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USING TURBIDITY TO PREDICT TOTAL SUSPENDED SOLIDS IN MINED STREAMS IN INTERIOR ALASKA

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Abstract:

Using Turbidity to Predict Total Suspended Solids in Mined Streams in Interior Alaska

Data from mined streams in interior Alaska were used to determine the extent to which data from different locations can be combined to predict total suspended solids (TSS) from turbidity measurements. The data was transformed into logarithms with log TSS regressed on log turbidity using linear regression. Coefficients of determination (r^2) for equations for 7 basins, 15 streams and 18 sites range from 0.261 to 0.996 with standard errors of estimates ranging from +155 percent (-61 percent) to +14 (-13 percent). Covariance analysis indicated that the relationships between TSS and turbidity data collected from different basins are statistically different, that within basins, the turbidity-TSS relationships of data from different streams may be different, and within streams, data from different sites may have statistically different relationships. Also, data collected in separate years may have statistically different relationships. Model validation confirmed the uncertainty of using previous years' data. Used at one site, multiple regression with turbidity and average velocity as predictors for TSS improved the r^2 from .20 of a simple turbidity-TSS model to 0.68 and reduced the standard error of estimate from +98 percent (-49 percent) to +49 percent (-33 percent).

Table of Contents

Appendices:

Appendix 1. Turbidity and TSS data from Interior Alaska Streams.

Appendix 2. Further Explanation of Statistical Techniques.

A. Standard Error of Estimate

B. Analysis of Covariance

Appendix 3. Model Validation Results.

List of Figures

List of Tables

page

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Using Turbidity to Predict Total Suspended Solids in Mined Streams in Interior Alaska

INTRODUCTION:

The purpose of this report is to present the results of an investigation of the statistical relationship between turbidity and total suspended solids in free flowing, placer-mined streams in interior Alaska. Because of the discharge of high levels of sediment, the placer mining industry is undergoing increasing and continuing scrutiny. To detect and measure the impact of released sediment, much time and effort is spent collecting and analyzing samples from mined streams for both turbidity and total suspended solids (TSS). The turbidity parameter is easier, less time consuming, and less expensive to measure. If a good statistical relationship between turbidity and TSS can be established, only turbidity would need to be extensively collected for many purposes. A good relationship should have both an acceptable coefficient of determination (r^2) and standard error of estimate.

Several governmental agencies and consulting firms have collected a considerable amount of paired turbidity and TSS data from placer mined streams in interior Alaska during the past three years. I have organized these observations on a basin-stream-site basis and applied statistical techniques in an attempt to determine the usefulness of predicting TSS from turbidity with existing data.

BACKGROUND:

Placer mining includes the location of free gold in alluvial (placer) deposits near bedrock, getting to the gold bearing layer (stripping), and separating the gold from the gold bearing materials (sluicing). Stripping and sluicing, as practiced in Alaska, often results in the discharge of noticeable amounts of sediment into many water bodies that otherwise would be virtually sediment free. This is contrary to state and federal laws and regulations to which the placer mining industry is being held more and more accountable. Two parameters which describe the impact of placer mining on water bodies are turbidity which relates to the muddiness or cloudiness of the water body and total suspended solids which describes the physical amount of sediment present in the water column.

For water quality purposes turbidity is defined as the "expression of the optical property that causes light to be scattered and absorbed rather than transmitted in straight lines through the sample." (APHA 1985) The scattering and absorption is caused by suspended particles in water. These particles may be suspended sediments such as clays or silts, algae, organic detritus, and other fine insoluble particles (Hach and others 1984). In Alaska, turbidity is currently measured with turbidimeters reporting in nephelometric turbidity units (NTU). Nephelometry refers to the measurement of the light scattered at right angles to the incident light beam passing through a sample (Hach and others 1984). The deleterious effects of turbidity on water bodies include aesthetic and functional impacts on recreational users, poorer productivity because of reduced light penetration with adverse impacts on the food chain, avoidance by fish populations and impairment of treatment for drinking water (Peterson and others 1985).

Measurement of turbidity requires a properly calibrated turbidimeter and appropriate glassware. Nephelometric turbidimeters can measure values up to 100 NTU's, however the standard method requires dilutions to below 40 NTU (APHA 1985). Placer mined streams are often above 100 NTU's and may require several dilutions. Portable turbidimeters are available and can accurately measure turbidity in the field.

Total suspended solids (TSS) can be defined as "the portion of total solids retained by a glass-fiber filter" (APHA 1985). It is reported as a concentration (usually milligrams per liter) and represents the mass of non-dissolved solids contained in the water column. The literature relates high TSS concentrations to damage to biota including impacts on fish at various life stages and impacts on invertebrates (Peterson and others 1985). Total suspended solids combined with discharge give estimates of sediment load which describes the total amount of sediment carried by a stream.

Measurement of TSS requires glassware for filtering samples, ovens, and analytical balances and is not practical outside a properly equipped laboratory. Total suspended solids analysis requires more time than turbidity measurements. The sample must be filtered, which can take hours with silt-laden samples, and dried in an oven. Turbidity can be done in the field and requires only the time for the turbidimeter readout to stabilize and, for highly turbid samples, time for dilutions.

Total suspended solids should not be confused with settleable solids. Settleable solids are the volumetric quantity of solids that will settle in an Imhoff cone in one hour (APHA 1985) and are reported in milliliters per liter. This project did not investigate any relationship between turbidity and settleable solids.

Extensive literature exists on turbidity-TSS relationships. The turbidity measurement was developed as an index for suspended material concentrations but it has been long recognized that no single, universal relationship is appropriate (Lloyd 1985). The reason is that turbidity is an optical measurement of reflected light while TSS measures the actual mass of all particles retained on a filter paper. Investigators have found that smaller particles cause turbidity - much of the variation in turbidity is attributed to particles 10 microns or smaller (Nichols 1986). Samples with identical TSS but different particle size distributions could have very different measured turbidity. Likewise, with two samples of similar turbidity, the sample with coarser material would have substantially higher TSS (Nichols 1986). Particle size differences may be less in streams affected by placer mining because of effluent treatment (usually settling ponds). Because settling ponds do a poor job of removing particles less than 25 microns (Dames and Moore 1986) and finer particles are also most responsible for turbidity, placer mined streams may have less variability due to particle size differences.

Consideration of the sources of error in the measurement of turbidity and TSS is necessary in the development of a turbidity-TSS relationship. Nichols (1986) identified the sources of error as: 1) error in sample collection, 2) subsample error, 3) error in turbidity analyses, and 4) error in TSS analyses. Error in sample collection refers to whether the sample collected is representative of the whole stream cross section and is not important for this project. Regardless of whether the sample is representative of a entire cross section, development of regression equations require only that the TSS and turbidity samples be taken at the same time and at the same location. Subsample error can be important. TSS and turbidity samples are commonly collected in bottles with capacity in excess of what is needed for analysis. Subsamples or splits are then taken from these bottles for the actual analysis. This is most critical with samples with coarse particles because these start settling immediately after a thorough shaking.

Of these sources of error, errors in turbidity measurement have received the most attention. Pickering (1976) recommended that the USGS stop reporting turbidity because of measurement error. Nichols (1986) looked extensively into this type of error. In the past, turbidity has been measured by different methods reporting in similar but not identical units. Recently nephelometry has become the standard and in Alaska is the method used for placer mining turbidity measurement. Even though nephelometry is the only method used, several brands and models within brands of nephelometric turbidimeters are used to measure turbidity. Concern exists that these instruments do not report identical results. Nichols tested three turbidimeters on replicate samples from a placer mined stream and found the results varied between instruments from six to twenty per cent. The coefficients of variation for the instruments for each set of replicates ranged from one to fifteen per cent. Rounding data according to standard methods (APHA 1985) may help reduce error due to turbidimeter brand and model variation (Peterson and others 1985).

Error in TSS values appear to be most attributable to subsample error (Nichols 1986). Paralleling the above cited turbidity variability trials, Nichols also tested the variability of TSS from replicate samples. He found higher coefficients of variation for TSS replicates (10 to 33 percent) than for turbidity (2 to 10 percent) for corresponding replicate sets.

Regardless of the problems relating TSS to turbidity, numerous attempts have been made and are continuing to be made to relate the two parameters. Lloyd (1985), Peterson and others (1985), and Nichols (1986), all summarize the attempts of others, with Lloyd and Nichols adding their own equations. Viewing the equations and graphical representation of those equations it is apparent that no one equation best describes the TSS-turbidity relationship (Peterson and others 1985). Nichols found that a statistical rationale exists for the common practice of using a logarithmic transformation of the data and commented that while all authors report the coefficient of determination (r^2), few give an estimate of the equation error. Both Nichols (1986) and Peterson and others (1985) caution that while turbidity-TSS equations can be useful, the error associated with the correlation must be known. Scatterplots of the data must be analyzed to determine if the data is clustered into discrete groups, and the relationship should be updated periodically. The regression model should consider drainage, season, and discharge and would be better if done on data from similar sources such as glacial streams or placer mined streams (Peterson and others 1985).

Nichols (1986) tested these recommendations on a placer mined stream near Fairbanks. Collecting samples above mining, directly below sluicing, and below settling ponds, he found his data clustered into distinct groups. Regression equations for the clusters predict TSS with average errors of 25 to 30 percent which compares well with the results of other investigators. The error associated with predicting individual TSS concentrations from turbidity was much higher - 600 to 1700 percent.

This investigation of the practicality of predicting TSS from turbidity data from mined streams in interior Alaska logically follows the work of Lloyd (1985), Peterson and others (1985), and Nichols (1986). A large amount of data collected by several different investigators exists for a number of sites in the interior. Experience from other investigators indicates that equations from different areas are statistically different. However, because placer mining throughout the interior is essentially similar, perhaps equations predicting TSS from turbidity are similar enough that one equation for the entire area or equations for single basins are appropriate. By organizing the data from the various sources on a geographical basis and using the computer to generate site, stream and basin-specific equations and apply appropriate statistical techniques, one can determine to what extent the historical data can be used and whether the concept of one predictive equation has merit.

In natural streams with no large point source of sediment, such as from placer mining, a positive relationship exists between sediment concentration and discharge or velocity (Leopold and Maddock 1953). In streams affected by placer mining the point source input of sluicing operations overwhelm this to the extent that dilution from extreme events may result in a negative relationship. However, in these streams sediment is settling from the water column onto the stream bottom during low flows and resuspending during high flows, and this can affect the turbidity-TSS relationship. All other things being equal, the particle size distribution in the water column will vary depending on flow with coarser particles suspended at higher velocities. Because changes in the water column particle size distributions will affect the turbidity-TSS relationship, the particle size distribution variation over a wide range of flows may introduce considerable error in a simple regression with turbidity as the predictor variable. To investigate this I constructed a multiple regression model using turbidity and velocity variables to predict TSS.

Because many investigators do not routinely measure discharge with water quality samples, multiple regression could not be applied to the entire database. Discharge data with the information needed to estimate velocity was available for many observations from the Crooked Creek basin. I used velocity as a variable because I wanted to combine observations from different sites to see if a basin model could be constructed.

METHODS:

1. Sources of Data:

Eight sources of data were used in the development of the data base used in this project:

1) Alaska Division of Geological and Geophysical Surveys (DGGS) placer mining research program;
2) United States Environmental Protection Agency (EPA) STORET database;
3) Alaska Department of Environmental Conservation (DEC), Environmental Quality Monitoring and Laboratory Operations data from 1983-85;
4) Alaska Department of Fish and Game (ADF&G), Habitat Division miscellaneous data from 1983-5;
5) "Fairbanks Area Ambient Water Quality Study, Placer Related Basins, 1984," (draft), Jerry Hilgert, Institute of Northern Forestry, USDA (INF);
6) "Placer Mining Wastewater Settling Pond Demonstration Project Report," R&M Consultants, Inc., 1982 (R&M);
7) "Placer Mining Wastewater Treatment Technology Project," Phase 2 Report, Shannon & Wilson, Inc., 1985, (S&W); and

8) data collected by the Alaska Cooperative Fishery Research Unit (ACFRU) investigators for several projects during 1982-83 (Wagener 1984).

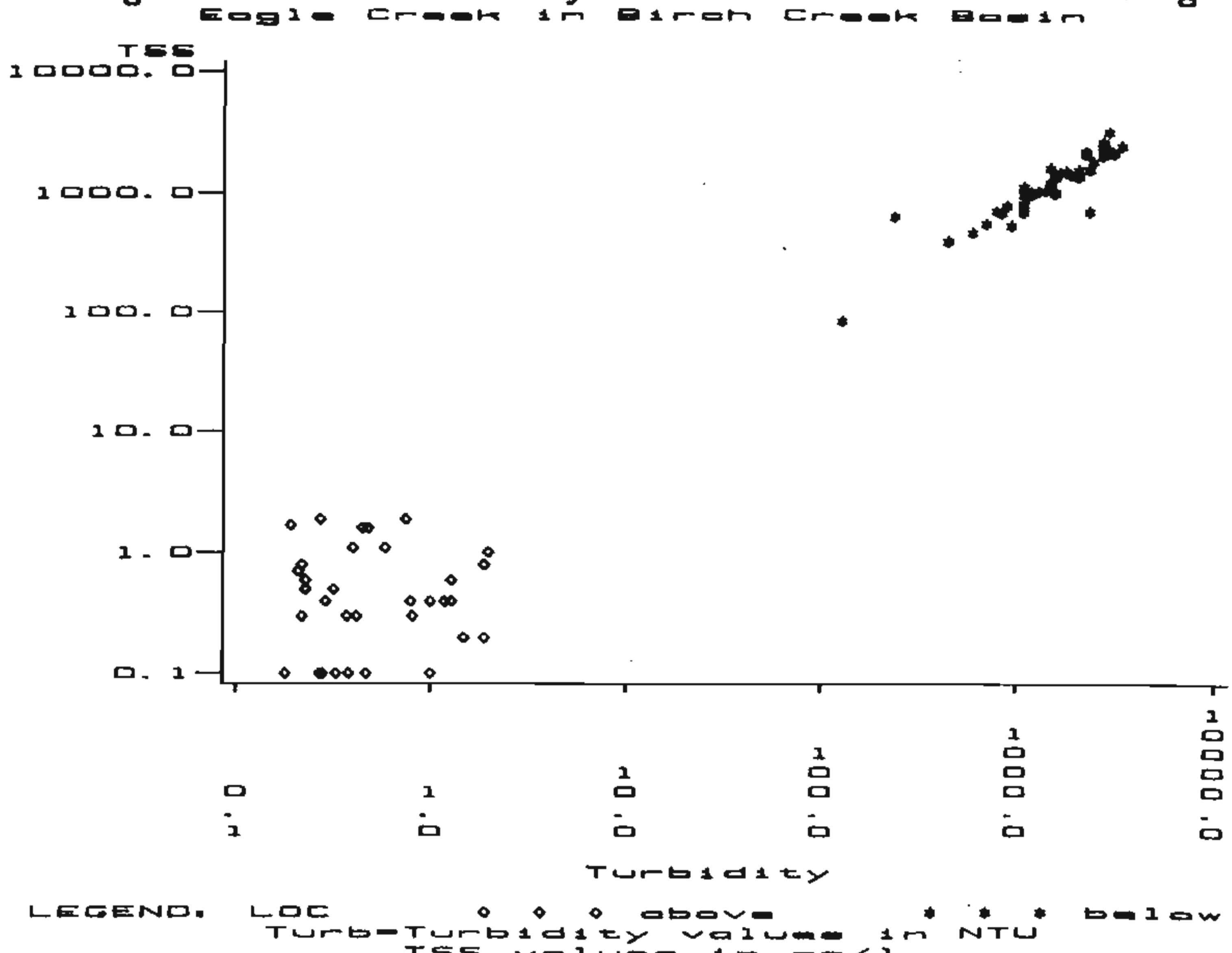
The total database of over 1100 observations does not contain all available data. I did not include data collected directly below a sluice or pond outlet. As noted above, particle size distribution will affect the turbidity-TSS relationship. Larger particles will settle out in settling ponds and in the stream channel. By not using data so directly affected by mining, the particle size problem could be minimized. As a result of this decision, no data from the R&M report was used and other data sources, particularly the S&W report, were scrutinized to make certain that only data from sites 500 feet or further from a mining operation outlet were included in the data base.

The EPA STORET database contains sample replication where, in some instances, an investigator collected multiple samples within a short time span. While building the database I was concerned that inclusion of replicates might bias the results toward the replicated samples. Where samples were taken less than thirty minutes apart by the same investigator at a site, I included only data from the first sample. Even with this restriction the database is not homogenous temporally. Much of the data is the result of intensive, short studies at sites where, for example, samples might be collected on a three hourly basis for three days. Because of the diurnal change in turbidity and TSS below a mining operation due to the starting and stopping of work, a range of values will be included, but it must be assumed that the relationship present for this short time did not vary throughout the operating season. These types of data are mixed with observations that are taken on a weekly or daily basis or are just miscellaneous samples that were not part of a systematic monitoring program.

Paired turbidity-TSS data that were not determined by weighing of a dried filter were not included in the development of the equations. The TSS data reported by Wagener (1984) was calculated from total solids using a conversion developed from conductivity. This is a standard method but because it is different I felt inclusion might add error to the equations. These data were later used to check the predictive value of the equations.

Considerable scatter can exist in the reported data at lower levels of turbidity and TSS. Figure 1, a plot of turbidity and TSS from Eagle Creek above and below mining, is a vivid demonstration of this. It shows well the clustering described by Nichols (1986). When these data are combined the sample coefficient of determination (r^2) value (.952) will be high, however, a correlation done on only the above mining data will result in a poor r^2 value (.031). A

Figure 1. Plot of Turbidity and TSS above and below Mining



correlation analysis done on the below mining data may result in a poorer r^2 (.837) than the combined data, but the equation will be more descriptive of the turbidity-TSS relationship within placer mining range and the equation error may be less. In this instance the standard error of estimate for the combined data is .412 (+158, -61 percent) and for the below mining data, it is .115 (+30,-23 percent).

A problem with using data from different sources is the differing TSS reporting procedures of laboratories. Various labs reported low TSS values using one to three significant figures, thus for differing labs, 1 could be equivalent to 0.6 or 1.4, which could be equivalent to 0.56 or 1.44. Complicating this is differing lower detection or reporting limits. Detection limits for data used in this study ranged from 0.01 mg/l to 4 mg/l. Because 4 mg/l is a high detection limit for clear streams, considerable scatter can be introduced when paired with turbidity data that is reported to the nearest hundredth down to 0.01 NTU. Less variability was noticed in the reporting procedures for turbidity. These reporting problems may not affect the sample coefficient of determination much but may affect the equation error.

Because of the reporting and clustering problems with lower value observations, I included in the database used for regression analyses only those observations with a turbidity greater than 5 NTU's. While admittedly arbitrary for the purposes of this project, 5

NTU's has importance because it is the background turbidity drinking water supply standard for the State of Alaska (ADEC 1982). Deletion of observations with turbidity less than 5 NTU's reduced the database to 885 observations.

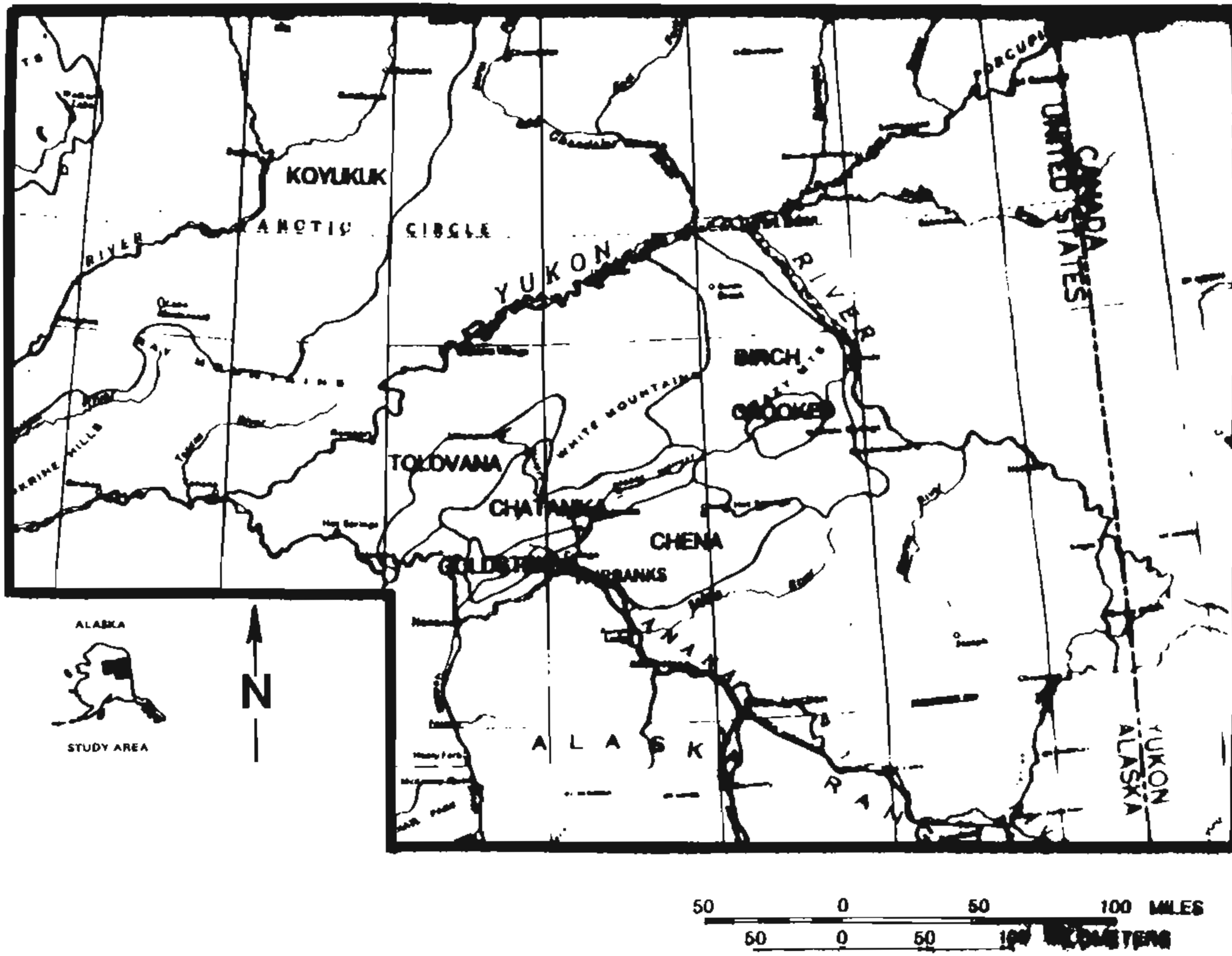
2. Geographical Organization:

Most investigations of mining have taken place in the road accessible areas near Fairbanks and along the Steese, Elliot, and Dalton Highways. Water from these streams eventually drain into the Yukon River via the Tanana and Koyukuk Rivers and Birch Creek. The major drainages used for this project are described by the recent draft version of the U.S. Geological Survey Hydrological Unit Map of Alaska (USGS 1985). In instances where more data was available smaller basins were delineated. For this project seven basins were selected for analysis: Birch Creek, Crooked Creek, Chena River, Chatanika River, Goldstream Creek, Upper Tolovana River, and Koyukuk River. Analysis was broken down further to creeks and rivers within the basins and sites on those creeks. Figure 2 shows the locations of the basins within interior Alaska.

3. Statistical Methods:

Important statistical techniques for this project include

FIGURE 2. INTERIOR ALASKA BASINS WITH PLACER MINING DATA



logarithmic transformation of data, simple and multiple linear regression, coefficient of determination, standard error of estimate, and analysis of covariance models. The turbidity and TSS values were transformed to logarithms for regression analyses. The wide range of values display well on a logarithmic scale and an initial plot of the data on linear scale showed a power curve that appears straight on a logarithmic scale. Nichols (1986) investigated the rationale behind logarithmic transformation of the data in the development of turbidity-TSS relationships and found that residual analysis indicated a logarithmic transformation of both turbidity and TSS fit the data best.

Linear regression uses the relation between two or more variables to predict one from the other(s) (Neter, Wasserman, and Kutner 1985). A simple linear regression model is expressed in an equation of the form $y=a+b(x)$ where x is the predictor variable, in this case turbidity, y is the response variable (TSS), b is the slope of the line and a is the y axis intercept. Because the analyses were performed on log transformed data the regression equations can be expressed as power functions in the form of $y=a*x^b$, where the terms are defined as above.

The coefficient of determination (r^2) and standard error of estimate indicate how well the regression equation fits. r^2 can be interpreted as the proportionate reduction of variation in the response variable associated with the predictor variable. It always lies between 0 and 1; the closer to 1, the greater the linear association between the two variables (Neter, Wasserman, and Kutner 1985).

The r^2 indicates how well two variables are linearly associated but gives no information on how much error would be involved if the model is used for predictive purposes. Since the predictive value of the turbidity-TSS relationship is very important to this project, error analysis is important. Standard error of estimate (SEE) is one way of reporting error. The standard error of estimate is the positive square root of the regression model mean square error and is an estimator of regression model standard deviation (Neter, Wasserman, and Kutner 1985). For this project the SEE is an estimator of the standard deviation for the predicted TSS for any turbidity value This was used to estimate error for the equations developed in this report and is reported as a percent. Appendix 2 describes how standard error of estimate was calculated including sample calculations.

Of great interest in this project is to what extent data from different areas can be combined to develop useful predictive equations. The approach I took was to determine whether the predictive regression equations for different groups of data (for example, data from different basins) are similar at a specified confidence level. A methodology to do this is called analysis of covariance. To determine the similarity of data from different groups, a covariance model is developed by adding qualitative indicator variables for each data group. The model is tested to determine if indicator variables improve the model. If not, the indicator variables are not needed. This indicates that the regression equations for the tested data groups are similar and the data can be combined to develop one equation. The assumptions of covariance analysis are: 1) independence of observations, 2) normality of residuals, and 3) common variability of the points around the individual regression lines. The data used for this project were independent observations. The latter two assumptions were not studied but were assumed to hold. Appendix two describes analysis of covariance in more detail.

The techniques described above were performed on the University of Alaska-Fairbanks VAX computer using the GLM (general linear model) procedure of the SAS statistical package (SAS 1985a; SAS 1985b). Both turbidity and TSS were transformed into base 10 logarithms with all analyses done on transformed data. All pairs had site, stream, basin, date collected and source descriptors enabling analysis on any of these. The geographical descriptors, based on the USGS hydrologic unit map, are hierarchical in nature allowing easy analysis of subbasins or streams within a larger basin.

4. Model Validation.

It is good statistical practice to measure the predictive value of a model with data not used in the model development (Neter, Wasserman, and Kutner 1985). Paired data from placer mined streams in interior Alaska not included in the principal data base were used to measure the predictive ability of the equations. The sources of these data were DEC fiscal year 1986 placer mining data from the 1985 summer (DEC 1986) and Alaska Cooperative Fishery Research Unit from the 1983 summer (Wagener 1984). TSS was estimated from the turbidity values reported by these researchers using the most appropriate regression equation, as indicated by analysis of covariance. These results were compared with the reported TSS. A Z score was developed by dividing the difference between the reported and predicted TSS by the regression equation standard error of estimate. The Z score gives a relative measure of how close, in multiples of the standard error of estimate, the predicted value is to the reported value. A negative Z score means the model overpredicted.

5 . Velocity-Turbidity Multiple Regression Model.

Velocity estimates were available for 76 paired turbidity-TSS observations from the Crooked Creek basin. Included in this were estimates for 16 observations at Crooked Creek at Central. These estimates were developed from staff gage readings using velocity rating curves. Multiple regression models and accompanying statistics were developed using the GLM procedure of the SAS statistical package (SAS 1985b).

RESULTS:

1. Summary Statistics.

The complete data base used for this project is listed in Appendix 1. It contains over 1100 observations from approximately 140 separate sites organized into seven basins: Birch Creek (excluding Crooked Creek), Crooked Creek, Chena River, Chatanika River, Goldstream Creek, Upper Tolovana River, and Koyukuk River.

The regression equations use only observations where the turbidity is greater than 5 NTU. Of these 885 observations, 552 observations (62 percent) come from 18 individual sites which have 15 or more observations. 766 observations (87 percent) come from 15 streams with 15 or more observations. Summary statistics for these sites and streams are presented in Table 1. Of the 15 streams, seven - Eagle, Gold Dust, Deadwood, Ketchem, Mammoth, Gilmore, and Goldstream Creeks - have over 70 percent of their observations coming from one of the 18 individual sites mentioned above and four - Crooked and Fish Creeks, and Chatanika and Tolovana Rivers - have over 70 percent coming from two or three sites with 15 or more observations. Even though the observations come from a large general geographic area, most of the data comes from relatively few sites on a few

Table 1. Summary statistics for streams and sites with 15 or more observations.

