Water Quality Status Report EIRO NO. 112

Henry's Lake
Fremont County, Idaho
1993 - 1994

State Agricultural
Water Quality
Program
(SAWQP)

Yellowstone Soil Conservation District

Idaho Department of Health and Welfare
Division of Environmental Quality
April 1995

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Prepared by:

Steve Robinson
Eastern Idaho Regional Office
900 North Skyline
Idaho Falls, Idaho 83402

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Executive Summary

Henry's Lake is located in northern Fremont County in southeastern Idaho. It was converted from a shallow bog in 1923 when a 32 foot high dam was constructed. It is highly eutrophic and experiences frequent fish kills due to decreased dissolved oxygen levels in the lake.

High nutrient and sediment loading coming from the many tributaries is considered to be of concern to the fisheries in the lake. For this reason, a State Agricultural Water Quality Program (SAWQP) planning grant was obtained in 1992. Subsequent to this, water quality monitoring was performed by personnel from the Idaho Division of Environmental Quality during the summer seasons of 1993 and 1994 on some of the major tributaries to the lake and to the outlet on Henry's Lake Flat. A Phase I Clean Lakes Study was performed by a private contractor in 1992 and a final report is now pending.

From this study, it can generally be concluded that although there are some tributaries which are contributing large amounts of nutrients and sediment to the lake and the outlet, the lake appears to be flushing itself at a near normal rate. The lake is tending toward a highly eutrophic state and will continue to do so. Riparian restoration projects designed to allow for the trapping of sediment and reduction in water temperature appears to be the recommendation which would achieve the greatest return in increased water quality for the monies spent.

Introduction

Location and History

Henry's Lake is located in the northern tip of Fremont County in southeastern Idaho. Henry's Lake and its tributaries make up the headwaters of the Henry's Fork of the Snake River. The lake is an internationally recognized trout fishery and destination vacation location.

Henry's Lake was historically a shallow, boggy lake containing approximately 1,000 acre feet of water. In 1923, the North Fork Reservoir Company built a 32 foot high dam at the outlet which raised the lake to its present level. The 6,108 acre lake has an irrigation storage capacity of 90,420 acre feet, all of which is controlled by the North Fork Reservoir Company.

Historically the North Fork Reservoir Company has recognized the extended period of time required to fill the lake and has managed it to minimize drawdown of the lake. During drought conditions, such as have existed for the last several years, it is common for storage water to be carried over in Henry's Lake adverse to downstream water rights holders in order to maintain the level of the lake. (Nelson, 1993)

Tributaries

There are eleven major tributaries to Henry's Lake which include: Tygee Creek, Howard Creek, Targhee Creek, Pittsburgh Creek, Hatchery Creek, Wild Rose Creek, Timber Creek, Gillan Creek, Kelly Creek, Duck Creek and Hope Creek.

There are five major tributaries to the Henry's Lake Outlet above the Big Springs Road which include: Twin Creek, Jesse Creek, Jones Creek, Stephens Creek and Meadow Creek.

Watershed Description

Land Use

The Henry's Lake watershed encompasses about 111,000 Acres. At present, land uses around Henry's Lake and on Henry's Lake Flat consist primarily of recreation and recreational property and livestock grazing. The Natural Resource Conservation Service (NRCS) estimates that 70 percent of the land adjacent to the lake is grazed by livestock; 25 percent is used for recreational purposes and 5 percent is either state or county parks. (NRCS, 1991)

There are presently over 1000 homes around the lake and on the Flat. The majority of these homes are recreational and are inhabited from 2-5 months of the year. (NRCS, 1991) Most of these homes use individual subsurface disposal systems which may be a potential source of contaminants to the lake. (NRCS, 1991) The Natural Resource Conservation Service 1991 Preliminary Investigation report notes that the soil types and presence of a high water table in much of the area indicates a very high likelihood that these disposal systems are contributing nutrient and possibly chemical contaminants to the lake, its tributaries and the Henry's Lake Outlet.

Land Ownership

Listed are the approximate acreages of the various types of land ownership as identified by the Yellowstone Soil Conservation District:

US Forest Service	76,000 Acres
Private	20,000 Acres
Idaho Department of Lands	6,680 Acres
Lake Surface	6,028 Acres
Bureau of Land Management	1,585 Acres
Idaho Dept. of Parks and Recreation	585 Acres
Fremont County	22 Acres

Pollutant Sources and Associated Problems

The NRCS 1991 report identified three problem areas within the project boundary (NRCS, 1991):

1. Recent fish kill in Henry's Lake and the possibility of future kills resulting from inadequate amounts of dissolved oxygen.

2. Reduced salmonid spawning capability of the lake and its tributaries due to water quality and quantity degradation and siltation of spawning beds.

3. Reduced ability of the lake and its tributaries to support cold water biota due to water quality degradation.

The NRCS reported that the problems associated with Henry's Lake, its tributaries and the Outlet are related to the introduction of nutrients and sediment into the system, resulting in adverse impacts to water quality and fish habitat. Other concerns include temperature, bacteria and fluctuating water levels.

The NRCS also reported that the sources of pollutants include failing subsurface sewage disposal systems, livestock grazing impacts including degraded riparian vegetation, stream bank erosion and animal wastes in the tributary streams as well as lake shore erosion. Impacts from these pollutants have been severe. Most notably was the 1990-91 fish kill which resulted from depleted dissolved oxygen levels in Henry's Lake. While Henry's Lake has a history of recorded fish kills since the 1950's, it is believed that the frequency and severity of the events precipitating the fish kills (low dissolved oxygen levels, shallow water, etc.) are getting worse. Another fish kill is expected in the near future. This prediction is based on steadily declining levels of dissolved oxygen in the lake. Sources of pollutants from forested land were thought to be minor within the project boundary. (NRCS, 1991)

The NRCS 1991 report also states that livestock grazing and related agricultural practices along the lake and its tributary streams are degrading the condition of the water in several ways. Grazing impacts to riparian and wetland areas along the streams are moderate to severe. Accelerated erosion along the streams and the lake shore were also identified at least in part as a result of direct animal access and grazing. Dewatering occurs in some of the streams as a result of diversions for pasture irrigation (NRCS, 1991).

Siltation and reduced vegetative cover in spawning streams have also impacted fishery resources in the area. Habitat problems identified during the 1991 Preliminary Investigation include: low flows during migration of fry back to the lake and during spawning runs, embedded spawning areas, lack of cover and high water temperature. (NRCS, 1991) All of these habitat impacts are directly related to grazing and irrigation practices within the project boundary. (Nelson, 1993)

Methods

Monitoring Stations

In October, 1992, an interagency group conducted an evaluation of the stream/riparian habitats on Duck Creek, Howard Creek, Timber Creek, Hope Creek and Targhee Creek. The work was performed in accordance with DEQ's Water Quality Monitoring Protocol, Report No. 4, Protocols for Evaluation and Monitoring of Stream/Riparian Habitats Associated with Aquatic Communities in Rangeland Streams. The results of this monitoring was used as a basis for selecting stations for the additional monitoring that was done in 1993 and 1994. The following is a summary of their findings:

Hope Creek - The reach of the stream from the Forest Boundary through the corral area is generally in poor condition. Diversions reduce the flow by as much as 80 percent of the original volume. Streambank erosion is severe. The reach from below the corrals to the lake are generally in good to excellent condition, but exhibit little habitat diversity. Streambank erosion is a minor problem.

Duck Creek - The upper reaches, but below the Forest Boundary are characterized by old beaver complexes. No new beaver activity is evident. The water table in the area appears to be at a lower level than when the beaver were active in the area. The lower reaches are also characterized by a few old beaver complexes. These are also out of the water channel due to lowering of the water table. Many irrigation diversion structures are also prevalent.

Timber Creek - The channel is generally shallow and wide. It extends through a pond, which seems to trap most of the sediment originating upstream of the Forest Boundary, onto a flatter boggy area characterized by many small springs and heavy grazing activity. An irrigation diversion greatly reduces flow. The stream then meanders through a pasture area and finally enters the lake. The overall stream condition is poor.

Targhee Creek - The overall riparian condition of the stream gradually degrades as it travels from the headwaters to the lake. The upper reaches are generally more stable and higher gradient while the lower reaches are of less gradient and gradually become more unstable in both bank and substrate conditions.

Howard Creek - The stream is generally in poor condition from the Forest Boundary to a point about one mile below Hiway 287. At this point, the stream is dewatered until it enters the vicinity of the lake where subsurface water constitutes the majority of the flow. Large portions of the lower reaches have recently been excluded from livestock grazing and in these areas, the stream condition seems to be improving.

In conjunction with the inventory, stations locations were chosen by DEQ and NRCS to differentiate pollutant sources entering Henry's Lake. Upper sites were selected at a point at or near the Forest Service boundary or at the source of the stream. Lower sites were selected at the point immediately above where the streams enter the lake.

During the 1993 field season, the following stations were monitored:

Meadow Creek at the Mouth
Meadow Creek at the Spring
Henry's Lake Outlet below the Dam
Henry's Lake Outlet at the Big Springs Bridge
Hope Creek at the Mouth
Hope Creek above Moedl's Corrals
Targhee Creek at the Mouth
Targhee Creek at the Forest Boundary
Timber Creek at the road above the lake
Timber Creek at the spring
Howard Creek at the Mouth
Howard Creek at the Fountain
Duck Creek at the Mouth
Duck Creek just above Rock Creek
North Fork Duck Creek above the Forest Boundary
Rock Creek just above Duck Creek

During the 1994 field season, the two stations on Timber Creek were dropped. It was felt by both The Division of Environmental Quality (DEQ) and NRCS that these stations were not contributing to the nutrient and sediment loading to the lake to any great extent and should therefore be discontinued. It was also felt that more emphasis should be placed on Henry's Lake Flat and consequently three more stations were added in that area (see the area map in Appendix A for actual site locations on each stream):

Jesse Creek above the Forest Boundary
Jesse Creek above Jones Creek
Garner Creek at the spring

Monitoring Parameters

The following parameters were either measured in the field or were sampled and sent to the Health and Welfare Laboratory for analysis:

Field Measurements

- pH
- Temperature
- Water Column Dissolved Oxygen
- Discharge

Lab Analyzed

- Total Suspended Sediment
- Ammonia (NH_3 - N)
- Nitrate (NO_3 - N)
- Total Kjeldahl Nitrogen
- Total Phosphorous
- Dissolved Ortho Phosphate
- Fecal Coliform Bacteria
- Fecal Streptococcus Bacteria

During the 1993 field season, six sites were selected for macroinvertebrate analysis using the rapid bioassessment protocol Report No. 5, Protocols for Assessment of Biotic Integrity (Macroinvertebrates) for Wadable Idaho Streams (Clark and Maret, 1993). These included:

- Duck Creek approximately 200 meters above the mouth
- North Fork Duck Creek at the Forest Boundary
- Meadow Creek at the Mouth
- Meadow Creek at the Spring
- Targhee Creek at the Mouth
- Targhee Creek at the Forest Boundary

During the 1994 field season, ten sites were selected for macroinvertebrate analysis and habitat condition analysis using the Beneficial Use Reconnaissance Program protocol Report No. 7, Protocols for Conducting Use Attainability Assessments for Determining Beneficial Uses to be Designated on Idaho Stream Segments (Maret and Jensen, 1991). These included:

Duck Creek at the Mouth
North Fork Duck Creek at the Forest Boundary
Targhee Creek at the Mouth
Targhee Creek at the Forest Boundary
Meadow Creek at the Mouth
Meadow Creek at the Spring
Jesse Creek above the Forest Boundary
Jesse Creek above Jones Creek
Garner Creek at the Springs
Howard Creek at the Fountain

Parameter Monitoring Methods

The methods and instrumentation used to measure the four field parameters were as follows:

pH - Temperature	An Extech "Oyster" Conductivity, pH, Temperature meter was used to measure both pH and temperature. It was calibrated according to the manufacturers specifications prior to each sampling run.
Dissolved Oxygen	A YSI Model 51B dissolved oxygen meter was used. It was calibrated at every other sampling station according to manufacturers specifications.
Discharge	A Marsh-McBirney Flowmate Model 2000 flow meter was used. Velocity and depth were taken at 1 foot intervals across the wetted width of the stream and discharge was calculated from those measurements. The Outlet at the Big Springs Bridge was measured at three foot intervals due to the large width. All velocity measurements were taken at 0.6 of the depth. The flow meter was calibrated according to manufacturers specifications prior to each sampling run and spot checked several times during each run.

The parameters requiring laboratory analysis were collected as follows:

Ammonia as N
Nitrate as N
Kjeldahl Nitrogen as N
Total Phosphorus as P

A sample was collected from the stream via a churn splitter. The sample was then churned 3 times and a 500ml cubitainer was filled. This was then treated with 2ml H_2SO_4 and cooled to 4°C and shipped in a cooler to the laboratory for analysis.

Total Suspended Sediment

From the same churn splitter mentioned above, the sample was again churned 3 times and another 500ml cubitainer was filled. This was then cooled to 4°C and shipped in the same cooler to the laboratory for analysis.

Dissolved Ortho Phosphate

A filtering apparatus was rinsed with 250ml distilled water. A filter was then placed in the apparatus and the rinsing repeated using 200ml distilled water. A 100ml sample was placed into the filtering apparatus from the churn splitter. Suction was then applied to the apparatus and the sample was filtered. The filtrate was then placed in a cubitainer and cooled to 4°C and shipped in the same cooler to the laboratory for analysis.

Fecal Coliform Bacteria
Fecal Streptococcus Bacteria

Using a sterile 200ml container, being careful not to contaminate the interior of either the lid or the container, a sample was taken from the stream. This sample was then cooled to 4°C, placed in a cooler and delivered to the District Seven Health and Welfare Laboratory for analysis.

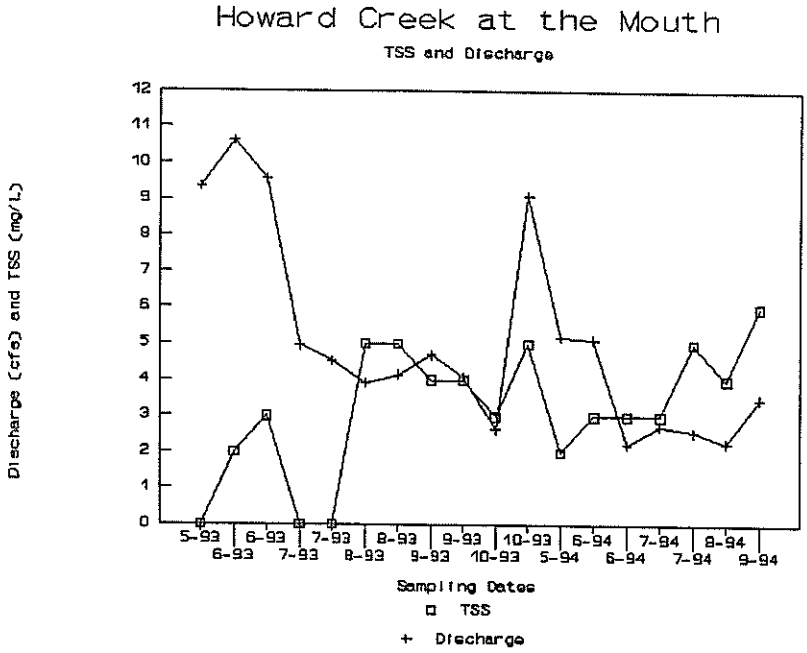
Macroinvertebrates

The macroinvertebrate samples collected in 1993-94 were collected according to the methods outlined in Water Quality Monitoring Protocols Report No. 5, Protocols for Assessment of Biotic Integrity (MacroInvertebrates) for Wadable Idaho Streams, (Clark and Maret, 1993), using a Hess sampler with a 500μm mesh screen and bucket. A minimum two minute effort was used to gather each sample.

Results and Discussion

Discharge and Total Suspended Solids

Figure 1



In Figure 1 above, there is a minor relationship between discharge and Total Suspended Solids (TSS) at the above station, especially when flows were at their highest. The peak flows appeared in early 1993 and late 1993. High flows in 1994 were about the same as base flows in 1993. This would indicate that 1994 was a much drier year than 1993. There was no evidence of livestock grazing in the immediate area of the station during any of the sampling events.

In the figure 2 below, there was no relationship between discharge and TSS. Discharge rates appeared to be consistent coming from the spring. The discharge rates in 1994 were also lower than those in 1993, indicating 1994 to be a drier year. The spikes in the TSS samples cannot be explained. There were never any grazing activities in the area, however, tourists visiting the fountain could possible account for the high

numbers in TSS. Generally, the discharge was so low that sample collection was difficult. Suspended sediment could have been artificially introduced into the sample by means of the collection methods.

