CHAPTER 7
SURFACE WATER HYDROLOGY

7.1 GENERAL DESCRIPTION

The Navajo Mine permit area (North Area and Areas II-IV North) covers approximately 26.2 square miles (16,730 acres) of high desert terrain consisting of badlands, grasslands, and mesas. The permit area is sparsely vegetated with generally low cover values (CHAPTER 9).

The permit and adjacent areas lie within the San Juan River Basin, a tributary to the Colorado River. The San Juan River Basin covers approximately 12,900 square miles, of which the permit area occupies approximately 0.2 percent of the total watershed area. TABLE 7-1 provides typical drainage basin and discharge characteristics of the San Juan River near Shiprock, New Mexico, as recorded by the United States Geological Survey (USGS) for the water year 1980. More specific detail on the discharge and chemical characteristics of the San Juan River is available from the USGS, Water Resources Division (WRD), Surveillance Section, in Albuquerque, New Mexico.

Several ephemeral or intermittent streams pass through the permit and adjacent areas and eventually drain into the San Juan River to the north. These streams are the Chaco River, Bitsui Wash, Chinde Wash, Hosteen Wash, Barber Wash, Neck Arroyo, Lowe Arroyo, Cottonwood Arroyo, and Pinabete Arroyo (EXHIBITS 7-3, 7-4, and 7-4C).

TABLE 7-1

DRAINAGE BASIN CHARACTERISTICS SAN JUAN RIVER AT SHIPROCK, NM[1]

Drainage Area:	12,900 square miles.
Period of Record:	February 1927 to 1980.
Maximum Discharge:	80,000 cfs (08/11/29).
Minimum Discharge:	8 cfs (08/25/39).
Average Volume:	1,589,000 acre feet/year.
Specific Conductance: a. Minimum b. Maximum	 180 umhos/cm 4,360 umhos/cm
Sediment Concentration: a. Minimum b. Maximum	 2 mg/l 114,000 mg/l

[1]Source: U.S. Geological Survey. 1980. Water Resource Report. Publication No. USGS/WRD/HD-81/086.

08/98

The ephemeral channels which cross the permit and adjacent areas all carry occasional flows of water in response to precipitation events. These flows are used by sheep or other livestock which might be in the vicinity when the channels are carrying water. However, livestock normally use stock watering ponds which have been constructed to catch surface flows from some of the tributary drainages. The location of stock watering ponds on and near the permit area are shown on EXHIBIT 10-3. Stock watering is the primary use of surface water flows. Surface water is not used for drinking by humans, irrigation, or other purpose.

7.2 SURFACE WATER DRAINAGES

7.2.1 Methodologies and Assumptions

The peak flows and sediment yields were predicted through the use of the Sediment, Erosion, Discharge by Computer Aided Design (SEDCAD+) computer program by Schwab and Warner (1987). Hydrograph development and peak flow determination are based on user inputs of a design storm, i.e. rainfall amount and duration, selection of a rainfall distribution, and convolution increment. Hydrographs are developed on a subwatershed basis with the input of area, time of concentration, Soil Conservation Service (SCS) curve number, and selection of one of three dimensionless double triangle unit hydrograph shapes. Routing of hydrographs is accomplished by Muskingum's method (Schwab and Warner, 1987).

The sediment yield is also determined on a subwatershed basis. The program offers three options for generating sediment graphs, Modified Universal Soil Loss Equation (MUSLE), Soil Loss Routine (SLOSS) and Revised Universal Soil Loss Equation (RUSLE). The MUSLE option was used exclusively for sediment yield predictions at the Navajo Mine. This method uses USLE inputs for a representative slope in a given subwatershed and combines this with peak flow and runoff volume.

The drainage network and the mine plan were the major considerations involved in subdivision of the watersheds. Designated subwatersheds must drain to a particular channel reach or structure. Locations of all anticipated structures had to be incorporated in the subdivision of channel reaches

and subwatersheds. Where possible, the subdivision of the drainage basin into relatively homogeneous subwatersheds helped facilitate determination of model parameters required by SEDCAD+.

Natural Resources Conservation Services (NRCS) Type II rainfall distribution was applied to all 6-hour storms. A medium hydrologic response class was applied to all subwatersheds. The hydrologic response class determines the shape of the unit hydrograph. The medium class is typical of agricultural and disturbed area conditions and was determined to be representative of both pre-mining and operational conditions.

Input parameters required to determine sediment yields using the SEDCAD+ program include the soil erodibility parameter (K), the representative slope and slope length, and the applicable control practice parameter (CP).

Curve Numbers

Refer to Chapter 11 Section 11.5.4.9 for discussion on curve numbers for undisturbed and reclaimed lands.

The analysis was performed using AMC II based curve numbers. Channel loss reductions were not used for Chinde Wash due to the existence of NIIP and its associated irrigation return flows. Precipitation area reductions for other watersheds are based on "NOAA Atlas II", Volume 4, New Mexico (USDC, 1973).

Time of Concentration

For each watershed the drainage length from the highest to lowest elevation within the watershed were measured. The length and elevation differences with the appropriate type of flow path were input into the computer model for time of concentration computation.

Particle Size Distributions

A study performed at the Navajo Mine site by Simons, Li & Associates, Inc., (1981) was used to estimate particle size distributions. Four particle size distributions were used, two for pre-mining soils and two for postmining soils. Simons and Li analyzed two soil types. The first type was a badlands soil with predominantly clay-sized particles. The second type was a predominantly sandy soil. Since these were the only particle size data available for the mine site, all the soils were categorized into predominantly sandy or clayey and the appropriate particle size distribution was used in the SEDCAD+ model runs for each subwatershed.

Slope Length and Average Slope

Slope length is defined as: "representative of the typical slope length found on the subwatershed and the distance from the point of origin of overland flow until the point that the slope decreases such that significant deposition occurs or until the flow enters a defined channel" (Schwab and Warner, 1987). Average slope is the typical or representative slope for overland flow for each subwatershed. These definitions, although subjective, served as a basis for determining slope length and average slope in this study. In an effort to make the slope length and average slope determination more objective, the topography and the depicted watersheds were imported into Arc View to determine the average slope of each watershed. Then the slope length was selected from the table below.

Slope/Length Values

Average WS Slope (%)	Slope Length (ft)
0-2.0	400
>2.0-3.0	300
>3.0-4.0	200
>4.0-6.0	175
>6.0-8.0	150
>8.0-10.0	125
>10.0-12.0	100
>12	75

Soil Erodibility Factor (k)

The K-factors for the pre-mine watersheds were obtained from "Baseline Surface Water Hydrology and Erodibility – Navajo Mine", a report prepared by Metric Corporation; Albuquerque, New Mexico; 1989. The report gives K-factors for the NRCS soil mapping units. A weighted K-factor was computed for watersheds comprised of more than one soil mapping unit.

The K-factor for the post-mining watersheds is an estimated weighted value. A weighted K-factor was computed for each mining area (Area I, II, III, and IV) based on the volume of each soil type that is projected to be salvaged for topdressing. Refer to Table 11-16A through 11-16D for the weighted K-factors for each mining area.

Cover and Management Practice Factor (CP)

The P-factor or management practice factor is the measure of the effectiveness of any erosion control practices. For no practices the value is 1.0. The P-factor for both pre and post-mining was assigned a value of 1.0.

The C-factor is the measure of the vegetation, litter, and rock cover in the watershed area. The C-factors for the pre-mine watersheds were obtained from " Baseline Surface Water Hydrology and Erodibility – Navajo Mine", a report prepared by Metric Corporation; Albuquerque, New Mexico; 1989. The report gives C-factors for the NRCS soil mapping units. A weighted C-factor was computed for watersheds comprised of more than one soil mapping unit.

The C-factor for the post-mine watersheds are based on the vegetative cover surveys done on the reclaimed lands. The average cover on reclaimed lands is approximately 10.4%, interpolated from Table 6 in Technical Note 28 (USDA-NRCS, 1984) this corresponds to a C-factor of 0.315

7.2.1 Chaco River

The Chaco River is an ephemeral stream which lies to the west of the permit area. The Chaco River has a watershed area of about 4,350 square miles, of which the permit area occupies approximately 0.6 percent of the total. The flow direction of the Chaco River is from south to north. TABLE 7-2 provides drainage basin and discharge characteristics for the Chaco River at Waterflow, New Mexico. As seen from TABLE 7-2 discharges range from 0.0 cubic feet per second (cfs) to 7,300 cfs. Total suspended sediment (TSS) concentrations reach as high as 140,000 milligrams per liter (mg/l).

TABLE 7-2

DRAINAGE BASIN CHARACTERISTICS CHACO RIVER NEAR WATERFLOW, NM[1]

Drainage Area:	4,350 square miles.
Period of Record:	1959 to 1969 and November 1975 to 1980.
Maximum Discharge:	7,300 cfs (09/69).
Minimum Discharge:	0.31 cfs (01/80)
Average Discharge:	Base flow from Four Corners Power Plant.
Specific Conductance:	Approximately 2,000 umhos/cm[2]
Sediment Concentrations: a. Maximum b. Minimum	 140,000 mg/l 15 mg/l

[1]Source: U.S. Geological Survey. 1980. Water Resource Report. Publication No. USGS/WRD/HD-81/086.

[2]Water year 1980 only.

7.2.3 Bitsui Wash

Bitsui Wash is located on pre-law ground near the northernmost portion of the permit area and flows from the Navajo Indian Irrigation Project (NIIP), east of the permit area, into the permit area, then turns north to the San Juan River. Under natural conditions, Bitsui Wash would flow ephemerally during times of high precipitation. However, due to the existence of NIIP and its associated irrigation return flows and sewage lagoon discharges, this stream flows intermittently.

As near as can be determined from USGS quadrangle maps, the pre-mining Bitsui Wash drainage was about 12 square miles in area. Because of internal drainage to Watson and Dodge pits, the present drainage area for Bitsui Wash is about 9.5 square miles. All mining disturbance within the present Bitsui Wash drainage predates the Surface Mining Control and Reclamation Act of 1977 (SMCRA). Upon final regrading of Watson and Dodge mine pits, the Bitsui area will be comparable to its pre-mining area.

7.2.4 Chinde Wash

Chinde Wash is located near the southern boundary of Navajo Mine North Area and flows from the NIIP, east of the permit area, through the permit area to the Chaco River, west of the permit area.

EXHIBIT 7-3 shows the watershed area and drainage configuration for the Chinde Wash watershed. As with Bitsui Wash, under natural conditions Chinde Wash would flow ephemerally or only in response to runoff from precipitation events. However, due to the existence of NIIP and its associated irrigation return flow and direct discharges, Chinde Wash flows perennially through the year with short term peak flows caused by precipitation or NIIP direct canal discharges.

Chinde Wash has a drainage area of about 54.2 square miles of which about 10 percent lies within the Permit Area. However, the present watershed area of Chinde Wash is about 42.7 square miles. An additional 12.5 square miles does not contribute to the present Chinde watershed as it is diverted by the NIIP Ojo Amarillo canal into Cottonwood Arroyo.

7.2.4.1 Pre-Mine and Existing Channel Gradients, Cross-Sections and Flow Conditions

Pre-mine channel characteristics for Chinde Arroyo are based upon pre-mine topographic maps at a scale of 1" = 100' and surveyed (July, 1987) cross-sections upstream and downstream of the leased boundary. The survey results from the July, 1987 survey of Chinde cross-sections upstream and downstream of the mine lease are found in Permit NM-0003C, CHAPTER 30, APPENDIX 30-G. Cross-sections OU-1 through OU-4 refer to cross-sections upstream of the mine lease. Cross-sections OD-1 through OD-5 refer to cross-sections downstream of the mine lease. Approximate locations of the surveyed cross-sections along with the map derived cross-sections used in the pre-mining HEC2 analysis, are found in Permit NM-0003C, CHAPTER 30, APPENDIX 30-G.

The pre-mining channel is generally incised and the geometry is very irregular throughout the channel length. The channel exhibits an average gradient of 0.99 percent across the mine lease. A pre-mining longitudinal profile which was developed from topographic maps is provided in FIGURE 7-1. Longitudinal profiles associated with the surveyed cross-sections up and downstream from the mine lease, associated with the July, 1987 conditions are also shown in FIGURE 7-1. These profiles clearly show the areas of sediment deposition upstream of the Chinde diversion at the original lease boundary and the headcut migration up to the base of the Big-Fill. These changes in channel conditions up and downstream of the lease must be considered in the design of a permanent diversion.

FIGURE 7-1 also shows nickpoints along the channel both down and upstream of the reclaimed section. Channel slopes vary from about 0.45 percent for the aggrading segment between cross-sections OU-2 and OU-4 to over two percent in the badlands areas above cross-sections OU-1 and in the pre-mine channel upstream of the confluence with the Chaco River. Other than the aggrading segment above the original lease boundary, existing and pre-mine slopes generally exceed 0.7 percent.

The downstream nickpoints may pose long term problems to the stability of the reclaimed section. Long term stability problems can result because the stream will erode the channel convexity as it seeks to establish a uniform "equilibrium" profile. This process generally results in a progression of erosional pulses upstream until a uniform channel gradient or equilibrium state is achieved.

A HEC2 backwater flow analysis of the pre-mining channel and flood plain system was completed to characterize velocities and flow conditions in the pre-mine channel. The HEC2 backwater analysis routine provides water surface profiles for specified discharges, channel gradients and channel geometries. Pre-mining cross-sections extending one mile up and downstream of the Navajo Mine lease boundary were entered into the program. A starting water surface slope approximately the average channel gradient of 1.0 percent was assumed. The pre-mining HEC2 analysis was performed for the peak flow from a 6-hour rainfall with 10-yr., 25-yr., and 100-yr. recurrence intervals. The HEC2 backwater analysis for the pre-mining stream channel produced supercritical flow conditions in several locations and relatively high velocities along several reaches for all three peak flow events. Results of the backwater analysis are found in Permit NM-0003C, CHAPTER 30, APPENDIX 30-J.

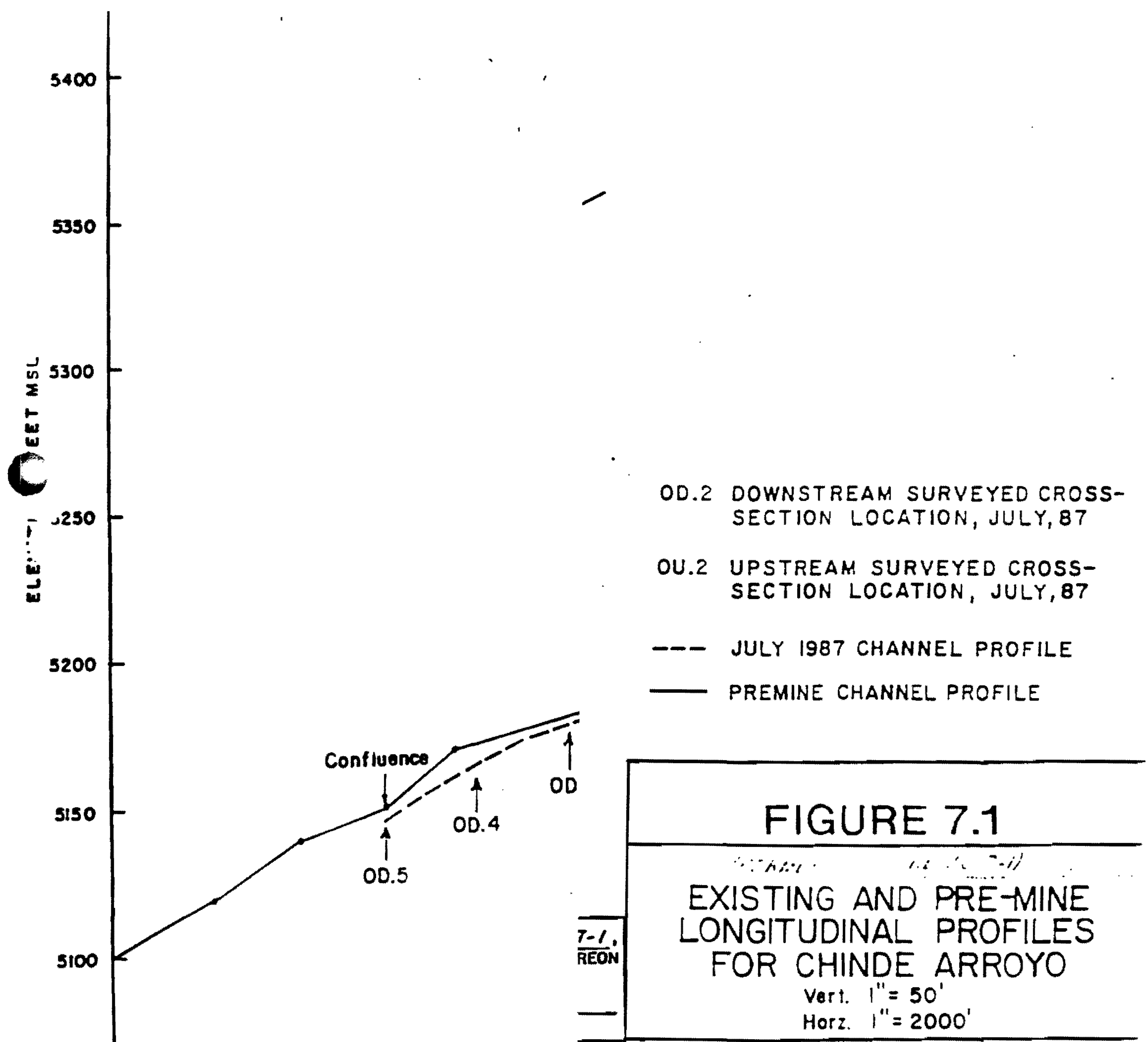

FIGURE 7.1

EXISTING AND PRE-MINE LONGITUDINAL PROFILES FOR CHINDE ARROYO

Vert. 1" = 50'

Horz. 1" = 2000'

PROJECT NUMBER: 7

DATE	REVISION	DRAWN	CHECKED	APPROVED

Pre-Mine Channel Meander

The pre-mine Chinde Arroyo exhibits a relatively straight channel with very few meandering reaches. It has an average channel sinuosity of 1.22. Several meanders located in the pre-mining channel within the lease area were measured for linear wavelength, channel wavelength, amplitude, and meander width. Chinde Arroyo linear wavelengths range from 130 to 490 feet; channel wavelengths range from 215 to 545 feet and amplitudes range from 60 to 207 feet.

