. (Figure 9). The mean instream fecal coliform counts below the lagoons were equal to or higher than the counts recorded above the treatment facility on four of the six sample dates.

Fecal coliform counts are not to exceed 500 colonies/100 ml at anytime or have a geometric mean of greater than 50 colonies/100 ml (based on 5 samples over a 30 day period) to be designated for primary contact recreation. Over the study period the geometric mean at Station #1, above the lagoons, was 75 colonies/100 ml excluding the sample which was TNTC (Figure 10). The maximum allowable fecal coliform standards set for primary contact use as previously discussed are apparently not being satisfied. Development along Big Elk Creek at Elk City probably contributes to the elevated counts. Additional investigation is necessary to determine if the fecal coliform counts can be brought within primary contact limits.

Phosphorus

Phosphorus is an important nutrient of water quality concern. Phosphorus is essential to organism growth, and may be of particular concern where phosphorus is a growth limiting nutrient. For this study it was decided that little additional information would be gained by breaking total phosphorus into its various components.

The mean phosphorus concentration of less than 0.10 mg/l remained constant over the course of the study at each instream station. The effluent concentration at Station 4 ranged from to <0.10 mg/l to 3.8 mg/l with the mean being 3.0 mg/l. The recommended instream concentration of 0.1 mg/l (MacMenthun 1973) for waters not directly entering reservoirs or lakes was not exceeded during the study period. The mean phosphorus concentration was unchanged as it flowed between the lagoon discharge point and the outfall weir at the end of the marsh.

Nitrogen

Nitrogen is another important nutrient which is present in large concentrations in Elk City's wastewater. All forms of nitrogen are biochemically interconvertible and, therefore, are of interest in effluent limitation studies.

Nitrite and nitrate are oxidized forms of nitrogen which are available for uptake by aquatic and terrestrial plants. Concentrations of these inorganic forms of nitrogen in excess of 0.3 mg/l are considered likely to contribute to acceleration of lake eutrophication. Organic forms of nitrogen include proteins, urea, nucleic acids, and numerous synthetic organic materials. Analysis of TKN includes organic forms as well as the ammonia fraction.

The average TKN concentration of Big Elk Creek was 0.24 mg/l. The average instream total ammonia concentration was 0.045 mg/l which represents 19 percent of the TKN value. Mean TKN concentrations of 8.4 mg/l in the effluent did not cause the instream values to increase. Ammonia is present in most waters and exists as part of the nitrogen cycle. The toxicity of aqueous solutions of ammonia is attributed to the un-ionized (NH_3) portion. However, due to the problems associated with mathematically converting total ammonia to un-ionized ammonia, the Idaho water quality standards refer to limits based on total ammonia values. Instream values for total ammonia were below these maximum allowable concentrations on each sample date.

CONCLUSIONS

1) Elk City's wastewater lagoons are discharging during portions of the year and the effluent water is entering Big Elk Creek via a marshy area adjacent to the facility. Except for fecal coliform limits the facility produced effluent concentrations which were equivalent to secondary quality standards on all but one sample date. On that particular date the suspended solids concentration was 80 mg/l. Since flows were restricted during the study, determining the percent removal during normal discharge periods could not be established.

2) Fecal coliform limits taken above the treatment facility in Big Elk Creek indicate that bacteria counts are in excess of the primary recreation limits described by the Idaho water quality standards. Effluent from the lagoons contributed to still higher fecal coliform densities downstream from the discharge point.

3) As the effluent moved through the marshy area prior to discharging into Big Elk Creek the BOD concentration decreased; the mean nutrient and S.S. concentrations remained essentially unchanged. The surface flow through the marsh is largely due to the wastewater effluent. The absence of additional flow to provide the necessary dilution may cause health and aesthetic problems to exist within the marsh.

4) Nutrients from the wastewater facility did not significantly impact Big Elk Creek during the study period.

5) Sufficient information could not be obtained from the limited study to determine if the lagoons are capable of meeting the hydraulic demands being imposed on the facility.