Figure 2

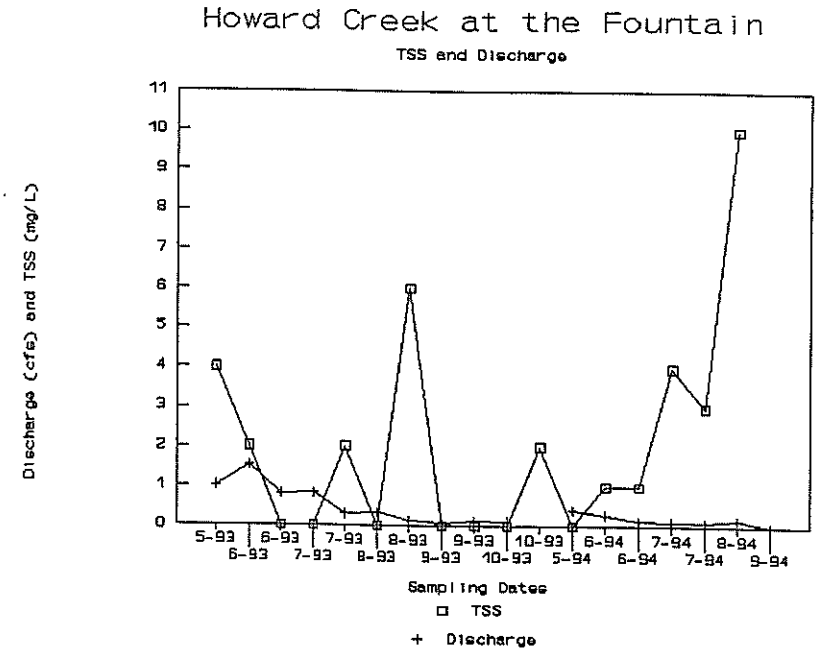


Figure 3

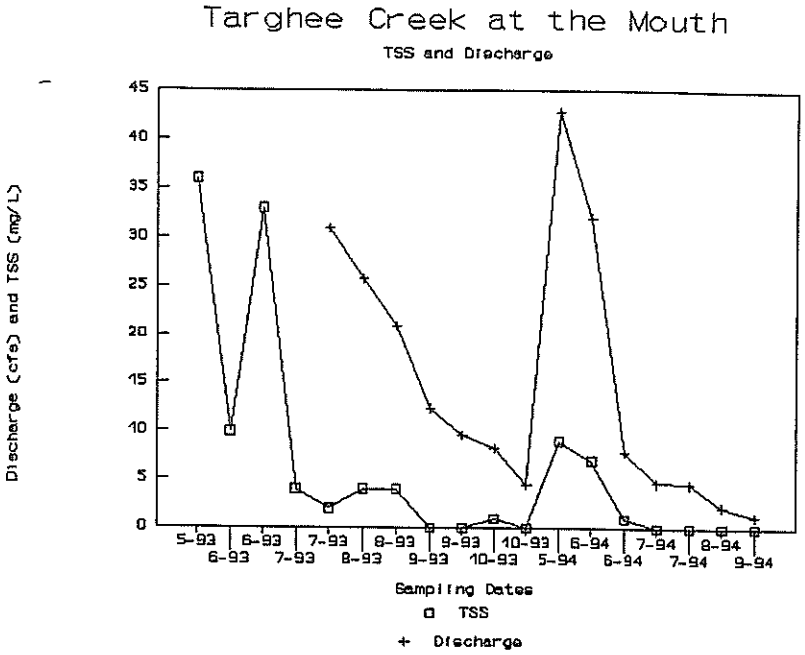
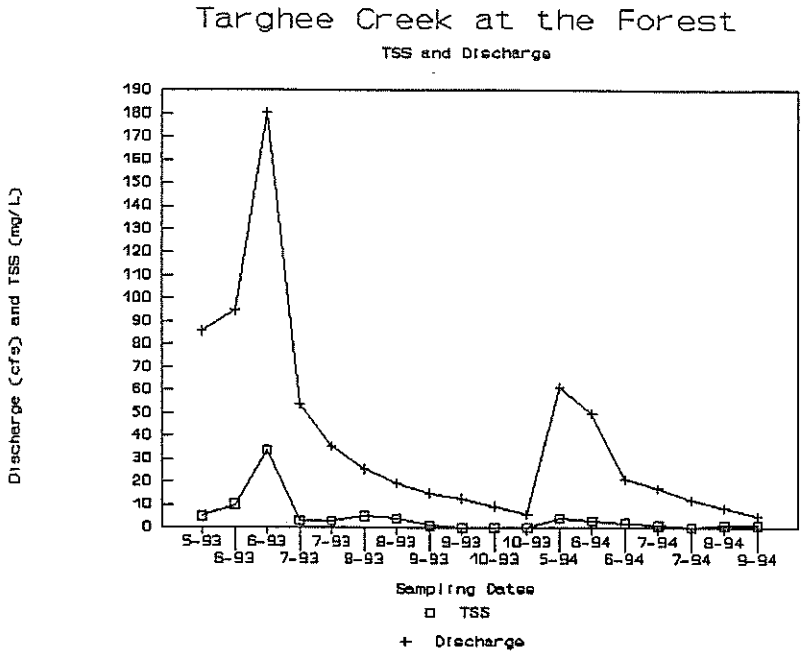


Figure 3 above represents Targhee Creek at the Mouth. There appears to be a good relationship between discharge and TSS, especially during times of high runoff. Livestock activity was again non existent in the immediate area of the station. There was some grazing activity several thousand meters above the station, but none was directly noted during any of the sampling events.

Figure 4



The station at upper Targhee Creek (see Figure 4) again exhibited a strong relationship between discharge and TSS, especially during the periods of highest flow. Again note that the peak flows in May and June of 1994 were less than half those for the same period in 1993. This also would indicate a much drier water year in 1994.

The lower Timber Creek station (see Figure 5 below) was only sampled during 1993. It cannot, therefore, be compared to 1994, however, for 1993 there was not a direct relationship between the discharge rates and the amounts of TSS. There was evidence of heavy grazing activities immediately above the station and this could account for all of the TSS found in the samples. The stream at this point does not exhibit high gradient nor high flow velocities which would indicate that any sediment being carried from higher up in the drainage basin would have been deposited prior to reaching the station.

Figure 5

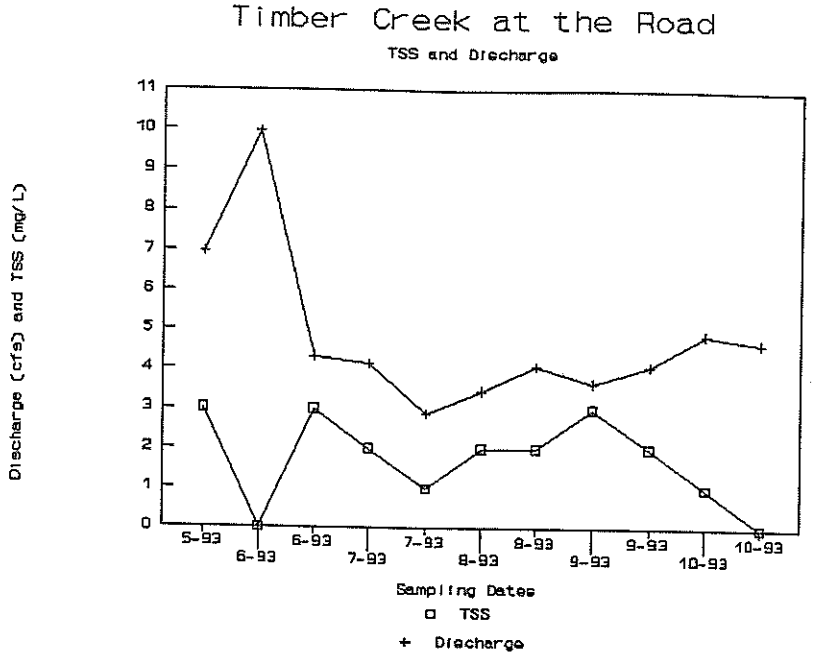
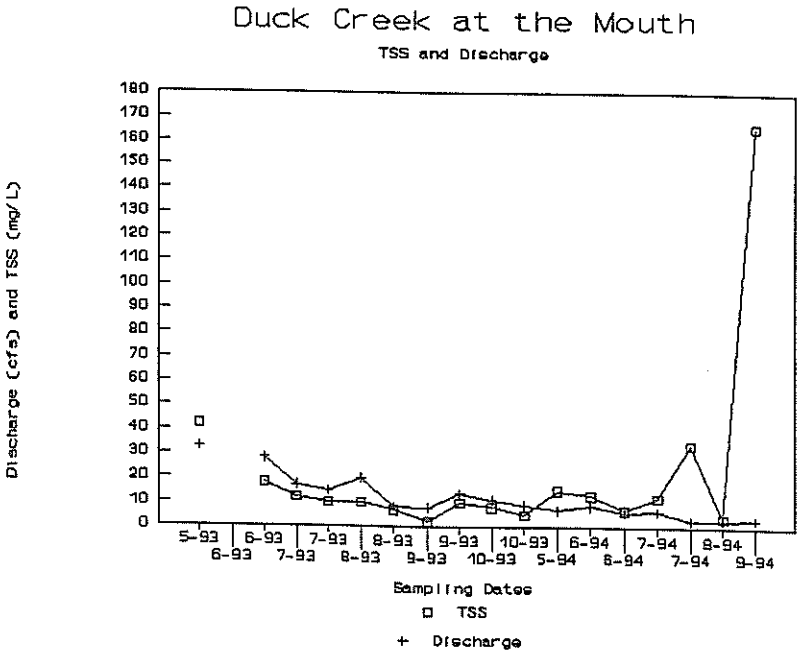


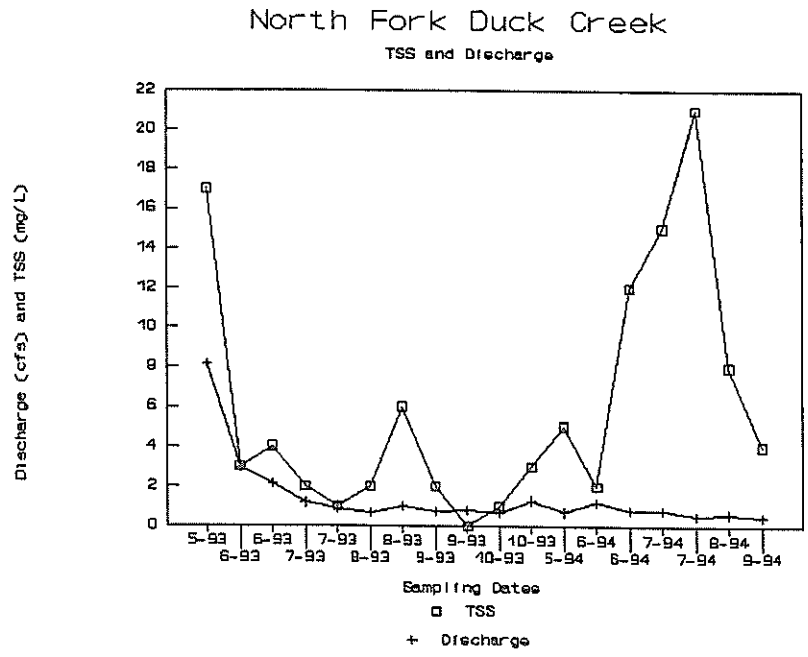
Figure 6



The lower Duck Creek station (see Figure 6 above) does exhibit a minor relationship between discharge and TSS. The spikes in the TSS numbers appearing late in 1994 were probably due to the heavy grazing activity taking place immediately upstream from the station. In September, 1994, There were cattle in the stream within 50 meters upstream of the station. The water at that time was extremely turbid. This was also the case in late July, 1994. This was the only time in which the recommended 100 mg/L TSS was exceeded during the entire monitoring.

The only positive relationship which can be found at the upper Duck Creek station (see Figure 7 below) is that which exists between the number of cattle camped in the stream and the amount of TSS found in the samples. It is easy to determine that the area above the Forest Service Boundary is grazed most often in May and September each year. Flows were generally low throughout both seasons, however, there was a lack of spring runoff in 1994.

Figure 7



At the Duck Creek station just above Rock Creek (see Figure 8 below), there was a strong relationship between discharge and TSS in early 1993, but not in 1994, due to the drier conditions. Grazing activity occurred sporadically immediately above the station and does not seem to be a factor in the amount of TSS here.

Figure 8

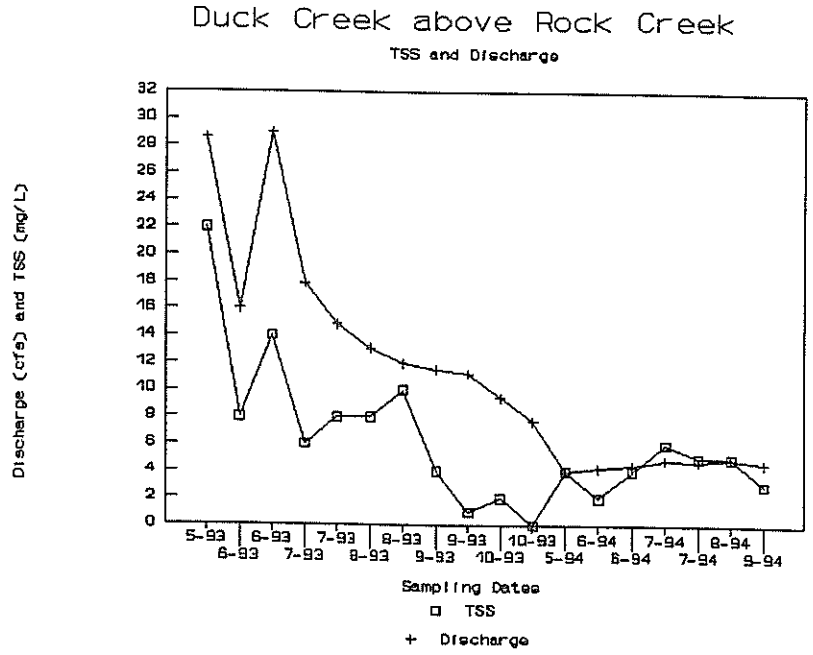
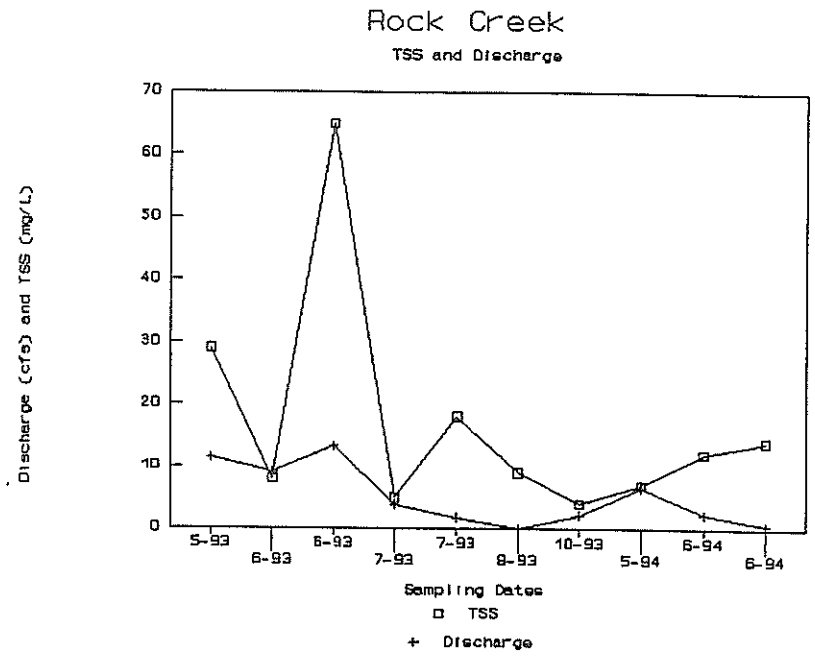


Figure 9



Rock Creek appears to have only minor consistencies between discharge and TSS. It should be noted that some or all of the flow in Rock Creek is generally diverted for irrigation purposes at various times each year.

Figure 10

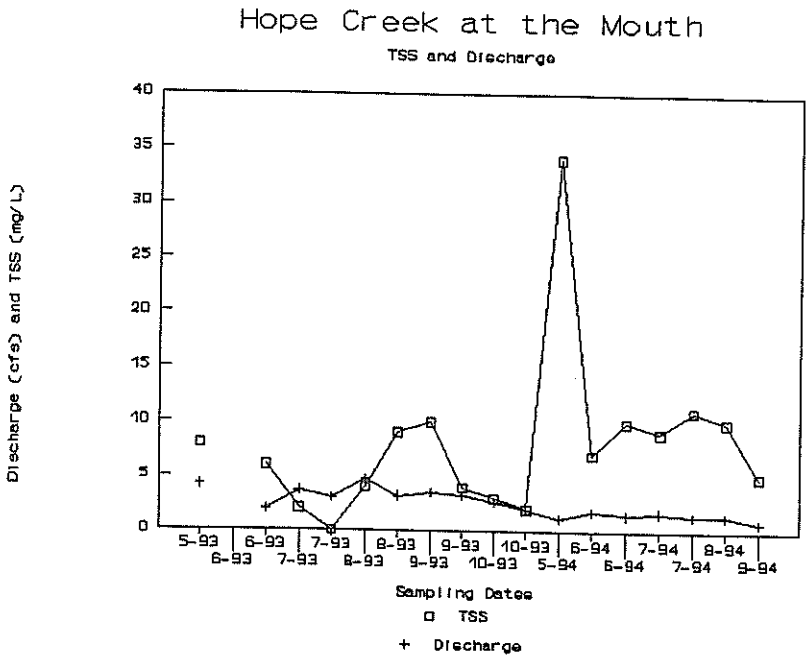
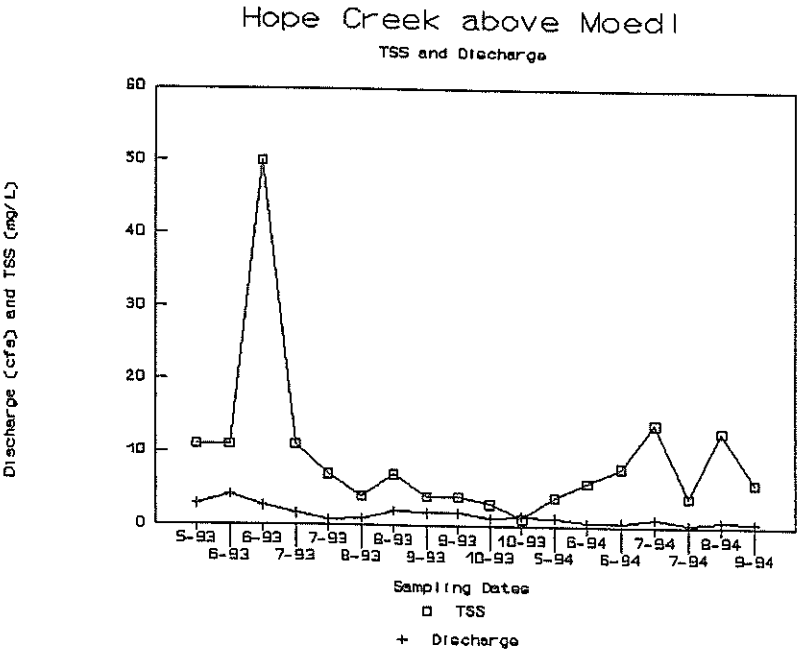
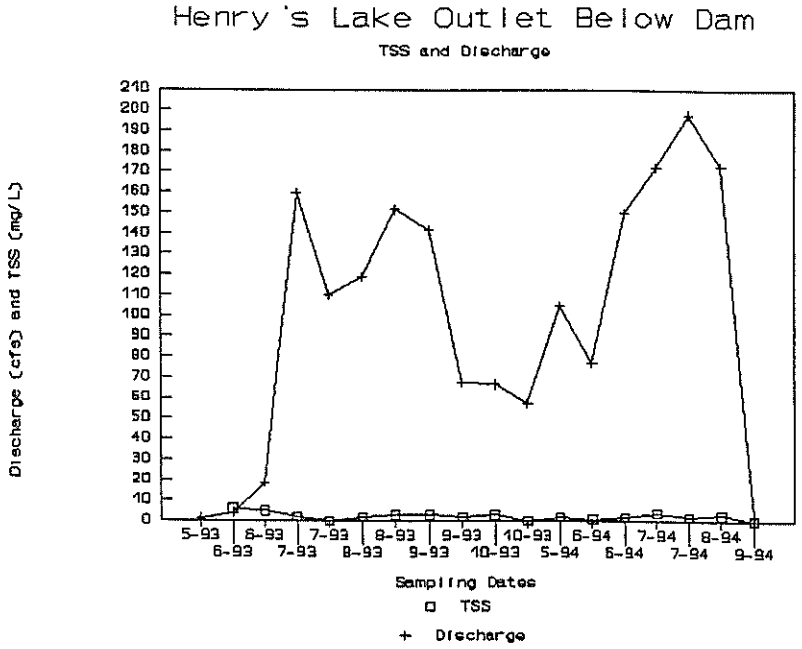


Figure 11



The only relationship found at the two Hope Creek stations (see Figures 10 and 11 above) seem to again be associated with the level of livestock activity. The upper station is located in an area of occasional heavy horse activity while the lower station is heavily grazed by cattle at various times. These times seem to be consistent with the peaks in TSS on both graphs.

Figure 12



The amount of TSS in the samples from the Henry's Lake Outlet (see Figures 12 and 13 above and below) seem to indicate that most of the suspended particles are being deposited and held in the lake. The amount of TSS at the upper station could be attributed to cattle activity in the river in the vicinity of the station while the amount of TSS at the lower station could be attributed to the tributaries entering the river. The differences found in discharge between the two stations could be attributed to errors in measurement at the lower station as well as differing flow conditions of the tributaries. The

discharge measurements for the upper station was obtained from the U.S. Geological Survey gaging station located approximately 50 meters below the station.