Peak flows and sediment yields were predicted for the 6-hr. rainfall event on 2-, 10-, 25-, and 100-yr. frequencies. Design storm precipitation values are provided on TABLE 7-3 for various design return periods. Area l reductions are provided for each of the drainage basins analyzed. Using the precipitation values of the Chinde drainage basin area, predictions were performed for pre-mining conditions on Chinde Wash, see APPENDIX 7-G. Postmining predictions are reported in APPENDIX 11-BB.

Results of the SEDCAD+ runs for pre-mining conditions show peak concentrations of suspended solids exceeding 50,000 mg/l for rainfall events of a 2-yr. frequency or larger. Sediment yields increase from 2,252 tons for a 2-yr., 6-hr rainfall to 22,398 tons for a 100-yr., 24-hr rainfall.

TABLE 7-3

PRECIPITATION VALUES (IN INCHES) FOR DESIGN STORMS, NAVAJO MINE DRAINAGE BASINS

Design Storm Frequency (6-hr.)	NOAA Atlas Point Values	Drainage Basin Designation					
		Cottonwood Arroyo ($79.8\ mi.^2$)	Chinde Wash ($42.7\ mi.^2$)	Neck Arroyo ($1.9\ mi.^2$)	Lowe Arroyo ($11.3\ mi.^2$)	Barber Wash ($5.3\ mi.^2$)	Hosteen Wash ($9.1\ mi.^2$)
2-year	0.8	0.72	0.75	0.79	0.78	0.79	0.78
10-year	1.3	1.17	1.22	1.29	1.27	1.28	1.28
25-year	1.6	1.44	1.50	1.58	1.56	1.58	1.57
100-year	2.0	1.80	1.88	1.98	1.95	1.97	1.96

Sources: NOAA Atlas II Precipitation – Frequency Atlas by the Western United States Volume IV – New Mexico. J. F. Miller. R. H. Fredrick and R. J. Tracey. U.S. Department of Commerce, 1973

SEDCAD+ modeling results were compared with field observation in order to determine the accuracy of the modeling. Since only a few rainfall events produce sufficient runoff to deliver samples to the single stage sediment samplers, few samples are available for comparison. Furthermore, extremely large runoff events usually destroy the single stage sediment samplers. Also, a sampler does not produce a representative depth-integrated sample. Nevertheless, the sample results do provide order-of-magnitude comparisons.

From a review of quarterly hydrologic monitoring reports submitted to the Office of Surface Mining (OSM), analytical results from samples collected on July 29, 1986 are compared with SEDCAD+ modeling results. These samples were obtained from the runoff response to 3.53 inches of precipitation over the period July 19 through July 24. The samples were not collected until July 29 because the single-stage sediment samplers were buried in debris from a flood event. Estimated peak flows at monitoring stations CD-1 and CD-2, located on Chinde Wash above and below the mine, were 277 cfs and 183 cfs, respectively. These peak flows would compare with the peak runoff from an event comparable to that resulting from a 10-yr., 6-hr design precipitation for the location CD-1 above the mine and an event between the 2-yr., 6-hr and the 10-yr., 6-hr event for the location CD-2 below the mine. It is likely that the Big-Fill Culvert associated with the rail crossing, attenuates flows, producing the lower peak flow below the mine.

Measured TSS and settleable solids (SS) concentrations in the sediment samplers suggest that the model underestimates settleable solids levels but overestimates the total suspended sediment concentrations by more than one order-of-magnitude. It is possible that natural flocculation of clays within the single stage sediment sampler could elevate the measured settleable solids levels above what would be measured during the event. On the other hand, the sample collected by the single stage sediment sampler may not have been representative of the peak flow but of a lower flow condition. In this case the measured TSS and SS concentrations should be less that the predicted peak concentrations obtained from SEDCAD+.

Other samples from storm runoff events show total suspended sediment concentrations of the magnitude predicted by SEDCAD+. For example, analytical results of samples collected on Chinde Wash in July, 1976, September, 1980, and July, 1984 showed total suspended sediment concentrations of 277,000 mg/l, 183,000 mg/l and 397,420 mg/l, respectively. Flow measurements were not obtained for these samples so it is difficult to compare with SEDCAD+ modeling results.

It is unlikely that monitoring of sediment concentrations on the major arroyos flowing through the permit area will be sufficient to calibrate or validate the SEDCAD+ modeling results. The sediment dynamics are too complex and variable to allow for representative sampling and accurate modeling. Recognizing the pitfalls of interpreting sediment concentration data from the major arroyos, the Navajo Mine has embarked on extensive plot studies of sediment yield to compare pre- and postmining conditions and to demonstrate best technology currently available (CHAPTER 11, Section 11.6.4). Despite the inaccuracy and limitations of modeling sediment yields and concentrations using SEDCAD+ or any other event based model, the modeling results are useful for relative comparison of pre- and postmining conditions (CHAPTER 11, Section 11.6.3).

7.2.5 Hosteen Wash

Hosteen Wash is an ephemeral stream located in the northern portion of Area II. The drainage area extends from the NIIP (east of the permit area) through the permit area to the Chaco River to the west. EXHIBIT 7-4C shows the watershed area and drainage configuration for the Hosteen Wash watershed. The Hosteen Wash watershed area is about 9.1 square miles. Approximately 3.7 square miles of this drainage is disturbed by mining activity.

Peak flows and sediment yields were predicted for the 6-hr. rainfall event on 2-, 10-, 25-, and 100-yr. frequencies. Predictions were performed for pre-mining conditions for Hosteen Wash. Postmining predictions are reported in CHAPTER 11, Section 11.6.3.

The peak flows and sediment yields were predicted through the use of the SEDCAD+ computer program (Schwab and Warner, 1987) following the methodology and assumptions described in Section 7.2.3.2. Watershed subdivisions used for Hosteen Wash are provided on the SEDCAD+ Watershed Map (EXHIBIT 7-4C). Input parameters and output results for each subwatershed are provided in APPENDIX 7-A. All input parameters are included in the output results. Sediment yields in Hosteen Wash were predicted to increase from 2,805 tons for the 2-yr., 6-hr precipitation event to 19,646 tons for the 100-yr., 6-hr precipitation event.

7.2.6 Barber Wash

Barber Wash is an ephemeral stream, which flows only in response to runoff from precipitation events. The drainage area extends from just east of the permit boundary through the permit area towards the Chaco River to the west. EXHIBIT 7-4C shows the watershed area and drainage configuration for the Barber Wash watershed. The Barber Wash watershed area is about 5.3 square miles. Approximately 1.4 square miles of this drainage is disturbed by mining activities.

Peak flows and sediment yields were predicted for the 6-hr. rainfall event on 2-, 10-, 25-, and 100-yr. frequencies. Predictions were performed for pre-mining conditions for Barber Wash. Postmining predictions are reported in CHAPTER 11, Section 11.6.3.

The peak flows and sediment yields were predicted through the use of the SEDCAD+ computer program (Schwab and Warner, 1987) following the methodology and assumptions described in Section 7.2.3.2. Watershed subdivisions used for Barber Wash are provided on the SEDCAD+ Watershed map (EXHIBIT 7-4C). Input parameters and output results for each subwatershed are provided in APPENDIX 7-B.

Sediment yields in Barber Wash were five and six times lower than those predicted for Hosteen. The lower sediment yields occur on Barber Wash because of lower curve numbers and runoff and lower slopes (less badlands area) as well as a slightly smaller drainage area. Sediment yields are predicted to increase from 447 tons for the 2-yr., 6-hr precipitation event to 4,240 tons for the 100-yr., 6-hr precipitation event. Peak suspended solids concentrations exceeded 23,000 mg/l for all events.

7.2.7 Neck Arroyo

Neck Arroyo is an ephemeral stream that flows only in response to runoff from precipitation events and is located south of the Area III shop complex just north of the Area III mining area (Lowe Pit). The drainage area extends from east of the permit boundary through the permit area towards the Chaco River to the west. EXHIBIT 7-4 shows the watershed area and the drainage configuration for this watershed. The Neck Arroyo watershed area is about 1.88 square miles. Approximately 14 percent of this drainage lies within the permit area.

Peak flows and sediment yields were predicted for the 6-hr. rainfall event on 2-, 10-, 25-, and 100-yr. frequencies. Predictions were performed for pre-mining conditions for Neck Arroyo. Postmining predictions are reported in CHAPTER 11, Section 11.6.3, even though the relative area affected by life of mine operations is very small.

The peak flows and sediment yields were predicted through the use of the SEDCAD+ computer program (Schwab and Warner, 1987) following the methodology and assumptions described in Section 7.2.3.2. Watershed subdivisions used for Neck Arroyo are provided on the SEDCAD+ Watershed Map (EXHIBIT 7-4). Input parameters and output results for each subwatershed are provided in APPENDIX 7-C.

Sediment yields predicted on Neck Arroyo were about twice the magnitude predicted for Barber Wash even though the Neck drainage area is less than 40 percent than that of Barber Wash drainage area. The higher sediment yields predicted for Neck Arroyo are due to higher curve numbers and runoff and higher slopes (more badlands area). Sediment yields are predicted to increase from 3,748 tons for the 2-yr., 6-hr precipitation event to 34,786 tons for the 100-yr., 6-hr precipitation event. Peak suspended solids concentrations were slightly higher than predicted for other drainages and exceeded 100,000 mg/l for all predicted events.

7.2.7.1 South Barber Drainage

The South Barber Drainage is an ephemeral stream that is a tributary to the Neck Arroyo. EXHIBIT 7-4C shows the watershed area and drainage configuration for the South Barber Drainage. The South Barber Drainage is about 0.82 square miles. Approximately 0.03 square miles (17 acres) of this drainage is disturbed by mining activities.

The Sedcad+ computer program was used to simulate the 2, 10, 25 and the 100 year-6 hour storm events following the methodology and assumptions outlined in Section 7.2.3.2. The watershed subdivisions used to model the South Barber Drainage is presented on Exhibit 7-4C.

The input parameters and output results for each subwatershed are provided in APPENDIX 7-N. The post-mining surface hydrology is presented in Section 11.6.3.

Results of the SEDCAD+ runs for pre-mining conditions show peak concentrations of suspended solids exceeding 34,000 mg/l for rainfall events of a 2-yr. frequency or larger. Sediment yields increase from 170 tons for a 2-yr., 6-hr rainfall to 1,449 tons for a 100-yr., 24-hr rainfall.

7.2.8 Lowe Arroyo

Lowe Arroyo lies in the middle of Area III and flows from NIIP, east of the permit area, through the permit area to Chaco River to the west. Lowe Arroyo is an ephemeral stream with flows occurring only in direct response to runoff from precipitation events. EXHIBIT 7-4 shows the watershed area and drainage configuration for Lowe Arroyo. Lowe Arroyo has a drainage area of about 11.25 square miles of which approximately 41 percent lies within the permit area.

Peak flows and sediment yields were predicted for the 6-hr. rainfall event on 2-, 10-, 25-, and 100-yr. frequencies. Predictions were performed for pre-mining conditions for Lowe Arroyo. Postmining predictions are reported in CHAPTER 11, Section 11.6.3.

The peak flows and sediment yields were predicted through the use of the SEDCAD+ computer program following the methodology and assumptions described in Section 7.2.3.2. Watershed subdivisions used for Lowe Arroyo are provided on the SEDCAD+ Watershed Map (EXHIBIT 7-4). Input parameters and output results for each subwatershed are provided in APPENDIX 7-D.

The sediment yields on Lowe Arroyo were only slightly larger than that of Barber Wash although the Lowe Arroyo drainage area is about twice the size of the Barber Wash drainage area. Sediment yields are predicted to increase from 2,129 tons for the 2-yr., 6-hr precipitation event to 25,383 tons for the 100-yr., 6-hr precipitation event. Peak suspended solids concentrations were slightly lower than predicted for Barber Wash although it exceeded 100,000 mg/l for all events.

7.2.9 Cottonwood Arroyo

Cottonwood Arroyo is a major sand bed ephemeral drainage that passes through the southern portion of the permit area. EXHIBIT 7-4 show the watershed area and drainage configuration for Cottonwood Arroyo. The arroyo has a drainage area of about 79.83 square miles of which approximately six percent lies within the permit area. This drainage area includes approximately 12.4 square miles of the Chinde Wash drainage that is diverted by the NIIP Ojo Amarillo canal into the Cottonwood drainage. About 49 percent of this watershed is occupied by badlands that accounts for the high discharge, flow intensities and sediment load observed in this drainage.

Cottonwood Arroyo is characterized by a rapid increase in discharge from a dry channel to peak discharge, followed by a recession to a low discharge over several hours. These rapidly varying flows can transport large of amounts of sediment and cause extensive change in the shape of the channel, particularly noted at surface water station CNS-1. Total sediment and dissolved solids concentrations are similar to regional values and average 97,989 mg/l and 656 mg/l, respectively.

7.2.9.1 Surface Water Monitoring

Since 1990, Navajo Mine has been monitoring surface water flows and quality in Cottonwood Arroyo at three stations, CS-1 (south fork), CN-1 (north fork), and CNS-1 (main channel). Data collected during the ten years of monitoring has been submitted to OSM as part of the quarterly hydrologic reports and annual hydrologic reports. From 1990 through 1996, monitoring consisted of single stage sediment samplers in conjunction with crest gauges. From 1997 through 1999, monitoring consisted of automated samplers and ultrasonic water level sensors. This type of monitoring allows water quality samples to be related to flow measurements.

Monitoring has been discontinued in Cottonwood Arroyo and the following description details where the stations were located and type of equipment used to collect monitoring information. Station CN-1 was located in an alluvial reach, which is relatively stable and confined. Stations CS-1 and CNS-1 were located in wide and unstable sand-bed washes.

Upper Cottonwood Arroyo, North Fork (CN-1):

Sample type: Automatic (ISCO Model 3700 sampler).
Sample frequency: 6 minutes (0.10 hour).
Sampling method/location: Fixed-position sampler intake 8 inches above thalweg in relatively stable channel section.
Sampling trigger stage: 12 inches, triggered by ultrasonic sensor.

Upper Cottonwood Arroyo, South Fork (CS-1):

Sample type: Automatic (ISCO Model 3700 sampler).
Sample frequency: 6 minutes (0.10 hour).
Sampling method/location: Variable-position sampler intake 8 or more inches above thalweg in unstable channel section.
Sampling trigger stage: 12 inches, triggered by ultrasonic sensor.

Lower Cottonwood Arroyo (CNS-1):

Sample type: Automatic (ISCO Model 3700 sampler).

Sample frequency: 6 minutes (0.10 hour)

Sampling method/location: Variable-position sampler intake 8 or more inches above thalweg in unstable channel section.

Sampling trigger stage: 12 inches, triggered by ultrasonic sensor.

Rating curves for the three Cottonwood Arroyo stations were developed from cross-sectional surveys and stage recorders using the slope-area method. The slope-area method is described in US Geological Survey Water-Supply Paper 2175 (1982). Discharges for incremental depths at the Cottonwood Arroyo stations were calculated by an in-house computer program for each surface water-monitoring site using the Mannings equation. The Mannings equation was developed for conditions of uniform flow where the cross-sectional area, hydraulic radius and depth remain constant throughout a reach. The Mannings equation is:

$$Q = A\frac{1.49}{n}\left(\frac{A}{WP}\right)^{2/3} S^{1/2}$$

Where:	Q	=	Discharge rate (ft^3/s)
	A	=	Cross-sectional area (ft^2)
	n	=	Mannings coefficient of channel roughness
	WP	=	Wetted perimeter (ft)
	S	=	Slope (ft/ft)

The cross-sectional area (A) and wetted perimeter (WP) are functions of the depth of flow and the cross-section of the reach. The n value for each station is estimated using USGS Water Supply Paper No. 1849, "Roughness Characteristics of Natural Channels". The cross-section (A) and slope (S) of each reach are determined by field surveys and stage measurements.

The characterization of Cottonwood Arroyo presented below is based on data collected by the automated system over a three year period, 1997-1999. The characterization includes a comparison of channel cross-sections (See Exhibit 7-6) taken before and after large flow events that occurred during 1999.

7.2.9.2 Cottonwood Arroyo Water Quality

Samples collected by the automated sampler were analyzed for chemistry and total sediment. For each sample/flow event, only the first sample bottle collected is analyzed for chemistry from each station with the remaining samples analyzed for total sediment. A total of 314 water samples were collected between 1997-1999 from stations CN-1, CS-1, and CNS-1, with 255 of these samples analyzed for total sediment and 59 samples analyzed for chemistry.

Table 7-4 lists average values for total sediment concentration, texture and particle size distribution by station. Appendix 7-I contains the analytical data for each sample analyzed for total sediment concentration and sieve analysis by monitoring station. Total sediment concentration is the total amount of sediment being transported by flowing water and is supported by hydraulic forces rather than by the streambed.

Total sediment concentrations in Cottonwood Arroyo average 97,989 mg/l for all three stations with a range of 29,500 mg/l to 268,000, which are typical values of an arid ephemeral channel. Elevated concentrations of sediment determined from laboratory analyses in Cottonwood Arroyo water samples confirms visual observations made in the field, such as the color, turbidity, and sand waves.

Texturally, the sediment from the automated water samplers are clay, clay loam or a sandy loam, and are commonly dominated by the clay fraction with nearly one-third of the sample represented by sand (See Table 7-4). This texture reflects the source materials in the watershed, which has a high percentage of badlands with some dune areas in the upper portion of the watershed. Fine sand and very fine sand comprise a majority of the particle size distribution, which is similar to the particle size distribution of dune areas (regolith) within the upland portions of the Cottonwood Arroyo watershed.