Location	N	TURBIDITY (NTU) Mean	SD*	Max	Min	TOTAL SUSPENDED SOLIDS (mg/l) Mean	SD*	Max	Min
A. Birch Creek Basin									
1. Lower Birch Cr	44	39.2	46.6	240	6.4	75.1	138	770	12.7
a. Birch ab Crooked Cr	16	15.08	9.48	32	6.4	71.6	187	770	14.8
2. Eagle Cr	47	1770	1150	7000	130	1450	1440	10000	85
a. Eagle b GHD	46	1654	860	3500	130	1312	695	3190	85
3. Gold Dust Cr	18	1590	1220	5000	100	1180	947	3040	52
a. Gold Dust b GDM	18	1590	1220	5000	100	1180	947	3040	52
4. Upper Birch Cr	16	739	542	2100	270	872	688	2640	244
B. Crooked Creek Basin									
1. Crooked Creek	96	459	412	1900	33	392	361	1530	37
a. Crooked at Central	38	663	482	1900	33	564	417	1532	37
b. Crooked ab mouth	19	134	68.1	310	60	110	55.9	250	55.2
2. Deadwood Cr	36	875	991	3500	45	1540	1540	5980	23
a. Deadwood at CHSR	32	866	995	3500	45	1559	1569	5980	23
3. Ketchem Cr	22	1640	1700	5100	110	2600	3200	9300	97.6
a. Ketchem at CHSR	20	1737	1750	5100	210	2800	3290	9300	97.6
4. Mammoth Cr	32	383	324	1300	16	493	457	1810	88
a. Mammoth at Steese	27	380	286	1200	50	496	459	1810	88
5. Porcupine Cr	34	167	162	750	23	186	270	1470	16.5

Location	N	TURBIDITY (NTU) Mean	SD*	Max	Min	TOTAL SUSPENDED SOLIDS (mg/l) Mean	SD*	Max	Min
C. Chena River Basin									
1. Fish Cr	67	214	225	1100	6.9	192	225	950	15
a. Fish Cr b Gold Dredge	22	16.5	7.18	36	6.9	51	78.4	396	15
b. Fish Cr b Lucky 7	43	623	212	1100	45	271	242	950	20
D. Chatanika River Basin									
1. Chatanika R	151	40.2	51	310	5.1	52.2	82.2	500	2
a. Chatanika at 39 mile	15	12.7	14.9	65	5.1	10.5	10.2	32	2
b. Chatanika at Long Cr	53	21.4	20	95	6.2	20	22.8	100	3
c. Chatanika b Faith Cr	56	74.6	68.1	310	6.2	102	113	500	6
2. Faith Cr	27	215	498	2600	6.7	233	375	1890	14
a. Faith at Steese	17	75.1	43.1	140	14	120	112	416	14
E. Goldstream Creek Basin									
1. Goldstream Cr	50	269	123	800	30	323	241	1400	30
a. Goldstream b Fox	36	284	105	800	65	335	239	1400	140
2. Gilmore Cr	50	1650	1100	5300	60	479	271	1300	20
a. Gilmore b BD Mining	44	1810	1070	5300	280	506	273	1300	20
F. Tolovana River Basin									
1. Tolovana R	76	20.8	23.8	180	5.4	61.6	176	1400	7.2
a. Tolovana at TAPS	30	18.1	10.1	40	6.1	39.1	43.6	238	11
b. Tolovana ab West Fork	36	18	9.16	38	5.4	33.9	19.2	83	13

* standard deviation

streams. Investigators from different agencies and consulting firms are using the same road-accessible sites.

Probably because of its distance from Fairbanks, the Koyukuk basin is an exception to this. No stream in the Koyukuk River basin had as many as ten observations. What data exists is mainly from sites along the Dalton Highway.

Figures 3 through 10 are plots of the paired observations by stream or site location. None of the stream data exhibit the definite cluster pattern demonstrated by Figure 1. The site data show a more clustered pattern. Figure 9, Sites on Fish Creek, illustrates the problems with using data from different sources. The data from Fish Creek below Lucky 7 were collected by a consulting firm (R&M) for a summer-long project and reflect a variety of seasonal conditions. The data from Fish Creek below Gold Dredge were collected by EPA researchers during a three day span and have a much tighter cluster pattern.

2. Regression Equations.

Table 2 presents regression equation coefficients with descriptive parameters for all sites and streams with 15 or more observations, for the seven basins, and for the combined interior

Figure 3. Plot of Turbidity and TSS

Streams in Birch Creek Basin

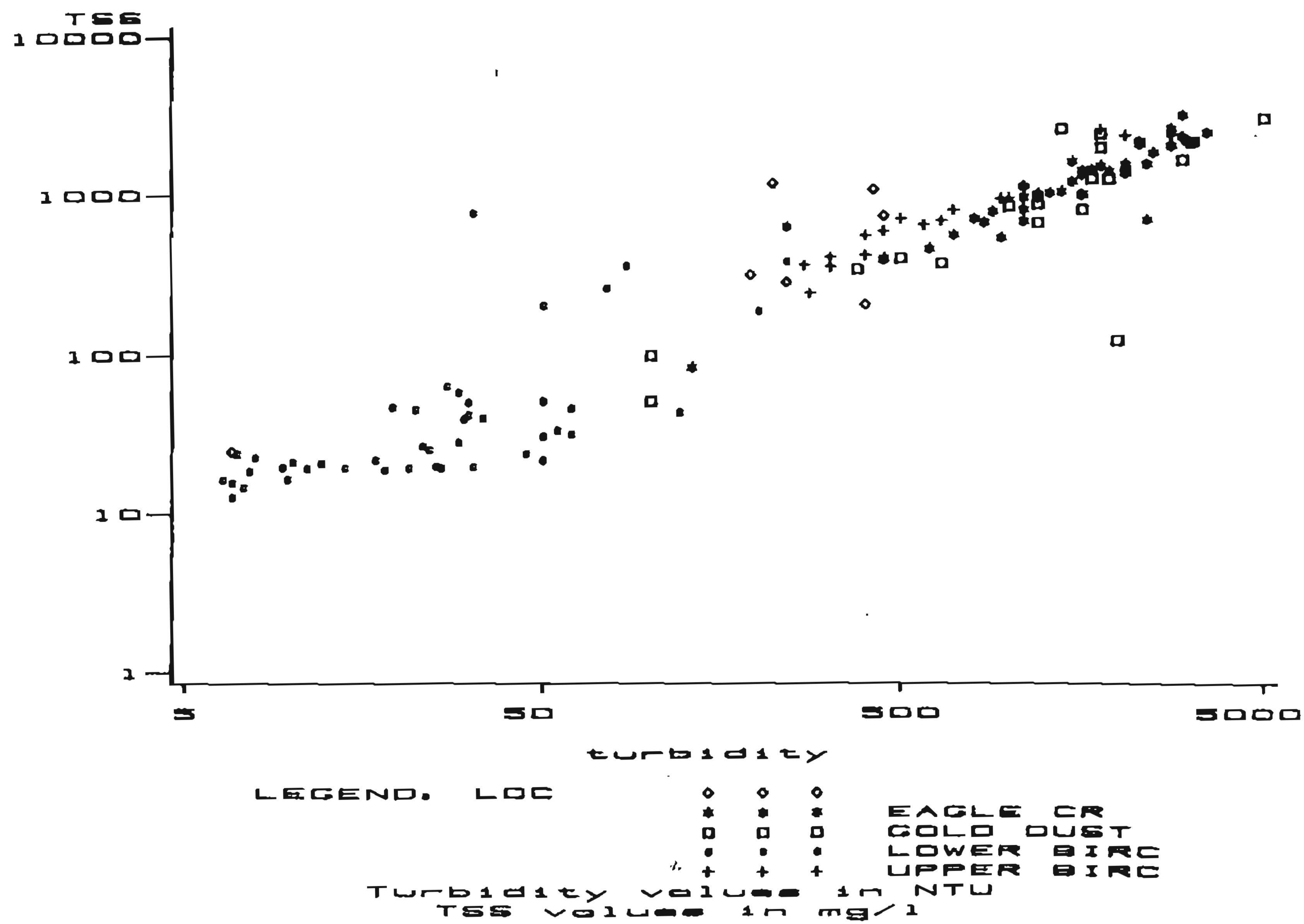
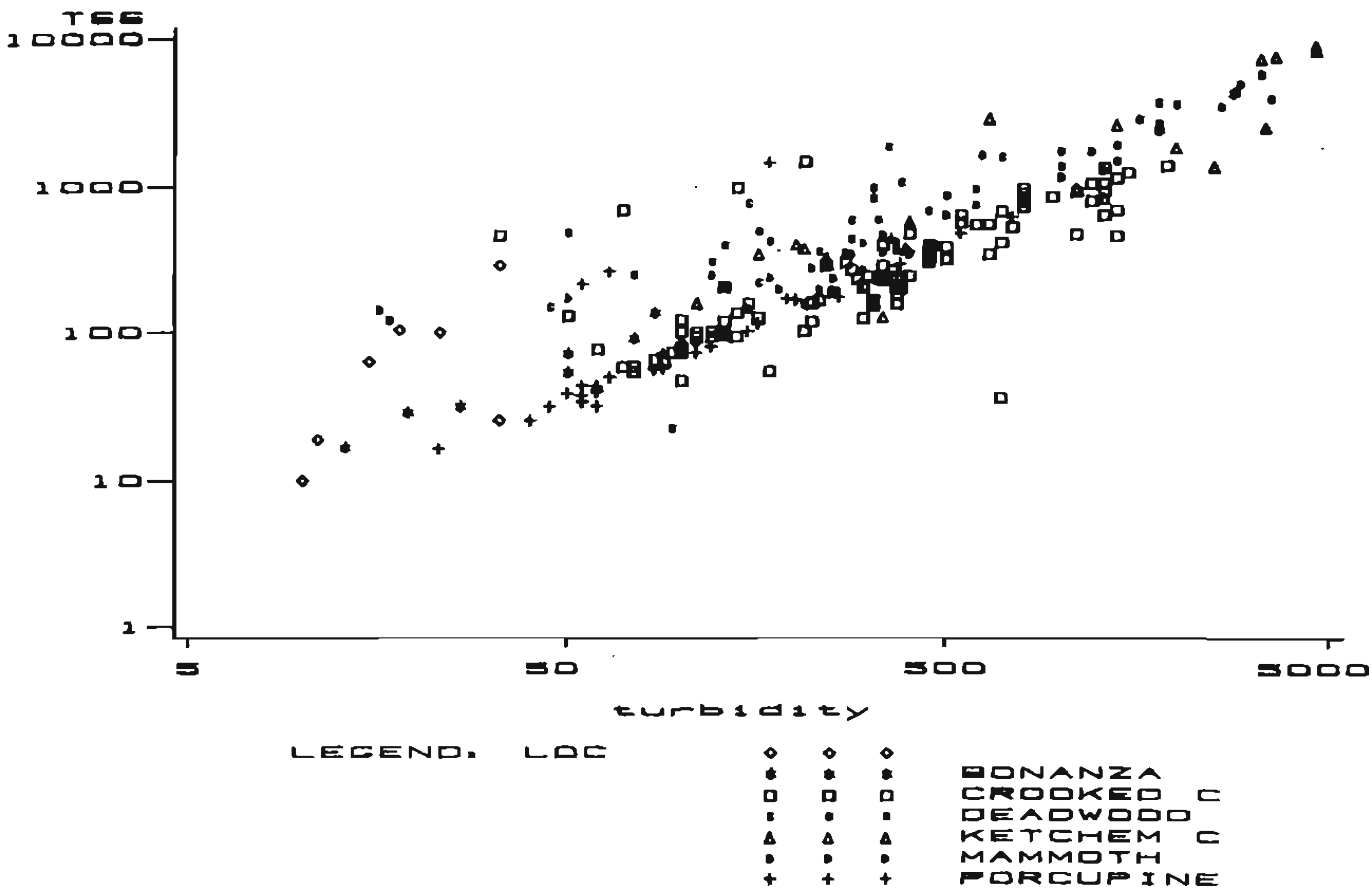


Figure 4. Plot of Turbidity and TSS

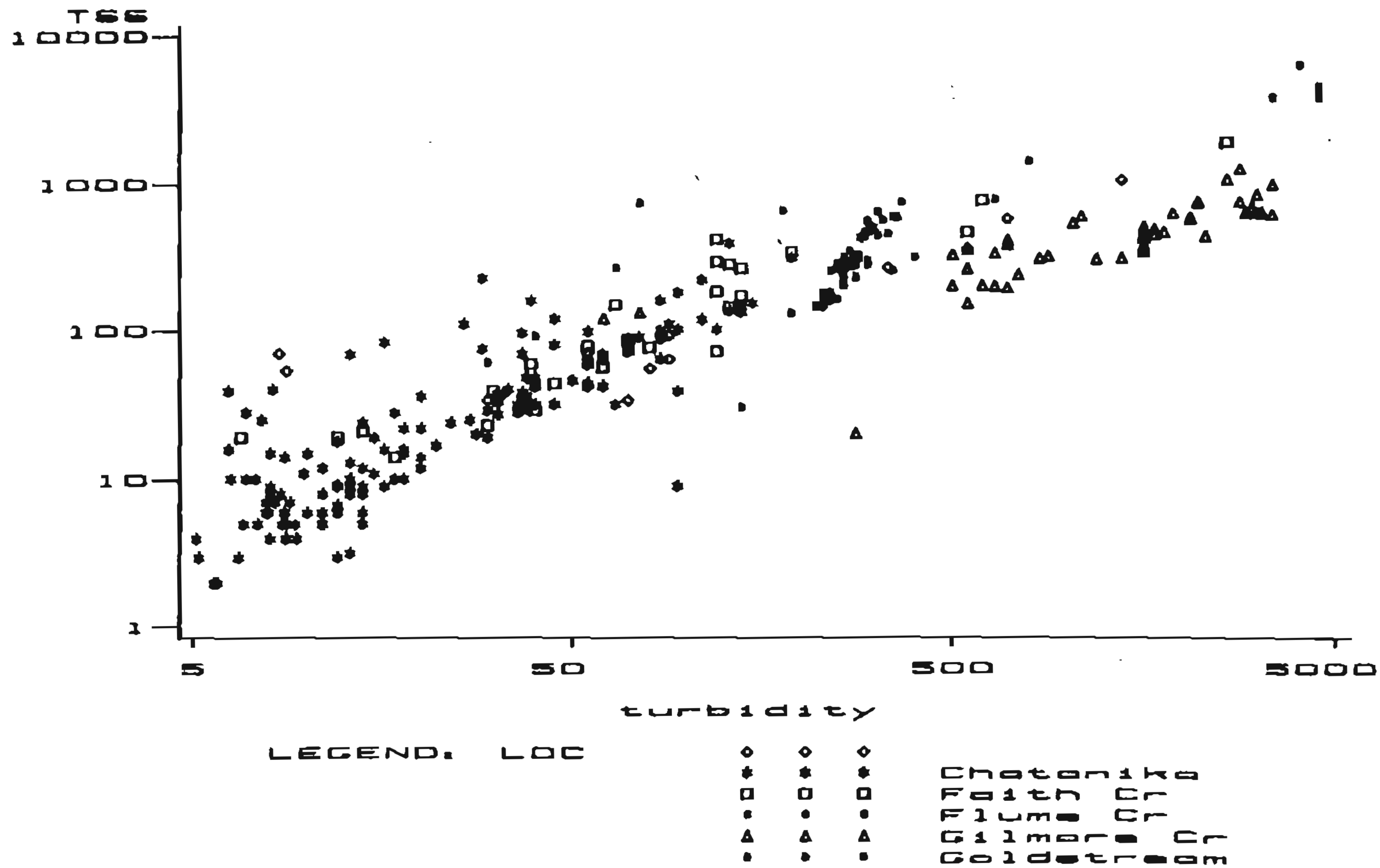
Streams in the Crooked Creek Basin



Turbidity values in NTU
TSS values in mg/l

Figure 5. Plot of Turbidity and TSS

Streams in the Chatanika and Goldstream Basins



Turbidity values in NTU
TSS values in mg/l

Figure 6. Plot of Turbidity and TSS

Streams in the Tolovana, Chena and Koyukuk Basins

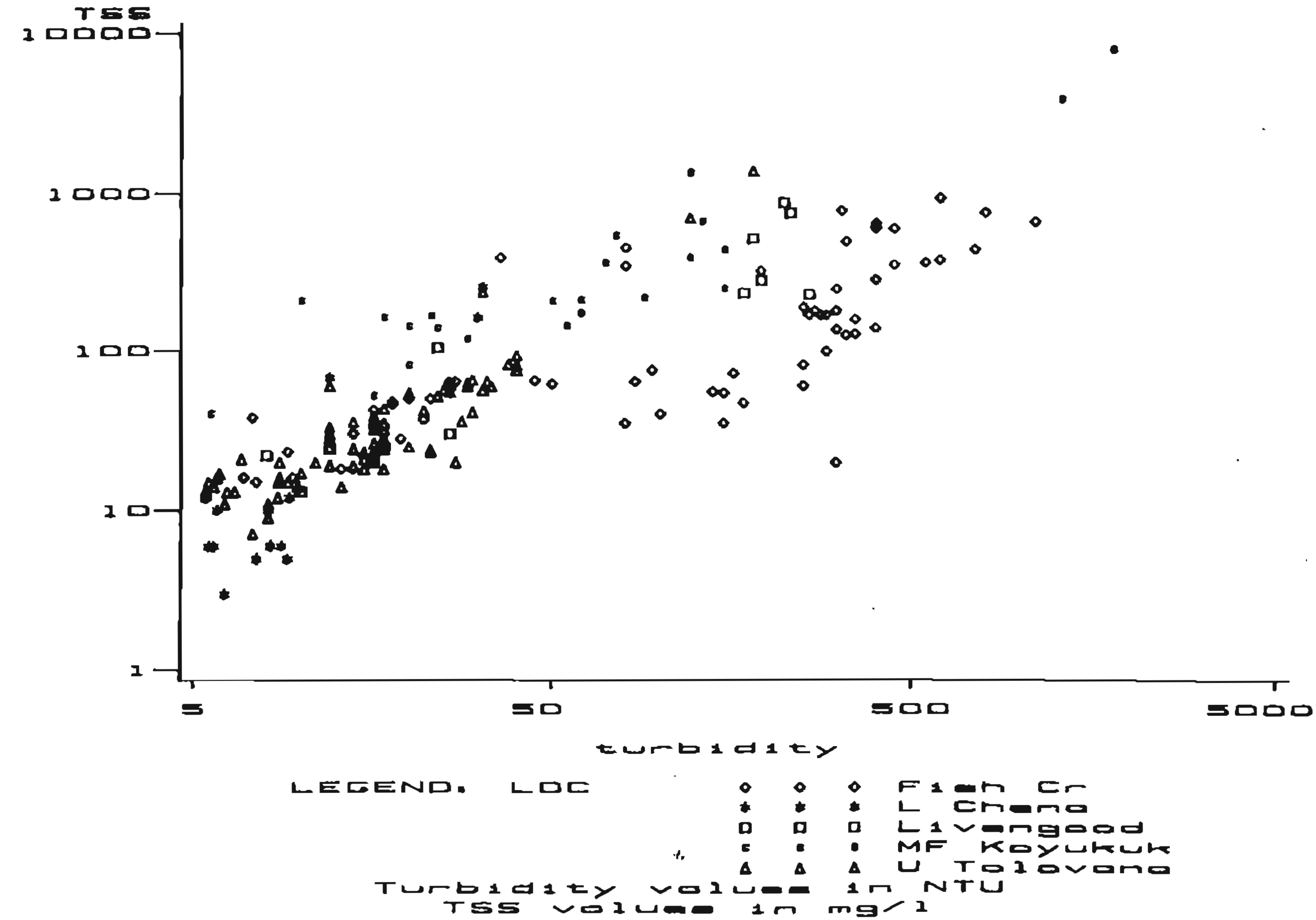


Figure 7. Plot of Turbidity and TSS

Sites on Crooked Creek

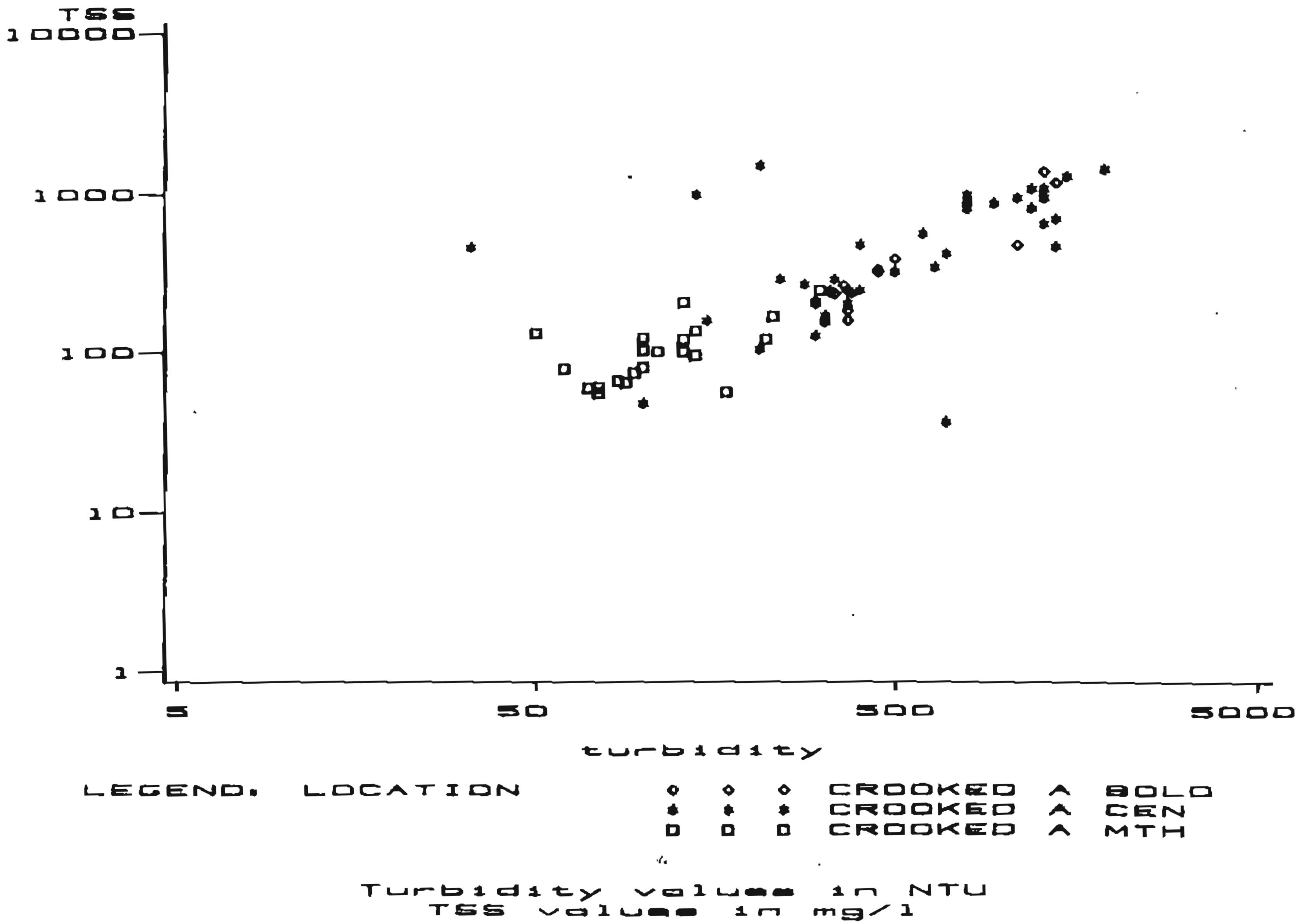


Figure 8. Plot of Turbidity and TSS

Sites on Chatanika River

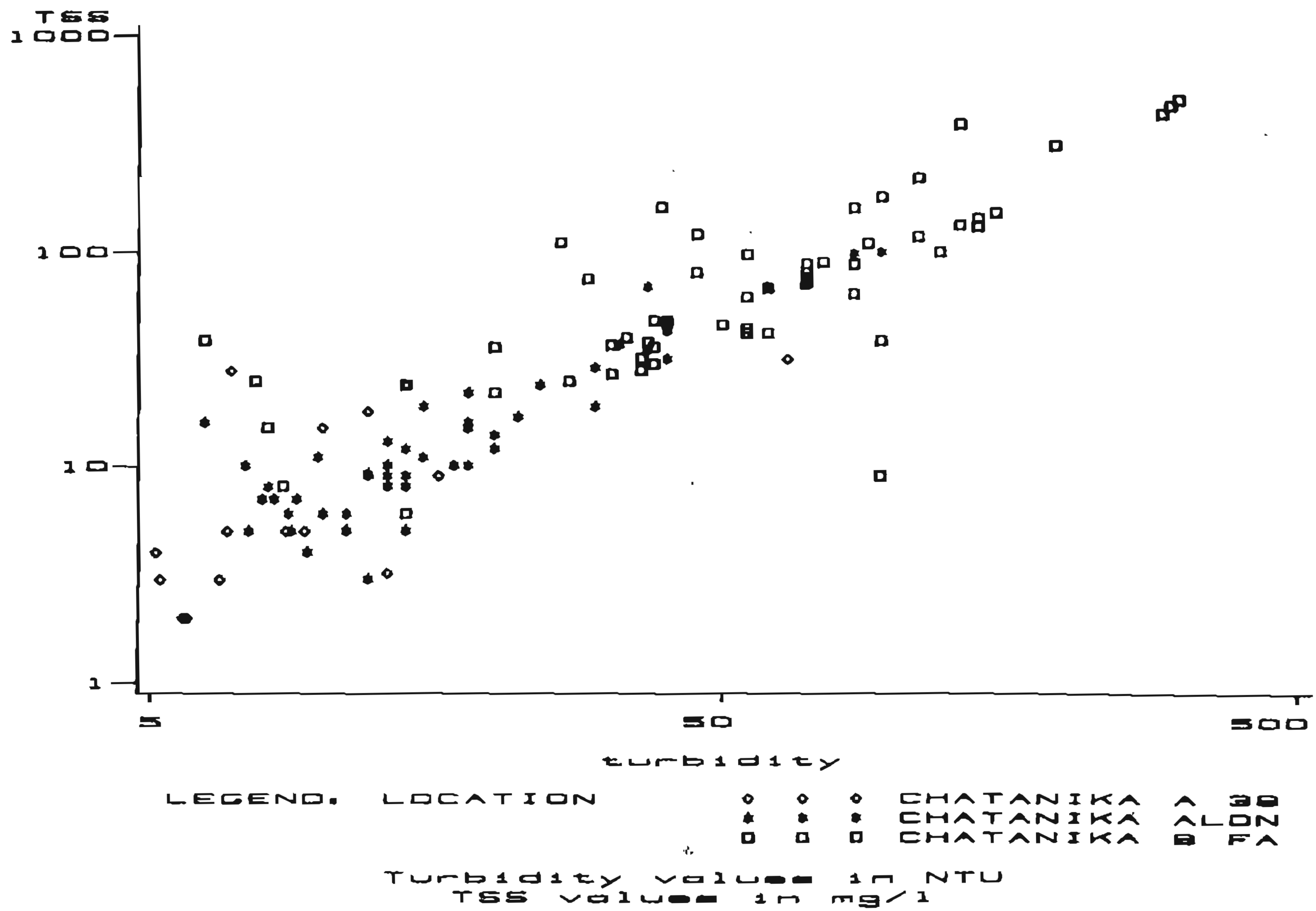


Figure 9. Plot of Turbidity and TSS

Sites on Fish Creek

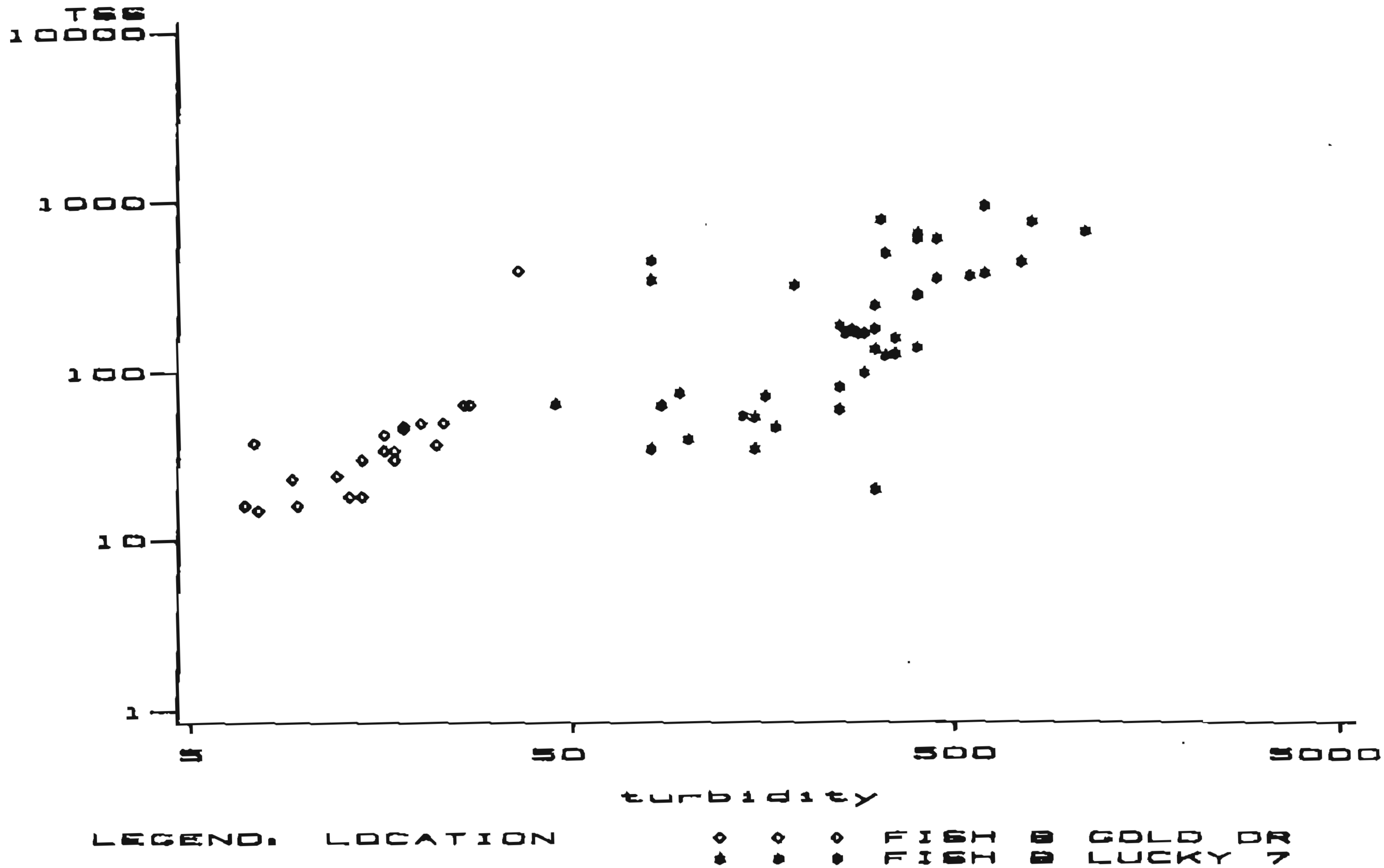


Figure 10. Plot of Turbidity and TSS

Sites on Tolovana River

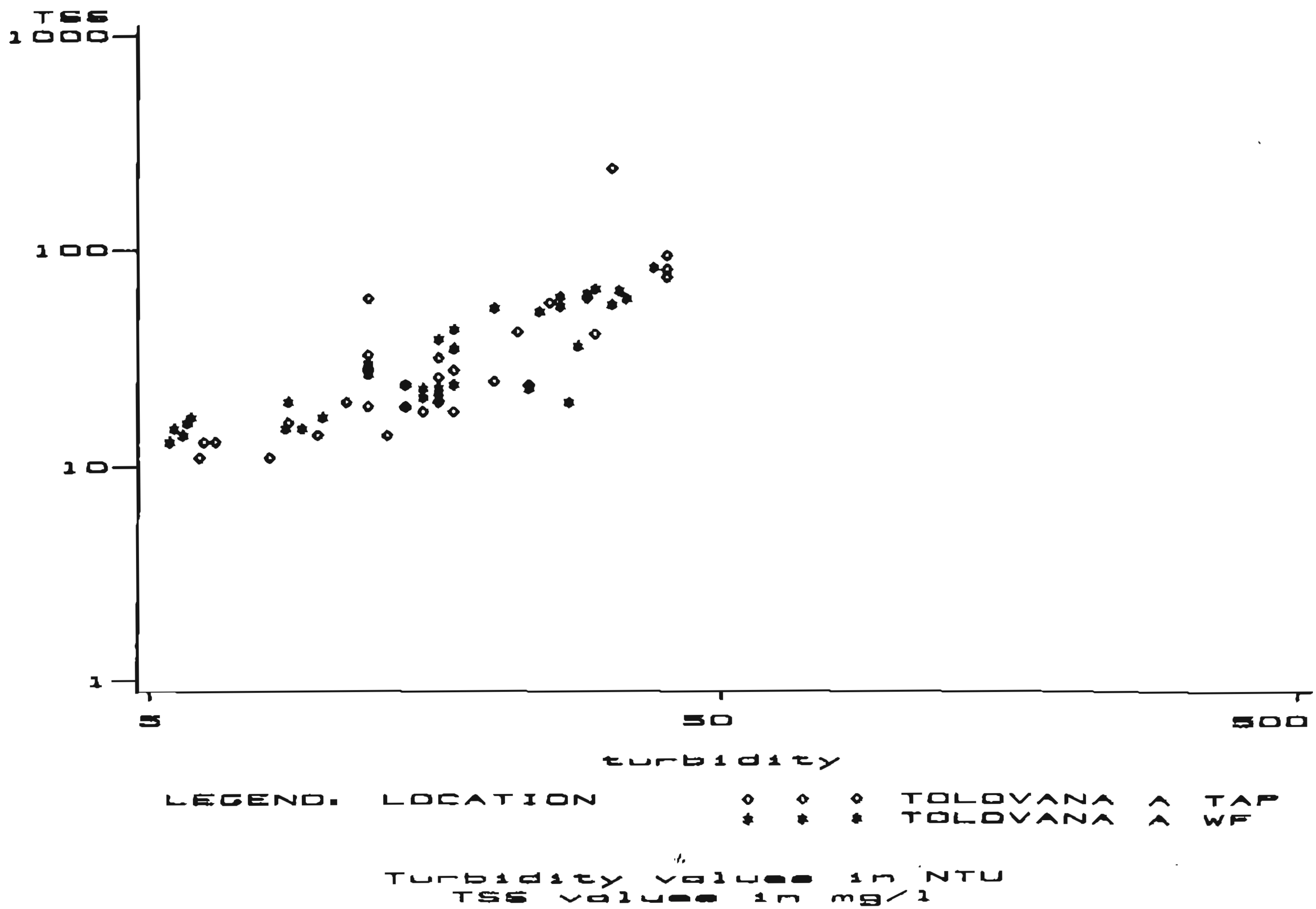


Table 2. Summary of regression equations and covariance analysis for basins, streams, and sites in interior Alaska.