Figure 13

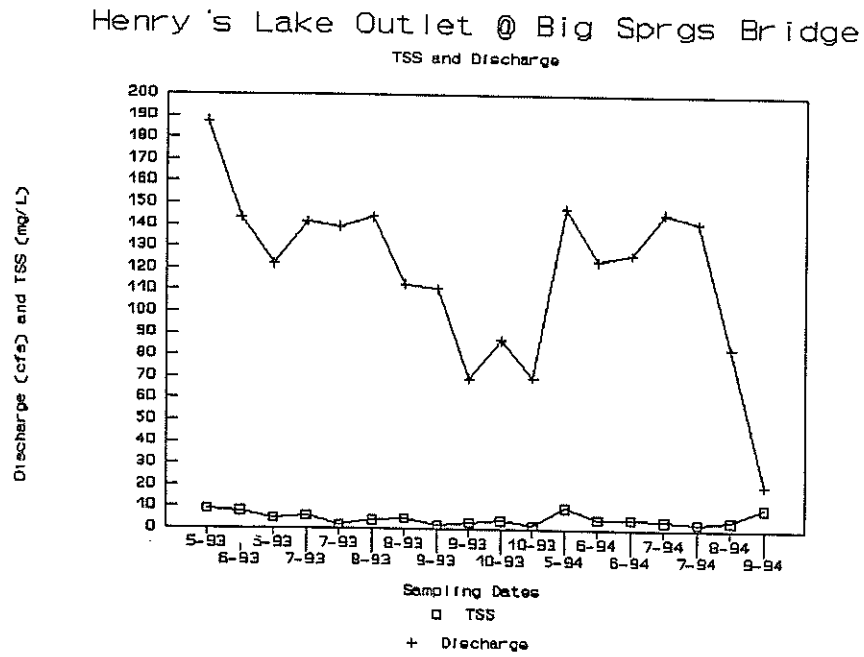
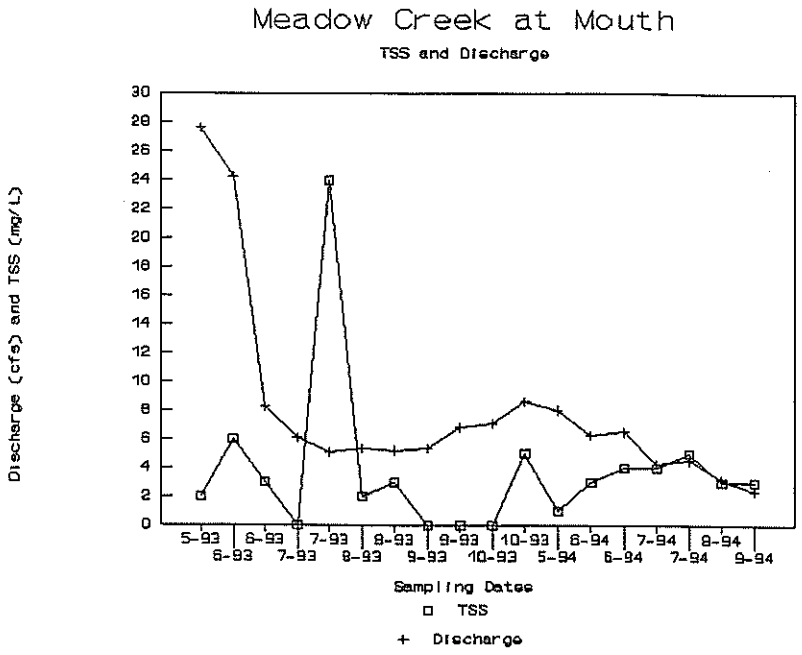
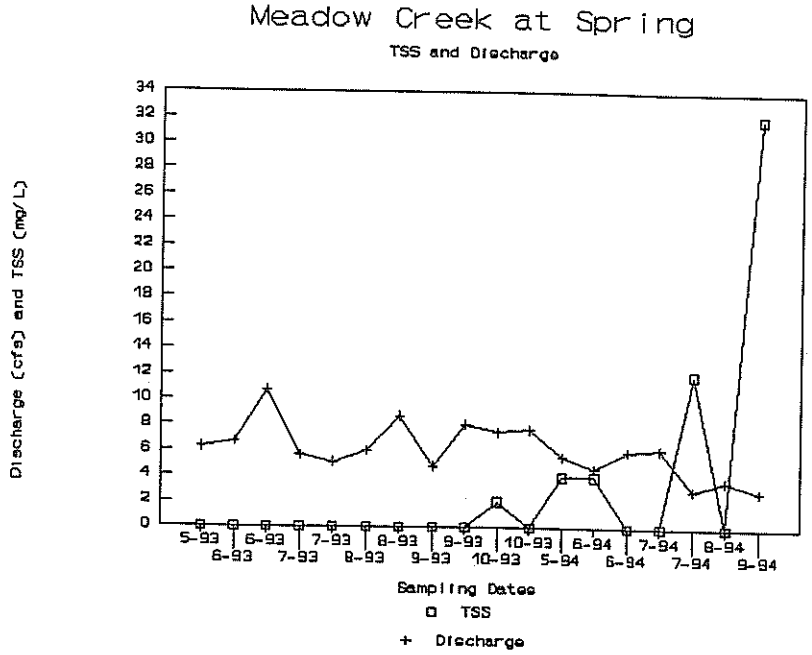


Figure 14



The two Meadow Creek stations (see Figures 14 and 15 above and below) seem to again show a relationship between TSS and grazing activity. Both stations receive heavy grazing activity several times throughout the year. The lower station primarily during mid summer months and the upper station primarily later in early fall.

Figure 15



The lower Jesse Creek station and the Garner Creek station are both located on private ground and are heavily grazed throughout the summer months (see Figures 17 and 18 below). This probably accounts for all of the suspended sediment in the samples. The upper Jesse Creek station (see Figure 16 above) is located on a Forest Service grazing allotment and is generally utilized during late summer months. Dewatering activities are also prevalent on Jesse Creek. This might account for the lower discharge volumes at the lower site. The lower site is also channelized. A canal was constructed many years ago and the entire volume of Jesse Creek has been diverted into the canal. The old channel is still visible some distance away, but is normally dry except for sub water during the spring and early summer months. Garner Creek is fed by two springs approximately 100 meters apart. The station was located 25 meters below the junction of the two spring channels.

Figure 16

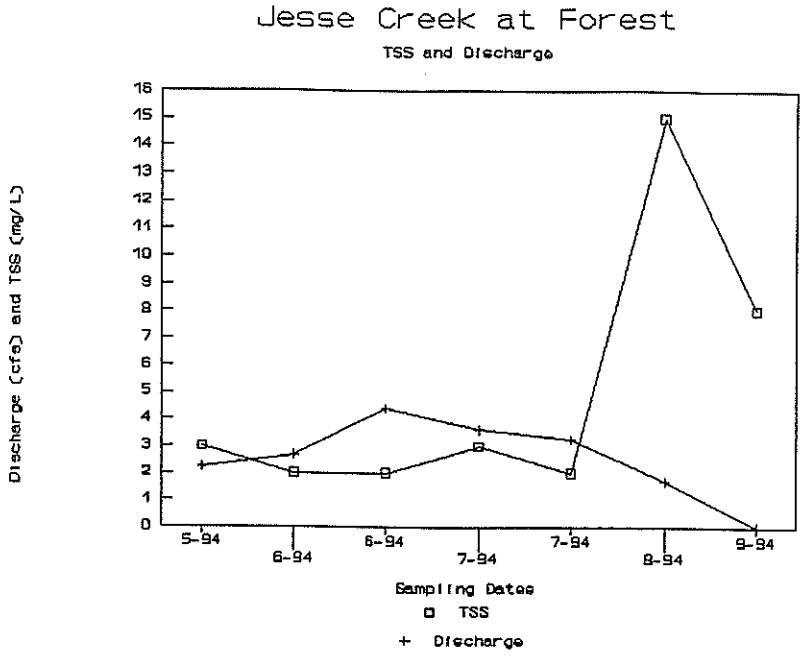


Figure 17

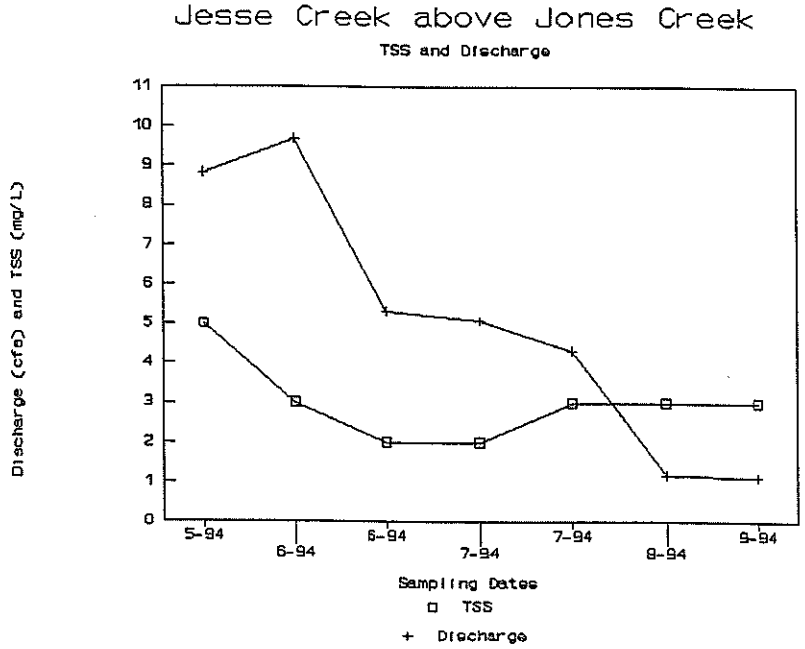


Figure 18

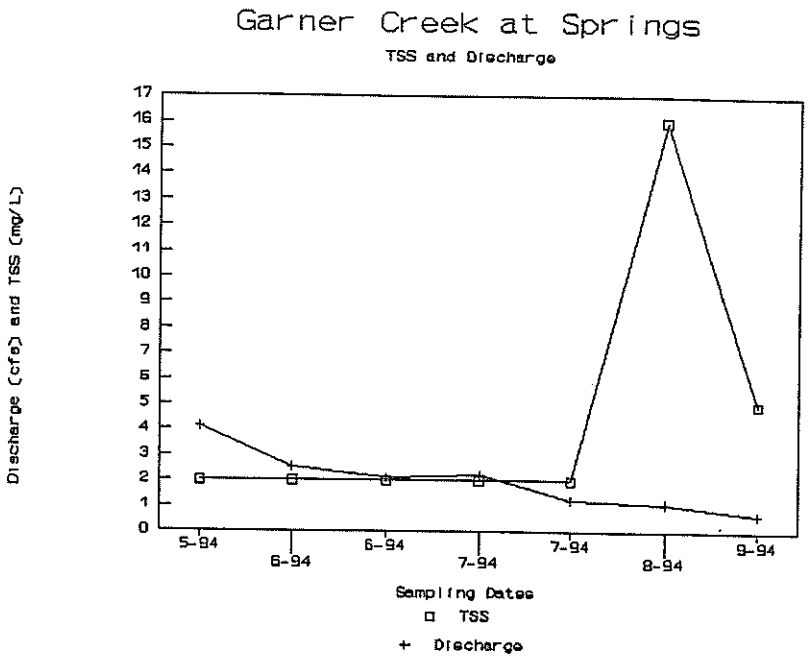
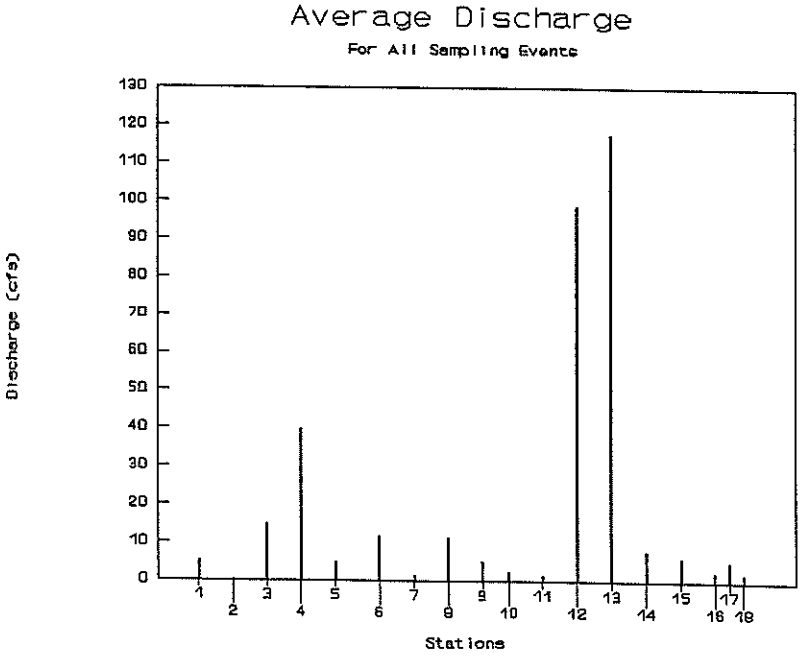


Figure 19



The stations numbers indicated on Figures 19 through 26 are associated with the following stations:

Station Number	Station Name
1	Howard Creek at the Mouth
2	Howard Creek at the Fountain
3	Targhee Creek at the Mouth
4	Targhee Creek at the Forest Boundary
5	Timber Creek at the Road
6	Duck Creek at the Mouth
7	North Fork of Duck Creek
8	Duck Creek above Rock Creek
9	Rock Creek
10	Hope Creek at the Mouth
11	Hope Creek above Moedl's Corrals
12	Henry's Lake Outlet below the Dam
13	Henry's Lake Outlet at Big Sprgs Bridge
14	Meadow Creek at the Mouth
15	Meadow Creek at the Spring
16	Jesse Creek on the Forest
17	Jesse Creek above Jones Creek
18	Garner Creek at the Springs

Figure 19 above shows the average discharge over all sampling events. Other than the Henry's Lake Outlet, upper Targhee Creek (number 4) had the highest average discharge over both sampling years.

Figure 20

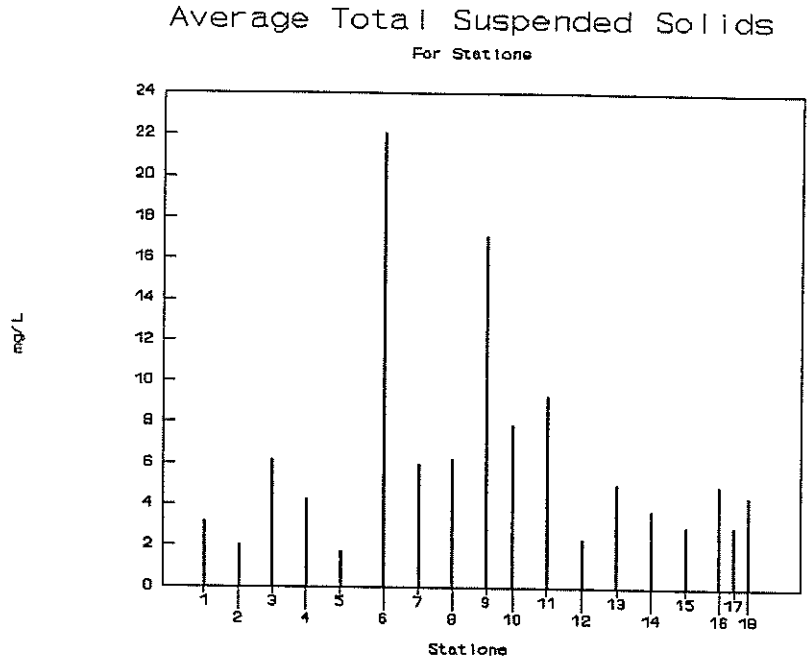
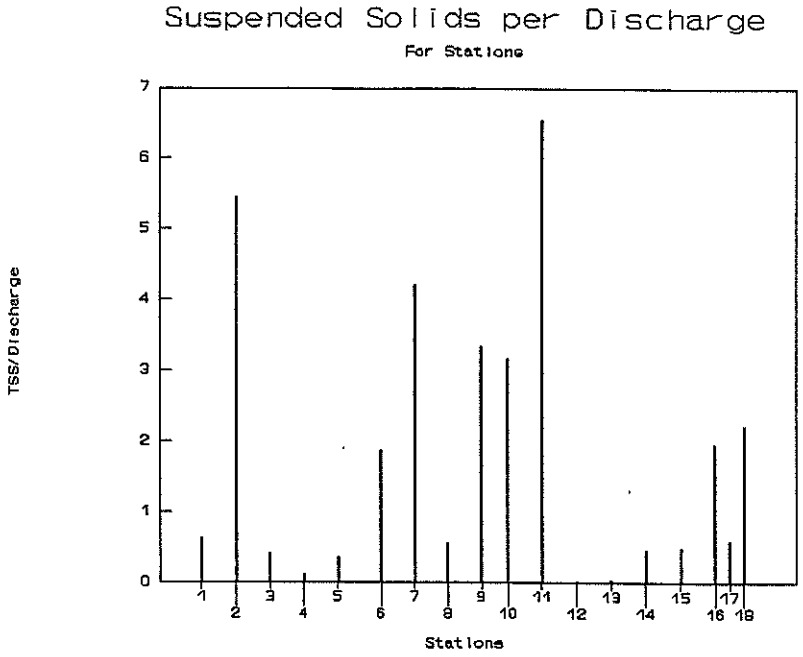


Figure 20 shows the average Total Suspended Solids being delivered by each stream. These are the average over all sampling events. This indicates that on average, Duck Creek and Rock Creek were delivering the highest amounts of suspended solids.

Figure 21 below depicts the amount of suspended solids being delivered as a function of unit of discharge. This graph would indicate that, in descending order, upper Hope Creek and upper Howard Creek were delivering the greatest amount of suspended solids per unit of flow. Lower Duck Creek and lower Targhee Creek, while delivering large amounts of suspended sediment overall, were near the lower end of the spectrum per unit of discharge. At the lower stations, Hope Creek (number 10), Duck Creek (number 6) and Howard Creek (number 1) were delivering the largest amounts of TSS per unit of flow to the lake.

It should be noted that the bottom substrate of these three streams is primarily fine silt. The bottom substrate of the remainder of the lower sites of the streams entering the lake is a mix of silt, sand and fine to coarse gravels.

Figure 21



Average Daily Load (TSS and Nutrients)

By calculating the daily load per discharge and then averaging these over the entire monitoring event, the average load in kg/day are found. Figures 22, 23, 24, 25 and 26 depict the results of these calculations for ammonia, nitrate, Kjeldahl (TKN), total phosphorus and TSS.