TABLE 7-4

COTTONWOOD ARROYO
1997-1999 MONITORING DATA
AVERAGE VALUES BY STATION

Station	Watershed Area	Number of Samples	Total Sediment	Maximum	Minimum	TEXTURE Sand	TEXTURE Silt	TEXTURE Clay	PARTICLE SIZE DISTRIBUTION very coarse sand	coarse sand	medium sand	fine sand	very fine sand
	acres		mg/L	mg/L	mg/L	%	%	%	%	%	%	%	%
CN-1	17,259	92	123,097	268,000	29,500	32	27	41	0	1	10	53	35
CS-1	29,385	40	79,420	143,200	44,500	21	29	50	0	1	5	46	48
CNS-1	49,221	123	85,247	193,800	29,800	29	28	43	0	1	5	49	44

Appendix 7-J contains graphs of total sediment verses flow, texture, and particle size distribution of water samples collected from Cottonwood Arroyo. The total sediment verses flow graphs show that only a weak correlation is possible between total sediment and discharge. In general, sediment concentrations vary independently of discharge. The texture and particle size distribution demonstrate the dominance of fine-grained materials within the water column, reflecting source areas and sampling method.

Total sediment data from station CN-1 is likely affected by extensive discharges from NIIP. Large erosion features in the upper portion of the watershed are evidence of these periodic flows. Large channels have developed within sandy materials up to 100 feet across with cutbanks up to 30 feet high.

Appendix 7-K contains statistical reports and a piper trilinear plot of the chemistry data collected from each station. The average total dissolved solids concentration (TDS) for CN-1 is 976 mg/l with a range of 420-2,780 mg/l. The average TDS concentration for CS-1 is 652 mg/l with a range of 340-910 and for CNS-1 the average TDS concentration is 639 mg/l with a range of 360-1,150 mg/l. These values indicate a slight decrease in TDS concentration from upstream to downstream. More importantly, these values are typical of regional TDS concentrations for surface water quality.

The piper trilinear plot indicates that for all three stations the dominant water type is a sodium sulfate. Station CN-1 has a slightly higher concentration of sulfate and TDS, which may reflect slightly different soil types in the watershed and possible Navajo Indian Irrigation Project (NIIP) impacts. Appendix 7-K also contains plots of time verses total suspended solids (TSS) and TDS for all three stations. The TDS and TSS graphs show that concentrations between stations are similar for individual storm events.

7.2.9.3 Cottonwood Arroyo Water and Sediment Quantity

Table 7-5 lists water and sediment yields for each station for several separate flow events during 1998 and 1999. Most of the flow events occurred during summer months as a result of high intensity, short duration thunderstorms. The exception is the storm event of April 22, 1999, which was due to a low-pressure system that produced low intensity precipitation.

Caution must be exercised when making upstream to downstream comparisons due to storm and watershed variability, however, it is still productive to compare and examine the data between stations. The hydrographs for several flow events (August 21, 1998, April 22, 1999, August 2, 1999, and August 3, 1999) for all three stations listed on Table 7-5 are located in Appendix 7-L. Water samples from each station were not collected for all of the flow events due to either equipment problems (plugged sample tubes) or flow stages below the minimum (1 foot) necessary to trigger the automated sampling device.

The flow and sediment data indicate that for most flow events, runoff volumes (acre/feet) decrease from upstream to downstream while sediment volumes (tons) increase. For example, the flow event on August 21, 1998 resulted in a net decrease of 121 acre/feet in the total runoff volume between stations CNS-1 and upstream stations CS-1 and CN-1. However, the two storm events in early August 1999 were in exception to this, in which runoff volumes increased from upstream to downstream .

The dominant condition of the loss of water from upstream to down stream may be the result of water infiltrating into the sand bed of the progressively widening channel downstream. The channel of the south fork and particularly the north fork, are incised and generally bedrock controlled. In contrast, the geomorphology of the main channel is broad, with a high width to depth ratio. In addition, the coarse alluvial materials that underlie the main channel are at least 22 feet thick, as evidenced by alluvial wells, such as Cottonwood alluvial well QACW- 1, which has a total depth of 22 feet into unconsolidated alluvial materials.

TABLE 7-5

COTTONWOOD ARROYO
1997-1999 SURFACE WATER DATA FROM AUTOMATED STATIONS
HYDROLOGY AND SEDIMENT UPSTREAM/DOWNSTREAM COMPARISONS

FLOW EVENT	STATION	NO. OF SAMPLES	TOTAL SEDIMENT CONC. - AVE.	PEAK DISCHARGE	SEDIMENT YIELD	RUNOFF VOLUME	DIFFERENCE IN RUNOFF VOLUME	DIFFERENCE IN SEDIMENT YIELD
			mg/l	cfs	tons	acre-feet	acre-feet	tons
7/24/98	CN-1	NO FLOW		-	-	-		
	CS-1	-	-	14	-	1.3		
	CNS-1	-	-	8	-	0.7	(0.6)	NA
7/25/98	CN-1	-	-	33	-	0.5		
	CS-1	-	-	25	-	1.3		
	CNS-1	-	-	9	-	0.8	(1.0)	NA
8/21/98	CN-1	3	53,700	682	13,904	190		
	CS-1	10	80,609	877	23,515	202		
	CNS-1	18	140,543	1,120	48,495	272	(121)	11,076
4/22/99	CN-1	-	-	142	0	98		
	CS-1	-	-	42	-	6		
	CNS-1	12	138,192	84	0	19	(85)	NA
7/15/99	CN-1	-	-	101	-	5.2		
	CS-1	NO FLOW		-	-	-		
	CNS-1	-	-	37	-	2.4	(2.8)	NA
7/23/99	CN-1	-	-	1,085	-	64.1		
	CS-1	4	89,500	281	4,376	40.0		
	CNS-1	3	63,500	1,118	8,999	104.2	0.2	NA
7/29/99	CN-1	4	167,925	247	2,496	10.9		
	CS-1	-	-	10	-	0.6		
	CNS-1	4	129,450	71	1,215	6.9	(4.6)	NA
8/2/99	CN-1	5	77,020	523	2,242	21		
	CS-1	4	52,600	1,018	3,022	42		
	CNS-1	3	62,867	1,455	5,873	69	5	609
8/3/99	CN-1	4	85,325	272	2,483	21		
	CS-1	4	94,525	1,742	27,574	215		
	CNS-1	4	102,275	1,415	35,290	254	18	5,233

Note: Flow values at CNS-1for the August 3, 1999 flow event may not be accurate due to recent changes in the channel cross-section.

The two flow events in early August 1999 that show a slight net increase in the total runoff volume from upstream to downstream were preceded by several flow events in late July 1999. These frequent flow and precipitation events would produce high antecedent moisture within the channel bottom, which in turn may limit channel bed infiltration. MET II recorded 2.6 inches of precipitation in August 1999, (the average precipitation for August is 1.1 inches) which is 230% above normal. In contrast, 1998 was a drought year, with only 0.5 inches of precipitation recorded at MET II during the first seven months of the year. As a result of this lack of precipitation, no recorded flow events occurred between January 5, 1998 and August 21, 1998 in Cottonwood Arroyo.

The net sediment yield increased from upstream to downstream for three flow events. This is the result of increasing flow volume and/or total sediment concentration. Field observations of mechanisms for increasing the total sediment concentration include bank failure, redistribution of stored sediment due to higher peak flows downstream, and a progressively changing channel morphology (less bedrock control) downstream. Sediment sources between the upstream and downstream stations include main channel bed and banks, tributary channel bed and banks, and upland erosion.

The hydrograph shape for most of the events, particularly in the summer, is characterized by a very sharp rise or spike in the rising limb with a very short duration peak, followed by a gradual falling limb of the hydrograph. This hydrograph shape is characteristic of flashy flows in ephemeral channels due to high intensity thunderstorms. The shape of the hydrograph and the duration and timing for an individual flow event is similar between stations.

The storm of August 3, 1999 highlights the spatial variability of flows due to thunderstorm precipitation. Station CN-1 recorded a total volume of flow of 21 acre/feet (a/f) compared to 215 a/f at CS-1 and 254 a/f at CNS-1. The majority of precipitation from this storm fell on the watershed of the south fork of Cottonwood Arroyo, producing greater volumes of runoff and larger peak discharges. Due to erosional changes in the cross-sectional area from previous storms at station CNS-1 (see section 7.2.8.4), measured flow values may underestimate actual peak flow and runoff volume for the August 3, 1999 flow event.

7.2.9.4 Comparison of Channel Cross-Sections

Exhibit 7-6 shows channel cross sections from monitoring stations in Cottonwood Arroyo before and after the large flow events that occurred in July and August 1999. The cross-sections, taken in early June 1999 and again in January 2000, show the extreme amount of channel transformation due to large flow events, particularly at station CNS-1. At station CNS-1, the north bank (cut-bank) of the channel moved approximately 80 feet horizontally (See Exhibit 7-6, CNS-1 cross-sections 2 and 2A) over a six-month time frame. In addition to the loss of sediment on the cut-bank, some sediment is temporarily stored as evidenced by the formation of sand bars on the opposite bank and the sediment deposition on the flood plain for these out of bank flows.

The amount of horizontal and vertical change depicted in the cross-sections reinforces the dynamics of sediment movement within this ephemeral sand bed channel that is subjected to short duration high intensity flows.

7.2.9.5 Sediment and Hydrologic Predictions Compared with Surface Water Data

Predictions for the 6-hr. rainfall event on 2-, 10-, 25, and 100-yr. frequencies for pre-mining peak flows and sediment yields are listed on Table 7-6 (see APPENDIX 7-H for detailed results). Postmining predictions are reported in CHAPTER 11, Section 11.6.3.

Sediment yields in Cottonwood Arroyo were higher than from the other drainages. The higher sediment yields predicted for Cottonwood Arroyo are due to the larger drainage area, nearly twice the size of Chinde Wash, the next largest drainage. Sediment yields in Cottonwood Arroyo were predicted to increase from 10,054 tons for the 2-yr., 6-hr precipitation event to 70,850 tons for the 100-yr., 6-hr precipitation event (see Table 7-6).

Peak suspended solids concentrations in Cottonwood Arroyo were similar to those predicted for Lowe Arroyo and lower than predicted for other drainages. Peak suspended sediment concentrations in Cottonwood Arroyo exceed 30,000 mg/l for all events.

TABLE 7-6

COTTONWOOD SEDCAD PREMINE RESULTS
OUTLET AT CHACO WASH - STRUCTURE 37

	PEAK SEDIMENT CONCENTRATION	PEAK DISCHARGE	SEDIMENT YIELD	RUNOFF VOLUME
DESIGN EVENT	mg/l	cfs	tons	acre-feet
2 YEAR - 6 HOUR	32,208	1,055	10,054	495
10 YEAR - 6 HOUR	34,186	2,841	30,644	1,512
25 YEAR - 6 HOUR	35,872	4,120	46,506	2,285
100 YEAR - 6 HOUR	36,850	5,976	70,805	3,444

Comparison of predicted sediment concentrations with measured sediment samples from storm runoff events on Cottonwood Arroyo shows total suspended sediment concentrations of the magnitude predicted by SEDCAD 4.0 for events of a magnitude similar to that predicted for a 10-yr., 6-hr storm or less. Table 7-6 lists the SEDCAD predictions for different design events. The results suggest that the SEDCAD 4.0 predictions for peak sediment concentration in Cottonwood Arroyo are reasonable compared to observed conditions.

The storm events of August 21, 1998 and August 3, 1999 may have been equivalent to a 25 year, 6 hour event or larger in portions of the watershed. Although the SEDCAD predictions for peak discharge, runoff volume and sediment yields are greater, the results compare reasonably to actual data for large flow events.

7.2.10 Pinabete Arroyo

Pinabete Arroyo flows east to west along the southern permit boundary or south of Area IV North to the Chaco River. Pinabete Arroyo is a large ephemeral stream that flows only in direct response to precipitation events. The Pinabete Arroyo has a drainage basin of approximately 59.1 square miles of which approximately 2.9 percent lies within the permit area.

For the pre and post-mine, the hydrology modeling was done only on the subwatersheds or the tributaries to the Pinabete Arroyo that are projected to be disturbed by mining, not on the entire drainage basin. This should be appropriate since the stream channel will not be disturbed and only a small portion of the drainage basin (approximately 2.9 percent) will be disturbed by mining activities.

The peak flows and sediment yields were predicted using the SEDCAD+ computer program following the methodology and assumptions outlined in Section 7.2.3.2. The computer model was used to simulate the 2, 10, 25 and 100 year-6 hour storm events, the results are presented in Appendix 7-O. The watershed subdivisions used to model the hydrology are presented on Exhibit 7-4. The post-mining predictions and hydrologic impacts are reported in CHAPTER 11, Section 11.6.3.12.

Table 7-7

Summary of Surface Water Monitoring Data - Average Values
NB-1, NB-2 CD-1 and CD-2 1986-1992
CD-1A and CD-2A 1997-1999 (Monthly Grab)
CN-1, CS-1 and CNS-1 1997-1999 (Automated Sampler)

Parameter	NB-1	NB-2	CD-1	CD-2	CD-1A	CD-2A	CN-1	CS-1	CNS-1
pH (S.U.)	7.6	7.8	7.7	7.7	8.13	8.21	7.99	8.14	8.17
# of Observations	24	55	218	55	31	20	28	12	19
Total Dissolved Solids (mg/l)	1862	1558	1231	1090	1157	1458	976	652	639
Total Suspended Solids (mg/l)	32211	26613	6995	26845	167.2	111.7	114919.2	74009	97282.4
Total Settleable Solids (mg/l)	240	439	81	233	0.3	0.2	311.6	85.5	133.2
Total Sediment (mg/l)							123097	79420	85247
Conductivity (ų mhos/cm)	2361	2069	1618	1873	1713	2162	1298	1728	861
Boron (mg/l)	0.41	0.32	0.18	0.16	0.35	0.27	0.07	0.14	0.08
Calcium (mg/l)	105.37	67.36	85.56	81.93	69.53	195.76	57.73	43.4	38.92
Chloride (mg/l)	115.99	97.00	40.69	92.02	61.45	73.5	29.37	21.25	16.89
Fluoride (mg/l)	0.91	0.97	0.98	0.79	1.76	1.15	0.83	0.68	0.74
Iron (mg/l)	0.77	1.46	0.35	0.68	0.21	0.23	3.59	7.54	6.65
Total Iron (mg/l)	63.78	211.44	24.79	74.73	1.39	1.99	669.6	540.17	181.55
Magnesium (mg/l)	19.19	13.76	20.00	14.33	17.67	26.33	7.61	5.46	4.22
Manganese (mg/l)	0.13	0.24	0.13	0.21	0.3	0.05	0.17	0.44	0.38
Total Manganese (mg/l)	0.82	2.23	0.32	0.90	0.42	1.10	14.48	11.01	5.84
Potassium (mg/l)	9.10	8.30	5.36	7.87	2.62	6.92	5.49	6.9	5.25
Selenium (mg/l)	0.005	0.007	0.004	0.003	0.005	0.005	0.006	0.003	0.003
Sulfate (mg/l)	1020.43	789.16	702.75	552.13	532.61	823.65	515.15	279.92	276.74
Sodium (mg/l)	464.71	412.76	277.54	248.84	239.54	358.76	239.74	166.18	169.37
Bicarbonate (mg/l)	141.77	182.96	127.82	149.64	281.45	265.10	167.70	189.25	191.66
Carbonate (mg/l)	0.00	0.72	0.52	0.29	7.84	4.60	0.65	1.13	6.84

*CD-1A & CD-2A are the remaining active sample points (3/04).

The pre-mine sediment yields from the tributaries are predicted to increase from 3 tons for the 2 yr- 6 hr precipitation event to 669 tons for the 100 yr- 6 hr precipitation event. Peak suspended solids concentrations are predicted to exceed 6,000 mg/l for all storm events.

7.3 SURFACE WATER QUALITY

Historically, seven surface water monitoring stations were established on ephemeral drainages that pass through the Navajo Mine. All of the monitoring stations except station CS-1 have been impacted by irrigation activities derived from the Navajo Agricultural Products Industries (NAPI) project located to the east of the mine. Surface water quality data collected at the seven stations from 1986 to 1992 and from 1997 to 1999 is summarized in TABLE 7-7. A geochemical analysis of historic surface water monitoring data is presented in APPENDIX 7-E. Surface water quality data collected for stations CD-1 and CD-2 from 1996-2003 is summarized with reference criteria monitoring analysis in Appendix 7M. The analysis shows very few exceedances that can be related to high precipitation events and the sampling will thus be reduced to a quarterly program in 2005.

7.4 SURFACE WATER MONITORING PLAN

Navajo Mine's surface water monitoring program was established to monitor surface water quality at locations where major watercourses enter and leave the permit area and/or lease area. The monitoring program provides the basis for assessment of the impact of mining on the surface water resource. While the chance of surface water impact resulting from mining remains remote, the following monitoring program has been developed to collect water quality information for use in the possible identification of impacts to the prevailing hydrologic regime.

7.4.1 Surface Water Monitoring Locations

The Chinde watershed was selected since it is the most representative watershed of the seven ephemeral arroyos which traverse the permit area. In addition, the drainage experiences direct discharges and irrigation return flows from NAPI. The irrigation season occurs generally from

TABLE 7-8

NAVAJO MINE SURFACE WATER MONITORING

Monitoring Station	Station Drainage	Sampling Frequency
		Quality
CD-1A	Chinde Wash – Upstream	Quarterly
CD-2A	Chinde Wash - Downstream	Quarterly

April through October. EXHIBIT 6-7 (CHAPTER 6, GROUNDWATER HYDROLOGY) shows the locations of the surface water monitoring stations. TABLE 7-8 identifies the surface water monitoring stations, and the sampling frequency. The sampling locations are located upstream and downstream within Chinde Wash to sample and assess water entering and leaving the permit area.

The remaining six watersheds not selected for monitoring are Hosteen Wash, Barber Wash, Lowe Arroyo, Neck Arroyo, Cottonwood Arroyo, and Bitsui Wash. Of the six, the first three listed were not selected because the watershed has been interrupted by mining and no flow passes through the permit area. Upstream check dams and present mining topography do not allow surface water to pass through the permit area. The fourth watershed, Neck Arroyo, does pass through the permit area, but was not selected for monitoring for the following reasons:

- The Neck Arroyo watershed (666 acres) represents 0.7 percent of the total seven (7) watershed areas (96,980 acres) located within and upstream of the permit area.

- The postmining disturbance within the Neck Arroyo watershed (160 acres) represents 0.2 percent of the total seven watershed areas (96,980 acres) located within and upstream of the permit area.