Equations in the form $y=a*(x^b)$ where y=TSS, x=turbidity, a=y axis intercept and b=slope

Location	N	a	b	r^2	+SEE(%	-SEE(%)	F*<F?*
Interior Alaska	885	2.317	0.851	0.813	112	53	no
A. Birch Cr Basin	133	2.630	0.840	0.899	75	43	yes
1. Lower Birch Cr	44	3.540	0.731	0.468	104	51	
Birch ab CC	16	2.158	1.014	0.372	119	54	
2. Eagle Cr	47	1.416	0.924	0.847	33	25	
Eagle b GHD	46	2.046	0.871	0.837	30	23	
3. Gold Dust Cr	18	1.259	0.911	0.671	102	51	
Gold Dust b GDM	18	1.259	0.911	0.671	102	51	
4. Upper Birch Cr	16	1.249	0.989	0.944	17	15	
B. Crooked Cr Basin	239	2.000	0.900	0.730	103	51	no
1. Crooked Cr	96	3.589	0.748	0.553	73	42	yes
Crooked ab Boulder	9	0.032	1.504	0.549	23	19	
Crooked at Central	38	14.655	0.535	0.261	123	55	
Crooked ab mouth	19	2.178	0.821	0.256	97	49	
2. Deadwood Cr	36	5.012	0.859	0.767	82	45	
Deadwood at CHSR	32	4.656	0.863	0.769	86	46	
3. Ketchem Cr	22	1.982	1.028	0.839	82	45	
Ketchem at CHSR	20	1.406	0.999	0.863	74	43	
4. Mammoth Cr	32	10.328	0.638	0.711	52	34	
Mammoth at Steese	27	1.858	0.928	0.808	40	28	
5. Porcupine Cr	34	0.713	1.044	0.696	81	45	

Location	N	a	b	r^2	+SEE(%	-SEE(%)	F*<F?*
C. Chena R. Basin	96	3.311	0.771	0.648	155	61	no
1. Fish Cr	67	5.598	0.630	0.629	107	52	no
Fish Cr b Gold Dredge	22	1.153	1.261	0.627	55	35	
Fish Cr b Lucky 7	43	1.315	0.879	0.370	124	55	
2. Little Chena	14	0.124	2.108	0.782	95	49	
D. Chatanika R Basin	186	0.932	1.034	0.789	90	47	yes
1. Chatanika R	151	0.729	1.098	0.743	88	47	no
Chat a 39m	15	0.771	0.965	0.418	115	54	
Chat at Long	53	0.473	1.179	0.803	47	32	
Chat b Faith	56	2.280	0.844	0.610	85	46	
2. Faith Cr	27	1.770	0.930	0.881	56	36	
Faith at Steese	17	0.611	1.186	0.787	57	36	
E. Goldstream Cr Basin	112	5.808	0.651	0.602	97	49	no
1. Goldstream Cr	50	5.781	0.694	0.320	76	43	
Goldstream b Fox	36	1.274	0.967	0.385	52	34	
2. Gilmore Cr	50	4.560	0.627	0.657	51	34	
Gilmore b SD Mining	44	0.848	0.852	0.719	44	31	
F. Upper Tolovana Basin	88	1.500	1.083	0.841	53	35	yes
1. Tolovana R.	76	1.233	1.157	0.778	50	33	yes
Tolovana at TAPS	30	1.419	1.088	0.673	53	35	
Tolovana ab West Fork	36	3.126	0.814	0.722	34	25	
2. Livengood Cr	12	1.871	1.015	0.882	74	43	

Location	N	a	b	r^2	+SEE(%	-SEE(%)	F*<F?*
G. Koyukuk River	31	5.768	0.867	0.635	140	58	

* A 'no' in this column indicates that the equations that combined would make up this geographical unit are statistically different at the 95 percent confidence level. For example, the 'no' for the interior Alaska equation indicates that the basin equations within interior Alaska are statistically different from each other. A 'yes' is the opposite.

Alaska database along with the results of the analysis of covariance. Figures 11 through 18 show the regression lines by basin and stream location.

The regression with all 885 observations has a coefficient of determination of .813 but a standard error of estimate of +112% (-53%). The coefficients of determination for the basin equations range from .602 (Goldstream Creek basin) to .899 (Birch Creek basin). Four of seven equations have standard errors of estimate less than +100 percent.

For the stream equations, the equation coefficients and regression parameters - coefficient of determination (r^2) and standard error of estimate (SEE) - vary considerably. The r^2's range from .320 (Goldstream Creek) to .996 (Upper Birch Creek) with 13 of 15 r^2's above .50. The SEE's vary from +107% (-52%) with Fish Creek data to +17% (-15%) for Upper Birch Creek, with 12 of 15 equations having +SEE's less than 100 percent.

The variation of the equation descriptors (r^2, SEE) for site equations is similar to that of the stream equations. The r^2's range from .262 at Crooked Creek at the bridge to .863 at Ketchem Creek at the Circle Hot Springs Road. Thirteen of 18 equations have r^2 above .50. Other sites with relatively poor r^2 are Birch above

Figure 11. Plot of Turbidity–TSS Regression Lines

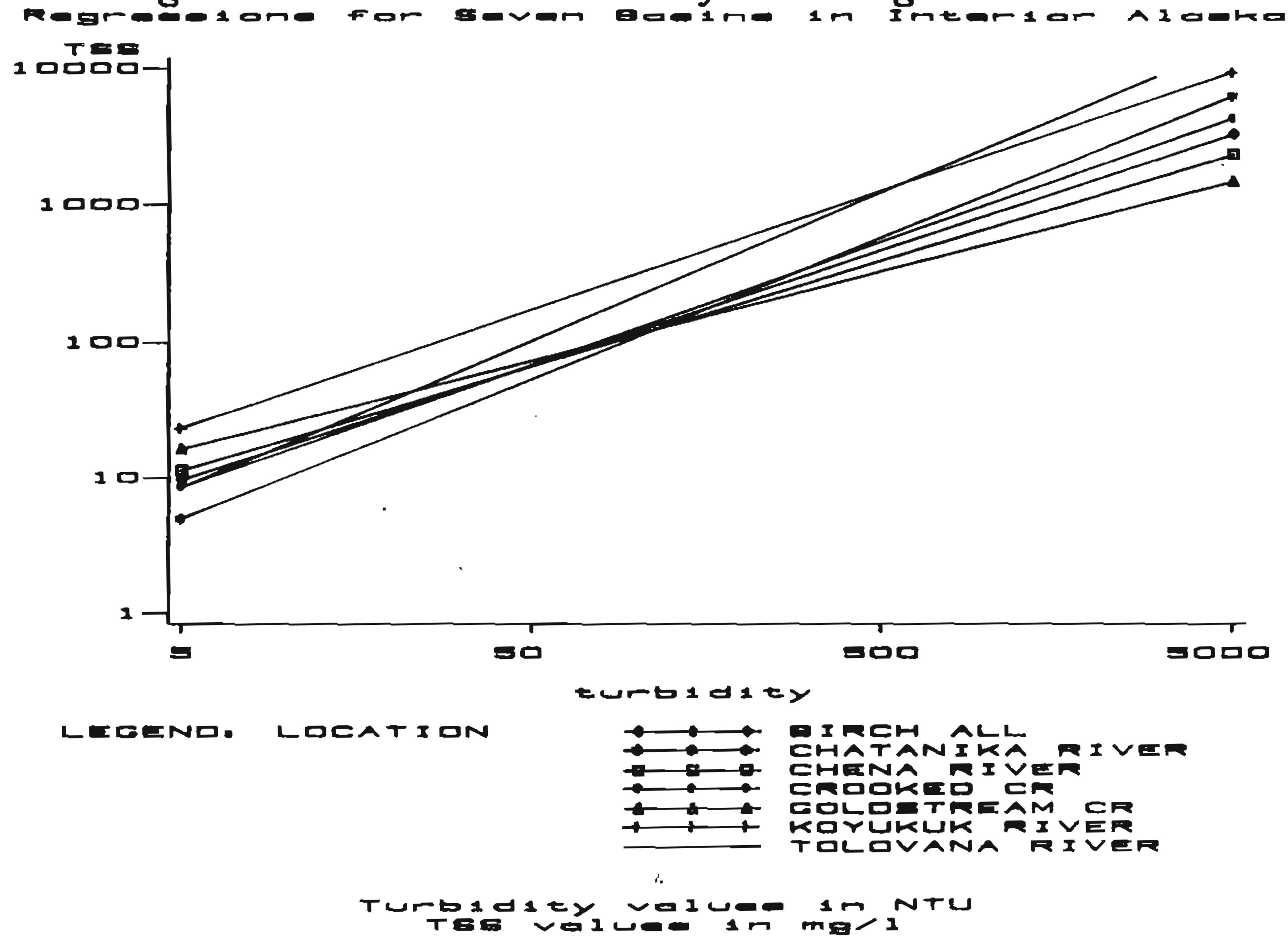
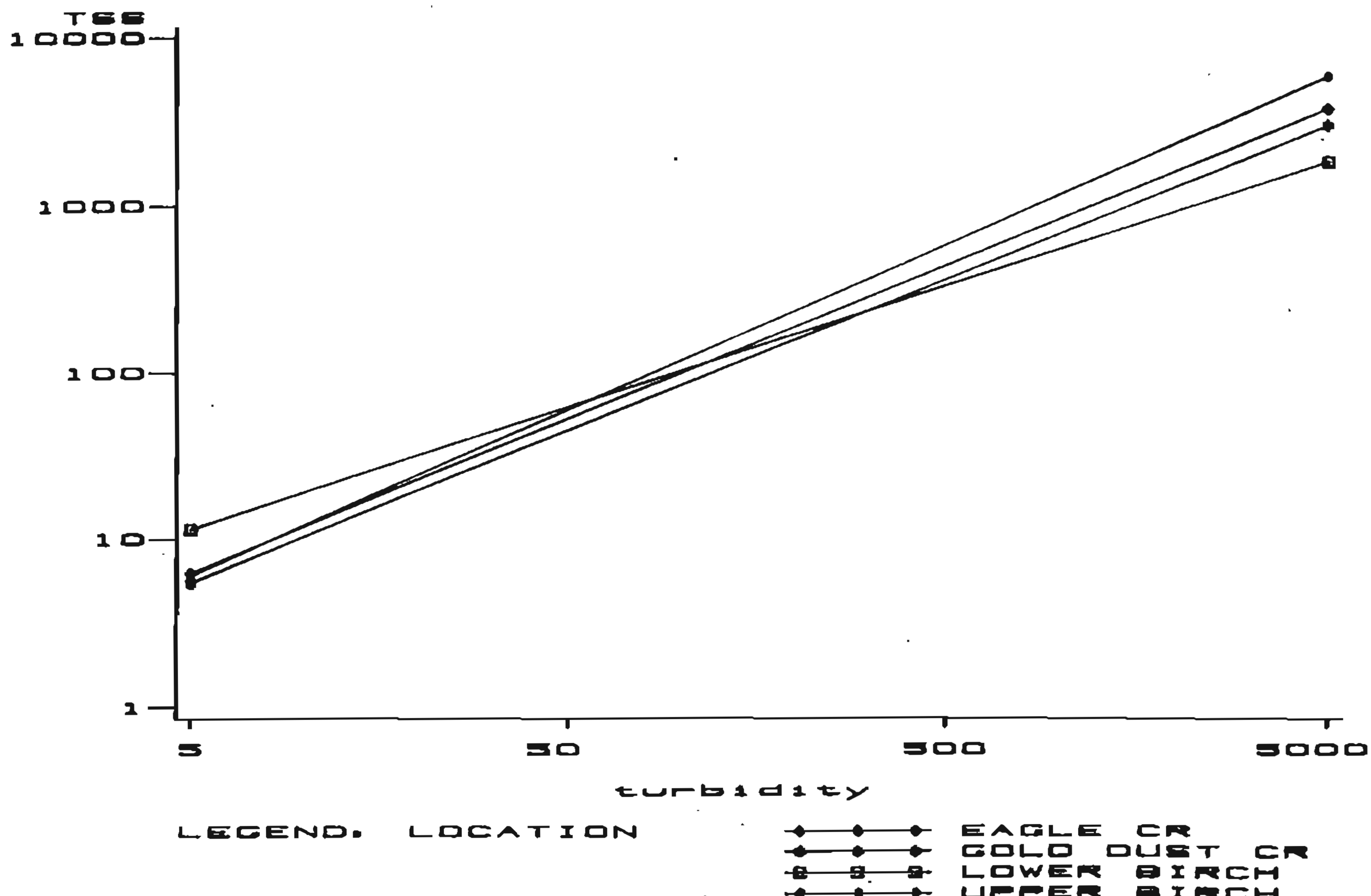