Figure 22

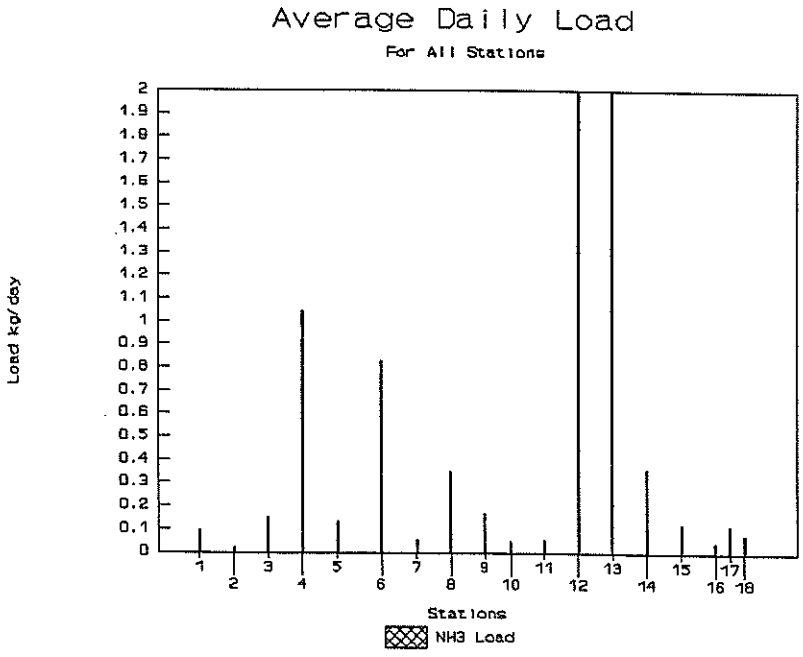


Figure 23

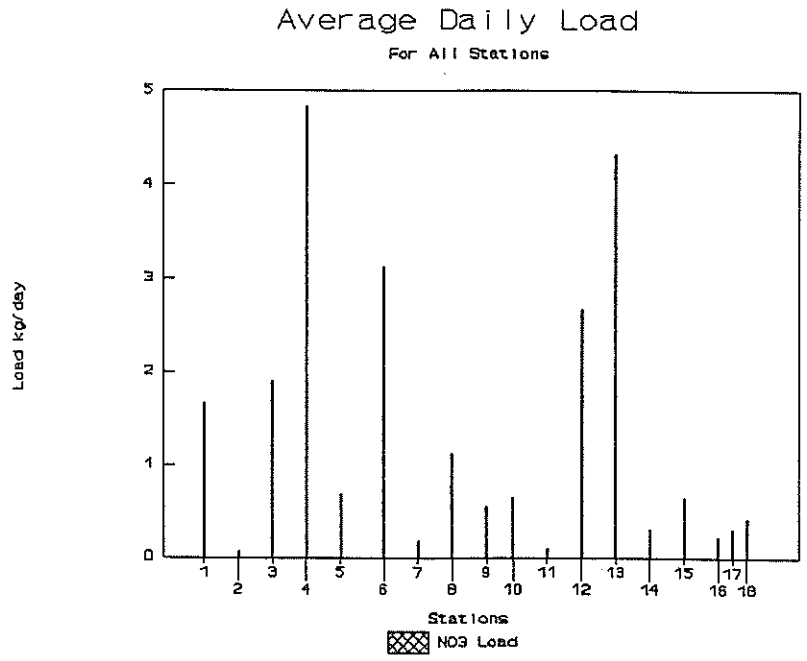


Figure 24

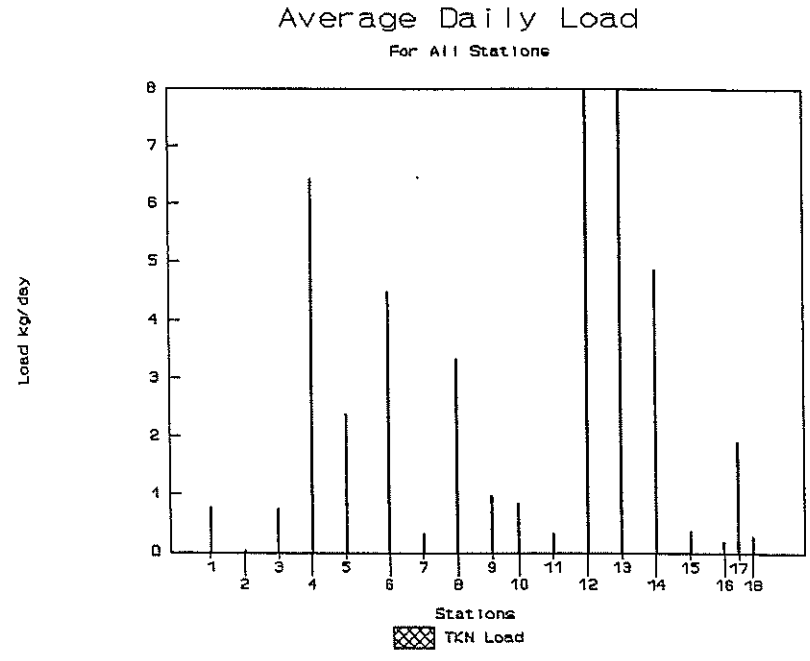


Figure 25

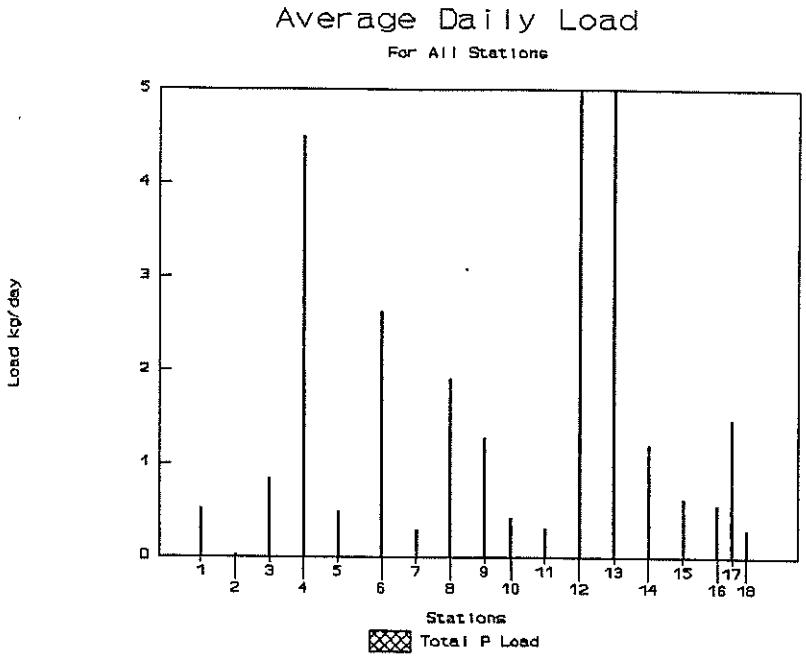
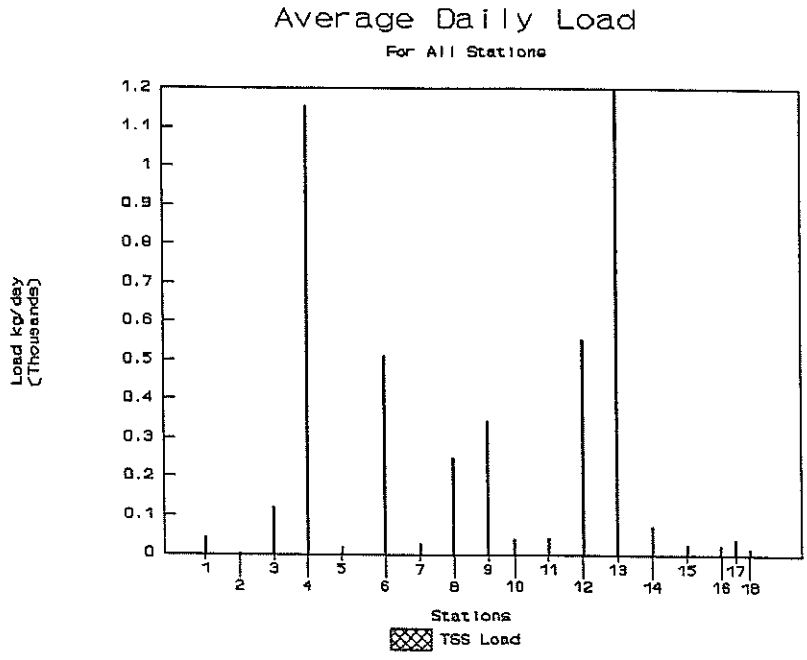


Figure 26



Nitrogen is a primary plant nutrient and is applied in various forms to agricultural lands. The four most common forms are nitrate, nitrite, ammonia and total Kjeldahl nitrogen (TKN). Because nitrate and nitrite are rapidly interchanged in nature, only nitrate was analyzed. TKN was used to determine the amount of organic nitrogen present. This method does not distinguish between organic forms and ammonia so ammonia was analyzed for so organic nitrogen could be found.

Phosphorus is another primary plant nutrient. Most phosphorus is bound to soil particles making it unavailable for plant use. However, a small percentage is water soluble and is available for plant use as dissolved ortho-phosphate.

The following tables summarize the loading graphs above. Table 1 lists those streams contributing to the nutrient and sediment balance of the lake.

Table 1 - Nutrient levels entering Henry's Lake

Streams In	NH_3	NO_3	TKN	Tot P	TSS
Howard Creek	0.091	1.652	0.782	0.521	40.728
Targhee Creek	0.152	1.901	0.753	0.845	118.822
Timber Creek	0.135	0.688	2.380	0.489	18.713
Duck Creek	0.828	3.119	4.487	2.629	510.156
Hope Creek	0.048	0.635	0.853	0.413	38.124
Total In(kg/day)	1.254	7.995	9.255	4.897	726.543
Total Out(kg/day	5.904	2.651	78.014	12.832	554.392
Net Gain To Lake	-4.650	5.344	-68.759	-7.935	172.151

Table 2 summarizes the nutrient and sediment balance as it relates to those amounts entering the Henry's Fork Outlet via the Henry's Lake Dam and various tributaries as compared to those amounts leaving the Henry's Lake Flat at the Big Springs Bridge.

Table 2 - Nutrient levels leaving Henry's Lake Flat

Streams In	NH_3	NO_3	TKN	Tot P	TSS
Outlet	5.904	2.651	78.014	12.832	554.392
Jesse Creek	0.118	0.303	1.920	1.472	39.811
Meadow Creek	0.360	0.309	4.869	1.207	71.731
Total In(kg/day)	6.382	3.263	84.803	15.511	665.934
Total Out(kg/day	4.531	4.320	59.513	19.885	1483.950

From Table 1 above, it can be seen that on average, Duck Creek is contributing the largest amounts of both nutrients and sediment to the lake. All parameters are at least twice the amounts of the next highest stream. Duck Creek and its tributaries are contributing over 70 percent of the TSS of all streams sampled. Second highest in nearly all parameters is Targhee Creek. It should be noted that the numbers above are only those of the stations located at the mouth of those streams. For the percentages of each parameters at any upper sites on these streams or any tributaries of these streams, see the Figures immediately above Table 1. It would appear that the outflow of nutrients from the lake exceeds inflows for ammonia, TKN and total phosphorus. However, inflows of total suspended sediment and nitrate appear to exceed outflow.

From Table 2 above, it can be seen that, of the loadings calculated at the Big Springs Bridge, Henry's Lake is contributing the vast majority of both nutrients and sediment being delivered downstream. The tributaries, both monitored and unmonitored, are contributing the remainder, to a much lesser extent.

If the load per day is carried out over a year, the following is determined:

Net Gain to Henry's Lake

TSS 172.151 kg/day * 2.21 bs/kg * 1 ton/2000 lbs * 365 days/year
= 69.12 tons per year gain in Suspended Solids in the lake

It must be noted here that this is only an estimate. It does not take into account seasonal variation in flows. It assumes that the average loading taking place over the duration of the sampling takes place over the entire year. This was only done to gain perspective about what may be taking place. If the same calculations are performed on the nutrients, it may be shown that the lake may actually be flushing itself of the nutrients transported to the lake by the tributaries.

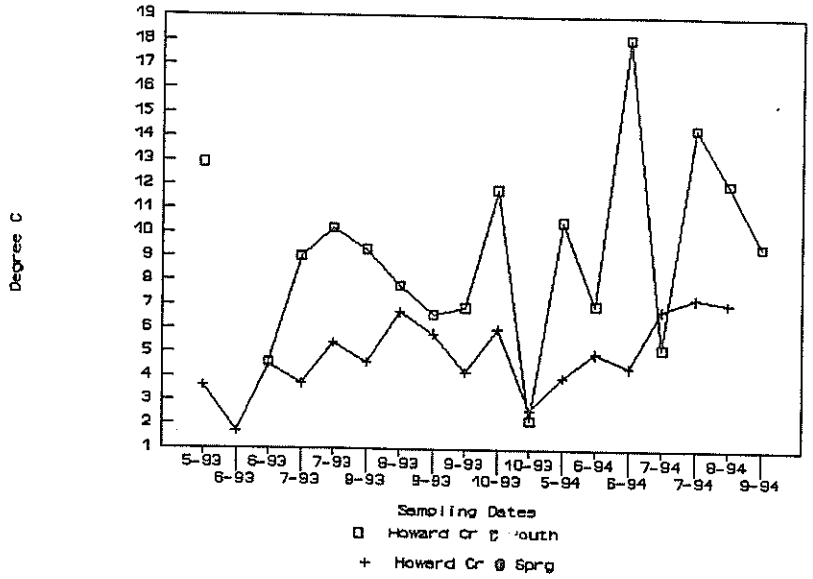
It can also be noted that nearly three times the amount of suspended solids leaving the lake are passing the Big Springs Bridge, yet the tributaries to the Outlet which were sampled only account for a small percentage of this. The amount of total Phosphorus at the Bridge is also higher than the total of the lake contribution combined with the tributary amounts. This may leave someone to wonder where the Outlet is picking up the additional solids and phosphorus between the Dam and the Big Springs Bridge. Not all tributaries were sampled, and the ones not sampled could account for a large portion of both.

Temperature

The following figures summarize the temperatures which were recorded during each sampling event for each station.

Figure 27

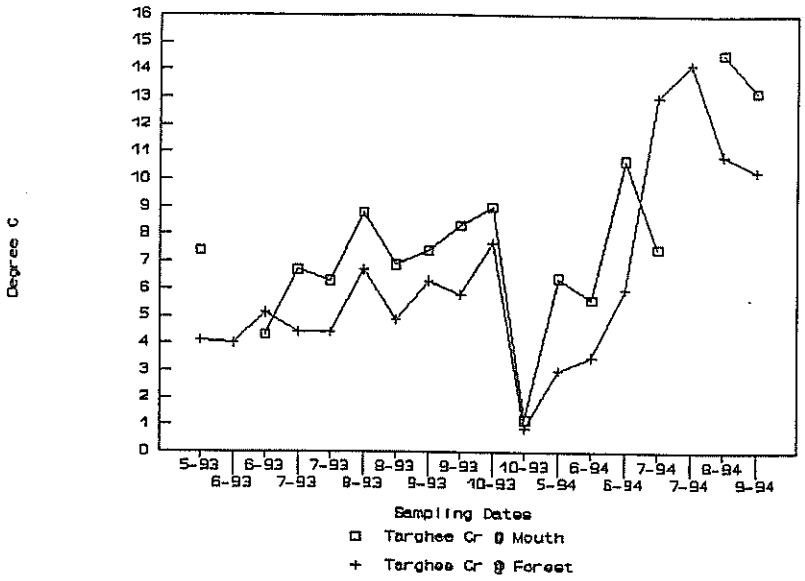
Temperature



The upper Howard Creek station did not appear to have any temperature readings which were abnormally high. However, the lower Howard Creek station exceeded the temperature standards for Salmonid Spawning (13° C) several times and Cold Water Biota (18° C) at least once. This could be due to the low water velocity and the lack of sufficient cover vegetation.

Figure 28

Temperature



Both Targhee Creek stations did exceed the temperature standard for Salmonid Spawning in the fall months of 1994. This could be the result of low discharge and velocity rates during that time period. (see Figure 28 above)

Figure 29

Temperature

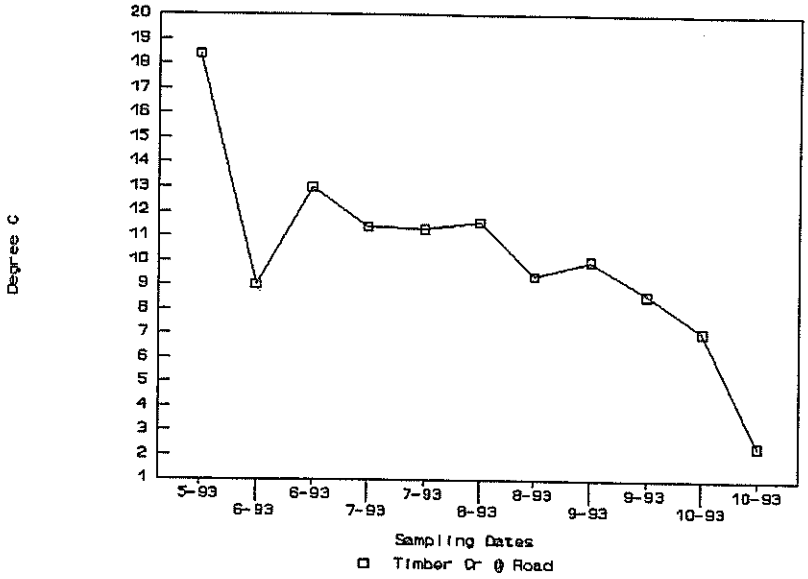


Figure 30

Temperature

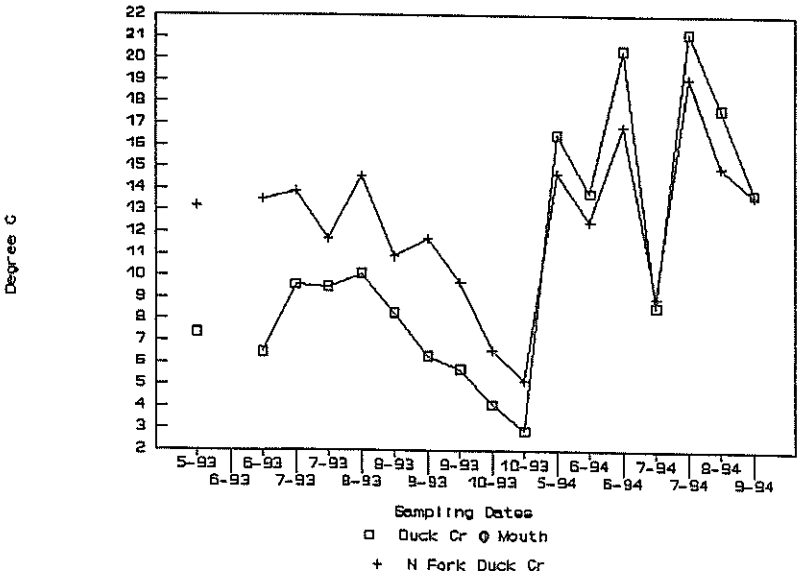


Figure 31

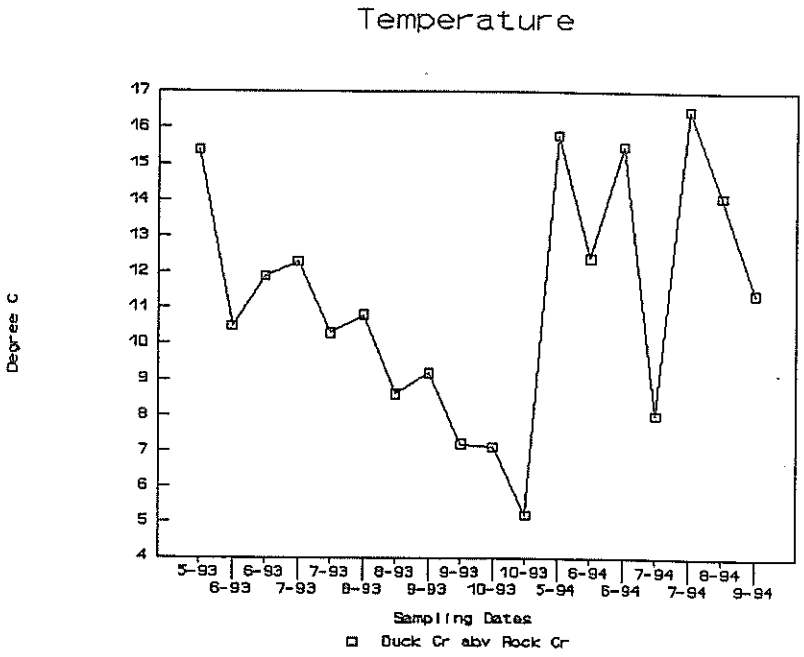
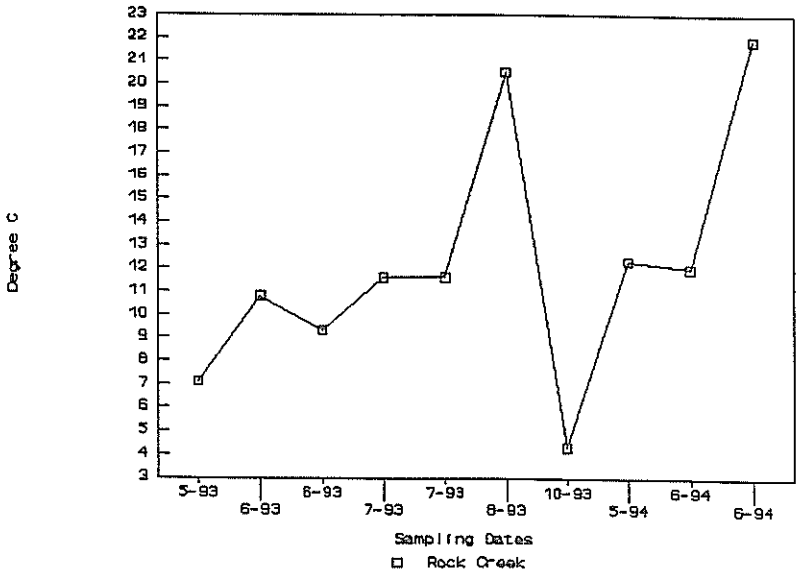