- The Neck Arroyo is identified as 100 percent badlands (very erosive) and is not representative of the watersheds in the area.

The Neck Arroyo is not monitored because it represents such a small fraction of the total permit area watersheds and is entirely badlands. The Bitsui Wash was not selected for monitoring because the flow passes through prelaw jurisdictional lands on the northern area of the mine lease. Table 7-9 (Watershed Areas Associated with Navajo Mine) shows the percent of the drainage area disturbed, and undisturbed plus the percentage pre-mining badland areas.

TABLE 7-9

WATERSHED AREAS ASSOCIATED WITH NAVAJO MINE

Watershed Size		Undisturbed Post-mining Area		Disturbed Post-mining Area		Pre-mining Badlands Area	
Watershed	Acres	Acres	Percent	Acres	Percent	Acres	Percent
Bitsui Wash	7,835	6,464	82.5	1,371	17.5	3,134	40.0
Chinde Wash	29,638	26,526	89.5	3,112	10.5	5,928	20.0
Hosteen Wash	8,384	6,036	72.0	2,348	28.0	4,192	50.0
Barber Wash	1,766	1,651	93.5	115	6.5	530	30.0
Neck Arroyo	666	506	76.0	160	24.0	666	100.0
Lowe Arroyo	5,837	3,444	59.0	1,393	41.0	1,634	28.0
Cottonwood Arroyo	42,854	39,854	93.0	3,000	7.0	24,855	58.0
Totals	**96,980**	**84,481**	**87.0**	**11,499**	**13.0**	**40,939**	**42.0**

Surface water monitoring was discontinued in Cottonwood Arroyo following extensive data collection that adequately characterized baseline conditions. The expansion of mining into Area IV North will involve the construction of a crossing with culverts in the Cottonwood Arroyo. Navajo Mine will not discharge into Cottonwood Arroyo during the Area IV North development and there will be minimal mine related impacts. The only effect from mining to Cottonwood Arroyo is the Lowe diversion, which diverts an undisturbed portion of the Lowe watershed into Cottonwood Arroyo (See section 11.6.3.8). Because the Lowe Diversion increases the Cottonwood watershed by only 4%, any water quality effects will likely be so small as to be immeasurable. Monitoring will resume within the Cottonwood Arroyo watershed if conditions change as the result of major NAPI impacts.

7.4.2 Monitoring Equipment

The existing Chinde Wash monitoring stations CD-1 and CD-2 have been relocated to take advantage of stable cross sections afforded by culvert crossings at BIA Highway 3005 (upstream station CD-1A) and at the BHP railroad embankment (downstream station CD-2A). FIGURE 7-2 shows the locations of the Chinde monitoring stations. Station CD-1A is located outside the mine lease and right of access permission was granted from the Navajo Nation to place the monitoring location within the road right-of-way. Station CD-2A is located within the Navajo Mine permit boundary.

Sampling Equipment: On Chinde Wash, grab samples are collected manually at a pre-established day and time each month.

Upon completion of the Navajo Mine hydrologic monitoring program BHP Navajo Mine will remove all monitoring equipment and appurtenances. The site of each stream monitoring station will then be reclaimed. Cost involved with the station removal and reclamation will be minor and is sufficiently covered by the contingency line item in the existing Reclamation Bond.

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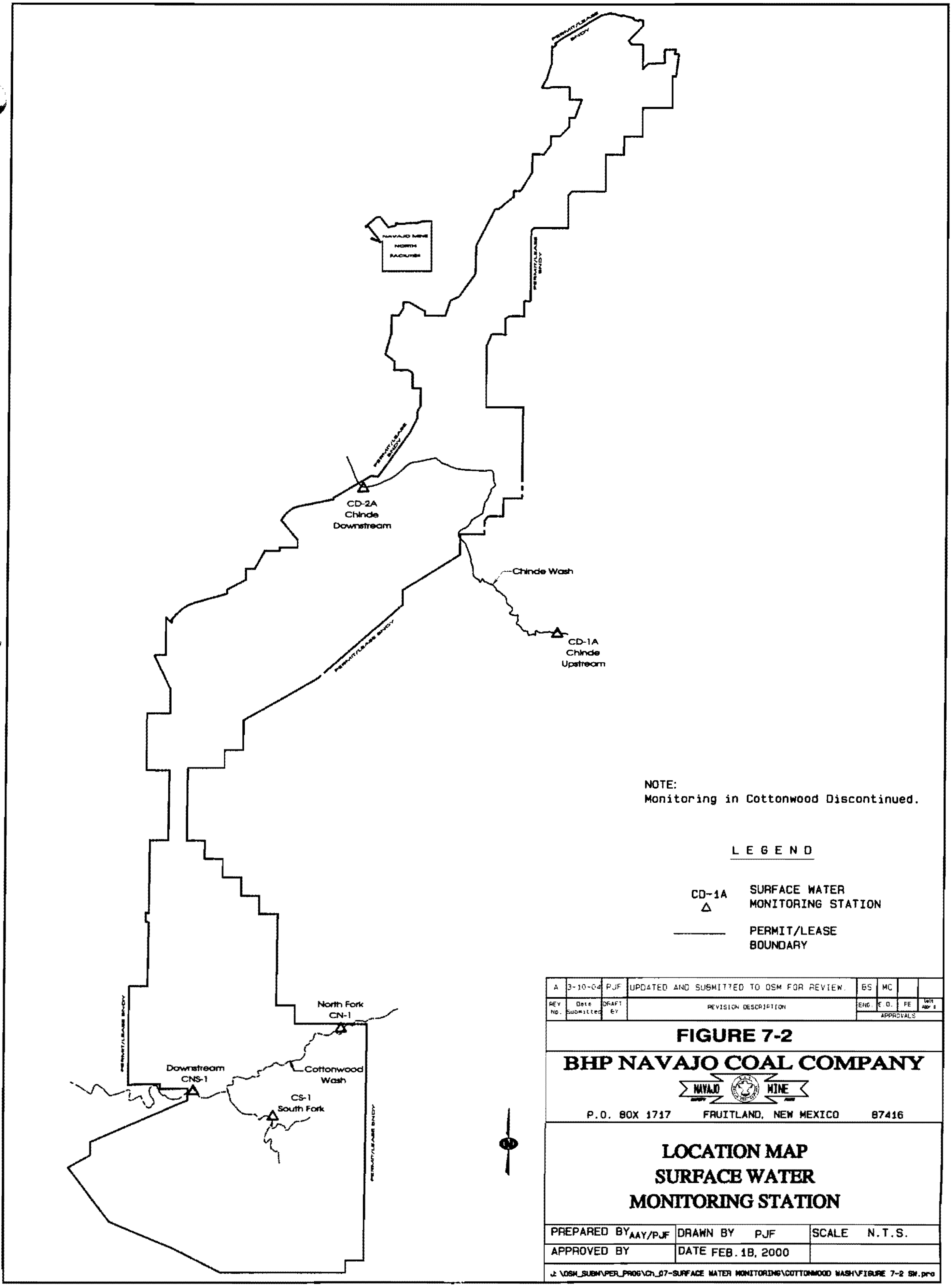

CD-2A
Chinde
Downstream
Chinde Wash
CD-1A
Chinde
Upstream
North Fork
CN-1
Downstream
CNS-1
Cottonwood
Wash
CS-1
South Fork
NOTE:
Monitoring in Cottonwood Discontinued.
LEGEND
CD-1A SURFACE WATER MONITORING STATION
PERMIT/LEASE BOUNDARY
A 3-10-04 PJF UPDATED AND SUBMITTED TO OSM FOR REVIEW. BS MC
REV No. Date Submitted DRAFT BY REVISION DESCRIPTION ENG. E.O. PE APPROVALS
FIGURE 7-2
BHP NAVAJO COAL COMPANY
NAVAJO MINE
P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416
LOCATION MAP
SURFACE WATER
MONITORING STATION
PREPARED BY AAY/PJF
DRAWN BY PJF
SCALE N.T.S.
APPROVED BY
DATE FEB. 18, 2000

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7.4.3 Monitoring Approach

Chinde Wash: Due to the NAPI impacted perennial nature of Chinde Wash, the sampling strategy for CD-1A and CD-2A is a grab sample technique, collected manually on a quarterly basis by the end of each quarter. The sampling strategy and methods for each of the two Chinde Wash stations are described in the following paragraphs.

Upper Chinde Wash (CD-1A):

Sample type: Grab.

Sample frequency: Quarterly, before the end of each quarter.

Sampling method/location: At culvert outfall.

Sampling trigger stage: Any flow on the sampling day will be sampled.

Lower Chinde Wash (CD-2A):

Sample type: Grab.

Sample frequency: Quarterly, before the end of each quarter.

Sampling method/location: At culvert outfall.

Sampling trigger stage: Any flow on the sampling day will be sampled.

7.4.4 Water Quality Analysis

The surface water monitoring parameter list provided in TABLE 7-10 was developed by identifying potential sources of constituents to the surface water which are either on or adjacent to the Navajo Mine and determining which constituents may potentially contribute to the hydrologic balance. The major ions were added to the list such that an ion balance can be performed by the laboratory as a quality control measure. TABLE 7-10 is the list of parameters that will be analyzed quarterly.

All samples collected in the field are packed in ice and in coolers and delivered to the laboratory in a sufficient amount of time to meet U.S. EPA established analytical holding times.

Once the samples are received by the contract laboratory, the samples are prepared and analyzed in accordance to Environmental Protection Agency (EPA) guidelines (Guidelines Establishing Test Procedures for the Analysis of Pollutants 40 CFR Part 136).

The contract laboratory is required to have an acceptable Quality Assurance/Quality Control (QA/QC) program (CHAPTER 6, APPENDIX 6-E). A new laboratory will be obtained if frequent analytical problems arise and cannot be corrected satisfactorily, or their QA/QC program has been changed which results in an unacceptable program.

Sediment concentrations: For the Chinde Wash stations, total suspended solids (TSS) settleable solids (SS), and total sediment (TS) will be determined by laboratory analysis for each monthly grab sample.

BHP has added a procedure for sample sediment load analysis which may provide more accurate values for total sediment concentration. The full sample volume and mass will be measured, the sample will settle for 24 hours, and without splitting the sample the water will be removed from the sediment by decanting and drying. The dry sediment mass will be measured and divided by the full sample volume to compute the concentration in mg/L. A sieve will then be used to separate the silt and clay particles (smaller than 0.0625 mm) from the sand and gravel and the change in dry mass will be recorded. APPENDIX 7-F contains a detailed description of the proposed method.

The sediment samples collected at the Chinde Wash stations CD-1A and CD-2A will be used to monitor the hydrologic conditions, and assess mining impacts and the impacts due to NAPI upstream land use.

<u>Water quality parameters</u>: For Chinde Wash surface water monitoring stations CD-1A and CD-2A, the first sampled event of each quarter will be analyzed for the constituents listed in TABLE 7-10.

All other sampled events will be analyzed for the following constituents,:

- Conductivity
- PH
- Iron
- Manganese
- Selenium

TABLE 7-10

SURFACE WATER QUALITY PARAMETERS

(All Surface Water Stations)

pH Total Dissolved Solids (TDS) Total Suspended Solids (TSS) Conductivity Settleable Solids Total Sediment
Boron Calcium Chloride Fluoride Iron Iron (Total) Magnesium Manganese Manganese (Total) Potassium Selenium Sulfate Sodium Bicarbonate Carbonate
Cation/Anion Balance

7.4.6 Data

The analytical data received from the laboratory is entered into an in-house database program. The data is used to determine and assess long-term trends for the parameters monitored and will be used to monitor and assess potential impacts to the hydrologic regime.

The Probable Hydrologic Consequences (PHC) predicts an overall reduction in sediment yields from the reclaimed areas as compared to the premine conditions. The Chinde main channel data collected will be used in conjunction with computer modeling results for the Bond Release Application to support the PHC.

7.4.7 Reporting

Surface water monitoring results will be submitted on a quarterly basis to OSM. In addition, a detailed review of monitoring results will be submitted to OSM twice during the permit term. See CHAPTER 11, SECTION 11.6.5 for additional information.

7.5 REFERENCES

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APPENDIX 7-A

HOSTEEN WASH PRE-MINE HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

September-04

Hosteen Wash Pre-mine Hydrology and Sedimentology

The hydrology model and drainage subdivisions are presented on Exhibit 7-4C. The pre-mine channel alignment and profiles are presented on Exhibit 11-76F thru 11-76H.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

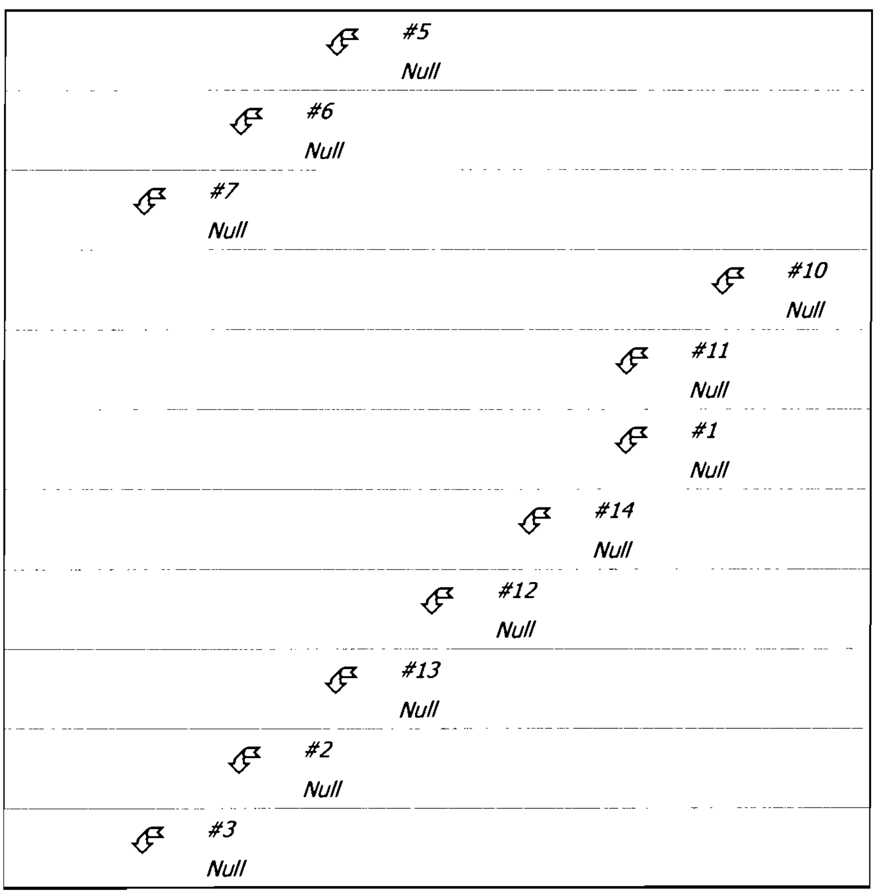
Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#14	0.000	0.000	Hosteen branch 1, S1
Null	#2	==>	#3	0.447	0.361	Hosteen branch 1, S2
Null	#3	==>	#4	0.000	0.000	Hosteen branch 1, S3
Null	#4	==>	#9	0.433	0.304	Hosteen branch 1 & 2 junction
Null	#5	==>	#6	0.503	0.338	Hosteen branch 2, S1
Null	#6	==>	#7	0.346	0.362	Hosteen branch 2, S2
Null	#7	==>	#4	0.000	0.000	Hosteen branch 2, S3
Null	#9	==>	End	0.000	0.000	Hosteen branch 1, J2
Null	#10	==>	#11	0.183	0.348	Hosteen branch 1
Null	#11	==>	#14	0.000	0.000	Hosteen branch 1
Null	#12	==>	#13	0.287	0.350	Hosteen branch 1
Null	#13	==>	#2	0.000	0.000	Hosteen branch 1
Null	#14	==>	#12	0.222	0.334	Hosteen branch 1



#4	
Null	
#9	
Null	

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	8. Large gullies, diversions, and low flowing streams	2.17	154.00	7,099.06	4.41	0.447
#2	**Muskingum K:**					**0.447**
#4	8. Large gullies, diversions, and low flowing streams	0.78	32.00	4,124.00	2.64	0.433
#4	**Muskingum K:**					**0.433**
#5	8. Large gullies, diversions, and low flowing streams	1.41	91.00	6,457.00	3.56	0.503
#5	**Muskingum K:**					**0.503**
#6	8. Large gullies, diversions, and low flowing streams	2.22	124.00	5,583.00	4.47	0.346
#6	**Muskingum K:**					**0.346**
#10	8. Large gullies, diversions, and low flowing streams	1.68	43.00	2,560.00	3.88	0.183
#10	**Muskingum K:**					**0.183**
#12	8. Large gullies, diversions, and low flowing streams	1.75	72.00	4,104.00	3.97	0.287
#12	**Muskingum K:**					**0.287**
#14	8. Large gullies, diversions, and low flowing streams	1.31	36.00	2,750.19	3.43	0.222
#14	**Muskingum K:**					**0.222**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	713.800	713.800	133.11	12.69	592.3	62,425	3.93	2.64
#6	1,250.500	1,964.300	238.38	31.61	1,209.2	51,753	2.04	1.37
#7	573.200	2,537.500	259.08	38.37	1,324.5	49,591	1.78	1.15
#10	551.100	551.100	62.06	7.73	295.2	46,631	0.70	0.52
#11	217.500	768.600	88.20	11.41	414.4	44,062	0.47	0.35
#1	373.300	373.300	46.34	5.99	187.4	39,872	0.42	0.31
#14	0.000	1,141.900	134.54	17.41	601.8	42,604	0.45	0.34
#12	467.400	1,609.300	179.79	25.89	828.2	38,229	0.49	0.37
#13	421.200	2,030.500	210.52	33.26	1,064.4	36,821	0.38	0.30
#2	348.700	2,379.200	225.59	36.98	1,162.0	35,837	0.52	0.42
#3	628.900	3,008.100	250.38	46.75	1,464.6	43,740	0.17	0.11
#4	0.000	5,545.600	509.44	85.12	2,789.2	41,701	0.79	0.56
#9	286.900	5,832.500	503.37	90.57	2,804.6	40,483	0.19	0.13