RECOMMENDATIONS

1) The Elk City wastewater facility is capable of producing an effluent that will not adversely affect the water quality of Big Elk Creek if disinfection is provided. The facility should provide equivalent-to-secondary treatment in order to protect existing beneficial uses.

2) Disinfection of the effluent should be required since instream fecal coliforms periodically exceed the limits set for the designated uses of Big Elk Creek, and bacteria counts routinely exceed customary equivalent-to-secondary permit limits.

3) The effluent flow should be redirected to allow a discharge directly to Big Elk Creek. The appropriate EPA monitoring and reporting should be required.

4) The hydraulic limitations of the lagoons should be determined in order to establish an operating plan and the minimum dilution factor that the lagoons can operate within. Based on the information of this limited study, the minimum dilution rate should be 375:1. However, additional hydraulic information and economic considerations may justify a lower dilution rate.

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APPENDIX

APPENDIX 1. WATER QUALITY DATA FROM BIG ELK CREEK STUDY.

DATE	TIME	TEMP. °C	D.O. mg/l	pH S.U.	COND. µmhos/cm	FLOW cfs	NH3 mg/l	NH3 LOAD #/day	TKN mg/l	TKN LOAD #/day	T.P. mg/l	T.P. LOAD #/day	S.S. mg/l	S.S. LOAD #/day	FECAL COLI. #/100ml	BOD mg/l	BOD LOAD #/day
STORET #2020185, STATION #1, AT BIG ELK CREEK ABOVE ELK CITY OUTFALL																	
5/07/86	10:10	3.6	11.8	7.1	109	86.0	0.044	20.4	0.38	176.0	0.1	46.4	2	927	10	0.1	46.4
5/28/86	15:30	15.7	9.2	6.2	19	46.2	0.157	39.1	0.30	74.7	0.1	24.9	42	10459	44	1.2	298.8
6/18/86	11:40	14.8	10.1	7.7	21	14.1	0.008	0.6	0.04	3.0	0.1	7.6	20	1520	12	1.2	91.2
7/02/86	06:40	14.6	9.0	6.8	21	7.8	0.090	3.8	0.20	8.4	0.1	4.2	110	4631	292	0.4	16.8
7/23/86	06:40	13.3	8.2	6.4	29	5.4	0.015	0.4	0.22	6.3	0.1	2.9	4	115	TNTC	1.0	28.8
8/06/86	09:15	14.3	8.3	6.7	31	3.4	0.025	0.5	0.29	5.4	0.1	1.8	2	37	166	0.8	14.8