Figure 32

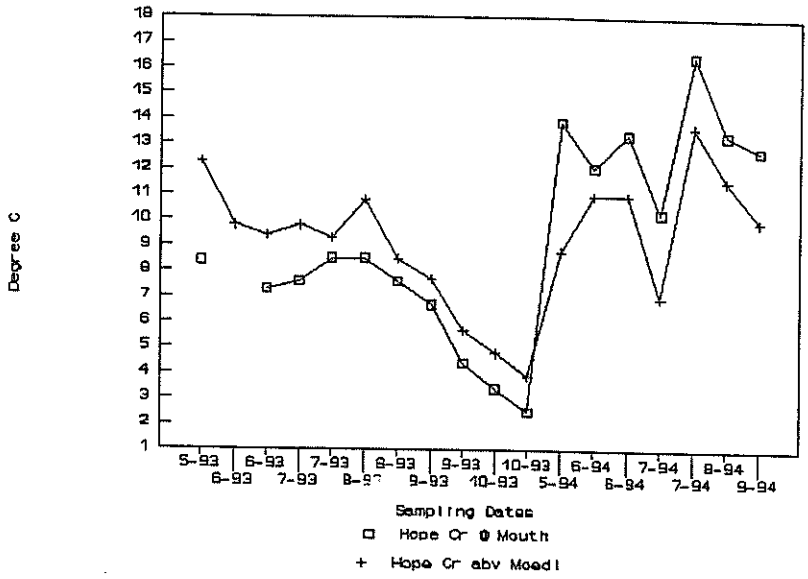


All of the Duck Creek (and Rock Creek) stations exhibited very high temperatures in 1994. Flows during that time period were also very low. (see Figures 30, 31, and 32 above)

Both Hope Creek stations (see Figure 33 below) also had high temperature readings in 1994, probably for the same reason.

Figure 33

Temperature



The two stations on the Henry's Lake Outlet seemed to exhibit temperature readings just the opposite, as flow increased, temperature increased. As flow decreased, temperature decreased. The two graphs (discharge and temperature) seem to line up closely. (see Figures 12, 13 and 34)

The lower Meadow Creek station (see Figure 35 below) was consistently higher than the upper site. Lack of riparian vegetation on the lower reach would account for the temperature difference.

Figure 34

Temperature

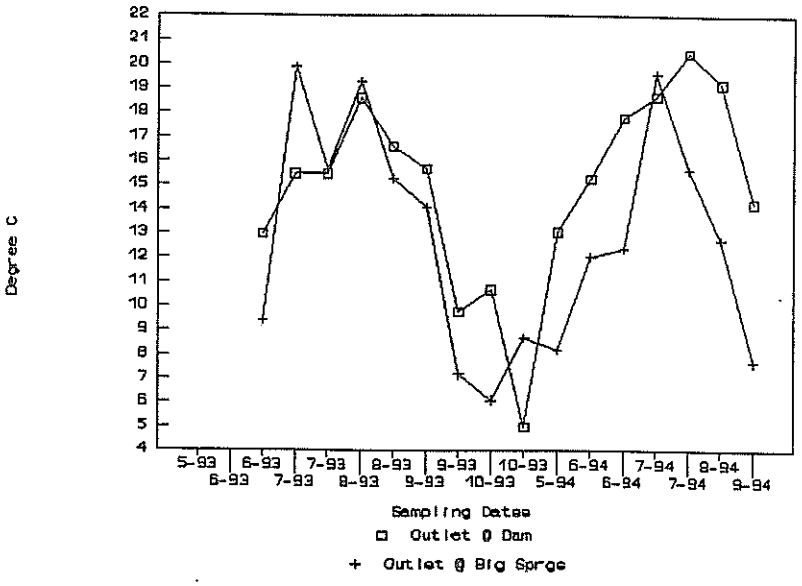


Figure 35

Temperature

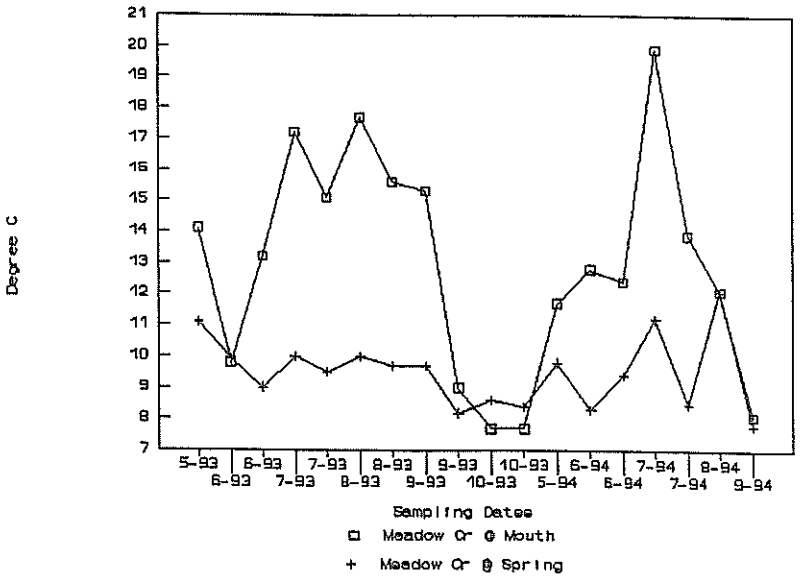
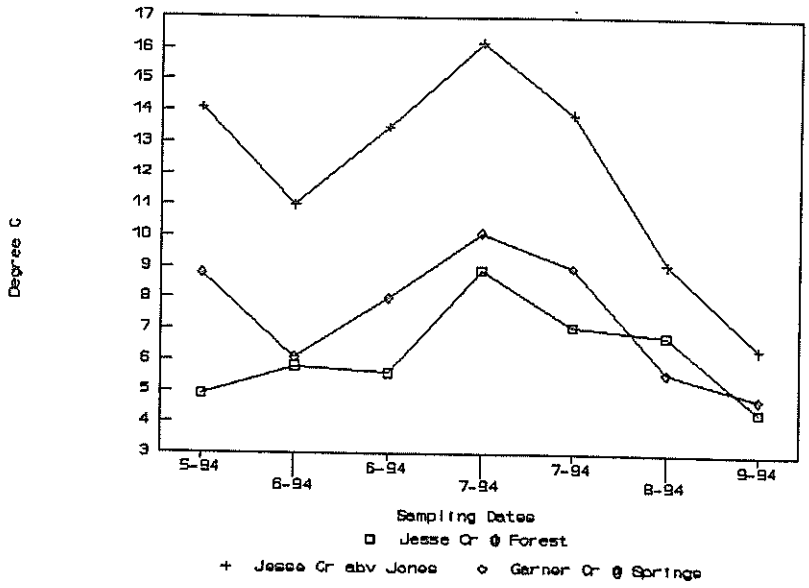


Figure 36

Temperature



The lower Jesse Creek station also had consistently higher temperatures. The stream at and above the station location is highly channelized characterized by a shallow, wide wetted perimeter with no riparian vegetation at all.

Fecal Coliform Bacteria

Figure 37 represents the stations at which the Fecal Coliform Bacteria levels were uneventful. The highest among these stations was 42 colonies per 100 ml. These were the lowest of all of the stations sampled.

Figure 37

Fecal Coliform Bacteria

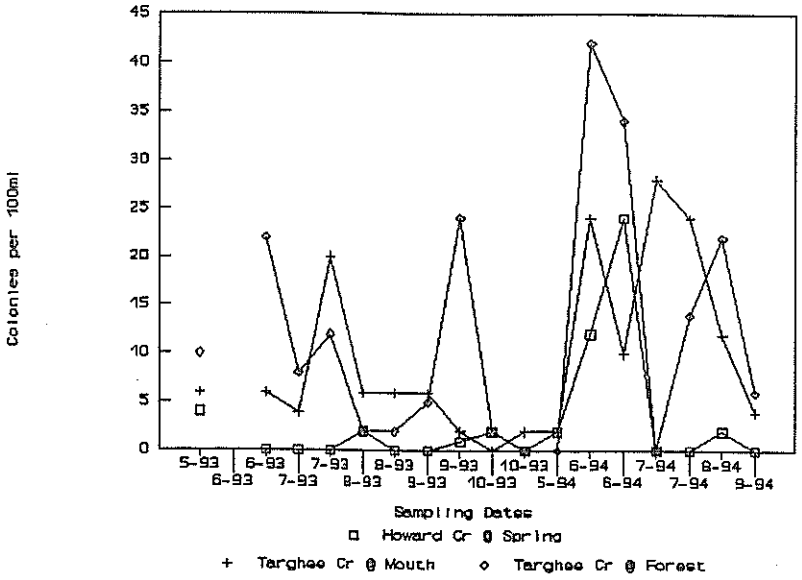


Figure 38

Fecal Coliform Bacteria

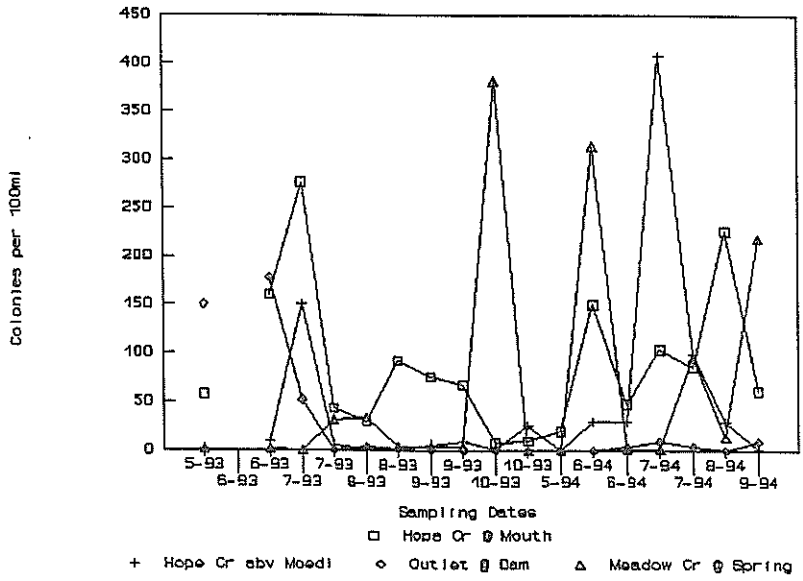
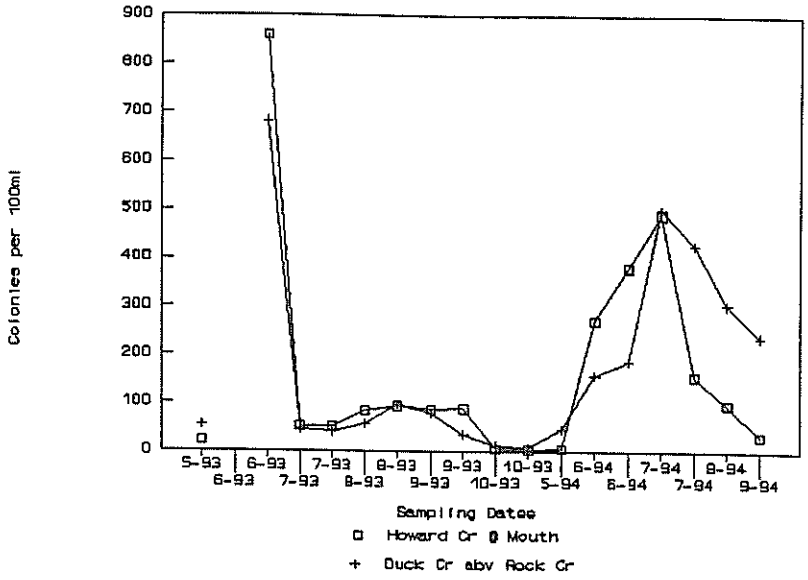


Figure 38 shows those stations at which the Fecal Coliform Bacteria counts were larger than the three lowest, they were still below the bacteria standard for Primary Contact Recreation (500 colonies/100ml).

Figure 39

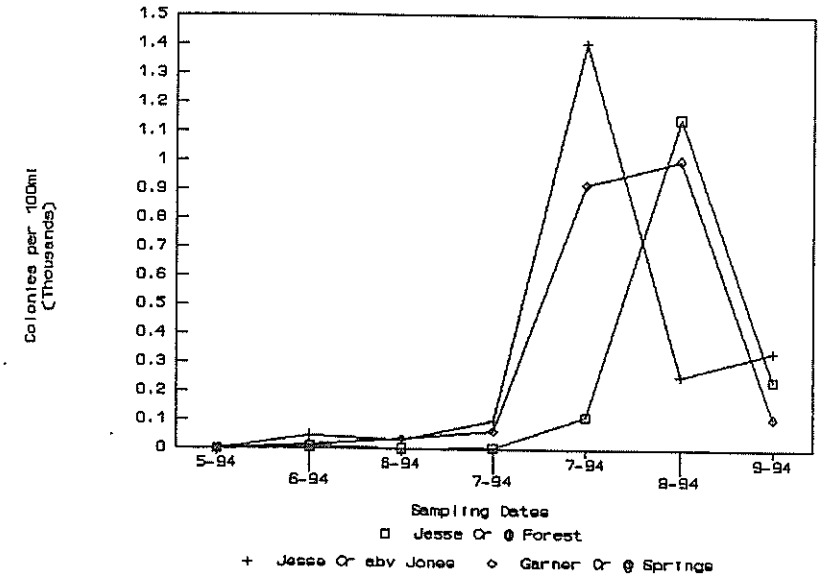
Fecal Coliform Bacteria



These stations all had highs above the standard for Primary Contact Recreation. Their highest values were approximately equaling the standard for Secondary Contact Recreation (800 colonies/100ml), although on average they were within acceptable limits.

Figure 40

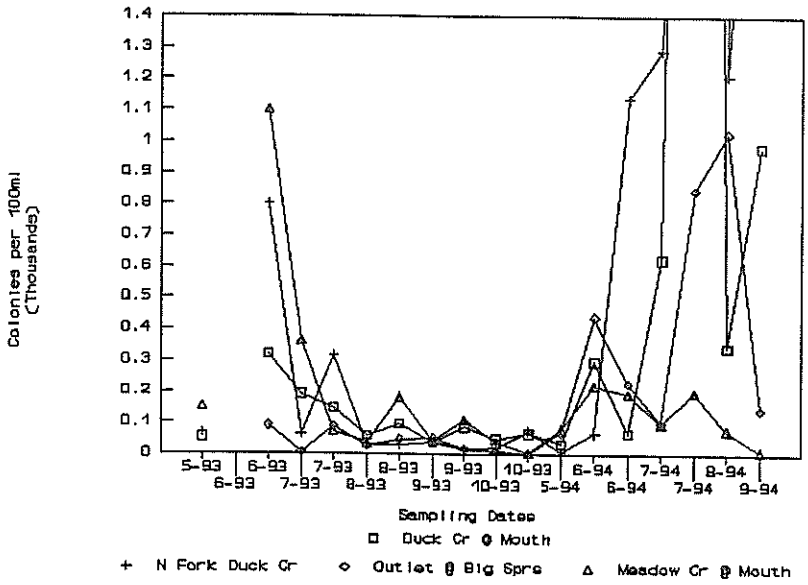
Fecal Coliform Bacteria



The stations shown in the graph above all had high counts well above the Secondary Contact Recreation Standard during mid summer and into fall.

Figure 41

Fecal Coliform Bacteria



The stations shown in Figure 41 had excessively high colony counts during at least one of the sampling events. The station at the North Fork of Duck Creek achieved a high of 11,616 colonies/100ml and the station at the mouth of Duck Creek achieved a high of 7,425 colonies/100ml. These are not shown on the graph as they were too high to compare with the other results. Overall, ten of the stations exceeded the Primary Contact Recreation standard (500 colonies/100ml) at least once and nine of those stations also exceeded the Secondary Contact Recreation standard (800 colonies/100ml) at least once.

Fecal Streptococcus Bacteria

Fecal Coliform/Fecal Streptococcus ratios were calculated on all samples (see Appendix C). Samples which contained fewer than 100 colonies/100ml of either were considered to have too few colonies to obtain a meaningful relationship and were not included. These samples were assumed to have livestock as the main source of bacteria. A ratio of less than 0.7 indicates livestock sources, 0.71 to 4.1 indicates a mix of livestock

and human sources and a ratio greater than 4.1 indicates humans as the only source.