Particle Size Distribution(s) at Each Structure

Structure #5 (Hosteen branch 2, S1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.200%
0.0500	97.489%
0.0020	85.430%
0.0010	0.000%

Structure #6 (Hosteen branch 2, S2):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.128%
0.0500	98.780%
0.0020	90.446%
0.0010	0.000%

Structure #7 (Hosteen branch 2, S3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.216%
0.0500	98.898%
0.0020	91.290%
0.0010	0.000%

Structure #10 (Hosteen branch 1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%

Size (mm)	In/Out
0.0020	95.783%
0.0010	0.000%

Structure #11 (Hosteen branch 1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.000%
0.0010	0.000%

Structure #1 (Hosteen branch 1, S1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.011%
0.0010	0.000%

Structure #14 (Hosteen branch 1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.003%
0.0010	0.000%

Structure #12 (Hosteen branch 1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	96.384%
0.0010	0.000%

Structure #13 (Hosteen branch 1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.089%
0.0010	0.000%

Structure #2 (Hosteen branch 1, S2):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.649%
0.0020	96.313%
0.0010	0.000%

Structure #3 (Hosteen branch 1, S3):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.901%
0.0010	0.000%

Structure #4 (Hosteen branch 1 & 2 junction):

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.627%
0.0500	99.477%
0.0020	95.286%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%

Size (mm)	In/Out
0.1000	100.000%
0.0500	100.000%
0.0020	98.648%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	140.800	0.349	0.314	0.343	90.600	M	28.94	2.527
	2	31.200	0.082	0.521	0.356	91.000	M	15.99	0.593
	3	50.400	0.209	0.209	0.330	91.000	M	13.62	0.957
	4	208.300	0.431	0.145	0.309	90.500	M	37.65	3.686
	5	117.800	0.290	0.209	0.330	91.000	M	27.97	2.237
	6	94.900	0.308	0.000	0.000	89.000	M	16.14	1.351
	7	26.100	0.136	0.145	0.309	91.000	M	7.68	0.496
	8	44.300	0.153	0.314	0.343	91.000	M	13.03	0.841
	Σ	**713.800**						**133.11**	**12.688**
#6	1	52.100	0.168	0.961	0.354	89.500	M	12.34	0.798
	2	33.900	0.162	0.961	0.354	89.300	M	7.81	0.504
	3	204.200	0.455	0.522	0.346	91.000	M	38.67	3.878
	4	112.900	0.347	0.522	0.346	91.000	M	24.71	2.144
	5	194.400	0.515	0.134	0.325	91.000	M	34.24	3.692
	6	474.700	0.818	0.134	0.325	86.400	M	28.06	4.522
	7	178.300	0.556	0.000	0.000	91.000	M	29.96	3.386
	Σ	**1,964.300**						**238.38**	**31.613**
#7	1	141.300	0.418	0.235	0.370	87.800	M	16.42	1.679
	2	127.200	0.684	0.235	0.370	85.900	M	7.61	1.116
	3	304.700	1.045	0.000	0.000	88.400	M	22.18	3.967
	Σ	**2,537.500**						**259.08**	**38.375**
#10	1	155.400	0.402	0.326	0.346	87.700	M	18.15	1.818
	2	130.900	0.335	0.176	0.352	89.000	M	21.32	1.864
	3	190.500	0.448	0.000	0.000	88.800	M	25.39	2.633
	4	74.300	0.302	0.000	0.000	91.000	M	17.34	1.411
	Σ	**551.100**						**62.06**	**7.726**
#11	1	217.500	0.494	0.000	0.000	90.200	M	34.57	3.687
	Σ	**768.600**						**88.20**	**11.413**
#1	1	190.000	0.460	0.320	0.351	88.500	M	23.62	2.511
	2	45.100	0.207	0.320	0.351	91.000	M	12.23	0.857
	3	138.200	0.479	0.000	0.000	91.000	M	25.41	2.625
	Σ	**373.300**						**46.34**	**5.992**
#14	Σ	**1,141.900**						**134.54**	**17.405**
#12	1	278.900	0.410	0.101	0.315	90.800	M	54.33	5.149

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	2	107.400	0.463	0.101	0.315	90.100	M	17.45	1.795
	3	51.200	0.280	0.000	0.000	91.000	M	12.35	0.972
	4	29.900	0.229	0.000	0.000	91.000	M	7.83	0.568
	Σ	**1,609.300**						**179.79**	**25.889**
#13	1	146.400	0.618	0.000	0.000	89.200	M	17.10	2.147
	2	274.800	0.401	0.243	0.353	91.000	M	55.86	5.219
	Σ	**2,030.500**						**210.52**	**33.255**
#2	1	202.900	1.004	0.000	0.000	82.500	M	4.55	0.956
	2	145.800	0.385	0.000	0.000	91.000	M	30.27	2.769
	Σ	**2,379.200**						**225.59**	**36.980**
#3	1	234.200	0.565	0.110	0.338	90.500	M	35.97	4.144
	2	187.300	0.585	0.191	0.362	88.600	M	20.46	2.513
	3	154.400	0.473	0.191	0.362	88.700	M	19.56	2.102
	4	53.000	0.249	0.000	0.000	91.000	M	13.43	1.007
	Σ	**3,008.100**						**250.38**	**46.746**
#4	Σ	**5,545.600**						**509.44**	**85.121**
#9	1	286.900	0.322	0.000	0.000	91.000	M	65.02	5.449
	Σ	**5,832.500**						**503.37**	**90.569**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.205	75.00	12.70	0.3960	1.0000	1	140.7	73,843	2.32	1.57
	2	0.203	75.00	17.20	0.3950	1.0000	1	64.7	118,767	30.84	20.14
	3	0.210	175.00	5.50	0.3990	1.0000	1	30.0	43,381	3.10	2.03
	4	0.207	150.00	7.20	0.3970	1.0000	1	132.4	47,793	0.45	0.31
	5	0.210	100.00	10.10	0.3990	1.0000	1	115.3	69,522	3.42	2.29
	6	0.224	175.00	5.00	0.3950	1.0000	1	38.6	39,840	1.20	0.78
	7	0.210	150.00	6.30	0.3990	1.0000	1	15.9	43,651	3.74	2.44
	8	0.210	75.00	13.60	0.3990	1.0000	1	54.9	86,903	7.44	4.91
	Σ							**592.3**	**62,425**	**3.93**	**2.64**
#6	1	0.211	75.00	15.40	0.3870	1.0000	1	58.9	95,230	7.37	5.02
	2	0.211	100.00	10.90	0.3770	1.0000	1	25.9	67,164	5.16	3.50
	3	0.210	125.00	8.70	0.3990	1.0000	1	162.5	54,809	0.43	0.30

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	150.00	7.10	0.3990	1.0000	1	77.7	48,027	1.68	1.14
	5	0.210	175.00	4.70	0.3990	1.0000	1	92.2	33,018	0.00	0.00
	6	0.242	175.00	4.80	0.3900	1.0000	1	106.2	29,638	0.00	0.00
	7	0.201	175.00	5.80	0.3920	1.0000	1	93.6	36,545	0.00	0.00
	Σ							**1,209.2**	**51,753**	**2.04**	**1.37**
#7	1	0.223	200.00	3.60	0.3840	1.0000	1	27.3	21,947	0.00	0.00
	2	0.235	200.00	4.00	0.3780	1.0000	1	17.9	20,527	0.00	0.00
	3	0.194	150.00	6.50	0.3200	1.0000	1	70.3	22,395	0.00	0.00
	Σ							**1,324.5**	**49,591**	**1.78**	**1.15**
#10	1	0.204	100.00	10.50	0.3710	1.0000	1	76.9	56,148	0.00	0.00
	2	0.196	100.00	10.70	0.3810	1.0000	1	86.5	62,576	1.40	0.94
	3	0.182	150.00	7.50	0.3850	1.0000	1	78.0	39,950	0.00	0.00
	4	0.210	150.00	7.60	0.3990	1.0000	1	53.8	52,381	2.42	1.60
	Σ							**295.2**	**46,631**	**0.70**	**0.52**
#11	1	0.205	150.00	6.90	0.3940	1.0000	1	119.2	43,061	0.00	0.00
	Σ							**414.4**	**44,062**	**0.47**	**0.35**
#1	1	0.208	150.00	7.40	0.3830	1.0000	1	81.9	43,194	0.00	0.00
	2	0.210	150.00	8.00	0.3990	1.0000	1	35.2	56,162	4.04	2.67
	3	0.210	150.00	6.10	0.3990	1.0000	1	76.5	38,933	0.08	0.06
	Σ							**187.4**	**39,872**	**0.42**	**0.31**
#14	Σ							**601.8**	**42,604**	**0.45**	**0.34**
#12	1	0.209	175.00	5.40	0.3990	1.0000	1	163.3	42,619	0.74	0.50
	2	0.206	200.00	3.50	0.3990	1.0000	1	27.4	20,600	0.00	0.00
	3	0.210	175.00	5.60	0.3990	1.0000	1	29.1	41,471	2.15	1.41
	4	0.210	200.00	3.20	0.3990	1.0000	1	8.6	21,350	1.41	0.91
	Σ							**828.2**	**38,229**	**0.49**	**0.37**
#13	1	0.202	175.00	5.40	0.3980	1.0000	1	50.5	30,826	0.00	0.00
	2	0.210	150.00	6.90	0.3990	1.0000	1	196.4	50,061	1.07	0.73
	Σ							**1,064.4**	**36,821**	**0.38**	**0.30**
#2	1	0.171	200.00	3.80	0.3950	1.0000	3	8.1	10,332	4.82	3.62
	2	0.210	150.00	6.30	0.3990	1.0000	1	89.6	44,028	1.11	0.74
	Σ							**1,162.0**	**35,837**	**0.52**	**0.42**
#3	1	0.205	75.00	12.90	0.3160	1.0000	1	170.7	53,768	0.00	0.00
	2	0.198	150.00	6.50	0.3850	1.0000	1	63.9	33,151	0.00	0.00
	3	0.198	150.00	6.60	0.3860	1.0000	1	57.3	36,271	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.174	75.00	18.60	0.2570	1.0000	1	48.3	65,947	3.99	2.60
	Σ							**1,464.6**	**43,740**	**0.17**	**0.11**
#4	Σ							**2,789.2**	**41,701**	**0.79**	**0.56**
#9	1	0.156	175.00	5.90	0.3250	1.0000	1	123.3	31,253	1.28	0.85
	Σ							**2,804.6**	**40,483**	**0.19**	**0.13**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	4.44	73.00	1,643.00	2.100	0.217
		8. Large gullies, diversions, and low flowing streams	2.89	129.00	4,465.00	5.090	0.243
#1	**1**	**Time of Concentration:**					**0.460**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	7.48	62.00	829.00	2.730	0.084
		8. Large gullies, diversions, and low flowing streams	3.36	82.00	2,442.00	5.490	0.123
#1	**2**	**Time of Concentration:**					**0.207**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	5.97	70.00	1,173.00	2.440	0.133
		8. Large gullies, diversions, and low flowing streams	2.11	115.00	5,440.18	4.360	0.346
#1	**3**	**Time of Concentration:**					**0.479**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.12	33.00	2,939.00	1.050	0.777
		8. Large gullies, diversions, and low flowing streams	2.59	102.00	3,941.00	4.820	0.227
#2	**1**	**Time of Concentration:**					**1.004**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	6.18	50.00	809.00	2.480	0.090
		8. Large gullies, diversions, and low flowing streams	2.21	105.00	4,746.00	4.460	0.295
#2	**2**	**Time of Concentration:**					**0.385**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	4.42	82.00	1,857.00	2.100	0.245
		8. Large gullies, diversions, and low flowing streams	2.98	178.00	5,969.00	5.180	0.320
#3	**1**	**Time of Concentration:**					**0.565**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	3.69	50.00	1,356.00	1.920	0.196

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.66	90.00	5,419.00	3.860	0.389
#3	**2**	**Time of Concentration:**					**0.585**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.62	120.00	2,595.00	2.150	0.335
		8. Large gullies, diversions, and low flowing streams	4.01	120.00	2,994.00	6.000	0.138
#3	**3**	**Time of Concentration:**					**0.473**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	23.01	110.00	478.00	4.790	0.027
		8. Large gullies, diversions, and low flowing streams	1.36	38.00	2,801.00	3.490	0.222
#3	**4**	**Time of Concentration:**					**0.249**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	4.59	35.00	763.00	2.140	0.099
		8. Large gullies, diversions, and low flowing streams	3.24	158.00	4,869.00	5.400	0.250
#5	**1**	**Time of Concentration:**					**0.349**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	15.41	55.00	357.00	3.920	0.025
		8. Large gullies, diversions, and low flowing streams	6.97	115.00	1,650.00	7.920	0.057
#5	**2**	**Time of Concentration:**					**0.082**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	6.44	43.00	668.00	2.530	0.073
		8. Large gullies, diversions, and low flowing streams	2.29	51.00	2,225.00	4.540	0.136
#5	**3**	**Time of Concentration:**					**0.209**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	12.85	55.00	428.00	3.580	0.033
		8. Large gullies, diversions, and low flowing streams	2.70	191.00	7,069.00	4.930	0.398
#5	**4**	**Time of Concentration:**					**0.431**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	41.67	115.00	276.00	6.450	0.011
		8. Large gullies, diversions, and low flowing streams	3.54	201.00	5,680.00	5.640	0.279
#5	**5**	**Time of Concentration:**					**0.290**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	779.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	2.72	91.00	3,351.00	4.940	0.188
#5	**6**	**Time of Concentration:**					**0.308**
#5	7	5. Nearly bare and untilled, and alluvial valley fans	6.79	47.00	692.00	2.600	0.073
		8. Large gullies, diversions, and low flowing streams	1.53	13.00	852.00	3.700	0.063
#5	**7**	**Time of Concentration:**					**0.136**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	8	5. Nearly bare and untilled, and alluvial valley fans	22.82	115.00	504.00	4.770	0.029
		8. Large gullies, diversions, and low flowing streams	4.01	108.00	2,693.00	6.000	0.124
#5	**8**	**Time of Concentration:**					**0.153**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	8.05	33.00	410.00	2.830	0.040
		8. Large gullies, diversions, and low flowing streams	3.87	106.00	2,738.00	5.900	0.128
#6	**1**	**Time of Concentration:**					**0.168**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	11.18	104.00	930.00	3.340	0.077
		8. Large gullies, diversions, and low flowing streams	4.86	99.00	2,035.00	6.610	0.085
#6	**2**	**Time of Concentration:**					**0.162**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	23.16	135.00	583.00	4.810	0.033
		8. Large gullies, diversions, and low flowing streams	2.56	186.00	7,279.00	4.790	0.422
#6	**3**	**Time of Concentration:**					**0.455**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.44	25.00	388.00	2.530	0.042
		8. Large gullies, diversions, and low flowing streams	2.70	146.00	5,416.00	4.920	0.305
#6	**4**	**Time of Concentration:**					**0.347**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	4.42	55.00	1,245.00	2.100	0.164
		8. Large gullies, diversions, and low flowing streams	1.91	100.00	5,238.00	4.140	0.351
#6	**5**	**Time of Concentration:**					**0.515**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	2.87	75.00	2,614.00	1.690	0.429
		8. Large gullies, diversions, and low flowing streams	1.96	115.00	5,879.00	4.190	0.389
#6	**6**	**Time of Concentration:**					**0.818**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	5.13	65.00	1,268.00	2.260	0.155
		8. Large gullies, diversions, and low flowing streams	1.88	112.00	5,943.00	4.110	0.401
#6	**7**	**Time of Concentration:**					**0.556**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	2.71	25.00	922.00	1.640	0.156
		8. Large gullies, diversions, and low flowing streams	2.50	112.00	4,479.00	4.740	0.262
#7	**1**	**Time of Concentration:**					**0.418**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	3.68	130.00	3,533.00	1.910	0.513