8/28/86	06:45	13.1	8.4	6.6	32	2.6	0.016	0.2	0.17	2.4	0.1	14.4	4	56	68	1.7	23.9
9/24/86	14:45	10.3	9.8	7.6	69	5.7	0.027	0.8	0.22	6.7	0.1	3.1	2	61	80	1.0	30.5
MIN		3.6	8.2	6.2	19	2.6	0.008	0.2	0.04	3.0	0.1	1.8	2	37	10	0.1	14.8
MAX		15.7	11.8	7.7	109	86.0	0.157	39.1	0.38	176.0	0.1	46.4	110	10459	TNTC	1.7	298.8
MEAN		12.5	9.4	6.8	41	21.4	0.048	8.2	0.23	35.5	0.1	11.6	23	2226	223	0.9	68.9
STORET #NONE , STATION #2, AT ELK CITY INFLUENT																	
5/07/86	08:50	6.8	8.7	6.5	218	0.17	3.27	3.00	11.2	10.3	1.9	1.71	36	33	17100	29	26.6
5/28/86	17:30	11.4	7.1	6.3	252	0.07	2.10	2.1	27.5	10.4	1.2	0.45	2714	1024	188000	81.0	81.1
6/18/86	10:10	14.9	4.4	7.7	390	0.05	19.90	5.36	38.9	10.5	14.6	3.93	198	53	TNTC	207	55.8
MIN		6.8	4.4	6.2	218	0.07	3.27	2.10	11.2	9.6	1.2	0.45	36	33	17100	29	26.6
MAX		14.9	8.7	7.7	390	0.17	19.90	5.36	38.9	10.5	14.6	3.39	2714	1024	TNTC	215	81.1
MEAN		11.0	6.7	6.8	287	0.10	9.58	3.49	25.9	10.4	5.9	2.03	983	370	68700	150	54.5
STORET #2020186, STATION #3, AT ELK CITY OUTFALL AT LAGOON																	
5/07/86	11:00	8.1	2.9	6.4	129	0.233	2.34	2.90	4.6	5.79	1.2	1.51	10	12.6	2800	11.0	13.8
5/28/86	14:30	12.3	0.8	6.3	92	0.007	1.53	0.06	4.2	0.16	1.1	0.04	38	1.4	1000	8.0	0.3
6/18/86	12:25	15.1	0.8	6.5	130	0.016	2.91	0.25	8.3	0.72	3.2	0.27	62	5.4	1895	29.7	2.6
7/02/86	07:45	14.0	1.0	6.2	165	0.010	3.33	0.18	9.3	0.50	3.2	0.17	80	4.3	2200	30.0	1.6
7/23/86	07:30	13.2	0.6	6.5	254	0.011	3.41	0.20	9.2	0.55	3.4	0.20	40	2.4	1500	30.3	1.8
8/06/86	10:00	14.1	1.1	6.0	162	0.007	5.40	0.20	10.4	0.39	3.5	0.13	38	1.4	1600	27.0	1.0
8/28/86	07:20	12.9	0.0	6.2	374	0.007	3.52	0.13	8.45	0.32	3.6	0.14	70	2.6	6200	23.0	0.9
9/24/86	15:15	9.1	1.6	6.9	221	0.04e	9.01	1.70	12.5	2.36	5.0	0.94	24	4.5	1810	17.1	3.2
MIN		8.1	0.0	6.0	92	0.007	1.53	0.06	0.2	0.04	0.1	0.04	2	1.4	1000	8.0	0.3
MAX		15.1	2.9	6.9	374	0.233	9.01	2.90	12.5	2.36	5.0	1.51	80	12.6	6200	30.3	13.8
MEAN		12.4	1.1	6.4	191	0.041	3.93	0.56	8.4	1.35	3.0	0.42	45	4.3	2376	22.0	3.1