Nearly all stations had ratios in the range that indicated animal caused bacteria. There were a few notable exceptions: Howard Creek at the Mouth has heavy human traffic and as a result the ratio was in the human related range.
The North Fork of Duck Creek station was located on a Forest Service grazing allotment. During nearly all of the sampling events, the permittee had a camp trailer located in the near vicinity of the stream. The possibility of human sewage finding its way to the stream is most likely.
The Meadow Creek at the Mouth station has several summer home sites used primarily by the land owners located approximately 1000 meters upstream of the station and adjacent to the stream. The septic tanks and drain fields have probably been in operation quite some time and may not be properly working.

pH

pH values were within acceptable ranges throughout the sampling period. A high value of 9.2 was recorded at the upper Howard Creek station and a low value of 7.07 was recorded at the lower Meadow Creek station. As a whole, the values ranged from 7.9 to 8.8.

Dissolved Oxygen

Dissolved oxygen levels ranged from a low of 7.0 mg/L at the mouth of Duck Creek (on more than one occasion), to a high of 11.2 mg/L at the upper Howard Creek station, the lower Timber Creek station and the Rock Creek station. The standard for dissolved oxygen is 6.0 mg/L, and there were no readings below this. The average was from 9.1 mg/L to 10.5 mg/L.

Ortho-Phosphate

The laboratory analyses of ortho-phosphate were unreliable due to problems with the analytical procedures used. A linear regression was calculated by the laboratory, but it is felt that this is not the most appropriate method to use to correct data. Therefore, the discussion will be centered on Total Phosphorus amounts.

Beneficial Use Reconnaissance Program

During 1994, a reconnaissance level habitat inventory was performed on some of the streams monitored as part of the State Agricultural Water Quality (SAWQP) planning project. Termed the "Beneficial Use Reconnaissance Program" (BURP), certain physical parameters were measured at each site. The results of these measurements were compiled and assigned a numerical score. This score referred to as the "Habitat Assessment Score" is listed below with each stream segment monitored. The parameters and the potential score value of each include:

Bottom substrate/instream cover	0 to 20
Embeddedness	0 to 20
Flow and temperature	0 to 20
Canopy cover	0 to 20
Channel alteration	0 to 15
Bottom scouring and deposition	0 to 15
Pool/riffle ratio	0 to 15
Lower Bank channel capacity-Width/depth ratio	0 to 15
Upper bank stability	0 to 10
Bank vegetation protection	0 to 10
Streamside cover	0 to 10
Riparian vegetative zone width	0 to 10

The parameters given the greatest weight (i.e. 0 to 20) are primary habitat characteristics directly pertinent to the support of aquatic communities. The parameters weighted in the mid-range (i.e. 0 to 15) are secondary habitat characteristics related to stream channel morphology. The parameters weighted lowest (i.e. 0 to 10) are tertiary habitat characteristics related to riparian vegetation and bank structure. Along with this, macroinvertebrate samples were taken at each site. The results of the macroinvertebrate samples were scored to obtain a Biotic Condition Score.

The Biotic Condition Score was arrived at in the following manner:

EPT/Chironomid Ratio	1 to 5	points
% EPT Taxa	1 to 5	points
Hilsenhoff Index	1 to 5	points
% Shredders	1 to 5	points
% Scrapers	1 to 5	points
Total Abundance	1 to 5	points
EPT Index	1 to 5	points
Taxa Richness	1 to 5	points
% Dominant Taxa	1 to 5	points
% Filterers	1 to 5	points
Scrapers/Filterers Ratio	1 to 5	points
Shannon Index	1 to 5	points

When the results of the macroinvertebrate analysis and the Habitat Assessment Score are compared graphically, it may be possible to determine the support status of the cold water biota beneficial use (see the Figure 42 below).

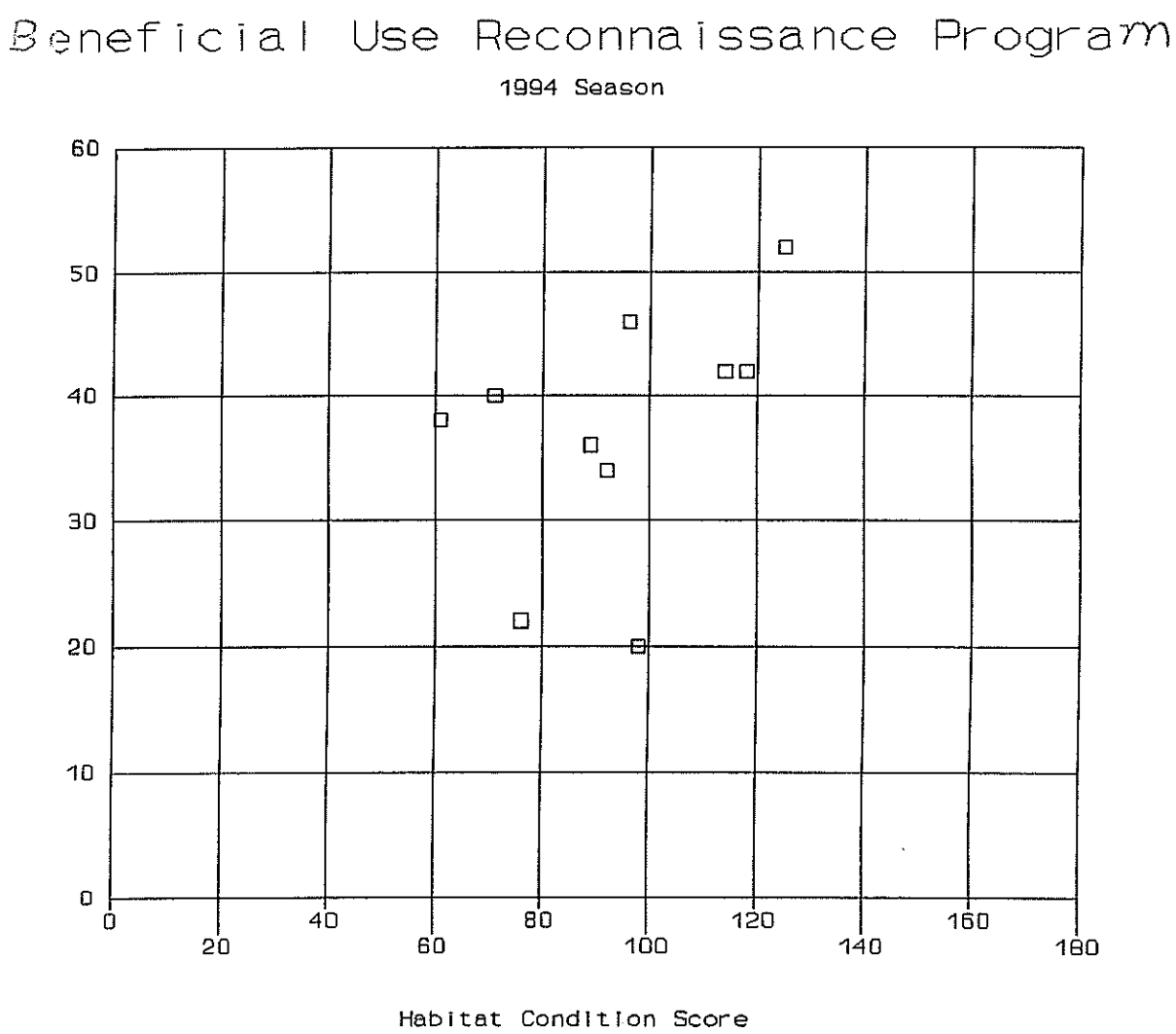

Beneficial Use Reconnaissance Program
1994 Season
60
50
40
30
20
10
0
0
20
40
60
80
100
120
140
160
180
Habitat Condition Score

Figure 42

The following is a list of stream sites and their associated scores:

Stream Name & Location		Habitat Score	Biotic Score	
			1994	1993
Meadow Creek	lower	98	20	34
Meadow Creek	upper	92	34	24
Jesse Creek	upper	118	42	
Jesse Creek	lower	61	38	
Garner Creek	upper	76	22	
Targhee Creek	upper	125	52	30
Targhee Creek	lower	71	40	30
Howard Creek	upper	114	42	
Duck Creek	lower	96	46	30
Duck Creek	upper	89	36	28

When comparing the Biotic Condition Score obtained from the 1993 macroinvertebrate samples to the Biotic Condition Score obtained from the 1994 macroinvertebrate samples, it appears that five of the six stations, utilizing the same Habitat Condition Score for both years, showed an increase in the level of support of the cold water biota beneficial use. Only the lower Meadow Creek station appeared to be in a poorer condition in 1994 than in 1993.

Conclusion

In general, discharge rates were drastically lower in 1994 than in 1993. Suspended sediment is a major problem, especially when livestock were actually in the stream. Spring runoffs were of little consequence. Duck Creek and Targhee Creek are contributing the largest quantities of nutrients to the lake, however, the lake appears to be flushing itself of nutrients via the Outlet. The amount of sediment in the lake is still accumulating though. Temperature is of concern at nearly all stations. However, the lack of appropriate amounts of riparian vegetation and dewatering could explain the high temperatures. Overall, the health of the drainage appears to be moderate to good as determined by the Beneficial Use Reconnaissance Program. Most of the sites fully support the cold water biota beneficial use and the biotic condition scores improved from 1993 to 1994 at all but one station. The high amounts of coliform bacteria, at those stations where the primary contact recreation and secondary contact recreation standards were exceeded, were the result of a combination of high temperatures, low flows and livestock activity in the streams.

All of these data supports the findings of the Clean Lakes Study performed by Montgomery Watson in 1992 (personal communication with Brian Liming).

Recommendations

To best address all of the adverse problems associated with Henry's Lake and its tributaries:

- Aggressive riparian management would probably yield the greatest returns. Riparian areas should be fenced and grazed only at those times when the least adverse impacts would occur. This rotational grazing would allow the vegetation to rejuvenate, thus reducing the sediment load entering the lake and providing shade/cover to lower the water temperatures.

- Some method to alleviate the dewatering of the streams would also be appropriate. This would provide a means for the streams to flush themselves naturally as well as allow enough flow for fish passage at the times of the year when needed.

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Water Quality Monitoring Protocols - Report No. 5, Protocols for Assessment of Biotic Integrity (Macroinvertebrates) for Wadable Idaho Streams, By William H. Clark and Terry R. Maret, Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho, March, 1993.

Idaho State Wide Work Plan for Completing Beneficial Use Attainability and Status Surveys, By Michael McIntyre, Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho, June, 1994.

Henry's Lake Clean Lakes Project, Draft Report, By Montgomery Watson, Consulting Engineers, Boise, Idaho, 1995.

Standard Methods For The Examination Of Water and Wastewater, By Arnold Greenberg, Lenore Clesceri and Andrew Eaton, American Public Health Association, Washington, D.C., 18th Edition, 1992.

Environmental Engineering And Sanitation, By Joseph Salvato, John Wiley And Sons, Inc., New York, New York, Fourth Edition, 1992.

Rapid Bioassessment Protocols For Use In Streams And Rivers, Benthic Macroinvertebrates and Fish, United States Environmental Protection Agency, May, 1989.

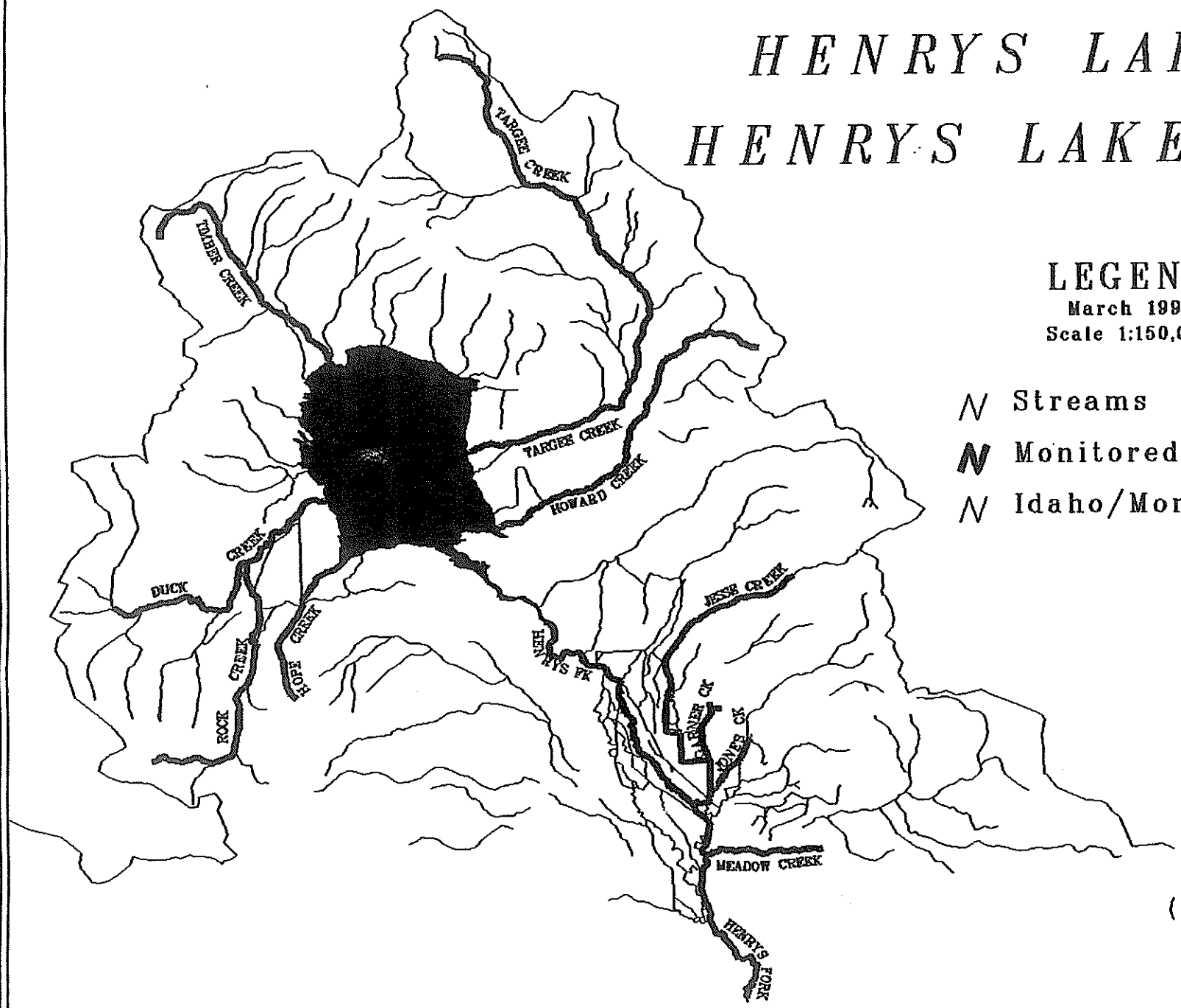
Preliminary Investigation, National Resource Conservation Service, 1991.

Monitoring Plan For The Henry's Lake Water Quality Program Planning Grant, By Matt Nelson, Idaho Division of Environmental Quality, Idaho Falls, Idaho, 1993.

Appendix A

Area Map

HENRYS LAKE & HENRYS LAKE FLAT



LEGEND

March 1995
Scale 1:150,000

- Streams
- Monitored Streams
- Idaho/Montana Border

Appendix B

Field Data

Field Data
Parameter Reporting Units

Below is a list of the units each parameter is reported in. This list applies to all of Appendix A:

Paramter	Units
TSS (Total Suspended Solids	mg/L
NH_4	mg/L
NO_3	mg/L
Kjeldahl Nitrogen (TKN)	mg/L
Total P	mg/L
Ortho P	mg/L
Fecal Coliform (Coli)	colonies/100ml
Fecal Streptococcus (Strep)	colonies/100ml
Temperature	°C
pH	$-\log[H^+]$
Dissolved Oxygen (DO)	mg/L
Discharge (Flow)	cfs

Note:

nd = amount below detection limit of laboratory equipment

Howard Creek at the Mouth

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	4	nd	0.013	nd	0.050	0.014
06-07-93	2	0.014	0.133	nd	0	0.009
06-22-93	3	nd	0.155	0.210	0.080	0.012
07-13-93	0	nd	0.124	0.160	0.008	0.026
07-27-93	0	nd	0.141	nd	0.070	0.015
08-09-93	5	0.005	0.177	nd	0.060	0.018
08-23-93	5	0.019	0.169	nd	0.120	0.019
09-06-93	4	0.017	0.184	nd	0.130	0.015
09-19-93	4	0.027	0.165	nd	0.039	0.023
10-03-93	3	nd	0.135	0.180	0.013	0.035
10-25-93	5	nd	0.180	nd	0.019	0.018
05-23-94	2	0.009	0.099	0.140	0.011	0.033
06-13-94	3	0.005	0.131	0.150	0.015	0.012
06-27-94	3	0.012	0.133	0.220	0.080	0.005
07-11-94	3	0.020	0.171	0.080	0.032	0.006
07-25-94	5	0.011	0.112	0.110	0.018	0.007
08-22-94	4	0.011	0.129	nd	0.011	nd
09-19-94	6	0.007	0.123	nd	0.018	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	22	8	12.9	8.31	9.6	9.347
06-07-93		16			10	10.619
06-22-93	860	23	4.6	8.46	10.2	9.558
07-13-93	52	16	9.0	8.18		4.957
07-27-93	52	4	10.2	8.40		4.523
08-09-93	84	38	9.3	8.31	9.3	3.913
08-23-93	94	23	7.8	8.46	9.8	4.151
09-06-93	87	17	6.6	8.34	9.4	4.706
09-19-93	89	128	6.9	8.41	9.7	4.101
10-03-93	6	6	11.8	8.42	8.8	2.631
10-25-93	4	6	2.2	8.61	9.9	9.097
05-23-94	6	23	10.5	8.46	8.1	5.182
06-13-94	272	81	7.0	8.49	9.7	5.122
06-27-94	382	52	18.1	8.36	7.3	2.217
07-11-94	490	113	5.2	8.53	9.9	2.726
07-25-94	156	77	14.4	8.31	7.9	2.559
08-22-94	98	39	12.1	8.59	8.2	2.266
09-19-94	32	35	9.5	8.79	7.2	3.495

Howard Creek at the Spring

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	4	0.049	0.078	nd	0.060	0.010
06-07-93	2	0.026	0.013	nd	nd	0.024
06-22-93	0	0.014	0.078	0.070	0.015	0.020
07-13-93	0	0.022	0.102	0.110	0.007	0.032
07-27-93	2	nd	0.098	nd	0.060	0.010
08-09-93	0	0.012	0.103	nd	0.009	0.023
08-23-93	6	0.011	0.087	nd	0.080	0.022
09-06-93	0	0.034	0.112	nd	0.210	0.022
09-19-93	0	0.021	0.083	nd	0.013	0.030
10-03-93	0	0.008	0.089	0.130	0.048	0.029
10-25-93	2	0.007	0.090	nd	0.014	0.027
05-23-94	0	0.005	0.087	0.090	0.011	0.046
06-13-94	1	0.008	0.089	nd	nd	0.025
06-27-94	1	nd	0.087	nd	0.008	0.015
07-11-94	4	nd	0.081	0.090	0.012	nd
07-25-94	3	0.016	0.079	0.110	0.014	nd
08-22-94	10	nd	0.076	0.050	0.015	nd
09-19-94						