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.48	72.00	2,906.00	4.720	0.171
#7	**2**	**Time of Concentration:**					**0.684**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	1.87	81.00	4,340.13	1.360	0.886
		8. Large gullies, diversions, and low flowing streams	3.65	120.00	3,286.05	5.730	0.159
#7	**3**	**Time of Concentration:**					**1.045**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.83	20.00	522.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	3.29	160.00	4,861.00	5.440	0.248
#9	**1**	**Time of Concentration:**					**0.322**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.36	15.00	1,102.00	1.160	0.263
		8. Large gullies, diversions, and low flowing streams	4.84	160.00	3,303.00	6.600	0.139
#10	**1**	**Time of Concentration:**					**0.402**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	3.37	15.00	445.00	1.830	0.067
		8. Large gullies, diversions, and low flowing streams	3.33	176.00	5,291.00	5.470	0.268
#10	**2**	**Time of Concentration:**					**0.335**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	2.31	15.00	649.00	1.520	0.118
		8. Large gullies, diversions, and low flowing streams	3.19	203.00	6,373.00	5.350	0.330
#10	**3**	**Time of Concentration:**					**0.448**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	6.48	70.00	1,081.00	2.540	0.118
		8. Large gullies, diversions, and low flowing streams	2.59	83.00	3,204.00	4.820	0.184
#10	**4**	**Time of Concentration:**					**0.302**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	6.01	45.00	749.00	2.450	0.084
		8. Large gullies, diversions, and low flowing streams	2.56	181.00	7,074.00	4.790	0.410
#11	**1**	**Time of Concentration:**					**0.494**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	8.58	35.00	408.00	2.920	0.038
		8. Large gullies, diversions, and low flowing streams	2.74	182.00	6,650.10	4.960	0.372
#12	**1**	**Time of Concentration:**					**0.410**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.38	47.00	1,974.00	1.540	0.356
		8. Large gullies, diversions, and low flowing streams	3.06	62.00	2,024.00	5.250	0.107
#12	**2**	**Time of Concentration:**					**0.463**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	3	5. Nearly bare and untilled, and alluvial valley fans	7.91	55.00	695.00	2.810	0.068
		8. Large gullies, diversions, and low flowing streams	1.25	32.00	2,560.00	3.350	0.212
#12	**3**	**Time of Concentration:**					**0.280**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	4.04	55.00	1,363.00	2.000	0.189
		8. Large gullies, diversions, and low flowing streams	1.09	5.00	458.00	3.130	0.040
#12	**4**	**Time of Concentration:**					**0.229**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.63	85.00	2,341.01	1.900	0.342
		8. Large gullies, diversions, and low flowing streams	1.99	84.00	4,214.00	4.230	0.276
#13	**1**	**Time of Concentration:**					**0.618**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	10.44	55.00	527.00	3.230	0.045
		8. Large gullies, diversions, and low flowing streams	2.94	194.00	6,604.00	5.140	0.356
#13	**2**	**Time of Concentration:**					**0.401**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	1.79	83.00	4,633.00	4.010	0.320
#1	**1**	**Muskingum K:**					**0.320**
#1	2	8. Large gullies, diversions, and low flowing streams	1.79	83.00	4,633.00	4.010	0.320
#1	**2**	**Muskingum K:**					**0.320**
#3	1	8. Large gullies, diversions, and low flowing streams	1.41	20.00	1,419.00	3.560	0.110
#3	**1**	**Muskingum K:**					**0.110**
#3	2	8. Large gullies, diversions, and low flowing streams	2.22	68.00	3,067.00	4.460	0.191
#3	**2**	**Muskingum K:**					**0.191**
#3	3	8. Large gullies, diversions, and low flowing streams	2.22	68.00	3,067.00	4.460	0.191
#3	**3**	**Muskingum K:**					**0.191**
#5	1	8. Large gullies, diversions, and low flowing streams	1.53	64.00	4,186.00	3.700	0.314
#5	**1**	**Muskingum K:**					**0.314**
#5	2	8. Large gullies, diversions, and low flowing streams	1.97	156.00	7,900.00	4.210	0.521
#5	**2**	**Muskingum K:**					**0.521**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	3	8. Large gullies, diversions, and low flowing streams	1.21	30.00	2,480.00	3.290	0.209
#5	**3**	**Muskingum K:**					**0.209**
#5	4	8. Large gullies, diversions, and low flowing streams	0.84	12.00	1,432.00	2.740	0.145
#5	**4**	**Muskingum K:**					**0.145**
#5	5	8. Large gullies, diversions, and low flowing streams	1.21	30.00	2,480.00	3.290	0.209
#5	**5**	**Muskingum K:**					**0.209**
#5	7	8. Large gullies, diversions, and low flowing streams	0.84	12.00	1,432.15	2.740	0.145
#5	**7**	**Muskingum K:**					**0.145**
#5	8	8. Large gullies, diversions, and low flowing streams	1.53	64.00	4,186.00	3.700	0.314
#5	**8**	**Muskingum K:**					**0.314**
#6	1	8. Large gullies, diversions, and low flowing streams	1.91	273.00	14,327.00	4.140	0.961
#6	**1**	**Muskingum K:**					**0.961**
#6	2	8. Large gullies, diversions, and low flowing streams	1.91	273.00	14,327.00	4.140	0.961
#6	**2**	**Muskingum K:**					**0.961**
#6	3	8. Large gullies, diversions, and low flowing streams	1.62	116.00	7,170.00	3.810	0.522
#6	**3**	**Muskingum K:**					**0.522**
#6	4	8. Large gullies, diversions, and low flowing streams	1.62	116.00	7,170.00	3.810	0.522
#6	**4**	**Muskingum K:**					**0.522**
#6	5	8. Large gullies, diversions, and low flowing streams	1.11	17.00	1,530.00	3.160	0.134
#6	**5**	**Muskingum K:**					**0.134**
#6	6	8. Large gullies, diversions, and low flowing streams	1.11	17.00	1,530.00	3.160	0.134
#6	**6**	**Muskingum K:**					**0.134**
#7	1	8. Large gullies, diversions, and low flowing streams	2.59	106.00	4,093.00	4.820	0.235
#7	**1**	**Muskingum K:**					**0.235**
#7	2	8. Large gullies, diversions, and low flowing streams	2.59	106.00	4,093.00	4.820	0.235
#7	**2**	**Muskingum K:**					**0.235**
#10	1	8. Large gullies, diversions, and low flowing streams	1.62	73.00	4,495.07	3.820	0.326
#10	**1**	**Muskingum K:**					**0.326**
#10	2	8. Large gullies, diversions, and low flowing streams	1.83	47.00	2,573.00	4.050	0.176
#10	**2**	**Muskingum K:**					**0.176**
#12	1	8. Large gullies, diversions, and low flowing streams	0.94	10.00	1,064.00	2.900	0.101

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#12	**1**	**Muskingum K:**					**0.101**
#12	2	8. Large gullies, diversions, and low flowing streams	0.94	10.00	1,064.00	2.900	0.101
#12	**2**	**Muskingum K:**					**0.101**
#13	2	8. Large gullies, diversions, and low flowing streams	1.85	66.00	3,574.00	4.070	0.243
#13	**2**	**Muskingum K:**					**0.243**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	713.800	713.800	358.36	33.10	1,722.2	67,582	5.53	3.75
#6	1,250.500	1,964.300	667.85	85.11	3,654.5	56,483	3.18	2.15
#7	573.200	2,537.500	732.77	105.67	4,073.7	53,878	2.75	1.75
#10	551.100	551.100	192.35	21.98	980.4	53,800	2.18	1.62
#11	217.500	768.600	261.74	31.78	1,344.9	50,469	1.80	1.36
#1	373.300	373.300	134.11	16.20	598.8	44,970	1.48	1.10
#14	0.000	1,141.900	395.16	47.97	1,943.8	48,605	1.69	1.28
#12	467.400	1,609.300	511.13	69.95	2,608.3	43,920	1.64	1.26
#13	421.200	2,030.500	590.96	89.28	3,309.5	42,035	1.43	1.14
#2	348.700	2,379.200	640.42	100.66	3,617.2	40,430	1.68	1.36
#3	628.900	3,008.100	705.52	127.41	4,542.3	43,935	1.06	0.78
#4	0.000	5,545.600	1,436.82	233.08	8,616.0	45,624	1.68	1.22
#9	286.900	5,832.500	1,417.39	246.97	8,657.6	45,433	1.11	0.77

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	713.800	713.800	512.95	47.19	2,551.8	69,456	6.20	4.25
#6	1,250.500	1,964.300	969.37	122.54	455.9	33,367	0.79	0.51
#7	573.200	2,537.500	1,070.88	153.15	1,118.1	31,285	0.47	0.31
#10	551.100	551.100	286.43	32.14	1,508.1	56,419	2.84	2.12
#11	217.500	768.600	387.22	46.17	2,057.7	52,866	2.43	1.85
#1	373.300	373.300	196.36	23.33	906.0	47,101	2.00	1.50
#14	0.000	1,141.900	582.61	69.50	2,963.7	50,919	2.29	1.73
#12	467.400	1,609.300	747.93	100.77	3,951.7	46,147	2.18	1.67
#13	421.200	2,030.500	860.02	128.35	4,997.0	44,117	1.91	1.53
#2	348.700	2,379.200	937.47	145.43	5,466.5	42,313	2.21	1.78
#3	628.900	3,008.100	1,029.04	184.11	6,856.7	45,268	1.50	1.12
#4	0.000	5,545.600	2,093.35	337.27	7,974.8	37,244	1.14	0.86
#9	286.900	5,832.500	2,068.43	356.93	8,223.4	35,092	0.79	0.60

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	713.800	713.800	729.89	67.20	3,768.5	71,238	6.84	4.74
#6	1,250.500	1,964.300	1,404.93	176.12	8,197.2	60,100	4.14	2.85
#7	573.200	2,537.500	1,554.22	221.42	9,231.3	57,149	3.56	2.32
#10	551.100	551.100	422.67	46.80	2,305.9	58,998	3.52	2.64
#11	217.500	768.600	568.61	66.87	3,130.0	55,245	3.07	2.34
#1	373.300	373.300	285.75	33.55	1,365.9	49,304	2.55	1.91
#14	0.000	1,141.900	854.34	100.42	4,496.0	53,238	2.90	2.20
#12	467.400	1,609.300	1,088.84	144.85	5,959.6	48,362	2.72	2.09
#13	421.200	2,030.500	1,248.36	184.20	7,513.3	46,203	2.42	1.93
#2	348.700	2,379.200	1,366.20	209.69	8,226.7	44,200	2.75	2.21
#3	628.900	3,008.100	1,496.71	265.48	10,317.1	46,863	2.00	1.50
#4	0.000	5,545.600	3,044.53	486.90	19,548.4	48,667	2.53	1.88
#9	286.900	5,832.500	3,002.48	514.72	19,645.7	47,755	1.91	1.38

APPENDIX 7-B

BARBER WASH PRE-MINE HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

September-04

Barber Wash Pre-mine Hydrology and Sedimentology

The hydrology model and drainage subdivisions are presented on Exhibit 7-4C. The pre-mine channel alignment and profiles are presented on Exhibit 11-76F thru 11-76H.

AY/LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

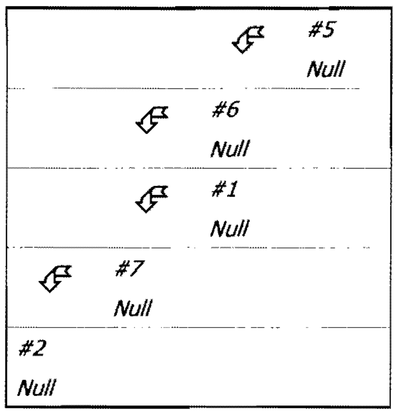
Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#7	0.000	0.000	Barber branch 1, S1
Null	#2	==>	End	0.000	0.000	Barber branch 1, S2
Null	#5	==>	#6	0.678	0.353	
Null	#6	==>	#7	0.000	0.000	
Null	#7	==>	#2	1.115	0.335	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#5	8. Large gullies, diversions, and low flowing streams	1.87	187.00	10,008.00	4.10	0.678
#5	**Muskingum K:**					**0.678**
#7	8. Large gullies, diversions, and low flowing streams	1.33	185.00	13,888.88	3.46	1.115
#7	**Muskingum K:**					**1.115**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	546.300	546.300	6.65	2.22	11.1	6,018	2.24	1.71
#6	677.700	1,224.000	59.59	12.46	165.7	19,253	0.42	0.27
#1	492.000	492.000	32.20	5.00	68.4	17,552	0.00	0.00
#7	0.000	1,716.000	90.24	17.46	234.1	18,532	0.29	0.19
#2	1,647.600	3,363.600	120.60	31.06	447.0	23,314	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	63.714%
0.0020	41.227%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.937%
0.0020	96.429%
0.0010	0.000%

Structure #1 (Barber branch 1, S1):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.540%

Size (mm)	In/Out
0.0020	97.473%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	546.300	2.139	0.000	0.000	81.800	M	6.65	2.224
	Σ	**546.300**						**6.65**	**2.224**
#6	1	677.700	1.018	0.000	0.000	89.400	M	59.52	10.233
	Σ	**1,224.000**						**59.59**	**12.457**
#1	1	492.000	0.787	0.000	0.000	86.800	M	32.20	4.999
	Σ	**492.000**						**32.20**	**4.999**
#7	Σ	**1,716.000**						**90.24**	**17.455**
#2	1	506.200	0.749	0.473	0.336	87.900	M	41.93	6.108
	2	383.000	0.948	0.697	0.338	79.700	M	4.16	0.950
	3	399.200	1.072	0.697	0.338	78.200	M	2.48	0.645
	4	97.800	0.364	0.473	0.336	86.900	M	10.40	1.010
	5	261.400	0.579	0.000	0.000	90.900	M	42.17	4.895
	Σ	**3,363.600**						**120.60**	**31.063**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.159	300.00	2.70	0.3580	1.0000	3	11.1	6,018	2.24	1.71
	Σ							**11.1**	**6,018**	**2.24**	**1.71**
#6	1	0.209	200.00	3.80	0.3910	1.0000	1	155.2	19,272	0.00	0.00
	Σ							**165.7**	**19,253**	**0.42**	**0.27**
#1	1	0.191	200.00	3.90	0.3880	1.0000	1	68.4	17,552	0.00	0.00
	Σ							**68.4**	**17,552**	**0.00**	**0.00**
#7	Σ							**234.1**	**18,532**	**0.29**	**0.19**
#2	1	0.186	150.00	7.19	0.3000	1.0000	1	126.6	26,447	0.00	0.00
	2	0.157	175.00	5.00	0.3820	1.0000	3	10.1	12,665	6.08	4.67
	3	0.151	300.00	2.45	0.3930	1.0000	3	3.1	5,520	2.92	2.30
	4	0.177	75.00	13.90	0.2560	1.0000	1	29.8	39,363	0.00	0.00
	5	0.190	125.00	9.00	0.1940	1.0000	1	90.1	24,359	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							447.0	23,314	0.00	0.00

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.65	45.00	1,698.00	1.620	0.291
		8. Large gullies, diversions, and low flowing streams	2.03	155.00	7,633.00	4.270	0.496
#1	**1**	**Time of Concentration:**					**0.787**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.37	40.00	916.00	2.080	0.122
		8. Large gullies, diversions, and low flowing streams	1.74	155.00	8,920.00	3.950	0.627
#2	**1**	**Time of Concentration:**					**0.749**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.55	102.00	2,872.00	1.880	0.424
		8. Large gullies, diversions, and low flowing streams	1.67	122.00	7,308.00	3.870	0.524
#2	**2**	**Time of Concentration:**					**0.948**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	3.55	122.00	3,440.00	1.880	0.508
		8. Large gullies, diversions, and low flowing streams	1.50	112.00	7,452.00	3.670	0.564
#2	**3**	**Time of Concentration:**					**1.072**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	3.83	45.00	1,176.00	1.950	0.167
		8. Large gullies, diversions, and low flowing streams	1.28	31.00	2,416.00	3.390	0.197
#2	**4**	**Time of Concentration:**					**0.364**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	5.87	56.00	954.00	2.420	0.109
		8. Large gullies, diversions, and low flowing streams	1.30	75.00	5,772.00	3.410	0.470
#2	**5**	**Time of Concentration:**					**0.579**
#5	1	8. Large gullies, diversions, and low flowing streams	1.28	45.00	3,519.00	3.390	0.288
		5. Nearly bare and untilled, and alluvial valley fans	1.62	137.00	8,464.00	1.270	1.851
#5	**1**	**Time of Concentration:**					**2.139**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	3.04	90.00	2,962.00	1.740	0.472
		8. Large gullies, diversions, and low flowing streams	1.99	165.00	8,308.00	4.220	0.546

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	**1**	**Time of Concentration:**					**1.018**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	8. Large gullies, diversions, and low flowing streams	1.35	80.00	5,933.00	3.480	0.473
#2	**1**	**Muskingum K:**					**0.473**
#2	2	8. Large gullies, diversions, and low flowing streams	1.40	125.00	8,915.00	3.550	0.697
#2	**2**	**Muskingum K:**					**0.697**
#2	3	8. Large gullies, diversions, and low flowing streams	1.40	125.00	8,915.00	3.550	0.697
#2	**3**	**Muskingum K:**					**0.697**
#2	4	8. Large gullies, diversions, and low flowing streams	1.35	80.00	5,933.00	3.480	0.473
#2	**4**	**Muskingum K:**					**0.473**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	546.300	546.300	35.85	10.81	69.2	7,872	3.23	2.42
#6	677.700	1,224.000	176.28	39.18	561.7	22,504	0.79	0.46
#1	492.000	492.000	115.29	16.16	269.6	21,568	0.00	0.00
#7	0.000	1,716.000	284.66	55.34	831.3	21,916	0.52	0.33
#2	1,647.600	3,363.600	404.08	100.74	1,672.0	27,241	0.36	0.21

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	546.300	546.300	61.47	17.97	124.4	8,570	3.68	2.74
#6	677.700	1,224.000	260.69	59.13	872.9	23,679	0.97	0.56
#1	492.000	492.000	178.78	24.44	434.6	22,986	0.00	0.00
#7	0.000	1,716.000	427.91	83.57	1,307.5	23,157	0.63	0.39
#2	1,647.600	3,363.600	621.73	153.52	2,674.9	28,540	0.77	0.44

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	546.300	546.300	102.19	29.12	216.6	9,259	4.14	3.06
#6	677.700	1,224.000	383.05	88.65	1,347.5	24,832	1.16	0.65
#1	492.000	492.000	272.80	36.66	691.0	24,319	0.00	0.00
#7	0.000	1,716.000	639.12	125.30	2,038.4	24,417	0.76	0.46
#2	1,647.600	3,363.600	949.46	232.22	4,239.9	29,848	1.24	0.71

APPENDIX 7-C

NECK ARROYO PRE-MINE HYDROLOGY AND SEDIMENTOLOGY SEDCAD+ FILES. 2-Yr., 6-Hr.; 10-Yr., 6-Hr.; 25-Yr., 6-Hr.; and 100-Yr., 6-Hr.