TNTC = To Numerous To Count
e = Estimated Value

APPENDIX 1. WATER QUALITY DATA FROM BIG ELK CREEK STUDY.

DATE	TIME	TEMP.	D.O.	pH	COND.	FLOW	NH3	NH3 LOAD	TKN	TKN LOAD	T.P.	T.P. LOAD	S.S.	S.S. LOAD	FECAL COLI.	BOD	BOD LOAD
		°C	mg/l	S.U.	µmhos/cm	cfs	mg/l	#/day	mg/l	#/day	mg/l	#/day	mg/l	#/day	#/100ml	mg/l	#/day
STORET #2020190, STATION #4, AT ELK CITY OUTFALL AT RIVER																	
5/07/86	NOT	SAMP	LED														
5/28/86	13:30	22.1	--	6.4	111	0.005	1.97	0.053	6.26	0.169	2.3	0.062	76	2.05	18000	11.0	0.30
6/18/86	12:10	16.4	2.7	6.8	123	0.015	3.14	0.254	8.43	0.682	2.6	0.210	54	4.37	1400	19.6	1.60
7/02/86	08:00	11.0	1.4	6.4	138	0.012	5.25	0.340	8.60	0.556	3.1	0.200	92	5.95	800	7.9	0.51
7/23/86	08:30	9.7	1.6	6.9	148	0.010	3.00	0.162	7.19	0.388	3.0	0.162	28	1.51	100	12.4	0.67
8/06/86	10:20	10.9	2.6	6.4	128	0.005	4.81	0.130	9.20	0.250	3.0	0.081	22	0.59	100	26.0	0.70
8/28/86	07:40	9.6	0.0	6.6	299	0.005	4.01	0.108	7.43	0.200	3.4	0.092	24	0.60	60	11.0	0.30
9/24/86	15:30	10.6	3.7	6.8	212	0.035	5.76	1.09	8.40	1.580	3.8	0.717	8	1.5	131	8.9	1.67
MIN		9.7	0.0	6.4	111	0.005	1.97	0.053	6.26	0.169	2.3	0.62	8	0.59	60	7.9	0.30
MAX		22.1	15.6	6.9	299	0.035	5.76	1.09	8.60	1.580	3.8	0.717	92	5.95	18000	26.0	1.67
MEAN		12.9	2.0	6.6	166	0.012	3.99	0.305	8.01	0.546	3.0	0.218	46	2.29	2942	13.8	0.82
STORET #2020187, STATION #5, AT BIG ELK CREEK AT MOUTH																	
5/07/86	13:20	5.1	11.7	6.8	45	86.00	0.050	23.17	0.24	111.2	0.1	46.4	6	2781	10	1.0	464
5/28/86	18:30	16.5	8.4	6.3	19	60.50	0.024	7.83	0.30	97.8	0.1	32.6	36	11739	50	0.8	261
6/18/86	12:40	15.5	9.9	7.0	23	13.40	0.019	1.37	0.17	12.3	0.1	7.2	20	1444	126	1.1	79
7/02/86	08:30	15.8	8.5	7.2	23	6.55	0.032	1.13	0.31	10.9	0.1	3.5	86	3036	310	0.5	18
7/23/86	09:15	14.5	8.8	6.7	39	3.93	0.034	0.72	0.22	4.7	0.1	2.1	6	127	TNTC	1.1	23
8/06/86	11:00	15.1	8.5	6.6	29	3.57	0.078	1.50	0.26	5.0	0.1	1.9	4	77	90	0.9	17
8/28/86	08:10	14.4	7.8	6.5	75	2.24	0.050	0.60	0.25	3.0	0.1	1.2	4	48	86	1.4	17
9/24/86	16:00	10.6	10.1	7.3	59	5.82	0.047	1.47	0.26	8.16	0.1	3.1	2	63	159	0.9	28
MIN		5.1	7.8	6.3	19	2.24	0.019	0.72	0.17	3.0	0.1	1.2	2	48	10	0.5	17
MAX		16.5	11.7	7.3	75	60.50	0.078	7.83	0.31	97.8	0.1	32.6	86	11739	TNTC	1.4	454
MEAN		13.4	9.2	6.8	39	22.75	0.041	4.72	0.25	31.6	0.1	12.2	20	2414	229	1.0	113
STORET #2020188, STATION #6, AT AMERICAN RIVER AT MOUTH																	
5/07/86	12:40	3.9	11.7	6.4	49	400e	0.056	120	0.10	216	0.1	216	3	6468	30	0.4	862
5/28/86	19:00	14.7	9.0	6.3	19	260.0	0.039	55	0.30	420	0.1	140	27	37838	24	1.2	1682
6/18/86	13:20	15.9	9.6	7.5	23	63.9	0.006	2	0.02	7	0.1	34	12	4133	30	1.6	551
7/02/86	09:30	15.4	9.7	6.8	20	34.4	0.028	5	0.20	38	0.1	18	33	6119	110	0.3	56
7/23/86	09:45	14.3	9.2	6.9	26	30.4	0.015	2	0.12	20	0.1	16	4	655	175	1.3	213
8/06/86	11:50	17.6	8.3	7.0	28	15.3	0.068	6	0.22	18	0.1	8	4	330	37	0.8	66
8/28/86	08:50	13.7	9.9	7.0	34	10.2	0.036	2	0.20	11	0.1	6	2	110	24	1.3	72
9/24/86	16:30	9.8	9.8	7.5	59	25.8	0.018	2	0.16	22	0.1	14	2	278	50	0.8	104
MIN		3.9	8.3	6.3	17	10.2	0.006	2	0.10	11	0.1	6	2	6	24	0.3	56
MAX		17.6	11.7	7.5	59	400	0.068	120	0.30	420	0.1	216	33	37838	175	1.6	1682
MEAN		13.2	9.7	6.9	32	105	0.033	24	0.16	94	0.1	57	11	6991	60	1.0	450

TNTC = To Numerous To Count
e = Estimated Value