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	4	0	3.6	7.92	10.6	1.007
06-07-93		0	1.7		10.2	1.523
06-22-93	0	0	4.5	8.38	10.5	0.804
07-13-93	0	0	3.7	7.98	10.2	0.823
07-27-93	0	0	5.4	7.71	11.0	0.288
08-09-93	2	0	4.6	7.95	10.4	0.333
08-23-93	0	2	6.7	8.30	11.2	0.137
09-06-93	0	0	5.8	8.33	9.7	0.066
09-19-93	1	1	4.2	8.69	10.1	0.134
10-03-93	2	0	6.0	8.79	10.8	0.112
10-25-93	0	0	2.6	8.72	9.8	
05-23-94	2	2	4.0	7.86	10.4	0.399
06-13-94	12	132	5.0	8.16	10.3	0.282
06-27-94	24	1	4.4	8.99	10.4	0.146
07-11-94	0	8	6.8	8.85	9.4	0.116
07-25-94	0	165	7.3	9.09	9.1	0.094
08-22-94	2	26	7.1	9.20	8.8	0.164
09-19-94	0	0				

Targhee Creek at the Mouth

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	36	0.020	0.075	nd	0.110	nd
06-07-93	10	0.015	0.071	nd	0.070	0.104
06-22-93	33	0.017	0.053	0.390	0.260	0.007
07-13-93	4	0.036	0.066	nd	nd	0.017
07-27-93	2	nd	0.052	nd	0.009	0.006
08-09-93	4	nd	0.065	nd	0.012	0.011
08-23-93	4	0.013	0.071	nd	0.070	0.010
09-06-93	0	nd	0.072	nd	0.160	0.009
09-19-93	0	0.011	0.048	nd	0.011	0.010
10-03-93	1	nd	0.055	nd	nd	0.014
10-25-93	0	0.011	0.079	nd	0.007	0.010
05-23-94	9	0.008	0.090	0.110	0.018	0.024
06-13-94	7	0.008	0.073	nd	0.015	0.007
06-27-94	1	nd	0.054	nd	0.090	nd
07-11-94	0	0.006	0.038	0.070	0.015	nd
07-25-94	0	0.009	0.041	0.110	nd	nd
08-22-94	0	0.005	0.021	nd	0.007	nd
09-19-94	0	0.011	0.016	nd	nd	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	6	4	7.4	8.27	10.4	
06-07-93		0			10.4	
06-22-93	6	8	4.3	8.51	10.3	
07-13-93	4	3	6.7	8.53	10.8	
07-27-93	20	18	6.3	8.55	9.8	30.904
08-09-93	6	19	8.8	8.54	10.0	25.734
08-23-93	5	5	6.9	8.67	9.9	20.866
09-06-93	6	1	7.4	8.68	9.9	12.409
09-19-93	2	1	8.3	8.72	9.6	9.649
10-03-93	0	0	9.0	8.60	9.6	8.316
10-25-93	2	1	1.2	8.56	10.4	4.519
05-23-94	2	21	6.4	8.34	10.3	42.793
06-13-94	24	87	5.6	8.56	10.2	32.082
06-27-94	10	15	10.7	8.48	9.0	7.869
07-11-94	28	18	7.5	8.51	9.6	4.700
07-25-94	24	26				4.551
08-22-94	12	33	14.6	8.71	7.6	2.218
09-19-94	4	0	13.2	8.63	8.2	1.231

Targhee Creek at the Forest

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	5	0.016	0.043	nd	0.080	nd
06-07-93	10	0.011	nd	nd	0.070	0.050
06-22-93	34	0.005	0.046	0.220	0.070	0.005
07-13-93	3	0.049	0.060	nd	nd	0.017
07-27-93	3	nd	0.054	nd	0.007	0.008
08-09-93	5	0.026	0.061	nd	0.011	0.010
08-23-93	4	0.010	0.069	nd	0.060	0.011
09-06-93	1	nd	0.062	nd	0.150	0.006
09-19-93	0	0.006	0.057	nd	0.008	0.013
10-03-93	0	nd	0.060	nd	nd	0.014
10-25-93	0	nd	0.092	nd	0.005	0.011
05-23-94	4	0.007	0.083	0.080	0.012	0.023
06-13-94	3	nd	0.079	nd	0.010	0.008
06-27-94	2	nd	0.072	nd	0.060	nd
07-11-94	1	0.014	0.046	0.050	0.012	nd
07-25-94	0	0.008	0.048	0.160	nd	nd
08-22-94	1	nd	0.049	nd	nd	nd
09-19-94	1	0.006	0.056	nd	nd	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	10	0	4.1	8.12	11.0	85.621
06-07-93		1	4.0		10.8	94.951
06-22-93	22	6	5.1	8.65	10.6	180.512
07-13-93	8	0	4.4	8.36	10.8	53.858
07-27-93	12	0	4.4	8.58	11.0	35.546
08-09-93	2	0	6.7	8.36	10.2	25.548
08-23-93	2	0	4.9	8.58	10.4	19.630
09-06-93	5	0	6.3	8.60	9.9	15.179
09-19-93	24	2	5.8	8.69	10.0	12.794
10-03-93	2	6	7.7	8.70	10.0	9.395
10-25-93	0	1	0.9	8.41	11.1	5.728
05-23-94	0	3	3.0	8.25	10.7	61.362
06-13-94	42	71	3.5	8.70	10.4	50.003
06-27-94	34	25	6.0	8.40	9.9	21.363
07-11-94	0	4	13.0	8.62	8.6	17.239
07-25-94	14	82	14.2	8.65	7.8	12.106
08-22-94	22	8	10.9	8.81	8.7	8.763
09-19-94	6	0	10.3	8.76	8.7	5.218

Timber Creek at the Road

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	3	0.023	nd	0.370	0.080	0.006
06-07-93	0	0.014	nd	0.250	nd	0.104
06-22-93	3	nd	0.005	0.310	0.022	0.014
07-13-93	2	nd	0.071	0.530	0.005	0.022
07-27-93	1	nd	0.101	0.180	0.060	0.010
08-09-93	2	0.044	0.120	0.070	0.015	0.017
08-23-93	2	0.018	0.090	0.080	0.090	0.023
09-06-93	3	0.008	0.114	nd	0.210	0.017
09-19-93	2	nd	0.086	nd	0.020	0.018
10-03-93	1	nd	0.094	0.100	0.006	0.026
10-25-93	0	0.011	0.102	0.110	0.012	0.024

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	12	8	18.4	7.90	9.5	6.967
06-07-93		100	9.0		8.8	9.973
06-22-93	310	508	13.0	8.36	8.0	4.325
07-13-93	44	49	11.4	8.60	10.1	4.148
07-27-93	46	23	11.3	8.53	9.1	2.878
08-09-93	22	7	11.6	8.17	9.4	3.456
08-23-93	340	70	9.4	8.50	9.6	4.079
09-06-93	124	14	10.0	8.41	9.4	3.660
09-19-93	66	19	8.6	8.46	9.7	4.069
10-03-93	44	10	7.1	8.49	10.2	4.887
10-25-93	46	17	2.4	8.60	11.2	4.686

Timber Creek at the Spring

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	0	0.030	0.072	0.190	0.190	0.024
06-07-93	2	0.014	0.037	0.160	0.090	0.026
06-22-93	3	0.018	nd	0.310	0.180	0.033

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	0	1	9.7	8.08	9.5	4.539
06-07-93		9	7.0		9.7	0.511
06-22-93	10	53	14.3	8.43	7.9	0.515

Duck Creek at the Mouth

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	42	0.027	0.548	0.300	0.140	0.016
06-07-93						
06-22-93	18	0.076	0.026	0.260	0.110	0.034
07-13-93	12	0.025	0.022	0.180	0.049	0.028
07-27-93	10	0.065	0.023	nd	0.140	0.016
08-09-93	10	0.023	0.031	0.100	0.100	0.042
08-23-93	7	0.024	0.054	nd	0.180	0.033
09-06-93	2	0.009	0.032	0.050	0.130	0.029
09-19-93	10	0.014	0.043	nd	0.052	0.036
10-03-93	8	nd	0.024	0.090	0.038	0.028
10-25-93	5	0.020	0.050	nd	0.027	0.023
05-23-94	15	0.015	0.032	0.210	0.049	0.032
06-13-94	13	0.010	0.043	0.130	0.090	0.035
06-27-94	7	0.016	0.037	0.120	0.029	0.012
07-11-94	12	0.012	0.017	0.260	0.051	0.023
07-25-94	34	0.014	0.014	0.540	0.096	0.011
08-22-94	4	0.009	nd	nd	0.029	0.008
09-19-94	166	0.042	nd	0.900	0.270	0.018

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	54	37	7.4	8.06	9.8	32.661
06-07-93						
06-22-93	322	54	6.5	8.42	10.0	28.236
07-13-93	192	22	9.6	8.54	9.8	17.222
07-27-93	148	34	9.5	8.50	9.5	14.861
08-09-93	60	27	10.1	8.49	9.7	19.936
08-23-93	96	28	8.3	8.52	10.4	8.381
09-06-93	37	12	6.3	8.48	9.9	7.925
09-19-93	87	34	5.7	8.41	10.0	13.634
10-03-93	48	74	4.1	8.55	10.6	11.154
10-25-93	66	19	2.9	8.84	11.0	8.923
05-23-94	34	51	16.5	8.47	7.0	6.962
06-13-94	298	118	13.8	8.42	8.2	8.622
06-27-94	68	22	20.4	8.64	6.5	6.073
07-11-94	622	133	8.6	8.40	9.3	6.436
07-25-94	7425	209	21.2	8.66	7.0	2.801
08-22-94	343	94	17.7	8.93	7.4	2.759
09-19-94	980	323	13.8	8.58	16.9	3.199

North Fork of Duck Creek

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	17	0.022	0.082	0.160	0.140	0.065
06-07-93	3	0.009	0.019	nd	0.100	0.114
06-22-93	4	0.021	nd	0.120	0.070	0.033
07-13-93	2	0.021	0.010	nd	0.023	0.033
07-27-93	1	0.045	0.021	0.090	0.070	0.023
08-09-93	2	nd	0.034	0.070	0.035	0.030
08-23-93	6	0.017	0.057	nd	0.090	0.033
09-06-93	2	nd	0.026	0.050	0.100	0.031
09-19-93	0	0.011	0.029	nd	0.024	0.035
10-03-93	1	nd	0.022	0.130	0.042	0.036
10-25-93	3	nd	0.093	0.060	0.030	0.028
05-23-94	5	0.009	0.028	0.130	0.033	0.047
06-13-94	2	0.008	0.028	nd	0.030	0.030
06-27-94	12	0.010	0.048	0.160	0.034	0.018
07-11-94	15	0.010	0.077	0.220	0.033	0.015
07-25-94	21	0.025	0.057	0.230	0.074	0.024
08-22-94	8	nd	0.048	nd	0.023	0.009
09-19-94	4	0.005	0.045	nd	0.020	0.010

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	68	10	13.2	7.42		8.146
06-07-93		5			9.4	2.941
06-22-93	800	18	13.5	8.19	7.4	2.148
07-13-93	64	65	13.9	8.20	8.2	1.172
07-27-93	316	11	11.7	8.24	9.3	0.881
08-09-93	30	7	14.6	8.21	8.8	0.691
08-23-93	30	9	10.9	8.60	9.0	1.015
09-06-93	36	33	11.7	8.41	9.2	0.734
09-19-93	14	125	9.7	8.45	9.6	0.814
10-03-93	20	12	6.6	8.38	10.0	0.668
10-25-93	74	5	5.2	8.94	10.2	1.290
05-23-94	8	7	14.7	8.39	8.2	0.721
06-13-94	66	157	12.5	8.59	8.4	1.189
06-27-94	1138	67	16.9	8.49	7.8	0.788
07-11-94	1292	125	9.0	8.49	9.2	0.816
07-25-94	11616	642	19.1	8.60	7.3	0.547
08-22-94	1211	61	15.0	8.78	7.7	0.625
09-19-94	2760	22	13.7	8.85	7.4	0.482

Duck Creek above Rock Creek

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	22	0.019	0.052	0.310	0.110	0.015
06-07-93	8	0.021	0.051	nd	0.080	0.017
06-22-93	14	0.006	0.026	0.200	0.110	0.026
07-13-93	6	0.022	0.029	0.160	0.021	0.023
07-27-93	8	nd	0.038	nd	0.080	0.012
08-09-93	8	0.023	0.041	0.130	0.060	0.020
08-23-93	10	0.018	0.051	nd	0.120	0.020
09-06-93	4	nd	0.044	0.120	0.140	0.021
09-19-93	1	0.016	0.044	nd	0.019	0.024
10-03-93	2	nd	0.044	0.150	0.012	0.021
10-25-93	0	0.009	0.062	nd	0.015	0.021
05-23-94	4	0.008	0.043	0.240	0.022	0.041
06-13-94	2	0.006	0.044	nd	0.020	0.020
06-27-94	4	0.015	0.046	0.130	0.019	0.005
07-11-94	6	0.013	0.040	0.060	0.017	0.006
07-25-94	5	0.019	0.027	0.140	0.017	0.007
08-22-94	5	0.011	0.017	nd	0.022	nd
09-19-94	3	0.007	0.018	nd	0.012	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	54	16	15.4	7.56	10.1	28.584
06-07-93		24	10.5		9.4	16.027
06-22-93	682	139	11.9	8.42	8.0	28.997
07-13-93	46	37	12.3	8.42	9.5	17.882
07-27-93	40	9	10.3	8.42	9.4	14.864
08-09-93	58	69	10.8	8.35	9.6	13.083
08-23-93	98	19	8.6	8.47	9.2	11.959
09-06-93	80	15	9.2	8.33	9.8	11.536
09-19-93	35	16	7.2	8.46	9.8	11.204
10-03-93	12	8	7.1	8.44	9.9	9.443
10-25-93	8	3	5.2	8.56	10.6	7.713
05-23-94	46	15	15.8	8.49	7.9	4.009
06-13-94	158	98	12.4	8.54	8.6	4.224
06-27-94	188	64	15.5	8.54	8.1	4.454
07-11-94	502	105	8.0	8.49	9.4	4.861
07-25-94	429	82	16.5	8.68	7.5	4.751
08-22-94	306	117	14.1	8.85	7.9	4.972
09-19-94	240	84	11.4	8.93	9.4	4.596

Rock Creek

Date	TSS	NH_3	NO_3	TKN	Tot P	$O\text{-}PO_4$
05-25-93	29	0.026	0.092	0.080	0.120	0.016
06-07-93	8	0.018	0.044	nd	0.050	0.064
06-22-93	65	0.006	0.019	0.110	0.190	0.022
07-13-93	5	0.011	0.007	0.080	0.025	0.028
07-27-93	18	nd	0.008	0.290	0.080	0.022
08-09-93	9	0.048	0.023	0.070	0.055	0.028
10-25-93	4	nd	0.008	0.090	0.034	0.032
05-23-94	7	0.012	0.058	0.070	0.050	0.039
06-13-94	12	0.011	0.022	0.060	0.080	0.029
06-27-94	14	0.008	0.016	0.090	0.120	0.029

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	24	4	7.1	8.02	11.2	11.388
06-07-93		3	10.8		10.4	9.061
06-22-93	32	5	9.3	8.68	8.3	13.259
07-13-93	28	2	11.6	8.90	9.8	3.921
07-27-93	96	13	11.6	8.73	9.2	1.791
08-09-93	140	96	20.5	8.48	7.5	0.067
10-25-93	88	22	4.3	8.65	10.6	2.246
05-23-94	2	22	12.3	8.57	8.7	6.646
06-13-94	278	56	12.0	8.67	8.6	2.303
06-27-94	834	74	21.9	8.65	7.1	0.527

Hope Creek at the Mouth

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	8	0.008	0.013	0.140	0.100	0.018
06-07-93						
06-22-93	6	nd	0.227	0.340	0.110	0.024
07-13-93	2	0.032	0.184	0.190	0.013	0.030
07-27-93	0	nd	0.181	0.050	0.110	0.024
08-09-93	4	0.005	0.220	0.120	0.029	0.027
08-23-93	9	0.016	0.130	0.080	0.130	0.027
09-06-93	10	nd	0.094	0.150	0.200	0.036
09-19-93	4	nd	0.069	nd	0.033	0.032
10-03-93	3	nd	0.058	0.070	0.021	0.038
10-25-93	2	0.011	0.060	0.110	0.030	0.034
05-23-94	34	0.027	0.039	0.990	0.160	0.066
06-13-94	7	0.007	0.093	nd	0.060	0.044
06-27-94	10	0.013	0.086	0.380	0.032	0.010
07-11-94	9	nd	0.090	0.210	0.031	0.011
07-25-94	11	0.015	0.077	0.180	0.044	0.012
08-22-94	10	0.009	0.020	nd	0.030	0.005
09-19-94	5	0.005	0.037	nd	0.034	0.007

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	58	21	8.4	7.96	9.8	4.201
06-07-93						
06-22-93	160	22	7.3	8.29	9.2	1.961
07-13-93	276	59	7.6	8.37	9.7	3.679
07-27-93	44	20	8.5	8.34	8.2	3.014
08-09-93	30	17	8.5	8.65	8.8	4.669
08-23-93	92	22	7.6	8.43	9.4	3.203
09-06-93	76	40	6.7	8.34	9.1	3.513
09-19-93	68	39	4.4	8.25	10.1	3.277
10-03-93	8	3	3.4	8.35	10.5	2.689
10-25-93	10	1	2.5	8.56	10.9	1.979
05-23-94	20	11	13.9	7.86	7.5	1.226
06-13-94	150	27	12.1	8.17	8.6	1.812
06-27-94	48	83	13.4	8.17	8.3	1.535
07-11-94	104	121	10.3	8.10		1.749
07-25-94	86	104	16.5	8.23	7.7	1.421
08-22-94	226	118	13.4	8.40	8.0	1.466
09-19-94	62	43	12.8	8.40	8.0	0.841

Hope Creek above Moedl

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	11	0.010	0.018	0.340	0.100	0.030
06-07-93	11	0.043	0.020	nd	0.080	0.178
06-22-93	50	0.023	0.009	0.240	0.140	0.028
07-13-93	11	0.028	0.008	0.120	0.045	0.033
07-27-93	7	nd	0.010	nd	0.140	0.024
08-09-93	4	nd	0.011	nd	0.140	0.029
08-23-93	7	0.009	0.012	nd	0.120	0.042
09-06-93	4	nd	0.013	nd	0.190	0.042
09-19-93	4	0.008	0.016	nd	0.042	0.046
10-03-93	3	nd	0.025	0.080	0.034	0.189
10-25-93	1	0.008	0.028	nd	0.035	0.048
05-23-94	4	0.009	0.015	0.200	0.060	0.063
06-13-94	6	nd	0.016	nd	0.031	0.032
06-27-94	8	0.016	0.035	0.140	0.039	0.026
07-11-94	14	nd	0.200	0.130	0.052	0.022
07-25-94	4	0.018	0.026	0.180	0.032	0.024
08-22-94	13	nd	0.024	nd	0.046	0.022
09-19-94	6	nd	0.025	nd	0.038	0.024