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*    File Currently Being Printed:       b:neck2                          *
*                                                                         *
***************************************************************************

************************ WATERSHED IDENTIFICATION *************************
*                                                                         *
* Premining Peak Flows for Neck Arroyo - 2 year 6 hour                    *
*                                                                         *
***************************************************************************

****************************** STORM INPUT ********************************
*                                                                         *
*                Storm Type          SCS TYPE 2                           *
*                Rainfall Depth       0.8 inches                          *
*                Storm Duration       6.0 hours                           *
*                                                                         *
***************************************************************************
```

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5

Submerged Bulk Specific Gravity = 1.25

		PERCENT FINER DISTRIBUTIONS:			
NO.	PARTICLE SIZE, (mm)	NO. 1	NO. 2	NO. 3	NO. 4
1	2.0000	100.00	100.00	100.00	100.00
2	0.1000	83.50	75.90	30.00	26.30
3	0.0500	77.00	70.00	17.00	14.00
4	0.0020	56.00	47.00	11.00	11.00
5	0.0010	0.00	0.00	0.00	0.00

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.673	0.673	0.348

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JUNCTION 1 , BRANCH 1 , STRUCTURE 1
NULL STRUCTURE
J1 B1 S1

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	251.61	81.99	0.741	0.049	0.049	0.367	MED
2	35.40	89.00	0.357	0.172	0.172	0.361	MED
3	153.35	89.00	0.544	0.049	0.049	0.367	MED
4	97.34	89.00	0.193	0.000	0.000	0.000	MED
5	89.99	84.00	0.151	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.32	800.0	5.0	0.450	1	(MUSLE)
2	1	0.37	200.0	10.0	0.450	1	(MUSLE)
3	1	0.37	400.0	10.0	0.450	1	(MUSLE)
4	1	0.37	400.0	10.0	0.450	1	(MUSLE)
5	1	0.32	400.0	10.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	4.668	0.048	49.24	0.001
2	11.717	0.166	133.51	0.001
3	16.490	0.166	317.33	0.001
4	17.805	0.166	256.81	0.002
5	6.153	0.072	73.70	0.002

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RESULTS TO J1 B1 S1

Total Drainage Area to This Point = 677.686 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	6.194	43.144	154658.00	5.955	530.57

		AVERAGE SETTLEABLE CONCENTRATION:			
	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.40	3.62	3.62	2.05	0.55

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JUNCTION 1 , BRANCH 1 , STRUCTURE 2
NULL STRUCTURE
J1 B1 S2

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	359.96	89.00	0.602	0.233	0.233	0.337	MED
2	168.04	84.00	0.427	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.36	800.0	15.0	0.450	1	(MUSLE)
2	1	0.32	600.0	16.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	36.472	0.166	2637.74	0.001
2	6.828	0.072	352.21	0.001

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RESULTS TO J1 B1 S2

Total Drainage Area to This Point = 1205.693 acres

Drainage Area Between Previous Structure and This One = 528.007 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	12.175	71.833	354957.31	2.965	3820.08

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.30	1.74	1.74	1.10	0.29

*** RUN COMPLETED ***

SEDCAD+(TM)
Sediment, Erosion, Discharge by Computer Aided Design

by

Pamela J. Schwab
Civil Software Design
P.O. Box 11092
Lexington, Kentucky 40572

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WATERSHED IDENTIFICATION

Premining Peak Flows for Neck Arroyo - 10 year 6 hour

STORM INPUT

Storm Type	SCS TYPE 2
Rainfall Depth	1.3 inches
Storm Duration	6.0 hours

<<< SEDCAD+ >>>

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WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2

SEDIMENTOLOGY INPUTS

Specific Gravity = 1.3

Submerged Bulk Specific Gravity = 1.25

NO.	PARTICLE SIZE, (mm)	PERCENT FINER DISTRIBUTIONS: NO. 1	NO. 2	NO. 3	NO. 4
1	2.0000	100.00	100.00	100.00	100.00
2	0.1000	83.50	75.90	30.00	26.50
3	0.0500	77.00	70.00	17.00	14.00
4	0.0020	56.00	47.00	11.00	11.00
5	0.0010	0.00	0.00	0.00	0.00

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.673	0.673	0.343

<<< SEDCAD+ >>>
--- Applied Hydrology Associates ---

JUNCTION 1 , BRANCH 1 , STRUCTURE 1
NULL STRUCTURE
J1 B1 S1

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	ROUTING COEF'S X	UNIT HYDRO RESPONSE
1	251.61	81.99	0.741	0.049	0.049	0.367	MED
2	85.40	89.00	0.357	0.172	0.172	0.361	MED
3	153.35	89.00	0.544	0.049	0.049	0.367	MED
4	97.34	89.00	0.193	0.000	0.000	0.000	MED
5	89.99	84.00	0.151	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.32	800.0	5.0	0.450	1	(MUSLE)
2	1	0.37	200.0	10.0	0.450	1	(MUSLE)
3	1	0.37	400.0	10.0	0.450	1	(MUSLE)
4	1	0.37	400.0	10.0	0.450	1	(MUSLE)
5	1	0.32	400.0	10.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	31.179	0.237	348.00	0.001
2	36.619	0.477	457.08	0.002
3	52.918	0.477	1102.60	0.001
4	53.993	0.477	864.49	0.002
5	31.382	0.294	402.34	0.002

<<< SEDCAD+ >>>
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RESULTS TO J1 B1 S1

Total Drainage Area to This Point = 677.686 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	20.547	161.763	176663.41	12.538	3174.48

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	AVERAGE SETTLEABLE CONCENTRATION: VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.50	7.63	7.63	4.04	1.10

<<< SEDCAD+ >>>
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JUNCTION 1 , BRANCH 1 , STRUCTURE 2
NULL STRUCTURE
J1 B1 S2

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	ROUTING COEF'S X	UNIT HYDRO RESPONSE
1	359.96	89.00	0.602	0.233	0.233	0.337	MED
2	158.04	84.00	0.427	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.36	800.0	15.0	0.450	1	(MUSLE)
2	1	0.32	600.0	16.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	117.129	0.477	9169.08	0.001
2	37.674	0.294	2009.29	0.001

<<< SEDCAD+ >>>
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RESULTS TO J1 B1 S2

Total Drainage Area to This Point = 1205.693 acres
Drainage Area Between Previous Structure and This One = 525.007 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	33.074	247.374	426430.31	14.660	14351.13

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	AVERAGE SETTLEABLE CONCENTRATION: VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.50	8.22	8.22	4.97	1.35

*** RUN COMPLETED ***

SEDCAD+(TM)
Sediment, Erosion, Discharge by Computer Aided Design

by

Pamela J. Schwab
Civil Software Design
P.O. Box 11092
Lexington, Kentucky 40572

Version No. 2.15 (6/20/88)

SEDCAD+(TM) Serial No. 101 has been Authorized and Released to:

Applied Hydrology Associates
1325 S. Colorado Blvd.
Denver, CO 80222
(303) 782-0164

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Current Date and Time:	01-05-1988 17:19:13
Computed Date and Time:	01-05-1988 17:13:31
File Created By:	Pam Tarquin
File Currently Being Printed:	b:neck25

WATERSHED IDENTIFICATION

Premining Peak Flows for Neck Arroyo - 25 year 6 hour

STORM INPUT

Storm Type	SCS TYPE 2
Rainfall Depth	1.6 inches
Storm Duration	6.0 hours

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5

Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1	NO. 2	NO. 3	NO. 4
1	2.0000	100.00	100.00	100.00	100.00
2	0.1000	83.50	75.90	30.00	26.50
3	0.0500	77.00	70.00	17.00	14.00
4	0.0020	56.00	47.00	11.00	11.00
5	0.0010	0.00	0.00	0.00	0.00

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.673	0.673	0.348

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--- Applied Hydrology Associates ---

JUNCTION 1 , BRANCH 1 , STRUCTURE 1
NULL STRUCTURE
J1 B1 S1

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	251.61	81.99	0.741	0.049	0.049	0.367	MED
2	85.40	89.00	0.357	0.172	0.172	0.361	MED
3	153.35	89.00	0.544	0.049	0.049	0.367	MED
4	97.34	89.00	0.193	0.000	0.000	0.000	MED
5	89.99	84.00	0.151	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.32	200.0	5.0	0.450	1	(MUSLE)
2	1	0.37	200.0	10.0	0.450	1	(MUSLE)
3	1	0.37	400.0	10.0	0.450	1	(MUSLE)
4	1	0.37	400.0	10.0	0.450	1	(MUSLE)
5	1	0.32	400.0	10.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	54.743	0.390	629.59	0.001
2	53.950	0.692	698.95	0.002
3	78.199	0.692	1688.93	0.001
4	78.423	0.692	1311.46	0.002
5	50.753	0.463	679.76	0.002

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

RESULTS TO J1 B1 S1

Total Drainage Area to This Point = 677.686 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	31.016	256.658	1[illegible]1642.70	14.927	5008.61

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.70	9.25	9.25	4.70	1.31

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

JUNCTION 1 , BRANCH 1 , STRUCTURE 2

NULL STRUCTURE

J1 B1 S2

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	ROUTING COEF'S X	UNIT HYDRO RESPONSE
1	359.96	89.00	0.602	0.233	0.233	0.337	MED
2	168.04	84.00	0.427	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.36	800.0	15.0	0.450	1	(MUSLE)
2	1	0.32	600.0	16.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 mm)
1	173.463	0.692	14062.02	0.001
2	62.329	0.463	3438.01	0.001

<<< SEDCAD+ >>>

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RESULTS TO J1 B1 S2

Total Drainage Area to This Point = 1205.693 acres

Drainage Area Between Previous Structure and This One = 529.007 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	38.247	302.493	445158.00	20.767	22506.06

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.70	11.64	11.64	6.79	1.90

*** RUN COMPLETED ***

SEDCAD+(TM)
Sediment, Erosion, Discharge by Computer Aided Design

by

Pamela J. Schwab
Civil Software Design
P.O. Box 11092
Lexington, Kentucky 40572

Version No. 2.15 (6/20/88)

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Applied Hydrology Associates
1325 S. Colorado Blvd.
Denver, CO 80222
(303) 782-0164

Current Date and Time:	01-05-1988 17:20:25
Computed Date and Time:	01-05-1988 17:13:56
File Created By:	Pam Tarquin
File Currently Being Printed:	b:neck100

WATERSHED IDENTIFICATION

Premining Peak Flows for Neck Arroyo - 100 year 6 hour

STORM INPUT

Storm Type	SCS TYPE 2
Rainfall Depth	2.0 inches
Storm Duration	6.0 hours

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

WATERSHED NETWORK

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1
		2

SEDIMENTOLOGY INPUTS

Specific Gravity = 2.5

Submerged Bulk Specific Gravity = 1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1	NO. 2	NO. 3	NO. 4
1	2.0000	100.00	100.00	100.00	100.00
2	0.1000	83.50	75.90	30.00	26.50
3	0.0500	77.00	70.00	17.00	14.00
4	0.0020	56.00	47.00	14.00	11.00
5	0.0010	0.00	0.00	0.00	0.00

BETWEEN STRUCTURE ROUTING PARAMETERS

J	B		TRAVEL TIME (hours)	MUSK. K (hours)	MUSK. X
1	1	Prior J or S to Structure 1	0.000	0.000	0.000
1	1	Prior J or S to Structure 2	0.673	0.673	0.348

<<< SEDCAD+ >>>
--- Applied Hydrology Associates ---

JUNCTION 1 , BRANCH 1 , STRUCTURE 1
NULL STRUCTURE
J1 B1 S1

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	251.61	81.99	0.741	0.049	0.049	0.367	MED
2	85.40	89.00	0.357	0.172	0.172	0.361	MED
3	153.35	89.00	0.544	0.049	0.049	0.367	MED
4	97.34	89.00	0.193	0.000	0.000	0.000	MED
5	89.99	84.00	0.151	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.32	800.0	5.0	0.450	1	(MUSLE)
2	1	0.37	200.0	10.0	0.450	1	(MUSLE)
3	1	0.37	400.0	10.0	0.450	1	(MUSLE)
4	1	0.37	400.0	10.0	0.450	1	(MUSLE)
5	1	0.32	400.0	10.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	93.496	0.635	1116.66	0.001
2	79.854	1.011	1077.17	0.002
3	116.454	1.011	2611.74	0.002
4	114.193	1.011	2002.68	0.002
5	80.852	0.730	1137.96	0.002

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

RESULTS TO J1 B1 S1

Total Drainage Area to This Point = 677.686 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	47.117	401.347	182306.00	16.908	7946.06

AVERAGE SETTLEABLE CONCENTRATION:

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	7.00	10.83	10.83	5.30	1.55

<<< SEDCAD+ >>>
--- Applied Hydrology Associates ---

JUNCTION 1 , BRANCH 1 , STRUCTURE 2
NULL STRUCTURE
J1 B1 S2

SUBWATERSHED INFORMATION

HYDRAULIC INPUT VALUES

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING COEF'S K-(hr)	X	UNIT HYDRO RESPONSE
1	359.96	89.00	0.602	0.233	0.233	0.337	MED
2	163.04	84.00	0.427	0.000	0.000	0.000	MED

SEDIMENT INPUT VALUES

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT	
1	1	0.36	800.0	15.0	0.450	1	(MUSLE)
2	1	0.32	600.0	16.0	0.450	1	(MUSLE)

COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	257.944	1.011	21727.51	0.001
2	101.028	0.730	5811.84	0.002

<<< SEDCAD+ >>>

--- Applied Hydrology Associates ---

RESULTS TO J1 B1 S2

Total Drainage Area to This Point = 1205.693 acres

Drainage Area Between Previous Structure and This One = 528.007 acres

	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (ml/l)	SEDIMENT YIELD (tons)
IN/OUT	87.675	598.777	443232.50	25.621	35481.36

	TIME OF SIGNIFICANT CONCENTRATION (hrs)	AVERAGE SETTLEABLE CONCENTRATION: VOLUME WEIGHTED DURING TIME OF SIGN. CONC. (ml/l)	VOLUME WEIGHTED DURING PEAK 24 HOUR (ml/l)	ARITHMETIC DURING TIME OF SIGN. CONC. (ml/l)	ARITHMETIC DURING PEAK 24 HOUR (ml/l)
IN/OUT	6.90	15.03	15.03	3.59	2.47

*** RUN COMPLETED ***

APPENDIX 7-D

LOWE ARROYO PRE-MINING HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

MAY 2001

Lowe Arroyo Pre-mining Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 7-4.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

Lowe Arroyo Pre-mine Hydrology and Sedimentology

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

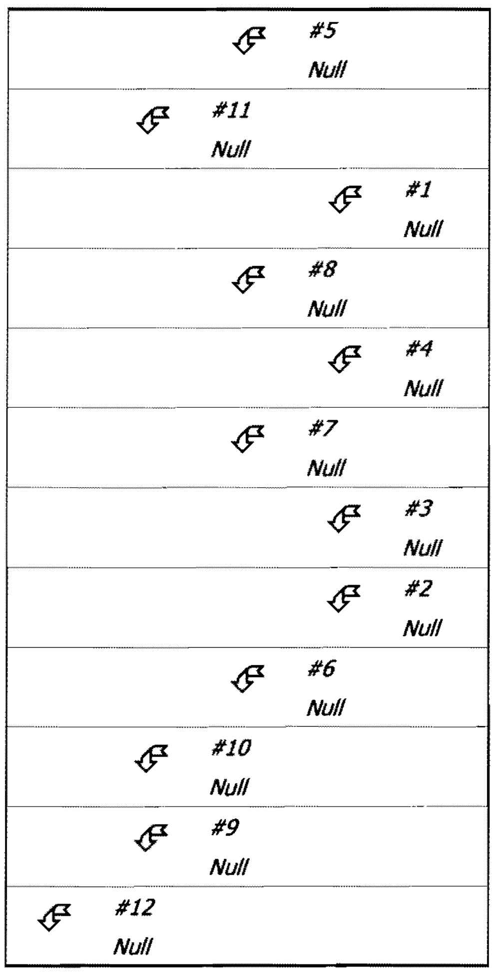
Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#8	0.419	0.337	
Null	#2	==>	#6	0.434	0.325	
Null	#3	==>	#6	0.396	0.322	
Null	#4	==>	#7	0.517	0.328	
Null	#5	==>	#11	5.868	0.239	
Null	#6	==>	#10	0.469	0.325	
Null	#7	==>	#10	0.469	0.325	
Null	#8	==>	#10	0.274	0.337	
Null	#9	==>	#12	0.000	0.000	
Null	#10	==>	#12	0.000	0.000	
Null	#11	==>	#12	0.000	0.000	
Null	#12	==>	#13	1.302	0.306	
Null	#13	==>	End	0.000	0.000	



#13
Null

Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	1.38	73.00	5,307.00	3.51	0.419
#1	**Muskingum K:**					**0.419**
#2	8. Large gullies, diversions, and low flowing streams	1.11	55.00	4,948.00	3.16	0.434
#2	**Muskingum K:**					**0.434**
#3	8. Large gullies, diversions, and low flowing streams	1.05	46.00	4,378.00	3.07	0.396
#3	**Muskingum K:**					**0.396**
#4	8. Large gullies, diversions, and low flowing streams	1.16	70.00	6,012.00	3.23	0.517
#4	**Muskingum K:**					**0.517**
#5	5. Nearly bare and untilled, and alluvial valley fans	0.33	38.00	11,449.23	0.57	5.579
	8. Large gullies, diversions, and low flowing streams	1.92	83.00	4,330.00	4.15	0.289
#5	**Muskingum K:**					**5.868**
#6	8. Large gullies, diversions, and low flowing streams	1.12	60.00	5,360.01	3.17	0.469
#6	**Muskingum K:**					**0.469**
#7	8. Large gullies, diversions, and low flowing streams	1.12	60.00	5,360.00	3.17	0.469
#7	**Muskingum K:**					**0.469**
#8	8. Large gullies, diversions, and low flowing streams	1.38	48.00	3,479.00	3.52	0.274
#8	**Muskingum K:**					**0.274**
#12	8. Large gullies, diversions, and low flowing streams	0.81	102.00	12,617.00	2.69	1.302
#12	**Muskingum K:**					**1.302**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	386.400	386.400	55.42	11.29	75.7	9,732	1.93	1.25
#11	1,459.300	1,845.700	128.96	55.22	246.0	9,727	3.67	1.59
#1	384.000	384.000	56.15	9.43	121.9	30,006	4.92	1.94
#8	224.900	608.900	96.48	15.66	166.0	20,180	5.50	2.62