Figure 12. Plot of Turbidity–TSS Regression Lines

Streams in Birch Creek Basin



Turbidity values in NTU
TSS values in mg/l

Figure 13. Plot of Turbidity-TSS Regression Lines

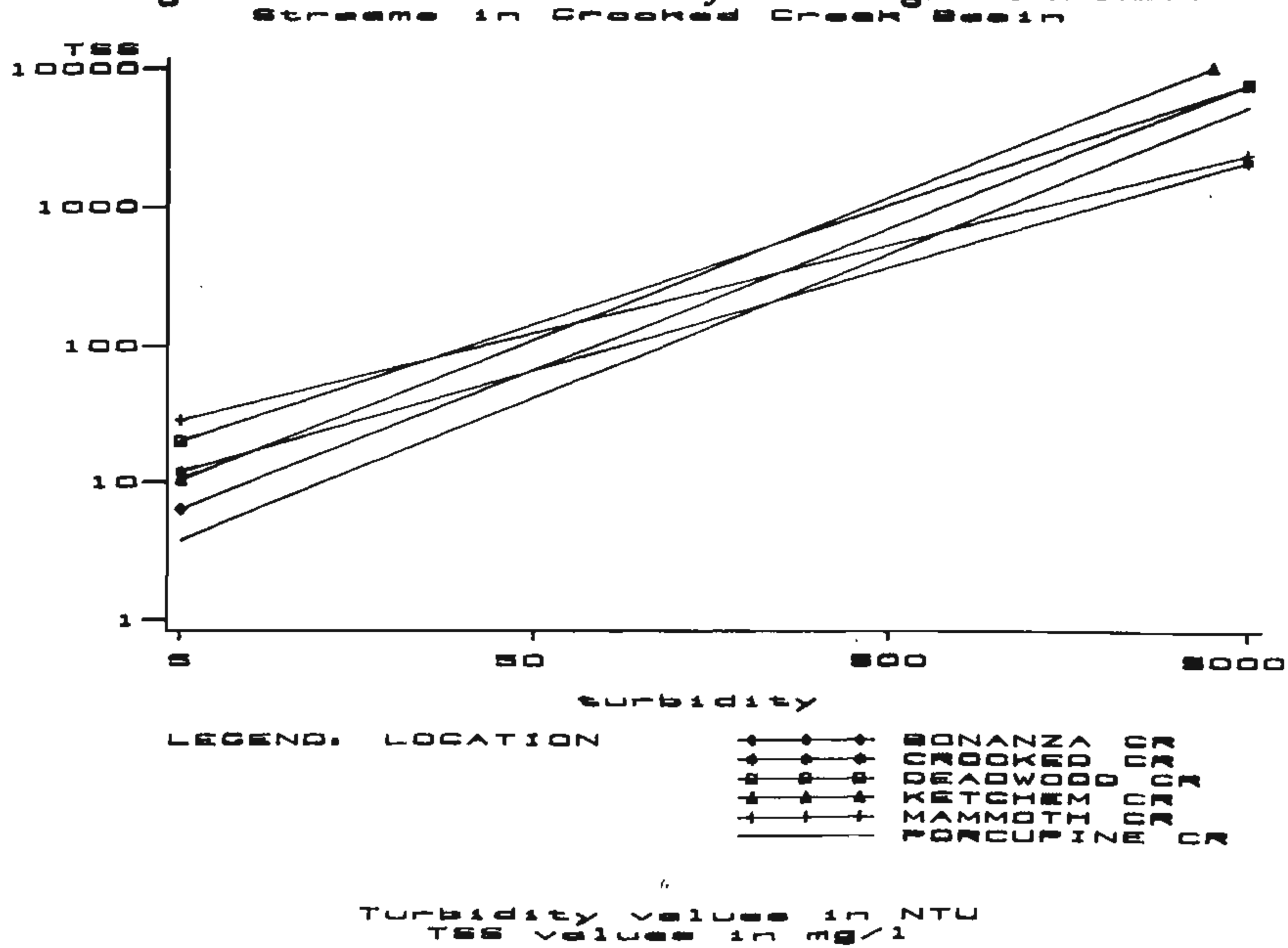


Figure 14. Plot of Turbidity—TSS Regression Lines

Streams in Chatanika and Goldstream Basins

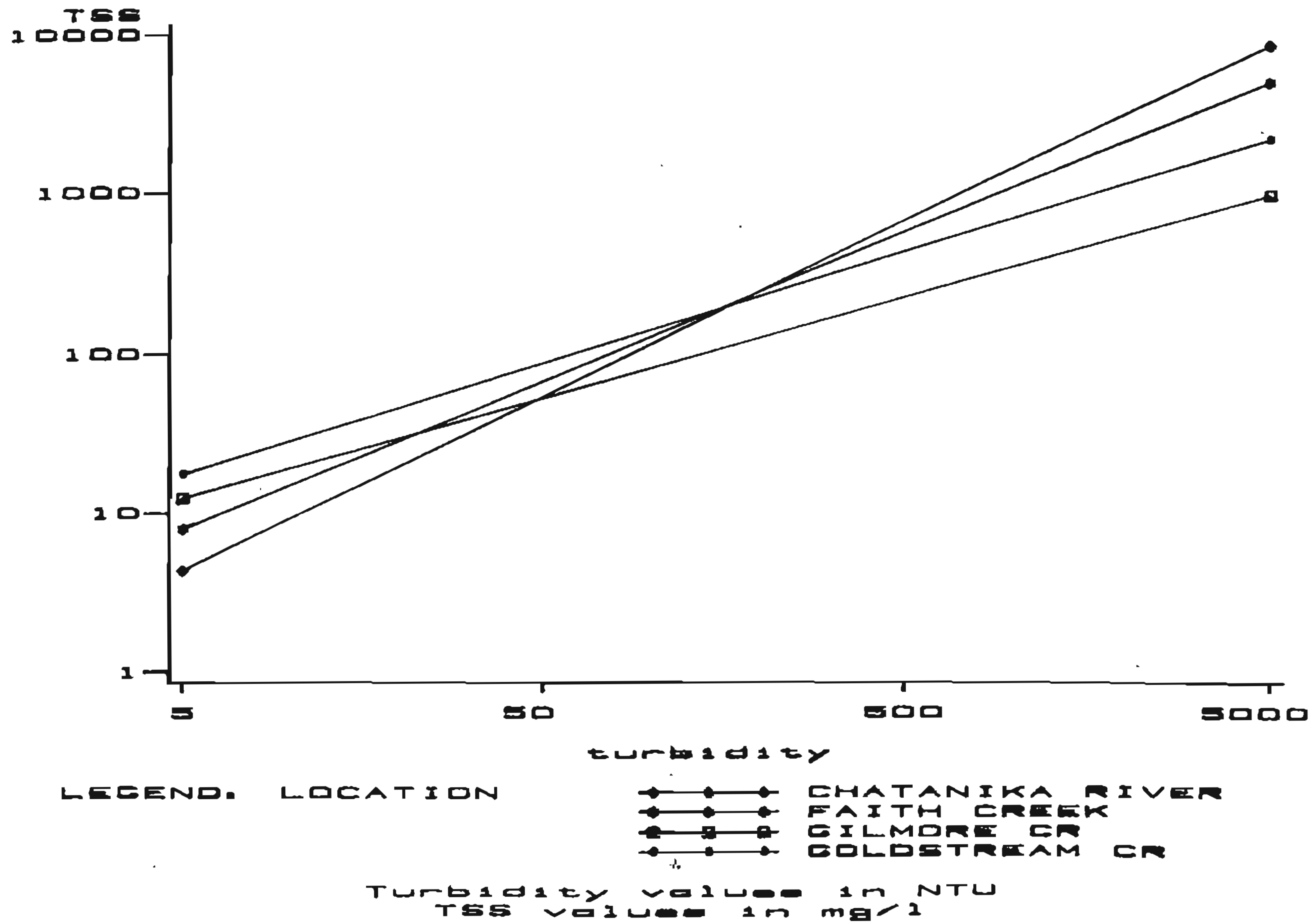


Figure 15. Plot of Turbidity–TSS Regression Lines

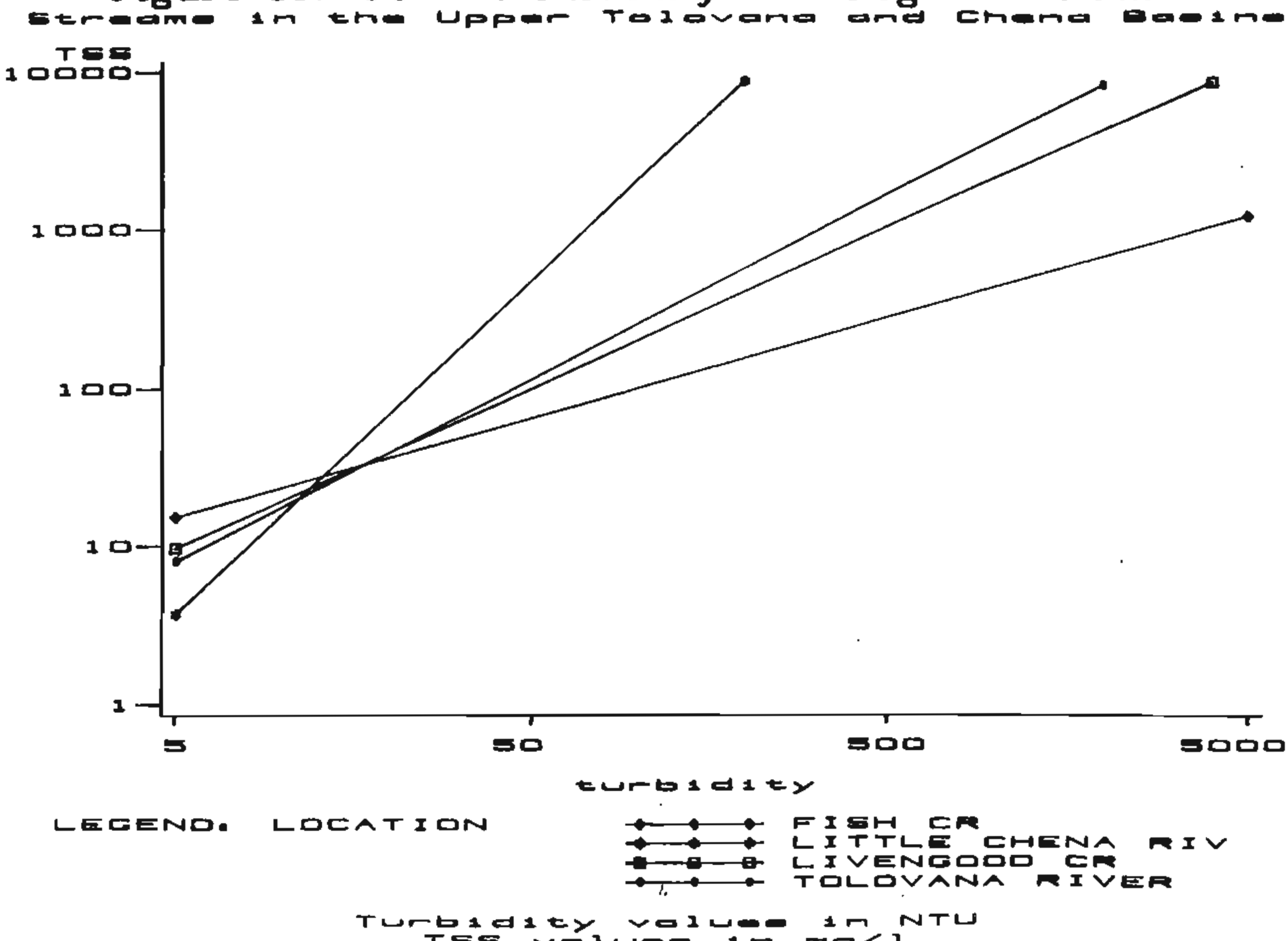


Figure 16. Plot of Turbidity–TSS Regression Lines

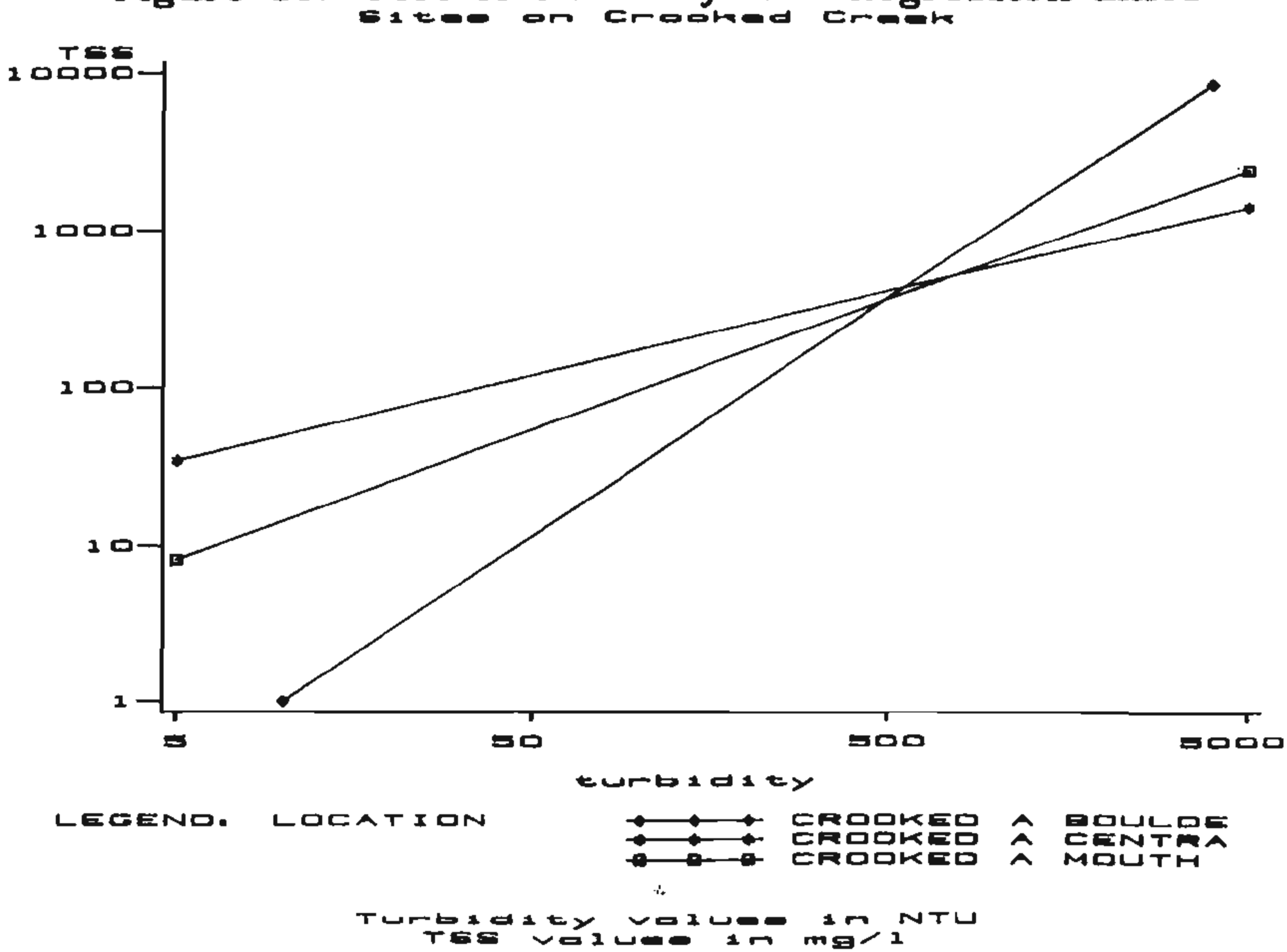


Figure 17. Plot of Turbidity—TSS Regression Lines

Sites on the Chatanika River

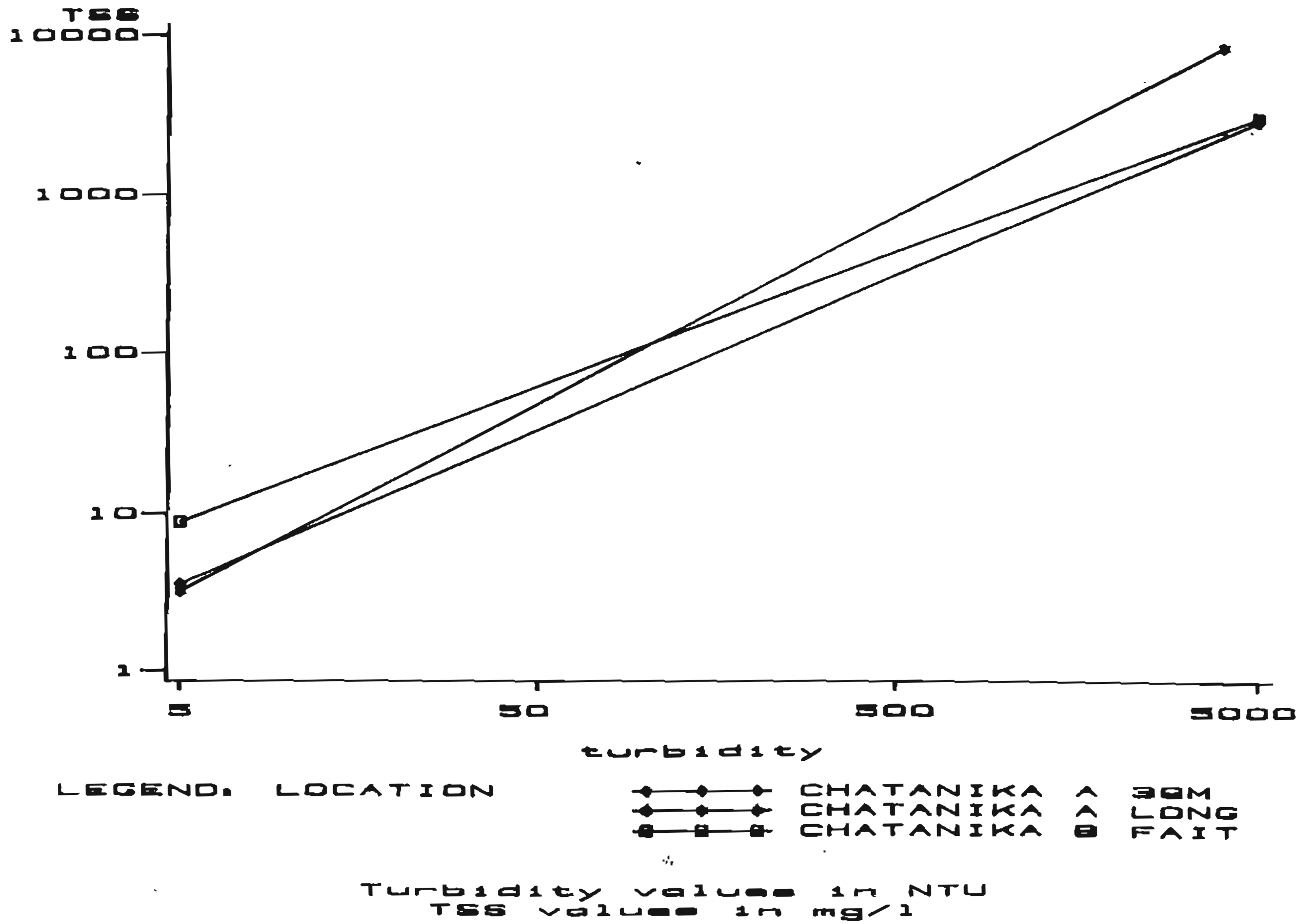
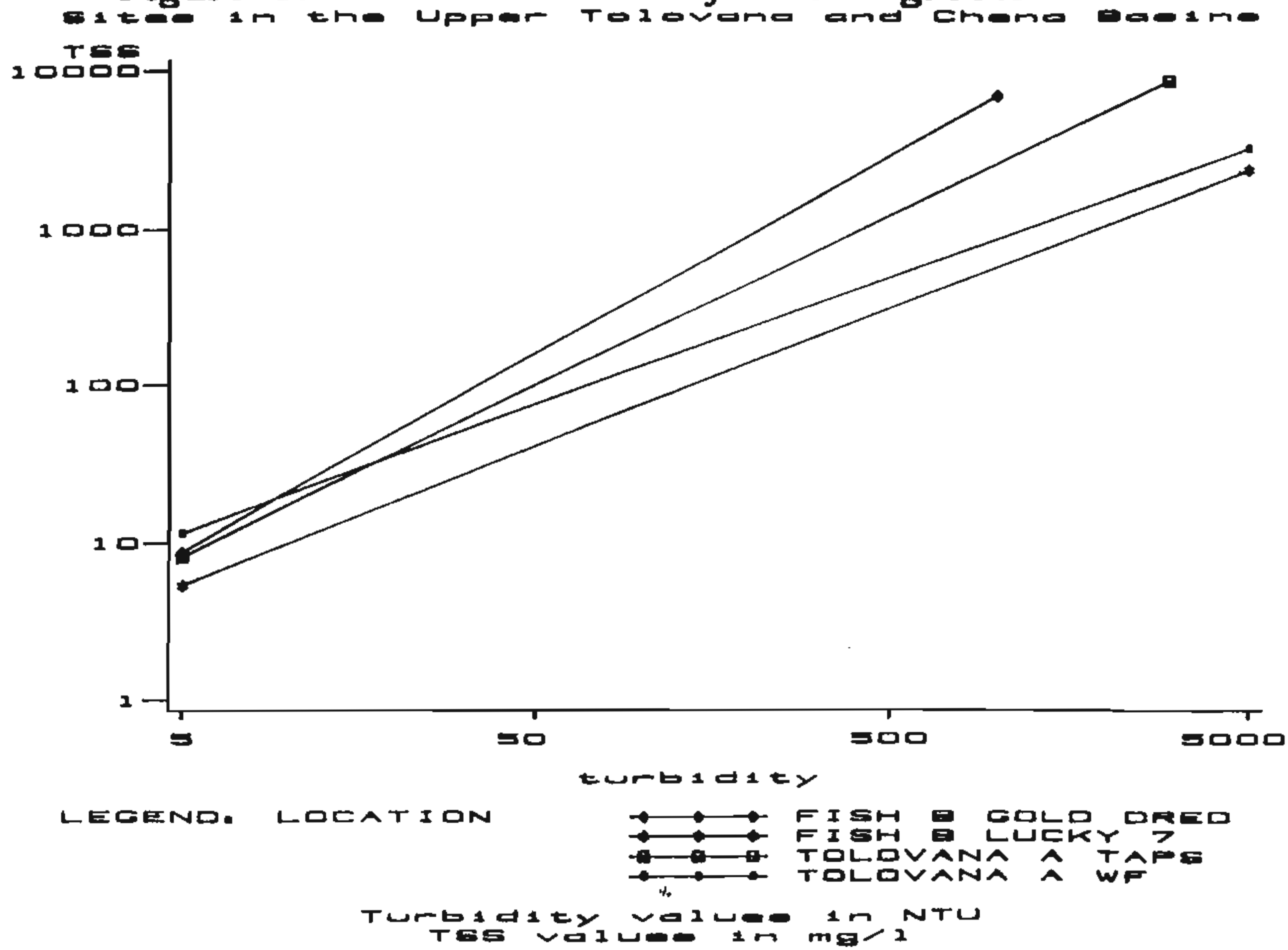


Figure 18. Plot of Turbidity–TSS Regression Lines



Crooked Creek (.372), Fish below Lucky 7 (.370), Chatanika at 39 mile Steese (.418), and Goldstream below Fox (.389).

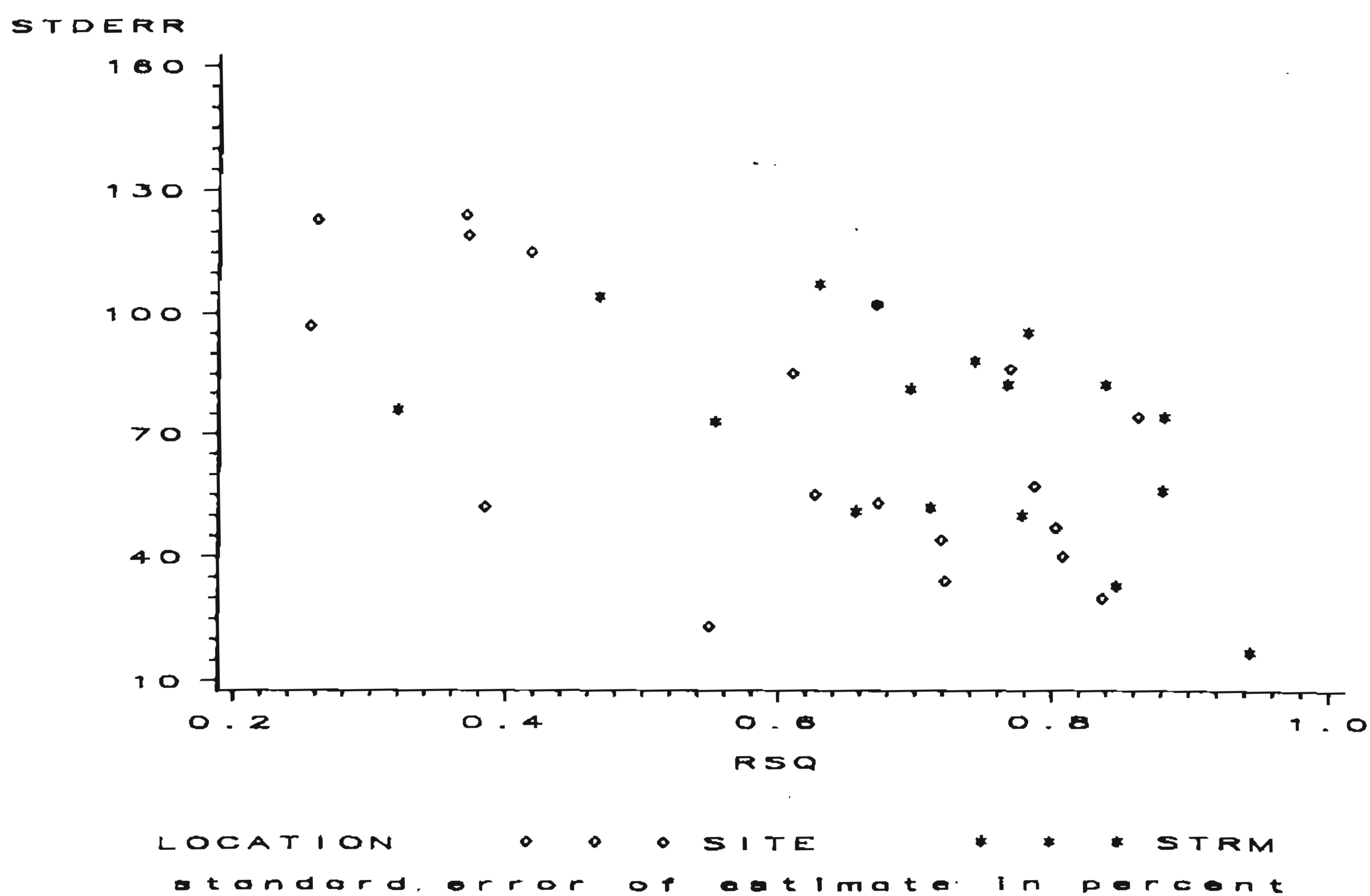
The standard errors of estimate for the site equations range from +30% (-23%) to +124% (-55%) with thirteen of 18 less than +100 percent. Standard error of estimate generally has an inverse relationship with r^2 for the site equations, that is, the equations with the lowest r^2 have high SEE. Figure 19, a plot of the coefficients of determination and corresponding standard errors of estimate for the site and stream equations, demonstrates the scatter that occurs with these equations. By inspection a general conclusion can not be drawn on whether combination of data into stream equations improves, reduces or averages the regression parameters.

3. Analysis of Covariance

For streams with two or more sites, for basins with two or more streams, and for all interior Alaska data, analysis of covariance was performed. The results of this work are presented in column 8 ($F^* < F$?) of Table 2. If this column has a 'yes' the equations describing the data groups included in the covariance analysis are statistically similar at the 95 percent

Figure 19. Plot of coefficients of determination and std errors

Sites and streams in Interior Alaska



level. This indicates that the equation describing the combined data is most appropriate.

The analysis of covariance results are mixed. The seven basin equations for interior Alaska are statistically different which means that these data should not be combined to develop one equation . At the basin level, the four streams in Birch Creek, the two streams in the Chatanika River basin, and the two streams in the Upper Tolovana River basin have statistically similar equations for each basin. The six streams in the Crooked Creek basin, the two streams in the Chena River basin, the two streams in the Goldstream Creek basin, are statistically different for each basin. At the stream level the F value comparison indicates that the three sites on Crooked Creek and the two sites on the Upper Tolovana River have statistically similar regressing equations. The three sites on the Chatanika River and the two sites on Fish Creek are statistically different.

Of note is the reversal in the Chatanika River basin. One might expect sites on one stream to have similar regression equations if the total stream equation was similar to that of a tributary stream. That is not the case with the Chatanika River. Covariance analysis indicates that the regression equations for the sites on the Chatanika River are different yet the equation for the combined data from the Chatanika River is not significantly different from the equation for Faith Creek. Using only 1984 data the regressions for the Chatanika River sites are statistically similar, but when the 1983 data are included the difference occurs.

Whether regression equations are similar between sites, streams and basins is a central question for this project. Also of interest is whether regression equations are similar between years. Does the equation developed from data collected in 1983 and 1984 accurately predict in 1985? Covariance analysis was used to investigate whether the equations for the combined database and equations for site data from Crooked Creek at Central, Chatanika River below Faith Creek, and Chatanika River above Long Creek differed between years. The results, presented in Table 3, show that regression equations can differ statistically from year to year. When all data are combined, the regression equations for each year (1983-5) are different. However, earlier analysis demonstrated that one should not combine data from different basins. The difference by year of the combined data might be a function of basin differences. To rule this out three individual sites - Crooked Creek at Central, Chatanika below Faith Creek, and Chatanika at Long Creek, were investigated. Covariance analysis based on year showed that the regression equations for Chatanika at Long Creek and Crooked Creek at Central are different while for Chatanika below Faith the regression equations are similar. Figures 20 and 21, plots of the observations at Chatanika River below

Table 3. Summary of covariance analysis by year.

Equations in the form $y=a*(x^{b})$ where y=TSS, x=turbidity, a=y axis intercept and b=slope

LOCATION	N	a	b	r^2	+SEE(%)	-SEE(%)	F*<F?
Int. Alaska (all)	885	2.317	0.851	0.81	112	53	no
Int. Alaska (83)	158	0.689	1.082	0.92	56	36	
Int. Alaska (84)	543	3.236	0.799	0.80	119	54	
Int. Alaska (85)	184	2.871	0.820	0.74	101	50	
Crooked Can (all)	38	14.655	0.535	0.26	123	55	no
Crooked Can (84)	19	234.423	0.156	0.04	121	55	
Crooked Can (85)	19	2.009	0.831	0.41	87	47	
Chat b Fai (all)	56	2.280	0.844	0.61	85	48	yes
Chat b Fai (83)	32	1.611	0.894	0.77	34	25	
Chat b Fai (84)	24	2.553	0.865	0.62	137	58	
Chat a Long (all)	53	0.473	1.179	0.80	47	32	no
Chat a Long (83)	28	0.514	1.092	0.55	33	25	
Chat a Long (84)	25	0.813	1.055	0.82	52	34	

Figure 20. Plot of Turbidity and TSS by Year

Chatanika River below Faith Creek, 1983–84

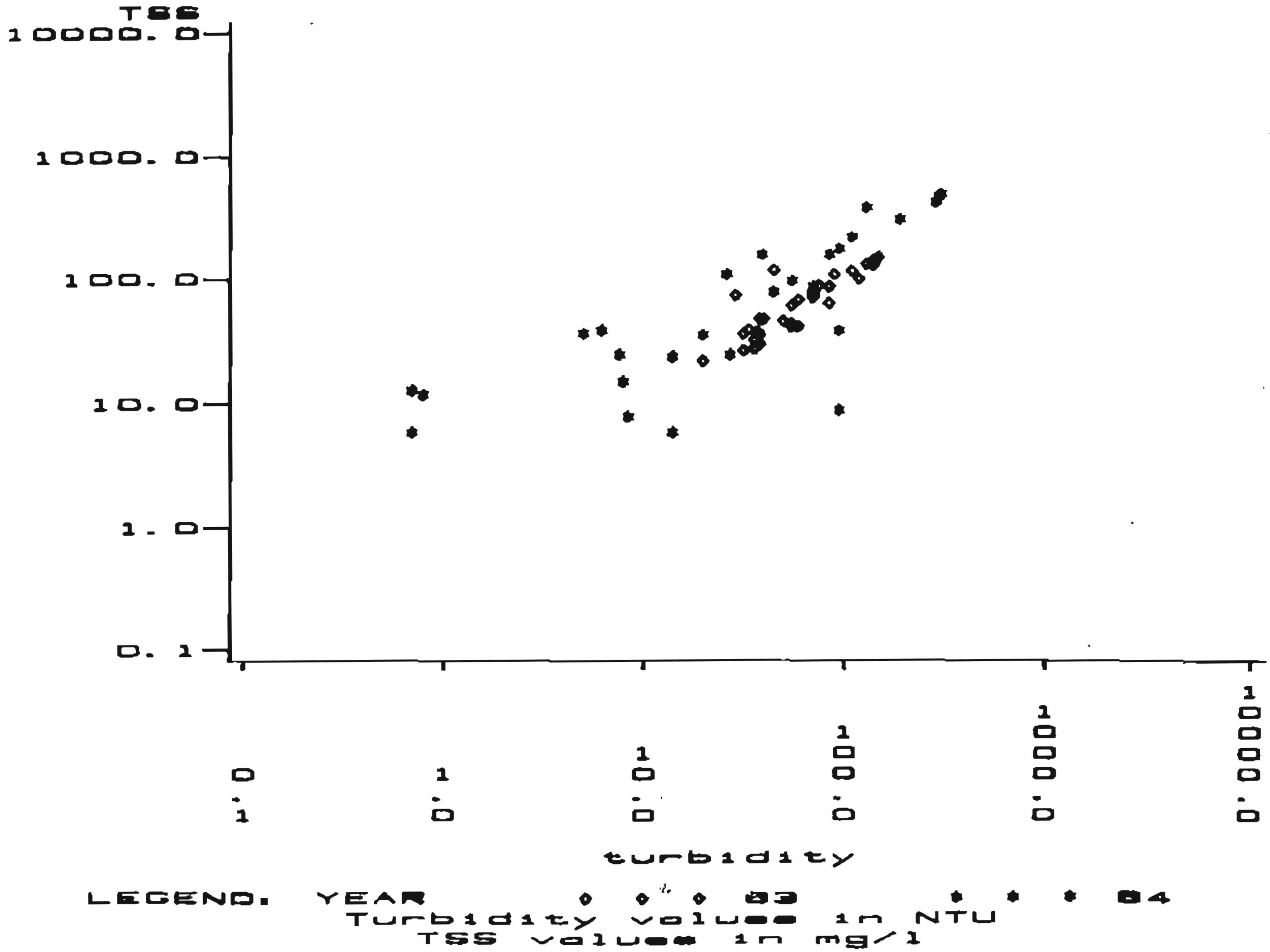
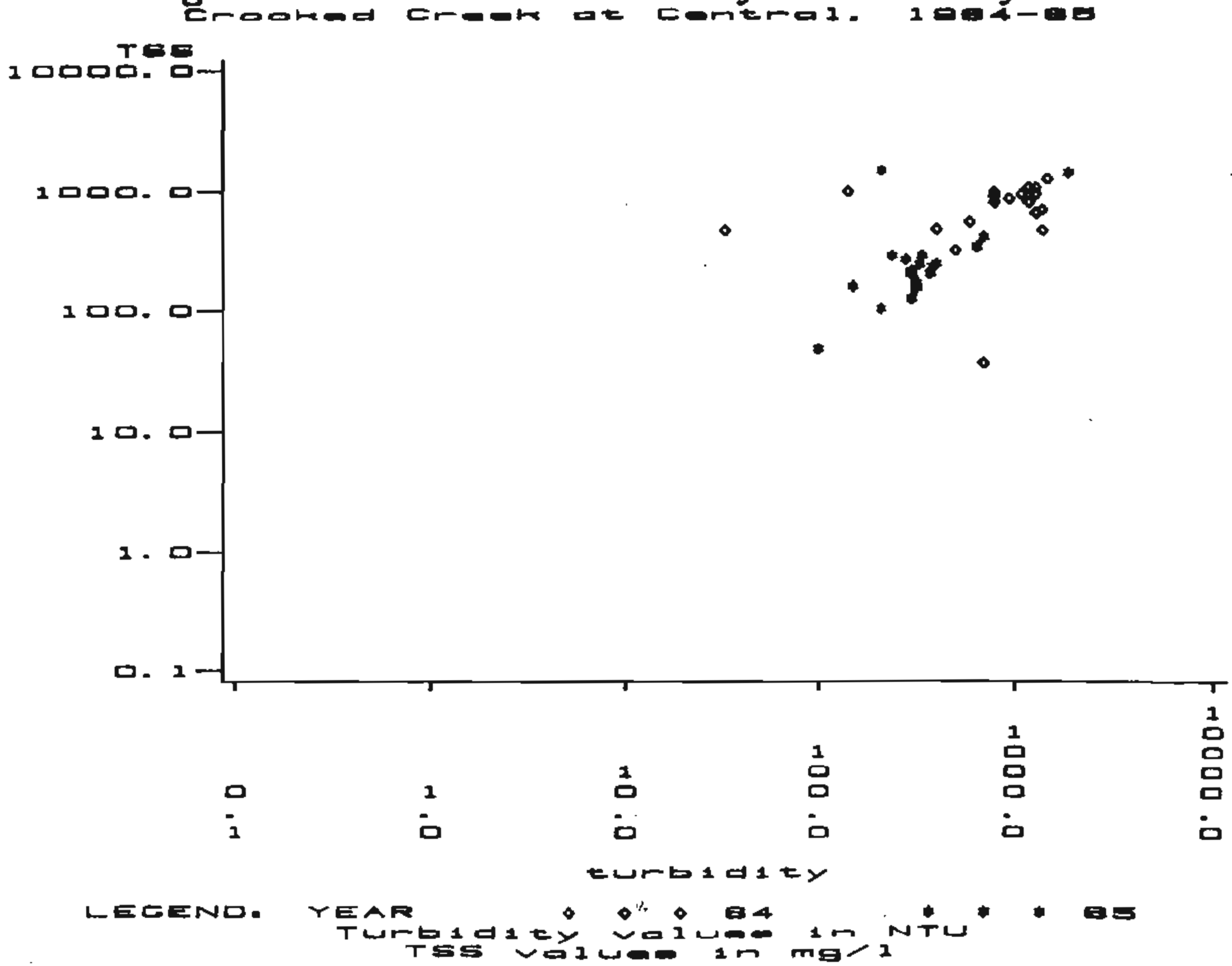


Figure 21. Plot of Turbidity and TSS by Year



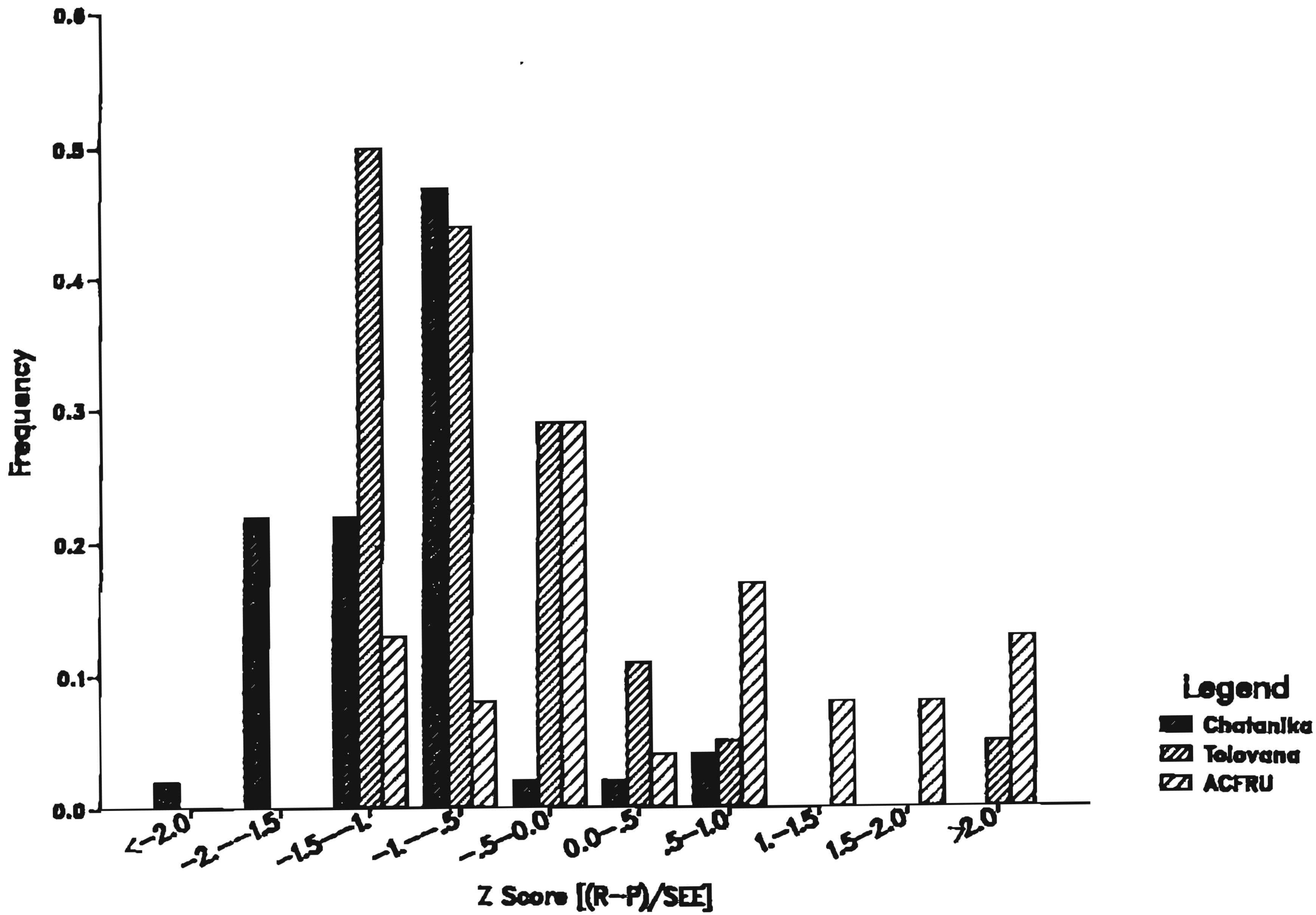
Faith Creek and Crooked Creek at Central by year, demonstrate the differences in the plotted data.

4. Model Validation.

Model validation was done with 1985 data from the Chatanika and Tolovana Rivers and Goldstream Creek (DEC 1986) and 1983 data from Upper Birch Creek, Crooked Creek, and Chatanika River (Wagener 1984). Appendix 3 presents the results of these comparisons. Figure 22 is a histogram of the Z scores for the 1985 Chatanika and Tolovana DEC data and the 1983 data reported by Wagener (1984). The Chatanika data have an average Z score of -1.07 with 55 percent of the observations within one standard error of estimate and 98 percent within two standard errors of estimates of the reported values. The Tolovana data have an average Z score of -.20 with 89 percent within one standard error of estimate and 95 percent within two standard errors of estimate of the reported values. The 1983 data have an average Z score of .56 with 58 percent within one standard error of estimate and 88 percent within two standard errors of estimate of the reported values.