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	2	0	12.3	7.83	10.4	2.843
06-07-93		1	9.8		10.2	4.205
06-22-93	10	6	9.4	8.62	9.0	2.649
07-13-93	150	16	9.8	8.66	8.7	1.541
07-27-93	6	7	9.3	8.48	9.3	0.695
08-09-93	2	15	10.8	8.44	8.9	0.905
08-23-93	2	3	8.5	8.52	10.0	2.041
09-06-93	6	1	7.7	8.28	10.2	1.763
09-19-93	9	7	5.7	8.60	10.2	1.750
10-03-93	2	2	4.8	8.68	10.5	1.021
10-25-93	26	0	3.9	8.92	9.6	1.346
05-23-94	0	15	8.8	8.17	9.3	1.166
06-13-94	30	19	11.0	8.68	8.8	0.600
06-27-94	30	38	11.0	8.69	8.8	0.615
07-11-94	408	144	7.0	8.61	9.7	1.056
07-25-94	99	42	13.7	8.60	8.0	0.330
08-22-94	30	54	11.6	8.71	8.2	0.652
09-19-94	2	39	10.0	8.93	8.6	0.494

Henry's Lake Outlet below the Dam

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93						
06-07-93	6	0.011	0.008	nd	0.080	0.013
06-22-93	5	0.028	nd	0.270	0.090	0.031
07-13-93	2	0.056	0.008	0.410	0.014	0.018
07-27-93	0	nd	0.006	0.230	0.070	nd
08-09-93	2	0.010	0.010	0.320	0.032	0.013
08-23-93	3	0.039	0.007	0.190	0.080	0.012
09-06-93	3	0.039	0.005	0.570	0.260	0.009
09-19-93	2	0.047	0.013	0.390	0.046	0.019
10-03-93	3	nd	nd	0.490	0.026	0.016
10-25-93	0	0.01	0.011	0.260	0.036	0.0075
05-23-94	2	0.028	0.008	0.350	0.070	0.016
06-13-94	1	0.009	0.015	0.400	0.018	nd
06-27-94	2	0.010	0.028	0.450	0.019	nd
07-11-94	4	0.016	0.009	0.300	0.020	nd
07-25-94	2	0.028	0.018	0.350	0.020	nd
08-22-94	3	0.022	0.010	nd	0.022	nd
09-19-94	0	0.022	0.014	0.380	0.022	0.006

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	150	10				1.542
06-07-93		30			9.8	4.076
06-22-93	178	12	13.0	8.50	8.9	18.712
07-13-93	52	12	15.5	8.82		159.334
07-27-93	0	13	15.5	8.80	8.2	109.842
08-09-93	4	1	18.6	8.84	7.9	118.880
08-23-93	2	0	16.6	8.77	9.2	151.600
09-06-93	0	0	15.7	8.66	9.1	141.495
09-19-93	0	1	9.8	8.43	9.6	67.458
10-03-93	0	0	10.7	8.96	9.2	66.560
10-25-93	0	0	5.0	8.94	10.3	57.306
05-23-94	0	23	13.1	8.37	8.4	105.000
06-13-94	0	10	15.3	8.73	7.9	77.000
06-27-94	4	3	17.8	8.75	8.5	150.000
07-11-94	10	2	18.7	8.87	7.8	172.000
07-25-94	4	13	20.5	8.18	7.7	198.000
08-22-94	0	11	19.2	8.99	7.1	173.000
09-19-94	10	1	14.3	9.11	8.5	2.600

Henry's Lake Outlet at the Big Sprgs Bridge

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	9	nd	0.034	0.150	0.110	0.025
06-07-93	8	0.032	0.019	0.110	0.090	0.060
06-22-93	5	nd	nd	0.260	0.060	0.038
07-13-93	6	0.042	0.009	0.280	0.034	0.026
07-27-93	2	nd	nd	0.150	0.100	0.024
08-09-93	4	0.020	0.015	0.140	0.130	0.028
08-23-93	5	0.019	0.006	nd	0.130	0.026
09-06-93	2	nd	0.007	0.120	0.200	0.025
09-19-93	3	0.010	0.016	0.060	0.031	0.032
10-03-93	4	nd	0.010	0.070	0.028	0.042
10-25-93	2	0.011	0.019	nd	0.021	0.026
05-23-94	10	0.010	0.022	0.340	0.044	0.047
06-13-94	5	0.006	0.016	0.270	0.029	0.029
06-27-94	5	0.013	0.029	0.350	0.037	0.021
07-11-94	4	0.064	0.013	0.400	0.024	0.007
07-25-94	3	0.011	0.020	0.280	0.030	0.009
08-22-94	4	0.017	0.007	0.360	0.023	0.005
09-19-94	10	0.005	0.012	0.070	0.030	0.006

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93					10.3	187.676
06-07-93					9.2	143.361
06-22-93	92	38	9.4	8.46	9.2	122.034
07-13-93	4	0	19.9	8.88	8.2	141.689
07-27-93	90	19	15.7	8.55	9.0	139.329
08-09-93	26	7	19.3	8.80	7.9	143.763
08-23-93	48	24	15.3	8.63	9.1	112.897
09-06-93	53	16	14.1	8.51	8.7	110.691
09-19-93	17	11	7.2	8.55	9.7	69.481
10-03-93	8	12	6.1	8.27	10.1	87.172
10-25-93	0	0	8.7	8.39	10.2	69.893
05-23-94	70	1	8.2	7.48	9.2	148.037
06-13-94	440	194	12.1	8.46	8.5	123.840
06-27-94	228	33	12.4	7.57	8.4	126.970
07-11-94	102	29	19.6	8.67	7.2	146.055
07-25-94	844	424	15.7	8.75	8.0	141.459
08-22-94	1026	839	12.8	8.68	8.5	83.960
09-19-94	144	90	7.7	8.98	6.6	20.490

Meadow Creek at the Mouth

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	2	0.019	0.033	0.270	0.090	0.009
06-07-93	6	0.046	0.017	0.600	0.060	0.019
06-22-93	3	0.027	nd	0.330	0.030	0.036
07-13-93	0	nd	0.009	0.190	0.009	0.053
07-27-93	24	0.024	nd	0.170	0.090	0.027
08-09-93	2	0.014	0.010	0.140	0.130	0.036
08-23-93	3	0.009	nd	nd	0.090	0.040
09-06-93	0	nd	0.006	nd	0.170	0.044
09-19-93	0	0.020	nd	nd	0.021	0.054
10-03-93	0	nd	0.052	nd	0.007	0.063
10-25-93	5	0.008	0.007	0.190	0.032	0.054
05-23-94	1	0.010	0.010	0.300	0.070	0.074
06-13-94	3	0.009	0.016	0.210	0.020	0.051
06-27-94	4	0.008	0.017	0.100	0.100	nd
07-11-94	4	0.013	nd	0.150	0.023	0.006
07-25-94	5	0.019	0.018	0.160	0.021	nd
08-22-94	3	nd	nd	0.160	0.011	nd
09-19-94	3	nd	nd	0.150	0.019	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	152	21	14.1	7.60	10.6	27.669
06-07-93			9.8		9.8	24.288
06-22-93	1100	144	13.2	8.01	8.2	8.289
07-13-93	364	13	17.2	8.04	9.0	6.094
07-27-93	72	32	15.1	8.75	8.4	5.115
08-09-93	36	8	17.7	8.01	8.0	5.384
08-23-93	184	7	15.6	8.10	7.8	5.235
09-06-93	43	5	15.3	7.90	8.2	5.363
09-19-93	111	9	9.0	7.83	9.2	6.803
10-03-93	36	43	7.7	7.99	9.6	7.127
10-25-93	4	5	7.7	8.52	9.2	8.638
05-23-94	82	47	11.7	7.07	8.6	8.041
06-13-94	220	246	12.8	7.74	9.8	6.295
06-27-94	194	18	12.4	7.75	8.6	6.510
07-11-94	96	27	19.9	8.12	7.2	4.265
07-25-94	198	137	13.9	8.44	8.2	4.533
08-22-94	78	100	12.1	8.52	8.6	3.149
09-19-94	10	64	8.1	8.74	5.4	2.396

Meadow Creek at the Spring

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-25-93	0	0.005	nd	nd	0.060	0.020
06-07-93	0	0.017	0.067	nd	nd	0.028
06-22-93	0	0.013	0.048	0.050	0.060	0.045
07-13-93	0	0.025	0.049	0.080	nd	0.053
07-27-93	0	nd	0.048	nd	0.080	0.018
08-09-93	0	0.009	0.050	nd	0.120	0.038
08-23-93	0	0.013	0.045	nd	0.080	0.040
09-06-93	0	0.006	0.062	nd	0.140	0.045
09-19-93	0	nd	0.049	nd	0.020	0.049
10-03-93	2	nd	nd	nd	0.021	0.059
10-25-93	0	0.006	0.053	0.090	0.015	0.055
05-23-94	4	0.007	0.045	0.070	0.008	0.094
06-13-94	4	0.005	0.049	nd	0.005	0.057
06-27-94	0	0.005	0.048	nd	0.060	nd
07-11-94	0	0.008	0.033	nd	0.016	nd
07-25-94	12	0.016	0.048	0.110	0.017	nd
08-22-94	0	0.005	0.055	nd	0.005	nd
09-19-94	32	0.005	0.051	0.130	0.015	nd

Date	Coli	Strep	Temp	pH	DO	Flow
05-25-93	2	0	11.1	7.10	10.2	6.277
06-07-93			9.9		9.0	6.737
06-22-93	2	0	9.0	7.67	9.2	10.759
07-13-93	0	0	10.0	7.54	10.0	5.686
07-27-93	32	0	9.5	7.56	8.9	5.097
08-09-93	34	0	10.0	7.89	8.3	6.004
08-23-93	4	0	9.7	7.57	10.0	8.702
09-06-93	4	0	9.7	7.77	8.9	4.799
09-19-93	4	1	8.2	7.68	10.0	8.099
10-03-93	382	0	8.6	7.94	9.6	7.487
10-25-93	0	0	8.4	8.32	9.1	7.684
05-23-94	0	1	9.8	6.81	9.2	5.572
06-13-94	314	0	8.3	7.41	9.2	4.612
06-27-94	2	0	9.4	7.64	9.2	5.983
07-11-94	2	3	11.2	8.42	8.4	6.157
07-25-94	96	83	8.5	8.03	9.0	2.970
08-22-94	14	6	12.1	8.52	8.6	3.703
09-19-94	218	28	7.8	8.34	6.4	2.882

Jesse Creek at the Forest

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-23-94	3	0.007	0.025	0.080	0.130	0.092
06-13-94	2	nd	0.036	nd	0.090	0.078
06-27-94	2	nd	0.045	nd	0.120	0.140
07-11-94	3	0.010	0.024	nd	0.065	0.048
07-25-94	2	0.016	0.039	0.110	0.061	0.048
08-22-94	15	0.008	0.037	nd	0.070	0.046
09-19-94	8	0.009	0.020	nd	0.087	0.049

Date	Coli	Strep	Temp	pH	DO	Flow
05-23-94	0	3	4.9	7.45	10.4	2.226
06-13-94	8	57	5.8	8.59	9.8	2.681
06-27-94	2	8	5.6	8.00	9.9	4.400
07-11-94	4	2	8.9	8.54	9.3	3.600
07-25-94	114	72	7.1	8.11	9.1	3.244
08-22-94	1144	64	6.8	8.54	9.5	1.687
09-19-94	240	129	4.4	8.55	9.6	0.026

Jesse Creek above Jones Creek

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-23-94	5	0.009	0.032	0.150	0.110	0.089
06-13-94	3	0.005	0.028	nd	0.090	0.070
06-27-94	2	0.012	0.018	0.450	0.310	0.043
07-11-94	2	nd	0.009	0.120	0.069	0.044
07-25-94	3	0.029	0.019	0.270	0.059	0.028
08-22-94	3	0.007	0.026	nd	0.041	0.025
09-19-94	3	0.010	0.051	nd	0.058	0.036

Date	Coli	Strep	Temp	pH	DO	Flow
05-23-94	0	17	14.1	7.46	8.3	8.831
06-13-94	48	48	11.0	8.32	8.8	9.689
06-27-94	34	75	13.5	8.43	8.4	5.316
07-11-94	102	46	16.2	8.72	8.0	5.082
07-25-94	1404	1581	13.9	8.13	8.2	4.324
08-22-94	254	215	9.1	8.66	8.9	1.173
09-19-94	340	326	6.4	8.51	8.8	1.128

Garner Creek below the Springs

Date	TSS	NH_3	NO_3	TKN	Tot P	O-PO_4
05-23-94	2	0.007	0.100	0.070	0.058	0.094
06-13-94	2	0.033	0.081	0.050	0.080	0.071
06-27-94	2	0.025	0.062	nd	0.047	0.027
07-11-94	2	0.006	0.044	0.130	0.046	0.030
07-25-94	2	0.020	0.105	nd	0.042	0.034
08-22-94	16	0.013	0.106	0.090	0.070	0.028
09-19-94	5	0.011	0.126	nd	0.050	0.033

Date	Coli	Strep	Temp	pH	DO	Flow
05-23-94	0	31	8.8	7.14	9.6	4.122
06-13-94	16	24	6.1	8.32	9.9	2.534
06-27-94	36	16	8.0	8.03	9.4	2.100
07-11-94	64	45	10.1	8.47	8.6	2.197
07-25-94	920	134	9.0	8.17	9.2	1.234
08-22-94	1003	587	5.6	8.28	9.7	1.116
09-19-94	112	111	4.8	8.55	8.4	0.670

Appendix C

Fecal Coliform/Fecal Streptococcus Ratio

X = Not Enough Colonies To Calculate
A Meaningful Ratio

	Howard Cr @ Mouth			Howard Cr @ Spring		
	Animal	Mix	Human	Animal	Mix	Human
05-93		2.75		X		
06-93	X			X		
06-93			37.4	X		
07-93		3.25		X		
07-93			13.0	X		
08-93		2.21		X		
08-93		4.09		X		
09-93			5.1	X		
09-93	0.69				1.00	
10-93		1.00		X		
10-93	0.67			X		
05-94	0.26				1.00	
06-94		3.36		0.09		
06-94			7.4			24.0
07-94			4.4	X		
07-94		2.03		X		
08-94		2.51		0.07		
09-94		0.91		X		

	Targhee Cr @ Mouth			Targhee Cr @ Forest		
	Animal	Mix	Human	Animal	Mix	Human
05-93		1.50		X		
06-93	X			X		
06-93		0.75			3.67	
07-93		1.33		X		
07-93		1.11		X		
08-93	0.32			X		
08-93		1.20		X		
09-93			6.0	X		
09-93		2.00				12.0
10-93	X			0.33		
10-93		2.00		X		
05-94	0.09			X		
06-94	0.28			0.59		
06-94	0.67				1.36	
07-94		1.56		X		
07-94		0.92		0.17		
08-94	0.36				2.75	
09-94	X			X		

	Timber Cr @ Spring		
	Animal	Mix	Human
05-93	X		
06-93	X		
06-93	0.19		
07-93			
07-93			
08-93			
08-93			
09-93			
09-93			
10-93			
10-93			
05-94			
06-94			
06-94			
07-94			
07-94			
08-94			
09-94			

	Timber Cr @ Road		
	Animal	Mix	Human
		1.50	
	X		
	0.61		
		0.89	
		2.00	
		3.14	
			4.86
			8.86
		3.47	
			4.40
		2.71	

	Duck Cr @ Mouth		
	Animal	Mix	Human
05-93		1.49	
06-93	X		
06-93			5.96
07-93			8.73
07-93			4.35
08-93		2.22	
08-93		3.43	
09-93		3.08	
09-93		2.56	
10-93	0.65		
10-93		3.47	
05-94	0.67		
06-94		2.53	
06-94		3.09	
07-94			4.68
07-94			35.53
08-94		3.65	
09-94		3.03	

	N Fork Duck Cr		
	Animal	Mix	Human
			6.80
	X		
			44.44
		0.99	
			28.73
			4.29
		3.33	
		1.09	
	0.11		
		1.67	
			14.80
		1.14	
	0.42		
			16.99
			10.34
			18.09
			19.85
			125.46

	Duck Cr abv Rock Creek			Rock Cr		
	Animal	Mix	Human	Animal	Mix	Human
05-93		3.37				6.00
06-93	X			X		
06-93			4.91			6.40
07-93		1.24				14.00
07-93			4.44			7.39
08-93		0.84			1.46	
08-93			5.16			
09-93			5.33			
09-93		2.18				
10-93		1.50				
10-93		2.67			4.00	
05-94		3.07		0.09		
06-94		1.61				4.96
06-94		2.94				11.27
07-94			4.78			
07-94			5.23			
08-94		2.62				
09-94		2.86				

	Hope Cr @ Mouth			Hope Cr abv Moedl		
	Animal	Mix	Human	Animal	Mix	Human
05-93		2.76		X		
06-93	X			X		
06-93			7.27		1.67	
07-93			4.68			9.38
07-93		2.20			0.86	
08-93		1.77		0.13		
08-93			4.18	0.67		
09-93		1.90				6.00
09-93		1.74			1.29	
10-93		2.67			1.00	
10-93			10.00	X		
05-94		1.82		X		
06-94			5.56		1.59	
06-94	0.58				0.79	
07-94		0.86			2.83	
07-94		0.83			2.36	
08-94		1.92		0.56		
09-94		1.44		0.05		

	Outlet @ Dam			Outlet @ Bridge		
	Animal	Mix	Human	Animal	Mix	Human
05-93			15.00	X		
06-93	X			X		
06-93			14.83		2.42	
07-93			4.33	X		
07-93	X					4.74
08-93		4.00			3.71	
08-93	X				2.00	
09-93	X				3.31	
09-93	X				1.55	
10-93	X			0.67		
10-93	X			X		
05-94	X					70.00
06-94	X				2.27	
06-94		1.33				6.91
07-94			5.00		3.52	
07-94	0.31				1.99	
08-94	X				1.22	
09-94			10.00		1.60	

	Meadow Cr @ Mouth			Meadow Cr @ Spring		
	Animal	Mix	Human	Animal	Mix	Human
05-93			7.24	X		
06-93	X			X		
06-93			7.64	X		
07-93			28.00	X		
07-93		2.25		X		
08-93			4.50	X		
08-93			26.29	X		
09-93			8.60	X		
09-93			12.33		4.00	
10-93		0.84		X		
10-93		0.80		X		
05-94		1.75		X		
06-94		0.89		X		
06-94			10.78	X		
07-94		3.56		0.67		
07-94		1.45			1.16	
08-94		0.78			2.33	
09-94	0.16					7.79

	Jesse Cr @ Forest			Jesse Cr abv Jones Cr		
	Animal	Mix	Human	Animal	Mix	Human
05-93						
06-93						
06-93						
07-93						
07-93						
08-93						
08-93						
09-93						
09-93						
10-93						
10-93						
05-94	X			X		
06-94	0.14				1.00	
06-94	0.25			0.45		
07-94		2.00			2.22	
07-94		1.58			0.89	
08-94			17.88		1.18	
09-94		1.86			1.04	

	Garner Cr @ Spring		
	Animal	Mix	Human
05-93			
06-93			
06-93			
07-93			
07-93			
08-93			
08-93			
09-93			
09-93			
10-93			
10-93			
05-94	X		
06-94	0.67		
06-94		2.25	
07-94		1.42	
07-94			6.87
08-94		1.71	
09-94		1.01	

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