The disparity between the 1985 Tolovana and Chatanika results is of note. These data were collected by the same people using the same methods during a two week period. The results from the 1983 data are

Figure 22. Z score distributions for 1985 Chatanika and Tolovana and 1983 ACFRU data



underpredicted, on average, with a more spread out distribution than that of the other two groups of data.

The Chatanika data come mostly from two sites, Chatanika below Faith Creek and Chatanika at Long Creek, which have different Z score distributions. At the Chatanika below Faith Creek site, 92 percent of the Z scores (22 out of 24) fall within the greater than -1.0 and less than -0.5 interval and at the Chatanika at Long Creek site, 81 percent of the Z scores are less than -1.0. At the Chatanika below Faith Creek site, in particular, the predicting equation may not be accurate for this set of data but the precision, 92% within one Z score interval, is good.

5. Velocity-Turbidity Multiple Regression.

Velocity estimates were available for 76 observations within the Crooked Creek basin. Simple regression of the log transformed turbidity and TSS data produced an r^2 of 0.82 with an SEE of 0.296 (+98,-49 percent). Velocity by itself does not have significant relationship with total suspended solids. The multiple regression model with log velocity as the second predictor variable produced an r^2 of 0.85 and an SEE of 0.271 (+87,-46 percent). These aren't substantial improvements but the added velocity variable is statistically significant at the 95 percent confidence level.

If only the data from Crooked Creek at Central are considered, the improvement is marked. Multiple regression (log turbidity and log velocity) improves the simple regression (log turbidity) r^2 of 0.207 to 0.686 and reduces the SEE from +98, -49 percent to +56, -36 percent. Table 4 presents the multiple regression analysis comparisons.

Table 4. Comparison of multiple and simple linear regression equations from Crooked Creek basin.

Equations in the form $y=a*(x_1b^1)*(x_2b^2)$ where x_1=turbidity, x_2=velocity, and b_1, b_2 and a are coefficients.

LOCATION	N	a	b_1	b_2	r^2	+SEE	-SEE
Crooked Cr basin							
Simple regression (turb)	72	1.211	0.985		0.788	91	48
Simple regression (vel)	72	134.896		0.165	0.005	305	75
Multiple regression	72	0.851	1.016	0.456	0.828	79	44
Crooked Cr at Central							
Simple regression (turb)	16	7.447	0.622		0.207	98	49
Simple regression (vel)	16	210.863		0.073	0.002	114	53
Multiple regression	16	0.001	1.919	2.127	0.686	56	36

DISCUSSION:

The underlying premise of this project is that because placer mining throughout interior Alaska is similar, the turbidity-TSS relationship in placer mined streams in interior Alaska also may be similar, allowing the use of one equation to define that relationship. This has not been borne out by the analysis. The regression equations for the seven basins are statistically different. Of the six basins that have two or more streams with 15 or more observations, in only three are the regression equations statistically similar and, in one of those, the equations for the individual sites are not similar. Of the four streams that had two or more sites with 15 or more observations two have statistically different regressions.

Covariance analysis also indicates that one should be careful using equations from previous years to predict TSS. The equations using all data from interior Alaska were different for 1983, 1984 and 1985. At three sites covariance analysis indicates that at two of those sites the equations differ between years. Model validation supports this uncertainty. Estimates from 1985 Chatanika River site data average more than one standard error of estimate from reported TSS.

Error as indicated by the standard error of estimate is reasonable for most equations. Individual observations can have considerable variation. Inspection of the data from the site equations with the worst error terms show that these sites include data from a variety of flow conditions or are sites close to sluice operations. It is important to note that these equations should only be used to estimate TSS within the range of the values in the data sets used to develop the equations. In particular, these equations should not be used with turbidity values less than 5 NTU. Also, these equations should not be used to predict TSS in non-placer-mined streams.

Stream flow levels - discharge or velocity - can be important when the turbidity-TSS relationship is examined over a wide range of flows. When velocity was added to the poor relationship at Crooked Creek at Central the r^2 improved remarkably and the error was reduced equally well. Inspection of the data show much different turbidity-TSS relationships at high flows. May and early June observations show TSS values much higher than the accompanying turbidity. Observations from Crooked Creek basin in late June and mid August in 1985 - times of high flows - have similar relationships. Low flows in early August may explain partly the poor prediction performance of the Chatanika site equations on 1985 DEC data. Lack of measured or estimated discharge and velocity data limits a more thorough exploration of this. I believe that to adequately predict TSS from turbidity over a wide range of flows, addition of a discharge or velocity variable is essential. A simple regression may be acceptable for average-level summer flows.

The research done in this report indicates that the most appropriate use of regression models to predict TSS from turbidity in mined streams is on a single site basis. The analyses from this report indicate that regression equations should be used with care if developed for more that one site, if used on sites that did not contribute data to the model development, or if used for years that did not contribute data to the model development. A simple regression equation developed with data collected during normal flows will underestimate TSS at high flows and overestimate TSS at low flows. Analysis of covariance indicates that the relationship may stay the same between years, sites, or streams, but this must be verified; it can't be assumed.

With so many restrictions one might wonder why bother with the work required to develop these equations? Why not just collect and analyze samples for determination of TSS and dismiss the notion developing a turbidity-TSS model? An alternative view - why bother with collecting TSS on a large scale? - is also arguable. A strong, if not perfect, relationship exists between it and turbidity;

turbidity is much less expensive to collect; and turbidity has a more enforceable standard. The ecological and aesthetic damage caused by excess amounts of sediment could be accurately monitored or estimated by either parameter. If sediment loads need to be estimated at some sites, this report has demonstrated a way to do so with a minimum amount of TSS analyses.

As state and federal funding declines and interest in solutions to the placer mining water quality question at least remains constant, funds to do all desired analyses may not exist. If monitoring of water quality on placer mined streams is desired and both turbidity and suspended sediment information is needed, then turbidity-TSS models of the sort recommended here can help stretch the analysis dollar.

CONCLUSION:

Equations to predict TSS from turbidity are most appropriate if developed on a site basis. Combining all data from interior Alaska into one equation is not supported by the analysis and even combining data within a basin or stream is not supported more that 50 percent of the time based on analysis of covariance. The turbidity-TSS relationship may change from one year to the next. Multiple regression models using turbidity and velocity to predict TSS give improved results over a wide range of flows.

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Appendix 1. Turbidity and TSS Data from Interior Alaska Streams.

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
1	BIRCH A BRDG	4040201	5	85-06-05	1100	75.00	265.00
2	BIRCH A BRDG	4040201	4	85-06-16	1405	50.00	206.00
3	BIRCH A BRDG	4040201	5	85-07-26	915	24.00	25.60
4	BIRCH A BRDG	4040201	5	85-07-27	915	23.00	27.00
5	BIRCH A BRDG	4040201	5	85-07-28	15	21.00	19.60
6	BIRCH A BRDG	4040201	5	85-07-28	615	18.00	19.00
7	BIRCH A BRDG	4040201	5	85-07-28	1215	25.00	20.20
8	BIRCH A BRDG	4040201	5	85-07-28	1815	26.00	19.70
9	BIRCH A BRDG	4040201	5	85-08-22	1034	34.00	40.60
10	BIRCH A BRDG	4040201	5	85-09-05	1600	29.00	58.80
11	BIRCH A CC	4040201	3	84-08-08	1030	7.00	24.00
12	BIRCH A CC	4040201	3	84-08-08	1130	32.00	20.00
13	BIRCH A CC	4040201	3	84-08-09	1105	32.00	770.00
14	BIRCH A CC	4040201	5	85-06-26	1702	27.00	64.50
15	BIRCH A CC	4040201	5	85-07-03	1200	14.00	19.60
16	BIRCH A CC	4040201	5	85-07-25	1100	7.90	22.80
17	BIRCH A CC	4040201	5	85-07-25	1700	6.40	16.50
18	BIRCH A CC	4040201	5	85-07-25	2300	7.60	18.70
19	BIRCH A CC	4040201	5	85-07-26	500	7.30	14.80
20	BIRCH A CC	4040201	5	85-07-26	2000	11.00	19.60
21	BIRCH A CC	4040201	5	85-07-27	1100	9.40	19.90
22	BIRCH A CC	4040201	5	85-07-27	1700	9.70	16.60
23	BIRCH A CC	4040201	5	85-07-27	2300	12.00	21.10
24	BIRCH A CC	4040201	5	85-07-28	500	10.00	21.50
25	BIRCH A CC	4040201	5	85-08-07	1410	4.90	5.56
26	BIRCH A CC	4040201	5	85-08-13	1522	4.50	5.56
27	BIRCH A CC	4040201	5	85-08-22	1230	29.00	28.60
28	BIRCH A CC	4040201	5	85-09-05	1644	19.00	47.70
29	BIRCH A CCI	4040201	5	85-07-25	1400	6.80	15.80
30	BIRCH A CCI	4040201	5	85-07-25	1445	6.80	12.70
31	BIRCH A CLUMS	4040201	4	85-06-12	1115	85.00	365.00
32	BIRCH A HARRING	4040201	4	85-06-10	1617	22.00	46.00
33	BIRCH A HARRISO	4040201	3	84-08-08	1505	50.00	22.00
34	BIRCH A HARRISO	4040201	3	84-08-08	1542	45.00	24.00
35	BIRCH A HARRISO	4040201	4	84-08-29	1415	60.00	47.00
36	BIRCH A HARRISO	4040201	4	85-06-13	930	31.00	42.00
37	BIRCH A SFORK	4040201	4	85-06-15	1025	31.00	51.00
38	BIRCH A SHEEP C	4040201	4	85-06-13	1138	50.00	52.00
39	BIRCH A WOLF	4040201	4	85-06-13	912	30.00	40.00
40	BIRCH B CC	4040201	3	84-08-08	1155	55.00	34.00
41	BIRCH B CC	4040201	3	84-08-09	1050	50.00	31.00
42	BIRCH B CC	4040201	4	84-08-23	1530	60.00	32.00
43	BIRCH B HARRING	4040201	4	84-08-29	1426	200.00	190.00
44	BIRCH B HARRISO	4040201	3	84-08-08	1515	120.00	44.00
45	BIRCH B HARRISO	4040201	4	84-08-29	1426	240.00	388.00
46	BIRCH B SOUTH F	4040201	4	84-08-29	1405	17.00	22.00
47	BIRCH SF A MTH	4040201	4	85-06-14	948	1.90	13.60
48	BIRCH,NF A MTH	4040201	1	83-08-09	1915	0.20	1.00
49	BEAR A STEESE	4040203	4	84-08-19	1130	0.55	0.05
50	BEAR A STEESE	4040203	5	84-08-29	1220	1.00	1.00
51	BEAR TR A CLUMS	4040203	4	85-06-11	1424	0.50	2.10
52	FISH A STEESE	4040203	5	84-08-02	1220	1.00	2.00
53	FISH A STEESE	4040203	4	84-08-22	1425	0.45	0.05

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
54	PTARMIGAN A STE	4040203	4	84-08-22	1800	4.60	2.80
55	PTARMIGAN A STE	4040203	5	84-08-30	1220	1.00	22.00
56	TWELVEMILE A MT	4040203	3	84-08-07	1916	0.40	4.00
57	TWELVEMILE A MT	4040203	3	84-08-07	1938	0.20	4.00
58	TWELVEMILE A MT	4040203	3	84-08-10	1253	0.30	4.00
59	TWELVEMILE A MT	4040203	3	84-08-21	1035	0.30	0.40
60	TWELVEMILE B NF	4040203	4	84-08-15	1815	0.30	2.00
61	TWELVEMILE B RC	4040203	4	84-08-15	1635	0.55	0.27
62	TWELVEMILE NF	4040203	4	84-08-15	1315	0.35	0.40
63	CLUMS A MTH	4040204	4	85-06-12	955	0.40	1.70
64	CLUMS A VOLCANO	4040204	4	85-06-12	1120	1.20	3.10
65	CROOKED A HARNG	4040204	4	85-06-10	1506	0.65	1.20
66	HARRINGTON A MT	4040204	4	85-06-10	1048	0.60	1.20
67	EAGLE A GHD	4040205	2	84-06-20	1545	0.48	1.60
68	EAGLE A GHD	4040205	2	84-06-21	855	1.30	0.40
69	EAGLE A GHD	4040205	2	84-06-21	1140	1.90	0.80
70	EAGLE A GHD	4040205	2	84-06-21	1510	1.90	0.20
71	EAGLE A GHD	4040205	2	84-06-21	2115	2.00	1.00
72	EAGLE A GHD	4040205	2	84-06-22	830	1.20	0.40
73	EAGLE A GHD	4040205	2	84-06-22	1330	1.00	0.40
74	EAGLE A GHD	4040205	2	84-06-22	1630	1.00	0.10
75	EAGLE A GHD	4040205	2	84-06-22	2030	1.50	0.20
76	EAGLE A GHD	4040205	2	84-06-23	910	0.50	0.05
77	EAGLE A GHD	4040205	2	84-06-23	1440	1.10	0.05
78	EAGLE A GHD	4040205	2	84-06-23	1840	1.20	0.40
79	EAGLE A GHD	4040205	2	84-06-24	850	1.00	0.05
80	EAGLE A GHD	4040205	2	84-06-24	1130	1.30	0.60
81	EAGLE A GHD	4040205	2	84-06-24	1355	0.80	0.40
82	EAGLE A GHD	4040205	2	84-07-17	1100	0.29	0.40
83	EAGLE A GHD	4040205	2	84-07-17	1520	0.19	1.70
84	EAGLE A GHD	4040205	2	84-07-17	1930	0.22	0.80
85	EAGLE A GHD	4040205	2	84-07-18	930	0.40	1.10
86	EAGLE A GHD	4040205	2	84-07-18	1205	0.27	1.90
87	EAGLE A GHD	4040205	2	84-07-18	1640	0.45	1.60
88	EAGLE A GHD	4040205	2	84-07-19	820	0.18	0.05
89	EAGLE A GHD	4040205	2	84-07-19	1200	0.27	0.10
90	EAGLE A GHD	4040205	2	84-07-19	1455	0.37	0.30
91	EAGLE A GHD	4040205	2	84-07-20	835	0.19	0.05
92	EAGLE A GHD	4040205	2	84-07-20	1115	0.42	0.30
93	EAGLE A GHD	4040205	2	84-07-20	1600	0.23	0.50
94	EAGLE A GHD	4040205	2	84-07-21	700	0.23	0.05
95	EAGLE A GHD	4040205	2	84-07-21	1030	0.27	0.05
96	EAGLE A GHD	4040205	2	84-07-21	1300	0.23	0.60
97	EAGLE A GHD	4040205	2	84-08-09	1200	0.59	1.10
98	EAGLE A GHD	4040205	2	84-08-09	1630	0.21	0.70
99	EAGLE A GHD	4040205	2	84-08-09	1945	0.75	1.90
100	EAGLE A GHD	4040205	2	84-08-10	830	0.28	0.10
101	EAGLE A GHD	4040205	2	84-08-10	1200	0.42	0.30
102	EAGLE A GHD	4040205	2	84-08-10	1425	0.82	0.30
103	EAGLE A GHD	4040205	2	84-08-11	1255	0.45	0.05
104	EAGLE A GHD	4040205	2	84-08-11	1555	0.47	0.10
105	EAGLE A GHD	4040205	2	84-08-11	2020	0.32	0.50
106	EAGLE A GHD	4040205	2	84-08-12	925	0.38	0.10

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
107	EAGLE A GHD	4040205	2	84-08-12	1425	0.20	0.05
108	EAGLE A GHD	4040205	2	84-08-12	1605	0.27	0.05
109	EAGLE A GHD	4040205	2	84-08-13	720	0.33	0.10
110	EAGLE A GHD	4040205	2	84-08-13	950	0.22	0.30
111	EAGLE A GHD	4040205	2	84-08-13	1100	0.18	0.10
112	EAGLE A PTARMIG	4040205	4	84-09-06	1440	7000.00	9999.00
113	EAGLE B GHD	4040205	2	84-06-20	1545	240.00	643.00
114	EAGLE B GHD	4040205	2	84-06-21	1015	130.00	85.00
115	EAGLE B GHD	4040205	2	84-06-21	1100	800.00	720.00
116	EAGLE B GHD	4040205	2	84-06-21	1215	1100.00	695.00
117	EAGLE B GHD	4040205	2	84-06-21	1230	450.00	398.00
118	EAGLE B GHD	4040205	2	84-06-21	1450	1200.00	999.00
119	EAGLE B GHD	4040205	2	84-06-21	1605	950.00	545.00
120	EAGLE B GHD	4040205	2	84-06-21	2220	700.00	568.00
121	EAGLE B GHD	4040205	2	84-06-22	950	450.00	406.00
122	EAGLE B GHD	4040205	2	84-06-22	1425	850.00	685.00
123	EAGLE B GHD	4040205	2	84-06-22	1745	1100.00	820.00
124	EAGLE B GHD	4040205	2	84-06-22	1910	2400.00	705.00
125	EAGLE B GHD	4040205	2	84-06-23	1100	900.00	800.00
126	EAGLE B GHD	4040205	2	84-06-23	1520	900.00	795.00
127	EAGLE B GHD	4040205	2	84-06-23	2050	600.00	468.00
128	EAGLE B GHD	4040205	2	84-07-17	1220	2100.00	1380.00
129	EAGLE B GHD	4040205	2	84-07-17	1715	1100.00	1150.00
130	EAGLE B GHD	4040205	2	84-07-17	2015	1100.00	972.00
131	EAGLE B GHD	4040205	2	84-07-18	1015	1600.00	1020.00
132	EAGLE B GHD	4040205	2	84-07-18	1425	1600.00	1000.00
133	EAGLE B GHD	4040205	2	84-07-18	1720	1300.00	1040.00
134	EAGLE B GHD	4040205	2	84-07-19	1000	1200.00	970.00
135	EAGLE B GHD	4040205	2	84-07-19	1325	1500.00	1230.00
136	EAGLE B GHD	4040205	2	84-07-19	1550	1600.00	1350.00
137	EAGLE B GHD	4040205	2	84-07-20	930	1200.00	1020.00
138	EAGLE B GHD	4040205	2	84-07-20	1340	2400.00	1580.00
139	EAGLE B GHD	4040205	2	84-07-20	1635	1900.00	1430.00
140	EAGLE B GHD	4040205	2	84-07-21	845	1400.00	1060.00
141	EAGLE B GHD	4040205	2	84-07-21	930	1200.00	1020.00
142	EAGLE B GHD	4040205	2	84-07-21	1140	1700.00	1480.00
143	EAGLE B GHD	4040205	2	84-07-21	1350	1600.00	1450.00
144	EAGLE B GHD	4040205	2	84-08-09	1500	2500.00	1860.00
145	EAGLE B GHD	4040205	2	84-08-09	1710	3000.00	2340.00
146	EAGLE B GHD	4040205	2	84-08-09	2030	2100.00	1420.00
147	EAGLE B GHD	4040205	2	84-08-10	1040	2800.00	2060.00
148	EAGLE B GHD	4040205	2	84-08-10	1250	3100.00	2200.00
149	EAGLE B GHD	4040205	2	84-08-10	1505	3200.00	2130.00
150	EAGLE B GHD	4040205	2	84-08-11	1440	3500.00	2480.00
151	EAGLE B GHD	4040205	2	84-08-11	1700	3000.00	3190.00
152	EAGLE B GHD	4040205	2	84-08-11	2110	2100.00	1570.00
153	EAGLE B GHD	4040205	2	84-08-12	1105	2800.00	2460.00
154	EAGLE B GHD	4040205	2	84-08-12	1510	1800.00	1540.00
155	EAGLE B GHD	4040205	2	84-08-12	1635	2300.00	2110.00
156	EAGLE B GHD	4040205	2	84-08-13	855	1500.00	1640.00
157	EAGLE B GHD	4040205	2	84-08-13	1035	2300.00	2200.00
158	EAGLE B GHD	4040205	2	84-08-13	1150	2800.00	2650.00
159	GOLD DUST B GDM	4040206	2	84-06-20	1325	1400.00	2670.00

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
160	GOLD DUST B GDM	4040206	2	84-06-21	1715	2000.0	125
161	GOLD DUST B GDM	4040206	2	84-06-22	1300	380.0	350
162	GOLD DUST B GDM	4040206	2	84-06-22	1600	1200.0	890
163	GOLD DUST B GDM	4040206	2	84-06-22	1720	1700.0	1280
164	GOLD DUST B GDM	4040206	2	84-06-23	1340	3200.0	2180
165	GOLD DUST B GDM	4040206	2	84-06-23	1835	1600.0	820
166	GOLD DUST B GDM	4040206	2	84-06-24	1240	3000.0	1670
167	GOLD DUST B GDM	4040206	2	84-06-24	1410	5000.0	3040
168	GOLD DUST B GDM	4040206	2	84-08-20	1830	1200.0	680
169	GOLD DUST B GDM	4040206	2	84-08-20	2015	1900.0	1270
170	GOLD DUST B GDM	4040206	2	84-08-21	1630	650.0	380
171	GOLD DUST B GDM	4040206	2	84-08-21	1800	1000.0	865
172	GOLD DUST B GDM	4040206	2	84-08-22	1300	1800.0	2440
173	GOLD DUST B GDM	4040206	2	84-08-22	1740	1800.0	2000
174	GOLD DUST B GDM	4040206	2	84-08-23	1815	100.0	52
175	GOLD DUST B GDM	4040206	2	84-08-24	1115	100.0	100
176	GOLD DUST B GDM	4040206	2	84-08-24	1340	500.0	408
177	HARRISON A BIRC	4040207	1	83-08-08	1500	240.0	290
178	HARRISON A BIRC	4040207	3	84-08-08	1500	240.0	290
179	HARRISON A BIRC	4040207	3	84-08-08	1540	190.0	320
180	HARRISON A MTH	4040207	4	84-08-29	1415	450.0	745
181	HARRISON A MTH	4040207	4	85-06-13	930	6.8	25
182	HARRISON A SQUA	4040207	3	84-08-08	1635	400.0	210
183	HARRISON B SQUA	4040207	3	84-08-08	1625	420.0	1100
184	SQUAW A HARRISO	4040207	3	84-08-08	1625	220.0	1200
185	BIRCH A 12 MILE	4040208	4	84-09-06	1438	1000.0	970
186	BIRCH A 12 MILE	4040208	4	84-09-23	1220	400.0	420
187	BIRCH A 12 MILE	4040208	4	85-06-12	1615	450.0	603
188	BIRCH A 12MILE	4040208	3	84-08-10	1258	400.0	560
189	BIRCH A 12MILE	4040208	3	84-08-21	1045	270.0	368
190	BIRCH A BUTTE C	4040208	4	84-09-06	1215	1800.0	2640
191	BIRCH A GOLD DS	4040208	4	85-06-12	1648	650.0	694
192	BIRCH AB NF CON	4040208	1	83-08-09	1845	320.0	360
193	BIRCH B 12 MILE	4040208	4	84-09-06	1422	700.0	820
194	BIRCH B 12MILE	4040208	3	84-08-07	1915	580.0	660
195	BIRCH B 12MILE	4040208	3	84-08-07	1930	500.0	720
196	BIRCH B 12MILE	4040208	3	84-08-10	1301	320.0	410
197	BIRCH B BEAR C	4040208	4	84-09-06	1300	950.0	960
198	BIRCH B NF CON	4040208	1	83-08-09	1850	280.0	244
199	BIRCH B PTARMIG	4040208	4	84-09-06	1150	2100.0	2380
200	BIRCH B WILLOW	4040208	4	84-09-06	1345	1100.0	1150
201	CROOKED A ALBER	4040210	1	84-08-09	1550	460.0	410
202	CROOKED A BLDRI	4040210	5	85-07-24	1325	380.0	205
203	CROOKED A BOLDR	4040210	3	84-08-08	1743	1100.0	490
204	CROOKED A BOLDR	4040210	3	84-08-09	1030	1400.0	1200
205	CROOKED A BOLDR	4040210	3	84-08-09	1612	1300.0	1400
206	CROOKED A BOLDR	4040210	5	85-07-24	114	360.0	269
207	CROOKED A BOLDR	4040210	5	85-07-24	714	330.0	241
208	CROOKED A BOLDR	4040210	5	85-07-24	1314	340.0	236
209	CROOKED A BOLDR	4040210	5	85-07-24	1914	370.0	248
210	CROOKED A BOLDR	4040210	5	85-07-25	1014	370.0	161
211	CROOKED A BOLDR	4040210	5	85-07-26	114	500.0	398
212	CROOKED A BOLDR	4040210	5	85-07-26	714	450.0	327

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
213	CROOKED A BOLDR	4040210	5	85-07-26	1314	370	184.0
214	CROOKED A BOLDR	4040210	5	85-07-26	1914	450	342.0
215	CROOKED A CEN	4040210	3	84-08-08	1215	800	1000.0
216	CROOKED A CEN	4040210	3	84-08-08	1540	400	490.0
217	CROOKED A CEN	4040210	3	84-08-08	1828	140	1000.0
218	CROOKED A CEN	4040210	3	84-08-08	2152	950	890.0
219	CROOKED A CEN	4040210	3	84-08-09	37	1200	1100.0
220	CROOKED A CEN	4040210	3	84-08-09	350	1500	1300.0
221	CROOKED A CEN	4040210	3	84-08-09	709	1300	960.0
222	CROOKED A CEN	4040210	3	84-08-09	937	33	470.0
223	CROOKED A CEN	4040210	3	84-08-09	1228	800	930.0
224	CROOKED A CEN	4040210	3	84-08-09	1531	1200	830.0
225	CROOKED A CEN	4040210	3	84-08-09	1828	1100	960.0
226	CROOKED A CEN	4040210	3	84-08-09	2029	800	830.0
227	CROOKED A CEN	4040210	3	84-08-10	100	1300	1100.0
228	CROOKED A CEN	4040210	3	84-08-10	634	1400	710.0
229	CROOKED A CEN	4040210	3	84-08-10	935	600	570.0
230	CROOKED A CEN	4040210	3	84-08-10	1138	700	37.0
231	CROOKED A CEN	4040210	4	84-08-21	850	1300	665.0
232	CROOKED A CEN	4040210	4	84-08-21	1830	1400	478.0
233	CROOKED A CEN	4040210	5	84-08-30	1220	500	327.0
234	CROOKED A CEN	4040210	5	85-06-13	1730	100	48.2
235	CROOKED A CEN	4040210	5	85-06-20	1410	210	105.0
236	CROOKED A CEN	4040210	5	85-06-25	1945	240	296.0
237	CROOKED A CEN	4040210	5	85-06-26	911	210	1532.0
238	CROOKED A CEN	4040210	5	85-07-04	1422	340	294.0
239	CROOKED A CEN	4040210	5	85-07-24	405	320	172.0
240	CROOKED A CEN	4040210	5	85-07-24	1005	300	128.0
241	CROOKED A CEN	4040210	5	85-07-24	1605	320	163.0
242	CROOKED A CEN	4040210	5	85-07-24	2205	330	248.0
243	CROOKED A CEN	4040210	5	85-07-25	1305	300	214.0
244	CROOKED A CEN	4040210	5	85-07-26	405	400	251.0
245	CROOKED A CEN	4040210	5	85-07-26	1005	380	238.0
246	CROOKED A CEN	4040210	5	85-07-26	1605	300	206.0
247	CROOKED A CEN	4040210	5	85-07-26	2205	370	206.0
248	CROOKED A CEN	4040210	5	85-07-29	1005	1900	1450.0
249	CROOKED A CEN	4040210	5	85-08-07	1140	650	353.0
250	CROOKED A CEN	4040210	5	85-08-13	1608	700	428.0
251	CROOKED A CEN	4040210	5	85-08-21	1850	280	274.0
252	CROOKED A CEN	4040210	5	85-09-05	1500	150	161.0
253	CROOKED A CEN I	4040210	5	85-07-24	1605	320	157.0
254	CROOKED A DEADW	4040210	3	84-08-08	1235	550	590.0
255	CROOKED A DEADW	4040210	3	84-08-08	1750	70	700.0
256	CROOKED A DEADW	4040210	1	84-08-08	1755	800	750.0
257	CROOKED A DEADW	4040210	3	84-08-09	1300	650	570.0
258	CROOKED A EBALB	4040210	3	84-08-09	1550	450	410.0
259	CROOKED A MTH	4040210	3	84-08-08	1200	230	170.0
260	CROOKED A MTH	4040210	3	84-08-09	1145	310	250.0
261	CROOKED A MTH	4040210	4	84-08-23	1526	170	56.0
262	CROOKED A MTH	4040210	5	85-06-14	1224	75	60.3
263	CROOKED A MTH	4040210	5	85-06-26	1504	130	210.0
264	CROOKED A MTH	4040210	5	85-07-03	1131	60	78.6
265	CROOKED A MTH	4040210	5	85-07-25	1030	130	122.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
266	CROOKED A MTH	4040210	5	85-07-25	1630	110.00	101.00
267	CROOKED A MTH	4040210	5	85-07-25	2230	100.00	80.30
268	CROOKED A MTH	4040210	5	85-07-26	430	85.00	66.40
269	CROOKED A MTH	4040210	5	85-07-26	1930	95.00	73.90
270	CROOKED A MTH	4040210	5	85-07-27	1030	70.00	59.80
271	CROOKED A MTH	4040210	5	85-07-27	1630	90.00	64.80
272	CROOKED A MTH	4040210	5	85-07-27	2230	140.00	95.90
273	CROOKED A MTH	4040210	5	85-07-28	430	75.00	55.20
274	CROOKED A MTH	4040210	5	85-08-07	1338	220.00	122.00
275	CROOKED A MTH	4040210	5	85-08-13	1515	230.00	170.00
276	CROOKED A MTH	4040210	5	85-08-22	1300	140.00	137.00
277	CROOKED A MTH	4040210	5	85-09-05	1700	100.00	124.00
278	CROOKED A MTH I	4040210	5	85-07-03	1830	50.00	132.00
279	CROOKED A MTH I	4040210	5	85-07-25	1215	130.00	101.00
280	CROOKED A MTH I	4040210	5	85-07-25	1218	100.00	103.00
281	CROOKED A WBALB	4040210	3	84-08-08	1050	160.00	130.00
282	CROOKED A WBALB	4040210	3	84-08-09	1220	290.00	240.00
283	CROOKED B ALBER	4040210	1	84-08-09	1545	270.00	310.00
284	CROOKED B BEDRK	4040210	5	85-07-23	1930	120.00	95.10
285	CROOKED B BEDRK	4040210	5	85-07-24	1930	120.00	103.00
286	CROOKED B BEDRK	4040210	5	85-07-25	1030	100.00	74.00
287	CROOKED B BEDRK	4040210	5	85-07-25	1630	110.00	94.80
288	CROOKED B BEDRK	4040210	5	85-07-25	2230	220.00	162.00
289	CROOKED B BEDRK	4040210	5	85-07-26	430	220.00	166.00
290	CROOKED B DEADW	4040210	3	84-08-08	1244	750.00	550.00
291	CROOKED B DEADW	4040210	1	84-08-08	1750	700.00	700.00
292	CROOKED B DEADW	4040210	3	84-08-09	1305	550.00	660.00
293	CROOKED B EBALB	4040210	3	84-08-09	1545	270.00	310.00
294	CROOKED B PORC	4040210	3	84-08-09	1006	340.00	410.00
295	CROOKED B WBALB	4040210	3	84-08-09	1230	250.00	190.00
296	CROOKED N KETCH	4040210	3	84-08-08	1000	500.00	330.00
297	ALBERT A BRDG	4040211	4	85-06-16	1610	15.00	64.00
298	ALBERT A BRDG	4040211	4	85-06-17	1008	33.00	293.00
299	ALBERT A MTH	4040211	4	85-06-16	952	18.00	105.00
300	ALBERT A STEESE	4040211	4	84-08-23	1630	11.00	19.00
301	ALBERT EB A CC	4040211	3	84-08-09	1540	10.00	10.00
302	ALBERT EB A CRK	4040211	1	84-08-09	1540	3.30	6.00
303	ALBERT WB A CC	4040211	3	84-08-09	1235	3.30	6.00
304	ALBERT WB A CRK	4040211	1	84-08-09	1540	10.00	10.00
305	BEDROCK A STEES	4040211	5	84-07-25	1220	1.00	4.00
306	BEDROCK A STEES	4040211	4	84-07-26	1450	4.50	7.60
307	BEDROCK A STEES	4040211	5	85-07-23	1130	0.29	0.46
308	BEDROCK A STEES	4040211	5	85-07-25	1055	0.41	2.67
309	BEDROCK A STEES	4040211	5	85-08-22	1440	3.60	27.90
310	BOULDER A CC	4040211	5	85-07-24	1314	0.66	1.70
311	BOULDER A CC	4040211	5	85-07-24	1914	0.37	1.91
312	BOULDER A CC	4040211	5	85-07-25	1014	0.38	7.67
313	BOULDER A CC	4040211	5	85-07-26	1014	0.48	1.29
314	BOULDER A GRNHR	4040211	5	84-07-25	1220	33.00	26.00
315	BOULDER A GRNHR	4040211	4	84-07-25	1700	23.00	101.00
316	BOULDER A GRNHR	4040211	4	84-07-26	1738	2.80	4.60
317	BOULDER A STEES	4040211	5	84-07-24	1220	1.00	2.00
318	BOULDER A STEES	4040211	4	84-07-26	1022	1.40	1.80

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
319	BOULDER A STEES	4040211	4	85-06-12	1132	1.60	5.60
320	BOULDER I	4040211	5	85-07-23	2252	0.31	2.27
321	BOULDER I	4040211	5	85-07-24	1135	0.30	1.54
322	GREENHORN A BLD	4040211	3	84-08-09	910	0.20	4.00
323	BONANZA	4040212	5	85-07-22	2202	1800.00	2540.00
324	BONANZA	4040212	5	85-07-23	402	238.00	311.00
325	BONANZA	4040212	5	85-07-23	1002	75.00	93.00
326	BONANZA	4040212	5	85-07-23	1602	50.00	72.50
327	BONANZA	4040212	5	85-07-24	702	50.00	54.30
328	BONANZA	4040212	5	85-07-24	2202	85.00	138.00
329	BONANZA	4040212	5	85-07-25	402	26.00	32.30
330	BONANZA	4040212	5	85-07-25	1002	13.00	17.00
331	BONANZA	4040212	5	85-07-25	1602	19.00	29.50
332	BONANZA A RD	4040212	5	84-08-07	1220	2800.00	4500.00
333	DEADWOOD A CC	4040213	3	84-08-0	1215	2600.00	3600.00
334	DEADWOOD A CC	4040213	3	84-08-08	1230	320.00	850.00
335	DEADWOOD A CC	4040213	3	84-08-08	1750	400.00	360.00
336	DEADWOOD A CC	4040213	3	84-08-09	1303	500.00	900.00
337	DEADWOOD A CHSR	4040213	5	84-07-24	1220	1400.00	1556.00
338	DEADWOOD A CHSR	4040213	4	84-07-27	1730	1400.00	1980.00
339	DEADWOOD A CHSR	4040213	3	84-08-08	1225	120.00	310.00
340	DEADWOOD A CHSR	4040213	3	84-08-08	1547	95.00	23.00
341	DEADWOOD A CHSR	4040213	3	84-08-08	1838	3500.00	4100.00
342	DEADWOOD A CHSR	4040213	3	84-08-08	2202	1600.00	3000.00
343	DEADWOOD A CHSR	4040213	3	84-08-09	51	380.00	1100.00
344	DEADWOOD A CHSR	4040213	3	84-08-09	402	170.00	430.00
345	DEADWOOD A CHSR	4040213	3	84-08-09	718	160.00	500.00
346	DEADWOOD A CHSR	4040213	3	84-08-09	949	620.00	1700.08
347	DEADWOOD A CHSR	4040213	3	84-08-09	1233	130.00	400.00
348	DEADWOOD A CHSR	4040213	3	84-08-09	1539	75.00	250.00
349	DEADWOOD A CHSR	4040213	3	84-08-09	1834	45.00	150.00
350	DEADWOOD A CHSR	4040213	1	84-08-09	2137	100.00	87.00
351	DEADWOOD A CHSR	4040213	3	84-08-10	115	50.00	490.00
352	DEADWOOD A CHSR	4040213	3	84-08-10	647	280.00	450.00
353	DEADWOOD A CHSR	4040213	3	84-08-10	945	450.00	700.00
354	DEADWOOD A CHSR	4040213	3	84-08-10	1131	320.00	1000.00
355	DEADWOOD A CHSR	4040213	4	85-06-13	1633	1000.00	1415.00
356	DEADWOOD A CHSR	4040213	5	85-06-20	1406	3300.00	5980.00
357	DEADWOOD A CHSR	4040213	5	85-06-25	1959	280.00	604.00
358	DEADWOOD A CHSR	4040213	5	85-07-04	1455	330.00	613.00
359	DEADWOOD A CHSR	4040213	5	85-07-24	100	230.00	363.00
360	DEADWOOD A CHSR	4040213	5	85-07-24	700	160.00	222.00
361	DEADWOOD A CHSR	4040213	5	85-07-24	1300	2000.00	3730.00
362	DEADWOOD A CHSR	4040213	5	85-07-24	1900	1800.00	2770.00
363	DEADWOOD A CHSR	4040213	5	85-07-25	1000	1800.00	2660.00
364	DEADWOOD A CHSR	4040213	5	85-07-26	100	350.00	1910.00
365	DEADWOOD A CHSR	4040213	5	85-07-26	700	700.00	1650.00
366	DEADWOOD A CHSR	4040213	5	85-07-26	1300	2900.00	5100.00
367	DEADWOOD A CHSR	4040213	5	85-07-26	1900	1800.00	3840.00
368	DEADWOOD A CHSR	4040213	5	85-08-22	930	150.00	780.00
369	DEADWOOD A MINE	4040213	4	84-07-24	1500	1.30	3.40
370	KETCHEM A CHSR	4040214	5	85-06-25	2007	130.00	97.60
371	KETCHEM A CHSR	4040214	3	84-08-08	1230	4600.00	8700.00

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
372	KETCHEM A CHSR	4040214	1	84-08-08	1550	4600.00	9300.0
373	KETCHEM A CHSR	4040214	3	84-08-08	2210	2500.00	1400.0
374	KETCHEM A CHSR	4040214	3	84-08-09	100	110.00	160.0
375	KETCHEM A CHSR	4040214	3	84-08-09	410	160.00	350.0
376	KETCHEM A CHSR	4040214	3	84-08-09	728	210.00	380.0
377	KETCHEM A CHSR	4040214	3	84-08-09	959	200.00	410.0
378	KETCHEM A CHSR	4040214	3	84-08-09	1545	3600.00	7900.0
379	KETCHEM A CHSR	4040214	3	84-08-09	1842	650.00	3000.0
380	KETCHEM A CHSR	4040214	3	84-08-09	2048	1400.00	2700.0
381	KETCHEM A CHSR	4040214	3	84-08-10	124	5100.00	7100.0
382	KETCHEM A CHSR	4040214	3	84-08-10	656	390.00	380.0
383	KETCHEM A CHSR	4040214	3	84-08-10	953	240.00	330.0
384	KETCHEM A CHSR	4040214	3	84-08-10	1124	450.00	310.0
385	KETCHEM A CHSR	4040214	5	84-08-27	1220	3300.00	7600.0
386	KETCHEM A CHSR	4040214	4	85-06-16	1638	400.00	594.0
387	KETCHEM A CHSR	4040214	5	85-08-22	915	1300.00	868.0
388	KETCHEM A MININ	4040214	4	84-08-29	1030	0.75	0.4
389	KETCHEM A CHSR	4040214	4	84-08-21	1338	2000.00	1910.0
390	KETCHEM A CHSR	4040214	4	84-08-23	1820	3400.00	2610.0
391	KETCHEM N CC	4040214	3	84-08-08	955	1100.00	1000.0
392	KETCHEM N CC	4040214	3	84-08-09	1505	340.00	130.0
393	MAMMOTH A MTH	4040215	3	84-08-09	1004	280.00	350.0
394	MAMMOTH A STEES	4040215	5	84-08-01	1220	1200.00	1812.0
395	MAMMOTH A STEES	4040215	4	84-08-01	1620	1000.00	1810.0
396	MAMMOTH A STEES	4040215	3	84-08-08	1150	300.00	270.0
397	MAMMOTH A STEES	4040215	3	84-08-08	1505	340.00	480.0
398	MAMMOTH A STEES	4040215	3	84-08-08	1752	600.00	990.0
399	MAMMOTH A STEES	4040215	3	84-08-08	2115	170.00	240.0
400	MAMMOTH A STEES	4040215	3	84-08-09	1	500.00	660.0
401	MAMMOTH A STEES	4040215	3	84-08-09	300	370.00	370.0
402	MAMMOTH A STEES	4040215	3	84-08-09	615	300.00	420.0
403	MAMMOTH A STEES	4040215	3	84-08-09	900	50.00	173.0
404	MAMMOTH A STEES	4040215	3	84-08-09	1157	210.00	160.0
405	MAMMOTH A STEES	4040215	3	84-08-09	1504	130.00	210.0
406	MAMMOTH A STEES	4040215	3	84-08-09	1800	120.00	250.0
407	MAMMOTH A STEES	4040215	3	84-08-09	2057	220.00	280.0
408	MAMMOTH A STEES	4040215	3	84-08-10	10	600.00	770.0
409	MAMMOTH A STEES	4040215	3	84-08-10	556	340.00	360.0
410	MAMMOTH A STEES	4040215	3	84-08-10	903	400.00	560.0
411	MAMMOTH A STEES	4040215	3	84-08-10	1208	370.00	400.0
412	MAMMOTH A STEES	4040215	4	84-08-21	850	110.00	88.0
413	MAMMOTH A STEES	4040215	4	85-06-17	1155	270.00	358.0
414	MAMMOTH A STEES	4040215	5	85-06-20	1440	1000.00	1205.0
415	MAMMOTH A STEES	4040215	5	85-07-23	1515	180.00	199.0
416	MAMMOTH A STEES	4040215	5	85-07-24	1515	250.00	239.0
417	MAMMOTH A STEES	4040215	5	85-07-25	615	230.00	199.0
418	MAMMOTH A STEES	4040215	5	85-07-25	1215	150.00	146.0
419	MAMMOTH A STEES	4040215	5	85-07-25	1815	450.00	394.0
420	MAMMOTH A STEES	4040215	5	85-07-26	15	400.00	349.0
421	MASTODON A MINE	4040215	4	84-08-01	1100	0.50	4.4
422	MASTODON A MTH	4040215	5	84-08-02	1220	370.00	430.0
423	MASTODON B WILK	4040215	4	84-08-01	1300	1300.00	1340.0
424	MILLER A MINING	4040215	4	84-07-31	1000	1.10	0.8

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
425	MILLER A MTH	4040215	4	84-07-31	1620	16.00	142.00
426	MILLER A MTH	4040215	5	84-08-02	1220	17.00	122.00
427	PORCUPINE A MHI	4040216	5	85-07-23	1818	60.00	41.10
428	PORCUPINE A MIN	4040216	5	85-07-24	324	0.28	1.62
429	PORCUPINE A MTH	4040216	3	84-08-09	1002	360.00	450.00
430	PORCUPINE A MTH	4040216	5	85-07-23	617	190.00	170.00
431	PORCUPINE A MTH	4040216	5	85-07-23	1217	65.00	49.60
432	PORCUPINE A MTH	4040216	5	85-07-23	1817	55.00	43.90
433	PORCUPINE A MTH	4040216	5	85-07-24	17	45.00	31.60
434	PORCUPINE A MTH	4040216	5	85-07-24	1517	40.00	25.40
435	PORCUPINE A MTH	4040216	5	85-07-25	617	60.00	43.90
436	PORCUPINE A MTH	4040216	5	85-07-25	1217	55.00	34.00
437	PORCUPINE A MTH	4040216	5	85-07-25	1817	50.00	38.80
438	PORCUPINE A MTH	4040216	5	85-07-26	17	60.00	39.80
439	PORCUPINE A RD	4040216	5	84-08-08	1220	55.00	215.00
440	PORCUPINE A RD	4040216	5	85-07-22	2203	23.00	16.50
441	PORCUPINE A RD	4040216	5	85-07-23	403	55.00	37.50
442	PORCUPINE A RD	4040216	5	85-07-23	1003	100.00	74.70
443	PORCUPINE A RD	4040216	5	85-07-23	1603	85.00	56.10
444	PORCUPINE A RD	4040216	5	85-07-24	603	60.00	31.90
445	PORCUPINE A RD	4040216	5	85-07-24	2203	110.00	72.60
446	PORCUPINE A RD	4040216	5	85-07-25	403	160.00	116.00
447	PORCUPINE A RD	4040216	5	85-07-25	1003	150.00	101.00
448	PORCUPINE A RD	4040216	5	85-07-25	1603	120.00	80.00
449	PORCUPINE A RDI	4040216	5	85-07-23	1602	90.00	57.30
450	PORCUPINE B GAM	4040216	5	85-06-04	1649	170.00	1465.00
451	PORCUPINE B GAM	4040216	5	85-06-13	1532	65.00	259.00
452	PORCUPINE B GAM	4040216	5	85-07-22	1612	90.00	71.30
453	PORCUPINE B GAM	4040216	5	85-07-22	2212	200.00	171.00
454	PORCUPINE B GAM	4040216	5	85-07-23	412	380.00	298.00
455	PORCUPINE B GAM	4040216	5	85-07-23	1012	250.00	188.00
456	PORCUPINE B GAM	4040216	5	85-07-24	112	260.00	175.00
457	PORCUPINE B GAM	4040216	5	85-07-24	1612	300.00	221.00
458	PORCUPINE B GAM	4040216	5	85-07-24	2212	400.00	360.00
459	PORCUPINE B GAM	4040216	5	85-07-25	412	550.00	483.00
460	PORCUPINE B GAM	4040216	5	85-07-25	1012	750.00	630.00
461	PORCUPINE B GMI	4040216	5	85-07-23	1345	200.00	166.00
462	PREACHER A NFOR	4040220	4	85-06-13	1426	5.80	32.00
463	PREACHER NF A M	4040220	4	85-06-13	1633	4.90	25.00
464	ALBERT WB A CC	4040411	3	84-08-08	1058	0.40	4.00
465	DEADWOOD I CHSR	4040413	5	85-07-24	1250	1400.00	2570.00
466	SALCHA A RICH	4050501	1	83-08-15	615	1.40	0.50
467	CHENA A NCDO	4050601	4	84-05-09	1200	17.00	71.00
468	CHENA A NCDO	4050601	4	84-05-15	1200	8.30	32.00
469	CHENA A NORDALE	4050601	1	83-08-04	2045	1.80	5.00
470	CHENA A NORDALE	4050601	1	83-08-05	2000	2.30	6.00
471	CHENA A NORDALE	4050601	1	83-08-10	1230	2.10	6.00
472	CHENA A NORDALE	4050601	1	83-08-10	1730	2.30	8.00
473	CHENA A NORDALE	4050601	1	83-08-15	1320	2.40	3.00
474	CHENA A NORDALE	4050601	4	84-05-09	1200	16.00	54.00
475	CHENA A NORDALE	4050601	4	84-05-15	1200	3.40	12.00
476	CHENA A NORDALE	4050601	3	84-08-11	1935	2.40	17.00
477	CHENA A NORDALE	4050601	3	84-08-13	1150	2.10	13.00

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
478	CHENA A NORDALE	4050601	3	84-08-13	1837	2.1	12.00
479	CHENA A NORDALE	4050601	3	84-08-20	2140	0.7	5.60
480	CHENA A NORDALE	4050601	4	85-05-15	1200	15.0	86.00
481	CHENA A SM TRAC	4050601	4	85-05-15	1200	13.0	47.00
482	CHENA A WENDELL	4050601	1	83-08-09	1210	2.7	5.00
483	CHENA A WENDELL	4050601	1	83-08-10	1755	3.0	7.00
484	CHENA A WENDELL	4050601	1	83-08-15	1250	5.2	4.00
485	CHENA A WENDELL	4050601	1	83-08-15	2100	3.0	4.00
486	CHENA A WENDELL	4050601	3	84-08-13	1120	2.5	4.00
487	CHENA A WENDELL	4050601	3	84-08-13	2058	2.5	11.00
488	CHENA MF A MINE	4050601	3	84-08-13	1150	0.5	1.00
489	CHENA MF B POND	4050601	3	84-08-13	1210	3.5	18.00
490	CHENA MF B POND	4050601	3	84-08-13	1211	3.8	22.00
491	CHENA MF B POND	4050601	3	84-08-13	1212	4.9	26.00
492	CHENA MF B POND	4050601	3	84-08-13	1300	3.5	17.00
493	CHENA NF A EF	4050601	3	84-08-13	1405	0.2	4.00
494	CHENA NR 2 RI	4050601	3	84-08-13	1305	3.0	4.00
495	CHENA NR 2 RI	4050601	3	84-08-13	1745	0.5	13.00
496	CHENA NR TWO RI	4050601	1	83-08-05	1800	3.4	4.00
497	CHENA NR TWO RI	4050601	1	83-08-10	1345	1.3	1.30
498	CHENA NR TWO RI	4050601	1	83-08-15	1430	2.2	1.00
499	CHENA,EF AB MTH	4050601	1	83-08-05	1620	2.5	8.00
500	CHENA,EF AB MTH	4050601	1	83-08-05	1625	2.7	5.00
501	CHENA,EF AB MTH	4050601	1	83-08-15	1615	9.5	5.00
502	CHENA,NF AB EF	4050601	1	83-08-05	1725	0.3	1.00
503	CHENA,NF AB EF	4050601	1	83-08-10	1530	0.7	2.00
504	CHENA,NF AB EF	4050601	1	83-08-10	1550	0.4	2.00
505	CRIPPLE A CHENA	4050602	4	84-05-09	1200	45.0	235.00
506	CRIPPLE A CHENA	4050602	4	84-05-15	1200	250.0	2060.00
507	CRIPPLE A CHENA	4050602	4	85-05-15	1200	26.0	226.00
508	FAIRBANKS A MTH	4050603	1	84-08-10	1910	0.8	0.05
509	FAIRBANKS A MTH	4050603	1	84-08-13	2030	0.6	0.20
510	FAIRBANKS A MTH	4050603	1	84-08-16	1925	0.5	0.80
511	FAIRBANKS A MTH	4050603	1	84-08-20	1815	0.5	0.80
512	FAIRBANKS A PAX	4050603	1	84-08-16	2100	120.0	118.00
513	FAIRBANKS A SAT	4050603	1	84-08-10	2020	60.0	40.00
514	FAIRBANKS A SAT	4050603	1	84-08-13	1645	360.0	3368.00
515	FAIRBANKS A SAT	4050603	1	84-08-16	2040	1800.0	7580.00
516	FAIRBANKS A SAT	4050603	1	84-08-20	1950	27.0	280.00
517	FISH AT GOLD DR	4050604	1	84-08-10	1905	50.0	62.00
518	FISH AT GOLD DR	4050604	1	84-08-20	1830	19.0	28.00
519	FISH B GOLD DRG	4050604	1	84-08-13	2000	7.3	38.00
520	FISH B GOLD DRG	4050604	1	84-08-13	2300	6.9	16.00
521	FISH B GOLD DRG	4050604	1	84-08-14	200	7.5	15.00
522	FISH B GOLD DRG	4050604	1	84-08-14	500	9.5	16.00
523	FISH B GOLD DRG	4050604	1	84-08-14	800	9.2	23.00
524	FISH B GOLD DRG	4050604	1	84-08-14	1100	13.0	18.00
525	FISH B GOLD DRG	4050604	1	84-08-14	1400	12.0	24.00
526	FISH B GOLD DRG	4050604	1	84-08-14	1700	14.0	18.00
527	FISH B GOLD DRG	4050604	1	84-08-15	200	17.0	30.00
528	FISH B GOLD DRG	4050604	1	84-08-15	500	14.0	30.00
529	FISH B GOLD DRG	4050604	1	84-08-15	1100	18.0	48.00
530	FISH B GOLD DRG	4050604	1	84-08-15	1400	18.0	46.00

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
531	FISH B GOLD DRG	4050604	1	84-08-15	1700	16	42
532	FISH B GOLD DRG	4050604	1	84-08-15	2300	14	30
533	FISH B GOLD DRG	4050604	1	84-08-16	200	17	34
534	FISH B GOLD DRG	4050604	1	84-08-16	500	20	50
535	FISH B GOLD DRG	4050604	1	84-08-16	800	26	64
536	FISH B GOLD DRG	4050604	1	84-08-16	1100	36	396
537	FISH B GOLD DRG	4050604	1	84-08-16	1400	27	64
538	FISH B GOLD DRG	4050604	1	84-08-16	1700	23	50
539	FISH B GOLD DRG	4050604	1	84-08-16	1900	22	37
540	FISH B GOLD DRG	4050604	1	84-08-16	2015	16	34
541	FISH B LUCKY 7	4050604	2	84-06-11	1100	85	64
542	FISH B LUCKY 7	4050604	2	84-06-11	1355	310	20
543	FISH B LUCKY 7	4050604	2	84-06-11	1715	550	372
544	FISH B LUCKY 7	4050604	2	84-06-12	1040	320	788
545	FISH B LUCKY 7	4050604	2	84-06-12	1525	750	448
546	FISH B LUCKY 7	4050604	2	84-06-12	1730	1100	675
547	FISH B LUCKY 7	4050604	2	84-06-13	1500	80	455
548	FISH B LUCKY 7	4050604	2	84-06-13	1700	80	350
549	FISH B LUCKY 7	4050604	2	84-06-14	1230	800	765
550	FISH B LUCKY 7	4050604	2	84-06-14	1510	600	385
551	FISH B LUCKY 7	4050604	2	84-06-18	1245	95	75
552	FISH B LUCKY 7	4050604	2	84-06-18	1520	400	286
553	FISH B LUCKY 7	4050604	2	84-08-18	1300	170	47
554	FISH B LUCKY 7	4050604	2	84-08-18	1530	150	35
555	FISH B LUCKY 7	4050604	2	84-08-18	1725	100	40
556	FISH B LUCKY 7	4050604	2	84-08-20	1025	250	82
557	FISH B LUCKY 7	4050604	2	84-08-20	1300	160	72
558	FISH B LUCKY 7	4050604	2	84-08-20	1500	150	54
559	FISH B LUCKY 7	4050604	2	84-08-21	945	350	160
560	FISH B LUCKY 7	4050604	2	84-08-21	1225	280	170
561	FISH B LUCKY 7	4050604	2	84-08-21	1430	250	190
562	FISH B LUCKY 7	4050604	2	84-08-22	1040	350	128
563	FISH B LUCKY 7	4050604	2	84-08-22	1245	290	99
564	FISH B LUCKY 7	4050604	2	84-08-22	1440	250	60
565	FISH B LUCKY 7	4050604	2	84-08-23	1030	400	140
566	FISH B LUCKY 7	4050604	2	84-08-23	1250	330	126
567	FISH B LUCKY 7	4050604	2	84-08-23	1430	310	137
568	FISH B LUCKY 7	4050604	2	84-09-03	1150	80	35
569	FISH B LUCKY 7	4050604	2	84-09-03	1505	140	55
570	FISH B LUCKY 7	4050604	2	84-09-03	1710	260	170
571	FISH B LUCKY 7	4050604	2	84-09-04	1220	270	180
572	FISH B LUCKY 7	4050604	2	84-09-04	1440	310	180
573	FISH B LUCKY 7	4050604	2	84-09-04	1640	290	170
574	FISH B LUCKY 7	4050604	2	84-09-05	1225	310	250
575	FISH B LUCKY 7	4050604	2	84-09-05	1435	450	360
576	FISH B LUCKY 7	4050604	2	84-09-05	1545	400	290
577	FISH B LUCKY 7	4050604	2	84-09-06	1145	45	65
578	FISH B LUCKY 7	4050604	2	84-09-06	1225	330	505
579	FISH B LUCKY 7	4050604	2	84-09-06	1405	450	610
580	FISH B LUCKY 7	4050604	2	84-09-11	1250	400	660
581	FISH B LUCKY 7	4050604	2	84-09-11	1415	400	615
582	FISH B LUCKY 7	4050604	2	84-09-11	1550	600	950
583	FISH B LUCKY 7	4050604	2	84-09-14	1140	190	325

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
584	LCHENA A CHRS	4050605	3	84-08-11	1905	5.8	10.0
585	LCHENA A CHRS	4050605	3	84-08-11	1915	5.4	12.0
586	LCHENA A CHRS	4050605	3	84-08-13	1819	3.5	15.0
587	LCHENA A CHRS	4050605	3	84-08-16	2200	2.2	5.0
588	LCHENA A CHRS	4050605	3	84-08-20	2100	1.9	6.4
589	LCHENA A CHSR	4050605	1	83-08-04	2020	3.8	6.0
590	LCHENA A CHSR	4050605	1	83-08-04	2200	6.1	3.0
591	LCHENA A CHSR	4050605	1	83-08-05	300	9.2	5.0
592	LCHENA A CHSR	4050605	1	83-08-05	700	8.8	6.0
593	LCHENA A CHSR	4050605	1	83-08-05	1200	5.5	6.0
594	LCHENA A CHSR	4050605	1	83-08-05	1300	4.3	4.0
595	LCHENA A CHSR	4050605	1	83-08-05	1340	5.7	6.0
596	LCHENA A CHSR	4050605	1	83-08-05	1900	3.9	6.0
597	LCHENA A CHSR	4050605	1	83-08-10	1305	8.1	10.0
598	LCHENA A CHSR	4050605	1	83-08-10	1710	9.3	12.0
599	LCHENA A CHSR	4050605	1	83-08-15	1335	8.2	6.0
600	LCHENA A CHSR	4050605	1	83-08-15	1730	7.5	5.0
601	LCHENA A NORDAL	4050605	4	84-05-09	1200	12.0	68.0
602	LCHENA A NORDAL	4050605	4	84-05-15	1200	31.0	164.0
603	LCHENA A NORDAL	4050605	4	85-05-15	1200	32.0	258.0
604	CHATANIKA A 39M	4050901	1	83-08-06	1345	9.3	5.0
605	CHATANIKA A 39M	4050901	1	83-08-06	2000	6.6	3.0
606	CHATANIKA A 39M	4050901	1	83-08-09	1030	5.8	2.0
607	CHATANIKA A 39M	4050901	1	83-08-09	1150	6.8	5.0
608	CHATANIKA A 39M	4050901	1	83-08-09	2140	5.2	3.0
609	CHATANIKA A 39M	4050901	1	83-08-12	1250	4.8	1.0
610	CHATANIKA A 39M	4050901	1	83-08-12	1430	5.7	2.0
611	CHATANIKA A 39M	4050901	1	83-08-12	2255	8.6	5.0
612	CHATANIKA A 39M	4050901	1	83-08-16	1315	12.0	18.0
613	CHATANIKA A 39M	4050901	1	83-08-16	1435	10.0	15.0
614	CHATANIKA A 39M	4050901	3	84-08-07	1255	6.9	28.0
615	CHATANIKA A 39M	4050901	3	84-08-07	1256	16.0	9.0
616	CHATANIKA A 39M	4050901	3	84-08-10	1723	65.0	32.0
617	CHATANIKA A 39M	4050901	3	84-08-14	1530	5.1	4.0
618	CHATANIKA A 39M	4050901	3	84-08-14	1540	2.2	4.0
619	CHATANIKA A 39M	4050901	3	84-08-15	705	2.3	4.4
620	CHATANIKA A 39M	4050901	3	84-08-15	1955	14.0	24.0
621	CHATANIKA A 39M	4050901	3	84-08-21	745	3.9	6.4
622	CHATANIKA A 39M	4050901	4	84-09-23	1630	13.0	3.2
623	CHATANIKA A 59M	4050901	4	84-09-23	1510	12.0	6.7
624	CHATANIKA A DOT	4050901	3	84-08-18	1605	8.0	9.0
625	CHATANIKA A ELL	4050901	1	83-08-07	1110	3.2	2.0
626	CHATANIKA A ELL	4050901	1	83-08-07	2010	8.0	4.0
627	CHATANIKA A ELL	4050901	1	83-08-11	1115	4.5	3.0
628	CHATANIKA A ELL	4050901	1	83-08-11	2145	3.3	2.0
629	CHATANIKA A ELL	4050901	1	83-08-13	1130	4.9	2.0
630	CHATANIKA A ELL	4050901	1	83-08-14	210	4.6	3.0
631	CHATANIKA A ELL	4050901	4	84-05-09	1200	13.0	69.0
632	CHATANIKA A ELL	4050901	4	84-05-15	1200	16.0	84.0
633	CHATANIKA A ELL	4050901	3	84-08-12	1122	11.0	8.0
634	CHATANIKA A ELL	4050901	3	84-08-16	2118	4.2	4.0
635	CHATANIKA A ELL	4050901	3	84-08-19	1410	6.3	10.0
636	CHATANIKA A ELL	4050901	4	85-05-15	1200	29.0	227.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
637	CHATANIKA A GLD	4050901	1	84-08-15	1305	8.1	40.0
638	CHATANIKA A POK	4050901	3	84-08-07	1225	3.9	8.0
639	CHATANIKA A POK	4050901	3	84-08-10	1845	16.0	16.0
640	CHATANIKA A POK	4050901	3	84-08-14	1423	1.5	91.0
641	CHATANIKA A POK	4050901	3	84-08-14	1510	2.6	5.6
642	CHATANIKA A POK	4050901	3	84-08-15	645	3.0	3.2
643	CHATANIKA A POK	4050901	3	84-08-15	2015	1.8	2.4
644	CHATANIKA A POK	4050901	3	84-08-21	710	4.6	8.4
645	CHATANIKA A POK	4050901	4	84-09-23	1728	12.0	6.0
646	CHATANIKA A TAT	4050901	3	84-08-15	1324	17.0	28.0
647	CHATANIKA A TOL	4050901	1	84-08-15	1335	11.0	12.0
648	CHATANIKA ALONG	4050901	1	83-08-09	1130	8.0	8.0
649	CHATANIKA ALONG	4050901	1	83-08-09	1630	8.7	6.0
650	CHATANIKA ALONG	4050901	1	83-08-09	1930	17.0	10.0
651	CHATANIKA ALONG	4050901	1	83-08-09	2100	20.0	12.0
652	CHATANIKA ALONG	4050901	1	83-08-09	2230	20.0	14.0
653	CHATANIKA ALONG	4050901	1	83-08-10	130	18.0	10.0
654	CHATANIKA ALONG	4050901	1	83-08-10	430	17.0	10.0
655	CHATANIKA ALONG	4050901	1	83-08-10	730	14.0	8.0
656	CHATANIKA ALONG	4050901	1	83-08-10	1030	13.0	8.0
657	CHATANIKA ALONG	4050901	1	83-08-10	1330	11.0	5.0
658	CHATANIKA ALONG	4050901	1	83-08-10	1630	11.0	5.0
659	CHATANIKA ALONG	4050901	1	83-08-10	1930	13.0	9.0
660	CHATANIKA ALONG	4050901	1	83-08-10	2230	14.0	9.0
661	CHATANIKA ALONG	4050901	1	83-08-11	130	14.0	12.0
662	CHATANIKA ALONG	4050901	1	83-08-11	430	18.0	15.0
663	CHATANIKA ALONG	4050901	1	83-08-11	730	13.0	10.0
664	CHATANIKA ALONG	4050901	1	83-08-11	1030	12.0	9.2
665	CHATANIKA ALONG	4050901	1	83-08-11	1330	9.0	7.0
666	CHATANIKA ALONG	4050901	1	83-08-11	1630	7.4	5.0
667	CHATANIKA ALONG	4050901	1	83-08-11	1930	11.0	6.0
668	CHATANIKA ALONG	4050901	1	83-08-11	2230	15.0	11.0
669	CHATANIKA ALONG	4050901	1	83-08-12	430	18.0	16.0
670	CHATANIKA ALONG	4050901	1	83-08-12	1030	12.0	3.0
671	CHATANIKA ALONG	4050901	1	83-08-12	1330	11.0	6.0
672	CHATANIKA ALONG	4050901	1	83-08-12	1525	10.0	6.0
673	CHATANIKA ALONG	4050901	1	83-08-12	1630	8.8	5.0
674	CHATANIKA ALONG	4050901	1	83-08-12	2210	18.0	16.0
675	CHATANIKA ALONG	4050901	1	83-08-16	1535	13.0	13.0
676	CHATANIKA ALONG	4050901	3	84-08-07	1318	40.0	32.0
677	CHATANIKA ALONG	4050901	3	84-08-07	1420	37.0	35.0
678	CHATANIKA ALONG	4050901	3	84-08-07	1600	30.0	19.0
679	CHATANIKA ALONG	4050901	3	84-08-07	1720	12.0	9.0
680	CHATANIKA ALONG	4050901	3	84-08-07	2020	0.6	4.0
681	CHATANIKA ALONG	4050901	3	84-08-07	2320	3.3	8.0
682	CHATANIKA ALONG	4050901	3	84-08-08	220	2.1	6.0
683	CHATANIKA ALONG	4050901	3	84-08-08	520	9.8	11.0
684	CHATANIKA ALONG	4050901	3	84-08-08	820	33.0	37.0
685	CHATANIKA ALONG	4050901	3	84-08-08	1120	6.2	16.0
686	CHATANIKA ALONG	4050901	3	84-08-08	1420	40.0	48.0
687	CHATANIKA ALONG	4050901	3	84-08-08	1720	22.0	17.0
688	CHATANIKA ALONG	4050901	3	84-08-08	2020	10.0	6.0
689	CHATANIKA ALONG	4050901	3	84-08-08	2320	4.9	7.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
690	CHATANIKA ALONG	4050901	3	84-08-09	220	3.9	6.0
691	CHATANIKA ALONG	4050901	3	84-08-09	520	7.8	7.0
692	CHATANIKA ALONG	4050901	3	84-08-09	820	70.0	71.0
693	CHATANIKA ALONG	4050901	3	84-08-09	1120	95.0	100.0
694	CHATANIKA ALONG	4050901	3	84-08-09	1420	40.0	43.0
695	CHATANIKA ALONG	4050901	3	84-08-09	1720	18.0	22.0
696	CHATANIKA ALONG	4050901	3	84-08-09	2020	8.2	7.0
697	CHATANIKA ALONG	4050901	3	84-08-09	2320	4.1	11.0
698	CHATANIKA ALONG	4050901	3	84-08-10	220	3.6	4.0
699	CHATANIKA ALONG	4050901	3	84-08-10	520	30.0	29.0
700	CHATANIKA ALONG	4050901	3	84-08-10	725	3.7	6.0
701	CHATANIKA ALONG	4050901	3	84-08-10	820	60.0	69.0
702	CHATANIKA ALONG	4050901	3	84-08-10	1120	85.0	99.0
703	CHATANIKA ALONG	4050901	3	84-08-10	1420	37.0	69.0
704	CHATANIKA ALONG	4050901	3	84-08-10	1620	24.0	24.0
705	CHATANIKA ALONG	4050901	3	84-08-10	1706	15.0	19.0
706	CHATANIKA ALONG	4050901	3	84-08-14	1554	9.4	4.0
707	CHATANIKA ALONG	4050901	3	84-08-14	1600	4.7	7.2
708	CHATANIKA ALONG	4050901	3	84-08-15	1930	7.3	10.0
709	CHATANIKA ALONG	4050901	3	84-08-21	805	4.1	3.6
710	CHATANIKA ALONG	4050901	4	84-09-23	1610	14.0	5.0
711	CHATANIKA B FAI	4050901	1	83-08-06	1725	45.0	120.0
712	CHATANIKA B FAI	4050901	1	83-08-09	1510	37.0	38.0
713	CHATANIKA B FAI	4050901	1	83-08-09	1730	32.0	27.0
714	CHATANIKA B FAI	4050901	1	83-08-09	2030	29.0	75.0
715	CHATANIKA B FAI	4050901	1	83-08-09	2330	38.0	30.0
716	CHATANIKA B FAI	4050901	1	83-08-10	230	70.0	80.0
717	CHATANIKA B FAI	4050901	1	83-08-10	530	75.0	90.0
718	CHATANIKA B FAI	4050901	1	83-08-10	830	70.0	76.0
719	CHATANIKA B FAI	4050901	1	83-08-10	1130	55.0	62.0
720	CHATANIKA B FAI	4050901	1	83-08-10	1430	38.0	48.0
721	CHATANIKA B FAI	4050901	1	83-08-10	1730	50.0	46.0
722	CHATANIKA B FAI	4050901	1	83-08-10	2030	34.0	40.0
723	CHATANIKA B FAI	4050901	1	83-08-10	2330	60.0	68.0
724	CHATANIKA B FAI	4050901	1	83-08-11	230	90.0	110.0
725	CHATANIKA B FAI	4050901	1	83-08-11	530	140.0	144.0
726	CHATANIKA B FAI	4050901	1	83-08-11	830	110.0	118.0
727	CHATANIKA B FAI	4050901	1	83-08-11	1130	85.0	88.0
728	CHATANIKA B FAI	4050901	1	83-08-11	1430	60.0	42.0
729	CHATANIKA B FAI	4050901	1	83-08-11	1730	36.0	32.0
730	CHATANIKA B FAI	4050901	1	83-08-11	1855	38.0	36.0
731	CHATANIKA B FAI	4050901	1	83-08-11	2030	36.0	28.0
732	CHATANIKA B FAI	4050901	1	83-08-11	2330	70.0	72.0
733	CHATANIKA B FAI	4050901	1	83-08-12	230	140.0	132.0
734	CHATANIKA B FAI	4050901	1	83-08-12	530	150.0	152.0
735	CHATANIKA B FAI	4050901	1	83-08-12	830	130.0	134.0
736	CHATANIKA B FAI	4050901	1	83-08-12	1130	120.0	100.0
737	CHATANIKA B FAI	4050901	1	83-08-12	1430	85.0	64.0
738	CHATANIKA B FAI	4050901	1	83-08-12	1730	55.0	44.0
739	CHATANIKA B FAI	4050901	1	83-08-12	1930	55.0	42.0
740	CHATANIKA B FAI	4050901	1	83-08-12	2010	40.0	48.0
741	CHATANIKA B FAI	4050901	1	83-08-16	1930	20.0	22.0
742	CHATANIKA B FAI	4050901	1	83-08-16	2025	32.0	37.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
743	CHATANIKA B FAI	4050901	3	84-08-07	1620	85.0	160.0
744	CHATANIKA B FAI	4050901	3	84-08-07	1640	39.0	160.0
745	CHATANIKA B FAI	4050901	3	84-08-07	1730	95.0	9.0
746	CHATANIKA B FAI	4050901	3	84-08-07	1940	95.0	180.0
747	CHATANIKA B FAI	4050901	3	84-08-07	2240	110.0	220.0
748	CHATANIKA B FAI	4050901	3	84-08-08	140	70.0	88.0
749	CHATANIKA B FAI	4050901	3	84-08-08	440	27.0	25.0
750	CHATANIKA B FAI	4050901	3	84-08-08	740	14.0	6.0
751	CHATANIKA B FAI	4050901	3	84-08-08	1040	0.8	12.0
752	CHATANIKA B FAI	4050901	3	84-08-08	1340	0.7	6.0
753	CHATANIKA B FAI	4050901	3	84-08-08	1640	190.0	310.0
754	CHATANIKA B FAI	4050901	3	84-08-08	1940	290.0	430.0
755	CHATANIKA B FAI	4050901	3	84-08-08	2240	310.0	500.0
756	CHATANIKA B FAI	4050901	3	84-08-09	140	26.0	110.0
757	CHATANIKA B FAI	4050901	3	84-08-09	440	14.0	24.0
758	CHATANIKA B FAI	4050901	3	84-08-09	740	5.0	37.0
759	CHATANIKA B FAI	4050901	3	84-08-09	1040	0.7	13.0
760	CHATANIKA B FAI	4050901	3	84-08-09	1340	8.5	8.0
761	CHATANIKA B FAI	4050901	3	84-08-09	1640	95.0	39.0
762	CHATANIKA B FAI	4050901	3	84-08-09	1940	130.0	390.0
763	CHATANIKA B FAI	4050901	3	84-08-09	2240	300.0	470.0
764	CHATANIKA B FAI	4050901	3	84-08-10	140	55.0	97.0
765	CHATANIKA B FAI	4050901	3	84-08-10	440	6.2	39.0
766	CHATANIKA B FAI	4050901	3	84-08-10	740	7.6	25.0
767	CHATANIKA B FAI	4050901	3	84-08-10	1040	8.0	15.0
768	CHATANIKA B FAI	4050901	3	84-08-10	1340	14.0	24.0
769	CHATANIKA B FAI	4050901	3	84-08-10	1500	20.0	36.0
770	CHATANIKA B FAI	4050901	3	84-08-14	1553	45.0	80.0
771	CHATANIKA B USC	4050901	1	83-08-06	1520	60.0	64.0
772	CHATANIKA B USC	4050901	1	83-08-06	1855	32.0	33.0
773	CHATANIKA B USC	4050901	1	83-08-09	1415	45.0	32.0
774	CHATANIKA B USC	4050901	1	83-08-09	2020	28.0	20.0
775	CHATANIKA B USC	4050901	1	83-08-12	1600	55.0	61.0
776	CHATANIKA B USC	4050901	1	83-08-12	1725	55.0	59.0
777	CHATANIKA B USC	4050901	1	83-08-12	2045	40.0	42.0
778	CHATANIKA B USC	4050901	3	84-08-07	1525	7.8	6.0
779	CHATANIKA B USC	4050901	3	84-08-07	1526	6.9	10.0
780	CHATANIKA B USC	4050901	3	84-08-10	1540	0.6	16.0
781	CHATANIKA B USC	4050901	3	84-08-14	1700	7.9	6.0
782	CHATANIKA B USC	4050901	3	84-08-14	1700	4.9	6.8
783	CHATANIKA B USC	4050901	3	84-08-14	1847	8.8	4.0
784	CHATANIKA B USC	4050901	3	84-08-15	745	37.0	96.0
785	CHATANIKA B USC	4050901	3	84-08-15	1855	3.2	5.0
786	CHATANIKA B USC	4050901	3	84-08-18	1345	8.7	14.0
787	CHATANIKA B USC	4050901	3	84-08-21	835	12.0	9.0
788	CHARITY B MCINT	4050902	4	85-07-17	1320	700.0	578.0
789	CHARITY B MCINT	4050902	4	85-07-17	2320	340.0	264.0
790	CHARITY B MCINT	4050902	4	85-07-18	720	90.0	64.0
791	CHARITY B MCINT	4050902	4	85-07-18	2120	1400.0	1062.0
792	CHARITY B MCINT	4050902	4	85-07-19	1120	550.0	357.0
793	CHARITY B MIXIN	4050902	4	85-07-19	1100	80.0	55.0
794	FAITH A BRDG	4050904	4	85-06-17	1332	6.7	19.0
795	FAITH A MCMANUS	4050904	4	84-09-23	1445	30.0	23.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
796	FAITH A STEESE	4050904	1	83-08-06	1645	45.0	44.0
797	FAITH A STEESE	4050904	1	83-08-06	1740	120.0	182.0
798	FAITH A STEESE	4050904	1	83-08-09	1500	120.0	71.0
799	FAITH A STEESE	4050904	1	83-08-09	1730	60.0	56.0
800	FAITH A STEESE	4050904	1	83-08-12	1805	80.0	76.0
801	FAITH A STEESE	4050904	1	83-08-12	2000	70.0	86.0
802	FAITH A STEESE	4050904	1	83-08-16	1910	31.0	39.0
803	FAITH A STEESE	4050904	1	83-08-16	2005	55.0	78.0
804	FAITH A STEESE	4050904	3	84-08-07	1715	140.0	260.0
805	FAITH A STEESE	4050904	3	84-08-07	1722	120.0	290.0
806	FAITH A STEESE	4050904	1	84-08-10	1516	39.0	59.0
807	FAITH A STEESE	4050904	3	84-08-14	1555	140.0	170.0
808	FAITH A STEESE	4050904	3	84-08-15	805	14.0	21.0
809	FAITH A STEESE	4050904	3	84-08-15	1825	120.0	416.0
810	FAITH A STEESE	4050904	3	84-08-21	900	17.0	14.0
811	FAITH A STEESE	4050904	3	84-08-21	2230	65.0	148.0
812	FAITH A STEESE	4050904	4	84-09-23	1445	40.0	29.0
813	FAITH AB MCCLAI	4050904	3	84-08-21	950	12.0	19.0
814	FAITH B MCINTSH	4050904	2	84-08-01	1300	2600.0	1890.0
815	FAITH B MCINTSH	4050904	2	84-08-02	1515	190.0	339.0
816	FAITH B MCINTSH	4050904	2	84-08-16	1525	550.0	465.0
817	FAITH B MCINTSH	4050904	2	84-08-17	1310	600.0	767.0
818	FAITH B MCINTSH	4050904	2	84-08-29	1555	280.0	315.0
819	FAITH B MCINTSH	4050904	2	84-08-30	1450	130.0	142.0
820	FAITH B MINE	4050904	4	85-06-09	1653	130.0	278.0
821	MCMANUS A FAITH	4050905	1	83-08-06	1655	0.3	1.0
822	MCMANUS A FAITH	4050905	1	83-08-09	1505	0.3	1.0
823	MCMANUS A FAITH	4050905	1	83-08-12	1940	0.2	1.0
824	MCMANUS A FAITH	4050905	1	83-08-16	1950	0.4	2.0
825	MCMANUS A FAITH	4050905	3	84-08-07	1615	0.2	4.0
826	MCMANUS A FAITH	4050905	3	84-08-07	1652	0.1	4.0
827	MCMANUS A FAITH	4050905	3	84-08-10	1515	0.3	4.0
828	MCMANUS A FAITH	4050905	3	84-08-14	1550	1.0	4.0
829	MCMANUS A FAITH	4050905	3	84-08-15	810	0.4	0.4
830	MCMANUS A FAITH	4050905	3	84-08-15	1830	0.5	0.5
831	MCMANUS A FAITH	4050905	3	84-08-21	910	0.3	3.2
832	MCMANUS A FAITH	4050905	4	84-09-23	1415	0.1	0.5
833	TATALINA A BRDG	4050906	4	84-05-09	1200	3.8	16.0
834	TATALINA A BRDG	4050906	4	84-05-15	1200	8.4	70.0
835	TATALINA A BRDG	4050906	3	84-08-16	1530	1.2	7.0
836	TATALINA A BRDG	4050906	4	85-05-15	1200	8.8	53.0
837	TATALINA A CHT	4050906	3	84-08-15	1326	2.3	4.0
838	GOLDSTREAM A FX	4050910	4	84-05-09	1200	40.0	90.0
839	GOLDSTREAM A FX	4050910	4	84-05-15	1200	180.0	645.0
840	GOLDSTREAM A FX	4050910	4	85-05-15	1200	75.0	726.0
841	GOLDSTREAM A LR	4050910	3	84-08-15	1200	190.0	128.0
842	GOLDSTREAM A MT	4050910	3	84-08-15	1240	30.0	60.0
843	GOLDSTREAM ALOG	4050910	1	84-08-15	1200	190.0	128.0
844	GOLDSTREAM B FX	4050910	1	83-08-06	1225	330.0	556.0
845	GOLDSTREAM B FX	4050910	1	83-08-08	1050	300.0	292.0
846	GOLDSTREAM B FX	4050910	1	83-08-08	1130	300.0	272.0
847	GOLDSTREAM B FX	4050910	1	83-08-14	1455	260.0	250.0
848	GOLDSTREAM B FX	4050910	1	83-08-14	1540	270.0	282.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
849	GOLDSTREAM B FX	4050910	1	83-08-14	1700	260	268
850	GOLDSTREAM B FX	4050910	1	83-08-14	1900	250	160
851	GOLDSTREAM B FX	4050910	1	83-08-14	2100	280	268
852	GOLDSTREAM B FX	4050910	1	83-08-14	2300	240	176
853	GOLDSTREAM B FX	4050910	1	83-08-15	100	240	156
854	GOLDSTREAM B FX	4050910	1	83-08-15	300	240	160
855	GOLDSTREAM B FX	4050910	1	83-08-15	500	230	160
856	GOLDSTREAM B FX	4050910	1	83-08-15	700	250	276
857	GOLDSTREAM B FX	4050910	1	83-08-15	900	230	176
858	GOLDSTREAM B FX	4050910	1	83-08-15	1100	230	140
859	GOLDSTREAM B FX	4050910	1	83-08-15	1300	220	144
860	GOLDSTREAM B FX	4050910	1	83-08-15	1500	220	140
861	GOLDSTREAM B FX	4050910	1	83-08-15	1700	230	176
862	GOLDSTREAM B FX	4050910	1	83-08-15	1900	250	256
863	GOLDSTREAM B FX	4050910	1	83-08-15	2100	240	248
864	GOLDSTREAM B FX	4050910	1	83-08-15	2300	300	548
865	GOLDSTREAM B FX	4050910	1	83-08-16	100	320	636
866	GOLDSTREAM B FX	4050910	1	83-08-16	300	350	588
867	GOLDSTREAM B FX	4050910	1	83-08-16	500	370	736
868	GOLDSTREAM B FX	4050910	1	83-08-16	700	360	580
869	GOLDSTREAM B FX	4050910	1	83-08-16	900	320	436
870	GOLDSTREAM B FX	4050910	1	83-08-16	1100	280	312
871	GOLDSTREAM B FX	4050910	1	83-08-16	1200	260	268
872	GOLDSTREAM B FX	4050910	1	83-08-16	1300	270	264
873	GOLDSTREAM B FX	4050910	1	83-08-16	1500	270	344
874	GOLDSTREAM B FX	4050910	1	83-08-16	1700	260	308
875	GOLDSTREAM B FX	4050910	1	83-08-16	1900	260	252
876	GOLDSTREAM B FX	4050910	1	83-08-16	2100	260	252
877	GOLDSTREAM B FX	4050910	3	84-08-10	1845	65	260
878	GOLDSTREAM B FX	4050910	3	84-08-12	1050	400	310
879	GOLDSTREAM B FX	4050910	3	84-08-13	1929	800	1400
880	GOLDSTREAM B SC	4050910	1	83-08-06	1130	650	770
881	GOLDSTREAM B SC	4050910	1	83-08-08	930	280	224
882	GOLDSTREAM B SC	4050910	1	83-08-08	1025	260	224
883	GOLDSTREAM B SC	4050910	1	83-08-14	1610	230	172
884	GOLDSTREAM B SC	4050910	1	83-08-16	1135	260	196
885	GOLDSTREAM B SC	4050910	3	84-08-10	1905	140	30
886	GOLDSTREAM B SC	4050910	3	84-08-12	1011	350	250
887	GOLDSTREAM B SC	4050910	3	84-08-13	2005	340	450
888	FLUME B FCMINE	4050911	2	84-08-01	1940	4500	3700
889	FLUME B FCMINE	4050911	2	84-08-02	1030	3400	3740
890	FLUME B FCMINE	4050911	2	84-08-15	1445	5500	8590
891	FLUME B FCMINE	4050911	2	84-08-16	1110	5500	7750
892	FLUME B FCMINE	4050911	2	84-08-30	1900	4500	4460
893	FLUME B FCMINE	4050911	2	84-08-31	1505	5500	5670
894	FLUME B FCMINE	4050911	2	84-09-11	1140	4000	6220
895	FLUME B FCMINE	4050911	2	84-09-12	1205	4500	3980
896	GILMORE A MTH	4050912	1	83-08-14	1400	1040	528
897	GILMORE A MTH	4050912	1	83-08-16	1225	700	404
898	GILMORE A MTH	4050912	3	84-08-10	1815	550	350
899	GILMORE A MTH	4050912	3	84-08-13	1912	550	150
900	GILMORE A STEES	4050912	4	84-05-09	1200	60	118
901	GILMORE A STEES	4050912	4	84-05-15	1200	75	130

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
902	GILMORE B BDMIN	4050912	2	84-06-13	1155	280.00	20.0
903	GILMORE B BDMIN	4050912	2	84-06-13	1825	1100.00	595.0
904	GILMORE B BDMIN	4050912	2	84-06-14	940	500.00	195.0
905	GILMORE B BDMIN	4050912	2	84-06-14	1430	550.00	256.0
906	GILMORE B BDMIN	4050912	2	84-06-14	1830	600.00	198.0
907	GILMORE B BDMIN	4050912	2	84-06-15	1155	500.00	324.0
908	GILMORE B BDMIN	4050912	2	84-06-15	1355	550.00	256.0
909	GILMORE B BDMIN	4050912	2	84-06-15	1510	650.00	332.0
910	GILMORE B BDMIN	4050912	2	84-06-16	955	700.00	190.0
911	GILMORE B BDMIN	4050912	2	84-06-16	1140	650.00	195.0
912	GILMORE B BDMIN	4050912	2	84-06-16	1430	850.00	305.0
913	GILMORE B BDMIN	4050912	2	84-06-17	1120	750.00	235.0
914	GILMORE B BDMIN	4050912	2	84-06-17	1250	700.00	374.0
915	GILMORE B BDMIN	4050912	2	84-06-17	1515	900.00	315.0
916	GILMORE B BDMIN	4050912	2	84-07-09	1415	5300.00	1300.0
917	GILMORE B BDMIN	4050912	2	84-07-09	1610	3400.00	600.0
918	GILMORE B BDMIN	4050912	2	84-07-09	1700	2900.00	620.0
919	GILMORE B BDMIN	4050912	2	84-07-10	1300	3000.00	660.0
920	GILMORE B BDMIN	4050912	2	84-07-10	1610	3200.00	620.0
921	GILMORE B BDMIN	4050912	2	84-07-10	1715	3100.00	620.0
922	GILMORE B BDMIN	4050912	2	84-07-11	940	3000.00	670.0
923	GILMORE B BDMIN	4050912	2	84-07-11	1310	2800.00	730.0
924	GILMORE B BDMIN	4050912	2	84-07-11	1525	2600.00	1050.0
925	GILMORE B BDMIN	4050912	2	84-07-12	1000	3400.00	960.0
926	GILMORE B BDMIN	4050912	2	84-07-12	1230	3100.00	820.0
927	GILMORE B BDMIN	4050912	2	84-07-12	1540	2300.00	430.0
928	GILMORE B BDMIN	4050912	2	84-07-13	930	1600.00	365.0
929	GILMORE B BDMIN	4050912	2	84-07-13	1245	1200.00	300.0
930	GILMORE B BDMIN	4050912	2	84-07-13	1510	1600.00	337.0
931	GILMORE B BDMIN	4050912	2	84-08-25	1210	1400.00	305.0
932	GILMORE B BDMIN	4050912	2	84-08-25	1515	1600.00	445.0
933	GILMORE B BDMIN	4050912	2	84-08-25	1755	2200.00	740.0
934	GILMORE B BDMIN	4050912	2	84-08-26	1135	1700.00	480.0
935	GILMORE B BDMIN	4050912	2	84-08-26	1440	2200.00	720.0
936	GILMORE B BDMIN	4050912	2	84-08-26	1630	2800.00	1240.0
937	GILMORE B BDMIN	4050912	2	84-08-27	1130	2100.00	560.0
938	GILMORE B BDMIN	4050912	2	84-08-27	1525	1900.00	620.0
939	GILMORE B BDMIN	4050912	2	84-08-27	1725	1800.00	460.0
940	GILMORE B BDMIN	4050912	2	84-08-28	1130	2100.00	580.0
941	GILMORE B BDMIN	4050912	2	84-08-28	1440	1600.00	460.0
942	GILMORE B BDMIN	4050912	2	84-08-28	1625	1600.00	420.0
943	GILMORE B BDMIN	4050912	2	84-08-29	1135	1600.00	500.0
944	GILMORE B BDMIN	4050912	2	84-08-29	1630	1600.00	420.0
945	GILMORE B BDMIN	4050912	2	84-08-29	1800	1700.00	440.0
946	PEDRO A MTH	4050913	1	83-08-14	1445	70.00	34.0
947	PEDRO A MTH	4050913	1	83-08-16	1235	55.00	70.0
948	PEDRO A MTH	4050913	3	84-08-10	1812	90.00	93.0
949	PEDRO A MTH	4050913	3	84-08-13	1900	30.00	34.0
950	TOLOVANA A BRDG	4050920	4	84-05-09	1200	2.40	10.0
951	TOLOVANA A BRDG	4050920	4	84-05-15	1200	3.80	30.0
952	TOLOVANA A BRDG	4050920	3	84-08-12	1255	1.60	1.0
953	TOLOVANA A BRDG	4050920	4	85-05-15	1200	4.20	24.0
954	TOLOVANA A BRDG	4050920	4	85-08-07	1440	1.02	1.2

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
955	TOLOVANA A CHAT	4050920	1	84-08-15	1338	2.0	2.0
956	TOLOVANA A CHAT	4050920	3	84-08-15	1338	2.0	4.0
957	TOLOVANA A ELLT	4050920	1	84-08-07	1230	1.1	1.0
958	TOLOVANA A ELLT	4050920	1	84-08-07	1900	0.7	0.5
959	TOLOVANA A ELLT	4050920	1	84-08-11	1230	1.6	2.0
960	TOLOVANA A ELLT	4050920	1	84-08-11	2000	1.4	1.0
961	TOLOVANA A PIPE	4050920	4	85-08-07	1400	7.3	7.2
962	TOLOVANA A TAPS	4050920	3	84-08-12	1515	12.0	60.0
963	TOLOVANA A TAPS	4050920	3	84-08-12	1700	6.5	13.0
964	TOLOVANA A TAPS	4050920	3	84-08-12	1700	3.8	12.0
965	TOLOVANA A TAPS	4050920	3	84-08-12	1704	3.9	14.0
966	TOLOVANA A TAPS	4050920	3	84-08-12	2000	4.6	11.0
967	TOLOVANA A TAPS	4050920	3	84-08-12	2300	14.0	19.0
968	TOLOVANA A TAPS	4050920	3	84-08-13	200	16.0	20.0
969	TOLOVANA A TAPS	4050920	3	84-08-13	500	16.0	32.0
970	TOLOVANA A TAPS	4050920	3	84-08-13	800	14.0	24.0
971	TOLOVANA A TAPS	4050920	3	84-08-13	1100	8.7	16.0
972	TOLOVANA A TAPS	4050920	3	84-08-13	1400	4.7	11.0
973	TOLOVANA A TAPS	4050920	3	84-08-13	1700	25.0	57.0
974	TOLOVANA A TAPS	4050920	3	84-08-13	2000	12.0	28.0
975	TOLOVANA A TAPS	4050920	3	84-08-13	2300	17.0	18.0
976	TOLOVANA A TAPS	4050920	3	84-08-14	200	9.8	14.0
977	TOLOVANA A TAPS	4050920	3	84-08-14	500	23.0	24.0
978	TOLOVANA A TAPS	4050920	3	84-08-14	800	15.0	18.0
979	TOLOVANA A TAPS	4050920	3	84-08-14	1100	40.0	81.0
980	TOLOVANA A TAPS	4050920	3	84-08-14	1400	40.0	94.0
981	TOLOVANA A TAPS	4050920	3	84-08-14	1700	29.0	60.0
982	TOLOVANA A TAPS	4050920	3	84-08-14	2000	8.1	11.0
983	TOLOVANA A TAPS	4050920	3	84-08-14	2300	6.2	13.0
984	TOLOVANA A TAPS	4050920	3	84-08-15	200	6.1	11.0
985	TOLOVANA A TAPS	4050920	3	84-08-15	500	13.0	14.0
986	TOLOVANA A TAPS	4050920	3	84-08-15	800	11.0	20.0
987	TOLOVANA A TAPS	4050920	3	84-08-15	1100	20.0	25.0
988	TOLOVANA A TAPS	4050920	3	84-08-15	1400	12.0	19.0
989	TOLOVANA A TAPS	4050920	3	84-08-15	1700	22.0	42.0
990	TOLOVANA A TAPS	4050920	3	84-08-15	2000	40.0	75.0
991	TOLOVANA A TAPS	4050920	3	84-08-15	2300	30.0	41.0
992	TOLOVANA A TAPS	4050920	3	84-08-16	200	16.0	26.0
993	TOLOVANA A TAPS	4050920	3	84-08-16	1720	17.0	28.0
994	TOLOVANA A TAPS	4050920	3	84-08-16	1720	12.0	33.0
995	TOLOVANA A TAPS	4050920	4	85-05-15	1200	32.0	238.0
996	TOLOVANA A WF	4050920	1	83-08-07	1435	27.0	20.0
997	TOLOVANA A WF	4050920	1	83-08-07	1530	16.0	22.0
998	TOLOVANA A WF	4050920	1	83-08-11	1530	29.0	63.0
999	TOLOVANA A WF	4050920	1	83-08-11	1600	20.0	54.0
1000	TOLOVANA A WF	4050920	1	83-08-13	720	17.0	35.0
1001	TOLOVANA A WF	4050920	3	84-08-12	1605	30.0	66.0
1002	TOLOVANA A WF	4050920	3	84-08-12	1620	26.0	61.0
1003	TOLOVANA A WF	4050920	3	84-08-12	1920	5.8	16.0
1004	TOLOVANA A WF	4050920	3	84-08-12	2220	5.5	15.0
1005	TOLOVANA A WF	4050920	3	84-08-13	120	15.0	21.0
1006	TOLOVANA A WF	4050920	3	84-08-13	420	17.0	24.0
1007	TOLOVANA A WF	4050920	3	84-08-13	720	17.0	35.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
1008	TOLOVANA A WF	4050920	3	84-08-13	1020	12.0	27.0
1009	TOLOVANA A WF	4050920	3	84-08-13	1320	8.6	15.0
1010	TOLOVANA A WF	4050920	3	84-08-13	1620	5.4	13.0
1011	TOLOVANA A WF	4050920	3	84-08-13	1920	24.0	52.0
1012	TOLOVANA A WF	4050920	3	84-08-13	2220	12.0	30.0
1013	TOLOVANA A WF	4050920	3	84-08-14	120	16.0	23.0
1014	TOLOVANA A WF	4050920	3	84-08-14	420	10.0	17.0
1015	TOLOVANA A WF	4050920	3	84-08-14	720	23.0	23.0
1016	TOLOVANA A WF	4050920	3	84-08-14	1020	15.0	23.0
1017	TOLOVANA A WF	4050920	3	84-08-14	1320	33.0	65.0
1018	TOLOVANA A WF	4050920	3	84-08-14	1620	38.0	83.0
1019	TOLOVANA A WF	4050920	3	84-08-14	1920	26.0	55.0
1020	TOLOVANA A WF	4050920	3	84-08-14	2220	8.7	20.0
1021	TOLOVANA A WF	4050920	3	84-08-15	120	5.7	14.0
1022	TOLOVANA A WF	4050920	3	84-08-15	420	5.9	17.0
1023	TOLOVANA A WF	4050920	3	84-08-15	720	14.0	19.0
1024	TOLOVANA A WF	4050920	3	84-08-15	1020	9.2	15.0
1025	TOLOVANA A WF	4050920	3	84-08-15	1320	14.0	24.0
1026	TOLOVANA A WF	4050920	3	84-08-15	1620	16.0	21.0
1027	TOLOVANA A WF	4050920	3	84-08-15	1920	16.0	39.0
1028	TOLOVANA A WF	4050920	3	84-08-15	2220	34.0	60.0
1029	TOLOVANA A WF	4050920	3	84-08-16	120	32.0	56.0
1030	TOLOVANA A WF	4050920	3	84-08-16	1415	28.0	36.0
1031	TOLOVANA A WF	4050920	3	84-08-16	1415	17.0	43.0
1032	TOLOVANA A WILB	4050920	3	84-08-16	1900	1.2	5.0
1033	TOLOVANA A WILB	4050920	3	84-08-16	1907	2.3	4.0
1034	TOLOVANA B WF	4050920	1	83-08-07	1430	8.6	12.0
1035	TOLOVANA B WF	4050920	1	83-08-07	1520	8.1	9.0
1036	TOLOVANA B WF	4050920	1	83-08-11	1540	14.0	36.0
1037	TOLOVANA B WF	4050920	1	83-08-11	1605	12.0	30.0
1038	TOLOVANA B WF	4050920	3	84-08-12	1658	16.0	35.0
1039	TOLOVANA B WF	4050920	3	84-08-16	1356	15.0	23.0
1040	TOLOVANA B WILB	4050920	1	84-08-12	2012	6.8	21.0
1041	TOLOVANA B WILB	4050920	1	84-08-12	2125	120.0	710.0
1042	TOLOVANA B WILB	4050920	1	84-08-16	1910	180.0	1400.0
1043	TOLOVANA WF	4050920	3	84-08-12	1642	1.6	4.0
1044	TOLOVANA WF	4050920	3	84-08-12	1747	0.7	14.0
1045	TOLOVANA WF	4050920	3	84-08-16	1602	0.7	4.0
1046	TOLOVANA WF	4050920	3	84-08-16	1602	0.7	3.0
1047	TOLOVANA WF ACG	4050920	1	83-08-07	1335	0.6	0.5
1048	TOLOVANA WF ACG	4050920	1	83-08-11	1420	1.9	1.0
1049	TOLOVANA WF ACG	4050920	1	83-08-11	1850	1.3	2.0
1050	LIVENGOOD A BRD	4050921	4	84-05-09	1200	180.0	525.0
1051	LIVENGOOD A BRD	4050921	4	84-05-15	1200	220.0	890.0
1052	LIVENGOOD A BRD	4050921	3	84-08-12	1330	190.0	284.0
1053	LIVENGOOD A BRD	4050921	3	84-08-12	1815	260.0	230.0
1054	LIVENGOOD A BRD	4050921	3	84-08-16	1750	17.0	25.0
1055	LIVENGOOD A BRD	4050921	3	84-08-16	1750	12.0	24.0
1056	LIVENGOOD A BRD	4050921	4	85-05-15	1200	230.0	757.0
1057	LIVENGOOD A BRG	4050921	1	83-08-07	1740	10.0	13.0
1058	LIVENGOOD A BRG	4050921	1	83-08-11	1300	170.0	234.0
1059	LIVENGOOD A BRG	4050921	1	83-08-11	1925	26.0	30.0
1060	LIVENGOOD A ELL	4050921	4	85-08-07	1425	24.0	105.0

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
1061	LIVENGOOD A MTH	4050921	3	84-08-16	1356	8.00	22.0
1062	DIETRICH A DALT	4060101	1	83-08-13	1840	90.00	220.0
1063	GOLD C A DALTON	4060101	1	84-08-03	2010	150.00	250.0
1064	GOLD C A DALTON	4060101	1	84-08-03	2045	120.00	1360.0
1065	GOLD C A DALTON	4060101	1	84-08-04	1530	10.00	210.0
1066	GOLD C A DALTON	4060101	1	84-08-05	1745	130.00	676.0
1067	GOLD C A DALTON	4060101	1	84-08-06	1540	1800.00	8020.0
1068	GOLD C A DALTON	4060101	1	84-08-07	1755	1300.00	3920.0
1069	GOLD C A DALTON	4060101	1	84-08-09	20	75.00	542.0
1070	GOLD C A DALTON	4060101	4	85-08-15	1240	0.75	5.6
1071	HAMMOND NR MTH	4060101	1	83-08-13	1745	50.00	208.0
1072	HAMMOND NR MTH	4060101	1	83-08-13	1910	120.00	396.0
1073	KOYUKUK MF AHAM	4060101	1	83-08-13	1725	55.00	145.0
1074	KOYUKUK MF AHAM	4060101	1	83-08-13	1940	60.00	174.0
1075	LINDA A DALTON	4060101	1	84-08-03	2110	17.00	164.0
1076	LINDA A DALTON	4060101	1	84-08-04	1545	4.50	64.0
1077	LINDA A DALTON	4060101	1	84-08-05	2030	3.20	17.0
1078	LINDA A DALTON	4060101	1	84-08-08	2355	1.70	9.0
1079	LINDA A DALTON	4060101	4	85-08-14	1340	1.20	3.0
1080	LINDA A JH MINE	4060101	1	84-08-08	2140	2.40	18.0
1081	LINDA A JHMINE	4060101	4	85-08-14	1625	0.65	3.1
1082	MARION A DALTON	4060101	1	84-08-03	1855	24.00	140.0
1083	MARION A DALTON	4060101	1	84-08-04	1345	2.10	20.0
1084	MARION A DALTON	4060101	1	84-08-05	1610	1.20	8.0
1085	MARION A DALTON	4060101	4	85-08-21	1200	0.75	1.6
1086	MINNIE A DALTON	4060101	1	84-08-03	1930	23.00	168.0
1087	MINNIE A DALTON	4060101	1	84-08-04	1415	1.20	8.0
1088	MINNIE A DALTON	4060101	1	84-08-05	1650	0.50	2.8
1089	MINNIE A DALTON	4060101	1	84-08-09	45	1.00	3.2
1090	MINNIE A DALTON	4060101	4	85-08-21	1545	0.30	0.3
1091	NUGGET A DALT	4060101	1	84-08-06	1900	0.80	1.0
1092	NUGGET A DALT	4060101	1	84-08-08	30	0.70	0.5
1093	NUGGET B PIPELN	4060101	4	85-08-15	1600	0.90	4.4
1094	PROSPECT A DALT	4060101	1	84-08-09	1550	2.90	8.0
1095	ROSIE A DALTON	4060101	1	84-08-03	1710	150.00	444.0
1096	ROSIE A DALTON	4060101	1	84-08-04	1225	60.00	212.0
1097	ROSIE A DALTON	4060101	1	84-08-05	1510	16.00	52.0
1098	ROSIE A DALTON	4060101	1	84-08-07	1140	3.50	6.0
1099	ROSIE A DALTON	4060101	1	84-08-09	1355	3.00	10.0
1100	ROSIE A DALTON	4060101	4	85-08-13	1515	0.50	11.0
1101	SHEEP A DALTON	4060101	1	84-08-03	1510	29.00	120.0
1102	SHEEP A DALTON	4060101	3	84-08-03	2010	150.00	250.0
1103	SHEEP A DALTON	4060101	1	84-08-05	1730	1.70	15.0
1104	SHEEP A DALTON	4060101	1	84-08-06	1450	3.60	12.0
1105	SLATE A DALTON	4060101	1	84-08-04	1325	70.00	368.0
1106	SLATE A DALTON	4060101	1	84-08-05	1540	20.00	144.0
1107	SLATE A DALTON	4060101	1	84-08-06	1325	20.00	81.0
1108	SLATE A DALTON	4060101	1	84-08-07	1210	5.60	40.0
1109	SLATE A DALTON	4060101	1	84-08-09	1100	2.40	14.4
1110	SLATE B COLDFT	4060101	4	85-08-13	1745	0.70	3.0
1111	SUKAKPAK A DALT	4060101	1	84-08-03	2245	1.00	14.0
1112	SUKAKPAK A DALT	4060101	1	84-08-04	2035	0.80	6.0
1113	SUKAKPAK A DALT	4060101	1	84-08-07	2150	0.60	0.5

OBS	LOCATION	HYUNIT	SOURCE	DATE	TIME	TURB	TSS
1114	WISEMAN A NOLAN	4060101	1	84-08-08	1735	3.70	14.0
1115	MASCOT B MINE	4060102	4	85-06-11	2200	4.00	7.7
1116	KOYUKUK SF A DA	4060201	1	84-08-03	1615	5.20	6.0
1117	KOYUKUK SF A DA	4060201	1	84-08-09	1500	0.70	3.2
1118	KOYUKUK SF A DA	4060201	4	85-08-16	1150	0.30	0.8
1119	KOYUKUK SF AHWY	4060201	1	83-08-13	2100	0.90	1.0
1120	PROSPECT A DALT	4060201	3	84-08-09	1550	2.90	8.0
1121	PROSPECT A MINE	4060201	4	85-07-30	1200	0.34	0.3
1122	PROSPECT A MING	4060201	4	85-08-13	1030	2.80	6.3
1123	PROSPECT A PIPE	4060201	4	85-08-16	1050	55.00	294.0
1124	PROSPECT B MING	4060201	4	85-08-13	1940	280.00	194.0
1125	PROSPECT B MING	4060201	4	85-08-15	140	65.00	48.0
1126	PROSPECT B MING	4060201	4	85-08-15	2240	85.00	73.0
1127	PROSPECT B MING	4060201	4	85-08-16	740	50.00	180.0
1128	PROSPECT B PIPE	4060201	4	85-08-01	1010	25.00	9.4

Appendix 2. Further Explanation of Statistical Techniques.

Appendix 2. Further Explanation of Statistical Techniques.

A. Standard Error of Estimate.

Because the linear regression uses logarithmic transformation of the data, the calculated standard error of estimate is a logarithm. In this report it is reported as a percentage which is calculated by adding (and substracting) the SEE to the logarithm of a base linear value, back transforming the result to a linear value, subtracting the base linear value from this result and dividing by the base linear value. Below is a sample calculation:

The standard error of estimate for the log-log equation for the combined data from Birch Creek basin is 0.243. Assume a linear value of 200 milligrams per liter.

$$+SEE(\%)=[(10^{(\log(200)+.243)})-200]/200 = .75 \text{ or } 75 \text{ percent}$$

$$-SEE(\%)=[200-10^{(\log(200)-.243)}]/200$$

$$= .43 \text{ or } 43 \text{ percent}$$

Appendix 2. Further Explanation of Statistical Techniques.

B. Analysis of Covariance.

Analysis of covariance is a technique to determine whether the regressions for two or more populations are similar. The covariance model is constructed by considering the different populations as classes of a predictor variable, defining indicator variables for the different populations, and developing a regression model containing appropriate interaction terms (Neter, Wasserman, and Kutner 1985). Below is an example covariance model to determine if regressions for stream A and stream B are similar:

$$y_i = b_0 + b_1 x_{i1} + b_2 x_{i2} + b_3 x_{i1} * x_{i2} + {}_i$$

where:

y_i=TSS

x_{i1}=turbidity

x_{i2}=1 if stream A

0 otherwise

b_0, b_1, and b_2, are coefficents and

${}_i$ is the residual term.

To determine whether the regressions for groups of data from different basins, streams or sites are similar, indicator variables for the different locations are added to the basic turbidity-TSS model. An F test is performed to see if the slope and y intercept coefficients of the full model (with indicator variables) are statistically different from those of a reduced model (without indicator variables) at a specified confidence level. The equation for this relationship is:

$$F^{*}=[(SSE_R-SSE_F)/(df_R-df_F)]/(SSE_F/df_F),$$

where:

SSE_F is the error sum of squares for the full model,
SSE_R is the error sum of squares for the reduced model,
df_F is the degrees of freedom for the full model, and
df_R is the degrees of freedom for the reduced model.

If the calculated F^{*} is less than F at a specified confidence level (F values are from an F value table), the inference is that the two groups of data are not statistically different at that level (Neter, Wasserman, and Kutner 1985). This type of analysis can also be used to see if data from different years or sources can be combined.

Appendix 3. Model Validation Results.

Appendix 3. Model Validation Results.

SAMPLE LOCATION	DATE & TIME	TURB lab (NTU)	TURB field (NTU)	TSS reprtd (mg/l)	TSS calcltd (mg/l)	Diff Rpt-Calc	Z VALUE (R-P)/SEE
A. Data collected by DEC at various location in interior Alaska in 1985.							
CHATANIKA A POK	85081605		4.2	1.0	3.5	-2.5	-0.79
" " "	85081676		6.5	8.0	5.7	2.3	0.45
CHATANIKA A 39 M	85081606		4.4	1.0	3.0	-2.0	-0.58
CHATANIKA A LONG	85081607		115.0	15.0	127.2	-112.2	-1.88
" " "	85081650		30.0	7.0	26.1	-19.1	-1.56
" " "	85081651		12.0	12.0	8.9	3.1	0.76
" " "	85081652		7.0	6.0	4.7	1.3	0.59
" " "	85081653		6.5	3.0	4.3	-1.3	-0.64
" " "	85081654		8.5	2.0	5.9	-3.9	-1.41
" " "	85081655		18.0	4.0	14.3	-10.3	-1.53
" " "	85081656		28.0	21.0	24.0	-3.0	-0.27
" " "	85081657		44.0	14.0	41.0	-27.0	-1.40
" " "	85081658		37.0	12.0	33.4	-21.4	-1.36
" " "	85081659		34.0	1.0	30.2	-29.2	-2.06
" " "	85081661		22.0	4.0	18.1	-14.1	-1.66
" " "	85081662		20.0	5.0	16.2	-11.2	-1.47
" " "	85081663		33.0	4.0	29.2	-25.2	-1.84
" " "	85081664		22.0	11.0	18.1	-7.1	-0.83
" " "	85081665		38.0	12.0	34.5	-22.5	-1.39
" " "	85081666		30.0	8.0	26.1	-18.1	-1.48
" " "	85081667		33.0	8.0	29.2	-21.2	-1.54
" " "	85081668		24.0	6.0	20.1	-14.1	-1.49
" " "	85081669		22.0	5.0	18.1	-13.1	-1.54
" " "	85081670		21.0	5.0	17.1	-12.1	-1.51
" " "	85081671		32.0	5.0	28.1	-23.1	-1.75
" " "	85081672		44.0	13.0	41.0	-28.0	-1.45
" " "	85081673		39.0	10.0	35.5	-25.5	-1.53
" " "	85081674		38.0	4.0	34.5	-30.5	-1.88
" " "	85081675		40.0	8.0	36.6	-28.6	-1.66
			Average for Chatanika at Long Cr				-1.30
FAITH ABOVE MCMAN	85081609		290.0	76.0	345.1	-269.1	-1.39
" " "	85081623		93.0	31.0	119.9	-88.9	-1.32
CHATANIKA B F&M	85081625		62.0	11.0	87.6	-76.6	-1.03
" " "	85081626		164.0	36.0	206.9	-170.9	-0.97
" " "	85081627		104.0	28.0	138.4	-110.4	-0.94
" " "	85081629		264.0	97.0	315.2	-218.2	-0.82
" " "	85081630		310.0	110.0	363.3	-253.3	-0.82
" " "	85081631		240.0	80.0	289.8	-209.8	-0.85
" " "	85081632		276.0	100.0	327.9	-227.9	-0.82
" " "	85081633		200.0	54.0	246.6	-192.6	-0.92

Appendix 3. Model Validation Results.

SAMPLE LOCATION	DATE & TIME	TURB lab (NTU)	TURB field (NTU)	TSS reprtd (mg/l)	TSS calcltd (mg/l)	Diff Rpt-Calc	Z VALUE (R-P)/SEE
CHATANIKA B F&M	85081634		147.0	39.0	187.9	-148.9	-0.93
" " "	85081635		145.0	44.0	185.6	-141.6	-0.90
" " "	85081636		220.0	54.0	268.3	-214.3	-0.94
" " "	85081637		350.0	110.0	404.5	-294.5	-0.86
" " "	85081638		392.0	130.0	447.1	-317.1	-0.84
" " "	85081639		325.0	100.0	378.8	-278.8	-0.87
" " "	85081640		255.0	80.0	305.7	-225.7	-0.87
" " "	85081641		275.0	83.0	326.8	-243.8	-0.88
" " "	85081642		212.0	57.0	259.7	-202.7	-0.92
" " "	85081643		160.0	43.0	202.5	-159.5	-0.93
" " "	85081644		120.0	30.0	157.0	-127.0	-0.95
" " "	85081645		164.0	52.0	206.9	-154.9	-0.88
" " "	85081646		180.0	53.0	224.7	-171.7	-0.90
" " "	85081647		112.0	39.0	147.7	-108.7	-0.87
" " "	85081648		80.0	23.0	109.7	-86.7	-0.93
" " "	85081649		36.0	7.0	54.2	-47.2	-1.03
			Average for Chatanika b Faith Cr				-0.90
CHATANIKA A ELL	85081934	16.00		1.0	15.3	-14.3	-1.04
L CHENA A NORDALE	85081612		26.0	7.0	40.7	-33.7	-0.87
L CHENA A NORDALE	85081948	15.00		8.0	26.6	-18.6	-0.74
L CHENA A NORDALE	85081943	23.00		21.0	37.0	-16.0	-0.46
CHENA A 2 RIVERS	85081613		22.0	8.0	35.8	-27.8	-0.50
GOLDSTREAM A SHEE	85081616		1080.0	440.0	736.3	-296.3	-0.53
GOLDSTREAM A SHEE	85081929	330		150.0	324.1	-174.1	-0.71
GOLDSTREAM A TAPS	85081617		1100.0	220.0	745.7	-525.7	-0.93
GOLDSTREAM A TAPS	85081928	650		450.0	517.7	-67.7	-0.17
GILMORE CREEK	85081618		217.0	64.0	133.0	-69.0	-1.02
GILMORE CREEK	85081930	150		180.0	105.5	74.5	1.38
PEDRO C AB GILMOR	85081619		2300.0	610.0	896.4	-286.4	-0.42
PEDRO C AB GILMOR	85081927	1500		1100.0	678.7	421.3	0.82
TOLOVANA A TAPS	85081938	4.80		8.0	8.2	-0.2	-0.05
LIVENGOOD C A L R	85081924	13.00		20.0	24.1	-4.1	-0.32
LIVENGOOD C A L R	85081997	19.00		42.0	36.4	5.6	0.29
TOLOVANA B W F	85081925	5.90		9.0	10.3	-1.3	-0.23
WILBER C AT MOUTH	85081932	17.00		20.0	32.3	-12.3	-0.72
WILBER C AT MOUTH	85081998	860		5100.0	2260.2	2839.8	2.37
TOLOVANA B WILBER	85081935	15.00		18.0	28.2	-10.2	-0.68
TOLOVANA B WILBER	*********	62.00		460.0	131.0	329.0	4.73
EAST F TOLOVANA	85081949	18.00		30.0	34.3	-4.3	-0.24
" " "	85081950	9.40		12.0	17.0	-5.0	-0.55
" " "	85081952	5.70		14.0	9.9	4.1	0.79
" " "	85081953	6.00		9.0	10.4	-1.4	-0.26

Appendix 3. Model Validation Results.

SAMPLE LOCATION	DATE & TIME	TURB lab (NTU)	TURB field (NTU)	TSS reprtd (mg/l)	TSS calcltd (mg/l)	Diff Rpt-Calc	Z VALUE (R-P)/SEE
EAST F TOLOVANA	85081954	5.50		6.0	9.5	-3.5	-0.69
" " "	85081955	5.90		13.0	10.3	2.7	0.50
" " "	85081956	5.50		3.0	9.5	-6.5	-1.29
" " "	85081957	4.90		6.0	8.4	-2.4	-0.54
" " "	85081958	4.70		7.0	8.0	-1.0	-0.24
" " "	85081959	6.80		12.0	12.0	0.0	0.01
" " "	85081960	6.50		10.0	11.4	-1.4	-0.23
" " "	85081961	12.00		58.0	22.1	35.9	3.05
" " "	85081962	6.80		12.0	12.0	0.0	0.01
" " "	85081963	5.50		6.0	9.5	-3.5	-0.69
" " "	85081964	4.90		6.0	8.4	-2.4	-0.54
" " "	85081965	5.00		6.0	8.6	-2.6	-0.56
" " "	85081966	5.50		6.0	9.5	-3.5	-0.69
" " "	85081967	5.60		7.0	9.7	-2.7	-0.52
" " "	85081968	6.20		8.0	10.8	-2.8	-0.49
" " "	85081969	6.10		8.0	10.6	-2.6	-0.47
" " "	85081970	6.40		7.0	11.2	-4.2	-0.71
" " "	85081971	5.10		6.0	8.8	-2.8	-0.59
" " "	85081972	4.70		5.0	8.0	-3.0	-0.71
			Average for Tolovana ab West For				-0.25
TOLOVANA A TAPS	85081973	5.80		4.0	10.1	-6.1	-1.13
" " "	85081974	5.70		5.0	9.9	-4.9	-0.93
" " "	85081975	5.40		5.0	9.3	-4.3	-0.87
" " "	85081976	5.60		6.0	9.7	-3.7	-0.72
" " "	85081977	6.20		8.0	10.8	-2.8	-0.49
" " "	85081978	6.40		10.0	11.2	-1.2	-0.20
" " "	85081979	5.00		11.0	8.6	2.4	0.53
" " "	85081980	5.50		6.0	9.5	-3.5	-0.69
" " "	85081981	5.70		11.0	9.9	1.1	0.21
" " "	85081982	5.40		9.0	9.3	-0.3	-0.06
" " "	85081983	5.70		9.0	9.9	-0.9	-0.17
" " "	85081984	6.00		7.0	10.4	-3.4	-0.62
" " "	85081985	6.20		9.0	10.8	-1.8	-0.32
" " "	85081986	5.70		5.0	9.9	-4.9	-0.93
" " "	85081987	5.60		9.0	9.7	-0.7	-0.13
" " "	85081988	5.30		6.0	9.1	-3.1	-0.65
" " "	85081989	5.10		3.0	8.8	-5.8	-1.24
" " "	85081990	5.10		6.0	8.8	-2.8	-0.59
" " "	85081991	4.90		5.0	8.4	-3.4	-0.76
" " "	85081992	5.00		6.0	8.6	-2.6	-0.56
" " "	85081993	4.70		6.0	8.0	-2.0	-0.47
" " "	85081994	4.80		9.0	8.2	0.8	0.18
" " "	85081995	4.40		10.0	7.5	2.5	0.64
" " "	85081996	5.30		6.0	9.1	-3.1	-0.65

Appendix 3. Model Validation Results.

SAMPLE LOCATION	DATE & TIME	TURB lab (NTU)	TURB field (NTU)	TSS reprtd (mg/l)	TSS calcltd (mg/l)	Diff Rpt-Calc	Z VALUE (R-P)/SEE
Average for Tolovana at TAPS							-0.44
ALL 1985 DEC DATA				90.6	116.8		-0.62
ALL 1985 TOLOVANA				111.0	55.0		-0.20
ALL 1985 CHATANIKA				32.4	128.0		-1.08

B. Comparison of equation predictions with turbidity-TSS data from Wagener, 1984.

LOCATION	DATE	TURB (NTU)	TSS REPRTD (mg/l)	TSS PRED (mg/l)	Z VALUE (R-P)/SEE
Mammoth	16-06-83	350	585	427	0.71
Mammoth	02-07-83	118	132	156	-0.29
Mammoth	30-07-83	5600	11303	5589	1.96
Mammoth	13-08-83	4000	8412	4090	2.03
Mammoth	25-08-83	4000	6791	4090	1.27
Boulder	16-06-83	24.5	28	36	-0.21
Boulder	30-07-83	14.5	39	22	0.74
Boulder	25-08-83	14	53	22	1.43
Boulder	25-09-83	14	24	22	0.11
Ketchem	16-06-83	140	185	196	-0.07
Ketchem	02-07-83	51	211	71	2.37
Ketchem	30-07-83	735	616	1027	-0.49
Ketchem	13-08-83	116	100	162	-0.47
Ketchem	25-08-83	1300	1307	1815	-0.34
Birch a 12m	14-07-83	925	871	1072	-1.09
Birch a 12m	14-08-83	1240	1233	1432	-0.81
Birch a 12m	26-08-83	510	1251	595	6.41
Ptarmigan	14-08-83	95	90	113	-1.18
Ptarmigan	26-08-83	83	366	99	
Faith	14-06-83	12.5	19	12	0.97
Faith	05-07-83	55	22	71	-1.21
Faith	28-07-83	22	22	24	-0.14
Faith	11-08-83	135	142	205	-0.54
Chatanika	05-07-83	112	175	122	0.51
Chatanika	28-07-83	15	55	22	1.71
All data		787	1361	860	0.56