#4	1,417.400	1,417.400	289.92	52.21	965.8	30,956	2.37	1.28
#7	669.200	2,086.600	382.04	73.97	1,131.9	25,049	3.17	1.75
#3	825.600	825.600	223.61	31.54	681.9	31,071	3.50	2.18
#2	798.200	798.200	100.05	19.62	290.5	33,737	2.28	0.91
#6	131.700	1,755.500	302.76	53.94	1,001.0	29,377	3.32	1.89
#10	208.400	4,659.400	735.39	154.05	2,430.9	25,143	3.12	1.77
#9	541.300	541.300	241.08	28.26	1,005.3	46,299	1.49	1.03
#12	0.000	7,046.400	925.58	237.53	3,682.2	33,793	3.91	1.63
#13	808.700	7,855.101	918.77	272.46	3,951.1	27,433	1.49	0.73

Particle Size Distribution(s) at Each Structure

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.533%
0.0500	78.288%
0.0020	71.252%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	85.499%
0.0500	58.887%
0.0020	45.248%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.042%
0.0500	88.202%
0.0020	68.787%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	87.022%
0.0500	73.709%

Size (mm)	In/Out
0.0020	56.300%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.885%
0.0500	96.065%
0.0020	83.357%
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	95.283%
0.0500	89.950%
0.0020	76.975%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.357%
0.0500	94.288%
0.0020	75.564%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.590%
0.0020	84.027%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.610%
0.0500	93.451%
0.0020	76.441%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.025%
0.0500	90.920%
0.0020	76.457%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	90.954%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.407%
0.0500	91.259%
0.0020	78.330%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%

Size (mm)	In/Out
0.0500	98.743%
0.0020	86.239%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	87.500	0.590	1.287	0.200	91.500	M	39.54	4.431
	2	298.900	1.434	0.000	0.000	83.200	M	31.04	6.861
	Σ	**386.400**						**55.42**	**11.292**
#11	1	412.100	2.888	0.734	0.325	84.300	M	28.67	10.590
	2	221.700	1.474	0.639	0.330	88.400	M	39.74	8.464
	3	446.000	1.668	0.377	0.347	84.900	M	50.35	12.171
	4	379.500	1.000	0.000	0.000	87.000	M	77.60	12.702
	Σ	**1,845.700**						**128.96**	**55.219**
#1	1	293.800	1.413	0.000	0.000	81.200	M	24.10	5.441
	2	90.200	0.263	0.000	0.000	90.000	M	51.85	3.989
	Σ	**384.000**						**56.15**	**9.430**
#8	1	87.100	0.557	0.211	0.323	83.200	M	16.90	1.999
	2	120.200	0.725	0.000	0.000	86.100	M	27.54	3.690
	3	17.600	0.228	0.673	0.330	86.100	M	7.47	0.540
	Σ	**608.900**						**96.48**	**15.660**
#4	1	470.600	1.256	0.387	0.350	87.000	M	82.04	15.752
	2	166.700	1.396	0.534	0.354	81.100	M	13.62	3.053
	3	66.500	0.818	0.534	0.354	82.600	M	9.45	1.433
	4	96.300	0.766	0.389	0.341	90.200	M	32.64	4.337
	5	54.100	0.199	0.389	0.341	93.000	M	43.64	3.132
	6	112.200	0.398	0.332	0.342	92.700	M	70.13	6.324
	7	56.900	0.238	0.183	0.333	93.000	M	44.03	3.294
	8	89.500	0.413	0.183	0.333	91.900	M	51.12	4.697
	9	226.200	0.610	0.000	0.000	87.500	M	67.31	7.938
	10	78.400	0.397	0.000	0.000	85.400	M	24.03	2.248
	Σ	**1,417.400**						**289.92**	**52.207**
#7	1	388.800	1.318	0.089	0.330	86.100	M	59.50	11.937
	2	207.300	1.094	0.089	0.330	86.900	M	39.43	6.873
	3	73.100	0.360	0.000	0.000	89.000	M	33.71	2.950
	Σ	**2,086.600**						**382.04**	**73.967**
#3	1	256.900	2.055	0.510	0.336	83.500	M	21.18	6.084
	2	138.800	0.315	0.510	0.336	89.900	M	74.01	6.083
	3	54.800	0.221	0.510	0.336	93.000	M	43.24	3.172
	4	98.200	0.277	0.176	0.362	89.900	M	54.97	4.303

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	5	111.900	0.466	0.176	0.362	92.700	M	64.83	6.307
	6	37.900	0.159	0.418	0.309	93.000	M	32.25	2.194
	7	127.100	0.386	0.000	0.000	84.700	M	36.63	3.400
	Σ	**825.600**						**223.61**	**31.542**
#2	1	549.100	2.696	0.436	0.369	80.300	M	25.37	9.187
	2	191.400	0.472	0.000	0.000	88.300	M	71.94	7.240
	3	57.700	0.205	0.000	0.000	92.500	M	44.34	3.195
	Σ	**798.200**						**100.05**	**19.621**
#6	1	131.700	0.434	0.000	0.000	82.400	M	27.02	2.779
	Σ	**1,755.500**						**302.76**	**53.942**
#10	1	179.300	0.676	0.000	0.000	91.200	M	72.49	8.838
	2	29.100	0.311	0.000	0.000	92.700	M	20.09	1.640
	Σ	**4,659.400**						**735.39**	**154.046**
#9	1	274.600	0.559	0.179	0.345	90.600	M	117.31	12.823
	2	266.700	0.484	0.000	0.000	93.000	M	155.83	15.438
	Σ	**541.300**						**241.08**	**28.260**
#12	Σ	**7,046.400**						**925.58**	**237.526**
#13	1	130.600	0.245	1.141	0.305	91.800	M	90.42	6.793
	2	101.000	0.160	1.048	0.302	92.300	M	81.48	5.493
	3	133.900	0.165	0.948	0.300	90.500	M	93.64	6.196
	4	443.200	1.345	0.000	0.000	88.100	M	82.41	16.454
	Σ	**7,855.101**						**918.77**	**272.463**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.198	300.00	2.62	0.3180	1.0000	3	47.7	13,650	0.17	0.12
	2	0.171	400.00	1.47	0.3320	1.0000	2	31.5	5,755	2.75	2.02
	Σ							**75.7**	**9,732**	**1.93**	**1.25**
#11	1	0.198	400.00	0.90	0.3290	1.0000	2	29.7	3,451	1.30	0.97
	2	0.190	400.00	0.82	0.3130	1.0000	2	26.7	3,966	2.00	1.47
	3	0.231	400.00	0.67	0.3450	1.0000	2	43.2	4,428	2.07	1.53
	4	0.200	400.00	1.96	0.3340	1.0000	2	112.1	11,292	6.09	4.38

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**246.0**	**9,727**	**3.67**	**1.59**
#1	1	0.146	300.00	2.28	0.3430	1.0000	2	28.5	6,517	3.04	2.25
	2	0.181	175.00	4.95	0.3390	1.0000	3	93.4	31,853	2.29	1.53
	Σ							**121.9**	**30,006**	**4.92**	**1.94**
#8	1	0.118	300.00	2.87	0.3400	1.0000	2	13.1	8,707	4.98	3.46
	2	0.141	200.00	3.15	0.3220	1.0000	2	26.6	9,408	5.31	3.74
	3	0.141	200.00	3.15	0.3220	1.0000	2	4.4	10,851	6.87	4.66
	Σ							**166.0**	**20,180**	**5.50**	**2.62**
#4	1	0.185	200.00	3.05	0.2970	1.0000	3	129.7	10,379	0.00	0.00
	2	0.184	300.00	2.66	0.3150	1.0000	2	19.9	8,104	3.79	2.81
	3	0.217	200.00	3.33	0.2980	1.0000	2	12.9	11,500	6.17	4.44
	4	0.207	150.00	6.22	0.3420	1.0000	3	100.3	29,619	0.00	0.00
	5	0.209	150.00	6.14	0.3920	1.0000	3	112.4	46,980	4.60	3.18
	6	0.205	150.00	7.39	0.3680	1.0000	3	238.9	49,209	2.86	1.99
	7	0.210	175.00	5.44	0.3990	1.0000	3	114.4	45,465	4.14	2.85
	8	0.198	175.00	4.66	0.3870	1.0000	3	119.8	33,648	1.70	1.18
	9	0.172	200.00	3.03	0.3630	1.0000	3	89.4	14,879	0.00	0.00
	10	0.176	200.00	3.36	0.3680	1.0000	2	28.3	17,238	10.44	6.97
	Σ							**965.8**	**30,956**	**2.37**	**1.28**
#7	1	0.180	300.00	2.29	0.3130	1.0000	2	82.9	8,738	4.41	3.23
	2	0.192	400.00	1.80	0.3380	1.0000	2	49.1	9,074	4.81	3.48
	3	0.185	200.00	3.64	0.2810	1.0000	3	34.4	15,848	0.72	0.48
	Σ							**1,131.9**	**25,049**	**3.17**	**1.75**
#3	1	0.215	300.00	2.93	0.3350	1.0000	2	50.9	10,327	4.42	3.30
	2	0.202	175.00	4.54	0.3220	1.0000	3	141.1	30,697	1.85	1.27
	3	0.208	175.00	5.72	0.3740	1.0000	3	108.0	44,184	4.17	2.90
	4	0.180	175.00	5.53	0.3450	1.0000	3	113.3	35,491	2.43	1.64
	5	0.205	175.00	4.67	0.3930	1.0000	3	170.1	35,379	1.59	1.11
	6	0.210	150.00	6.04	0.3990	1.0000	3	78.3	45,725	5.28	3.67
	7	0.100	300.00	2.77	0.3090	1.0000	2	20.4	8,293	5.02	3.33
	Σ							**681.9**	**31,071**	**3.50**	**2.18**
#2	1	0.150	400.00	1.06	0.3310	1.0000	2	22.2	2,954	1.07	0.81
	2	0.175	175.00	5.69	0.3280	1.0000	3	167.3	30,892	0.52	0.36
	3	0.201	175.00	5.48	0.3730	1.0000	3	101.7	42,684	4.04	2.74
	Σ							**290.5**	**33,737**	**2.28**	**0.91**
#6	1	0.155	200.00	3.21	0.3700	1.0000	2	28.8	14,163	8.32	5.59

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**1,001.0**	**29,377**	**3.32**	**1.89**
#10	1	0.189	175.00	4.10	0.2370	1.0000	3	107.6	15,889	0.00	0.00
	2	0.190	150.00	6.90	0.2030	1.0000	3	26.7	21,813	1.64	1.11
	Σ							**2,430.9**	**25,143**	**3.12**	**1.77**
#9	1	0.186	175.00	5.87	0.3630	1.0000	3	367.2	37,441	0.46	0.32
	2	0.209	150.00	7.17	0.3850	1.0000	3	638.1	53,961	2.35	1.63
	Σ							**1,005.3**	**46,299**	**1.49**	**1.03**
#12	**Σ**							**3,682.2**	**33,793**	**3.91**	**1.63**
#13	1	0.194	150.00	7.45	0.2660	1.0000	3	197.6	37,036	3.12	2.22
	2	0.190	150.00	6.64	0.2120	1.0000	3	115.7	26,701	2.95	2.09
	3	0.183	150.00	7.16	0.2340	1.0000	3	152.9	31,544	3.12	2.19
	4	0.175	175.00	4.23	0.2690	1.0000	3	177.2	13,592	0.00	0.00
	Σ							**3,951.1**	**27,433**	**1.49**	**0.73**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.14	50.00	4,385.00	1.060	1.149
		8. Large gullies, diversions, and low flowing streams	3.18	162.00	5,088.00	5.350	0.264
#1	**1**	**Time of Concentration:**					**1.413**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	2.30	10.00	434.00	1.510	0.079
		8. Large gullies, diversions, and low flowing streams	3.70	142.00	3,834.00	5.770	0.184
#1	**2**	**Time of Concentration:**					**0.263**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.77	60.00	7,840.00	0.870	2.503
		8. Large gullies, diversions, and low flowing streams	1.22	28.00	2,301.00	3.300	0.193
#2	**1**	**Time of Concentration:**					**2.696**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	3.97	23.00	580.00	1.990	0.080
		8. Large gullies, diversions, and low flowing streams	2.60	178.00	6,838.00	4.840	0.392
#2	**2**	**Time of Concentration:**					**0.472**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	13.68	45.00	329.00	3.690	0.024

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	3.12	108.00	3,466.00	5.290	0.181
#2	**3**	**Time of Concentration:**					**0.205**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	0.79	46.00	5,799.00	0.890	1.809
		8. Large gullies, diversions, and low flowing streams	3.31	160.00	4,837.00	5.450	0.246
#3	**1**	**Time of Concentration:**					**2.055**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	4.93	75.00	1,521.00	2.220	0.190
		8. Large gullies, diversions, and low flowing streams	2.98	70.00	2,345.00	5.180	0.125
#3	**2**	**Time of Concentration:**					**0.315**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	6.42	83.00	1,293.00	2.530	0.141
		8. Large gullies, diversions, and low flowing streams	3.21	50.00	1,559.00	5.370	0.080
#3	**3**	**Time of Concentration:**					**0.221**
#3	4	5. Nearly bare and untilled, and alluvial valley fans	8.98	60.00	668.00	2.990	0.062
		8. Large gullies, diversions, and low flowing streams	2.82	110.00	3,900.00	5.030	0.215
#3	**4**	**Time of Concentration:**					**0.277**
#3	5	5. Nearly bare and untilled, and alluvial valley fans	4.11	50.00	1,216.00	2.020	0.167
		8. Large gullies, diversions, and low flowing streams	1.86	82.00	4,404.00	4.090	0.299
#3	**5**	**Time of Concentration:**					**0.466**
#3	6	5. Nearly bare and untilled, and alluvial valley fans	9.01	53.00	588.00	3.000	0.054
		8. Large gullies, diversions, and low flowing streams	1.64	24.00	1,463.00	3.840	0.105
#3	**6**	**Time of Concentration:**					**0.159**
#3	7	5. Nearly bare and untilled, and alluvial valley fans	3.83	50.00	1,304.00	1.950	0.185
		8. Large gullies, diversions, and low flowing streams	1.42	37.00	2,598.00	3.580	0.201
#3	**7**	**Time of Concentration:**					**0.386**
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.08	35.00	3,237.00	1.030	0.872
		8. Large gullies, diversions, and low flowing streams	2.41	155.00	6,442.00	4.650	0.384
#4	**1**	**Time of Concentration:**					**1.256**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	0.86	37.00	4,286.00	0.920	1.294
		8. Large gullies, diversions, and low flowing streams	4.10	92.00	2,243.00	6.070	0.102
#4	**2**	**Time of Concentration:**					**1.396**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	3	5. Nearly bare and untilled, and alluvial valley fans	0.93	23.00	2,478.00	0.960	0.717
		8. Large gullies, diversions, and low flowing streams	3.83	82.00	2,141.00	5.870	0.101
#4	**3**	**Time of Concentration:**					**0.818**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	0.63	10.00	1,582.00	0.790	0.556
		8. Large gullies, diversions, and low flowing streams	3.62	157.00	4,332.00	5.710	0.210
#4	**4**	**Time of Concentration:**					**0.766**
#4	5	5. Nearly bare and untilled, and alluvial valley fans	8.38	73.00	871.00	2.890	0.083
		8. Large gullies, diversions, and low flowing streams	2.64	54.00	2,043.00	4.870	0.116
#4	**5**	**Time of Concentration:**					**0.199**
#4	6	5. Nearly bare and untilled, and alluvial valley fans	4.90	80.00	1,632.02	2.210	0.205
		8. Large gullies, diversions, and low flowing streams	2.57	86.00	3,346.04	4.800	0.193
#4	**6**	**Time of Concentration:**					**0.398**
#4	7	5. Nearly bare and untilled, and alluvial valley fans	12.89	70.00	543.00	3.590	0.042
		8. Large gullies, diversions, and low flowing streams	1.40	35.00	2,508.00	3.540	0.196
#4	**7**	**Time of Concentration:**					**0.238**
#4	8	5. Nearly bare and untilled, and alluvial valley fans	3.98	30.00	754.00	1.990	0.105
		8. Large gullies, diversions, and low flowing streams	1.87	85.00	4,548.00	4.100	0.308
#4	**8**	**Time of Concentration:**					**0.413**
#4	9	5. Nearly bare and untilled, and alluvial valley fans	2.53	40.00	1,584.00	1.580	0.278
		8. Large gullies, diversions, and low flowing streams	1.61	73.00	4,546.00	3.800	0.332
#4	**9**	**Time of Concentration:**					**0.610**
#4	10	5. Nearly bare and untilled, and alluvial valley fans	3.26	50.00	1,536.00	1.800	0.237
		8. Large gullies, diversions, and low flowing streams	1.21	23.00	1,901.00	3.290	0.160
#4	**10**	**Time of Concentration:**					**0.397**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	2.32	75.00	3,231.00	1.520	0.590
#5	**1**	**Time of Concentration:**					**0.590**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	1.37	83.00	6,044.00	1.170	1.434
#5	**2**	**Time of Concentration:**					**1.434**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	2.93	22.00	752.00	1.710	0.122

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	1.52	63.00	4,146.00	3.690	0.312
#6	**1**	**Time of Concentration:**					**0.434**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	1.93	102.00	5,288.00	1.380	1.064
		8. Large gullies, diversions, and low flowing streams	1.09	31.00	2,857.00	3.120	0.254
#7	**1**	**Time of Concentration:**					**1.318**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	1.54	55.00	3,561.00	1.240	0.797
		8. Large gullies, diversions, and low flowing streams	1.40	53.00	3,788.00	3.540	0.297
#7	**2**	**Time of Concentration:**					**1.094**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	3.26	60.00	1,842.00	1.800	0.284
		8. Large gullies, diversions, and low flowing streams	0.98	8.00	817.00	2.960	0.076
#7	**3**	**Time of Concentration:**					**0.360**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	3.08	75.00	2,436.00	1.750	0.386
		8. Large gullies, diversions, and low flowing streams	1.53	35.00	2,291.00	3.700	0.171
#8	**1**	**Time of Concentration:**					**0.557**
#8	2	5. Nearly bare and untilled, and alluvial valley fans	3.67	37.00	1,008.00	1.910	0.146
		8. Large gullies, diversions, and low flowing streams	0.96	59.00	6,130.00	2.940	0.579
#8	**2**	**Time of Concentration:**					**0.725**
#8	3	5. Nearly bare and untilled, and alluvial valley fans	4.25	72.00	1,695.00	2.060	0.228
#8	**3**	**Time of Concentration:**					**0.228**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	130.00	2,477.00	2.290	0.300
		8. Large gullies, diversions, and low flowing streams	2.40	104.00	4,333.00	4.640	0.259
#9	**1**	**Time of Concentration:**					**0.559**
#9	2	5. Nearly bare and untilled, and alluvial valley fans	7.24	80.00	1,105.00	2.690	0.114
		8. Large gullies, diversions, and low flowing streams	2.34	143.00	6,113.00	4.580	0.370
#9	**2**	**Time of Concentration:**					**0.484**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	3.67	68.00	1,855.00	1.910	0.269
		8. Large gullies, diversions, and low flowing streams	1.16	55.00	4,740.00	3.230	0.407
#10	**1**	**Time of Concentration:**					**0.676**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	4.40	103.00	2,342.00	2.090	0.311

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#10	**2**	**Time of Concentration:**					**0.311**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	0.70	60.00	8,630.00	0.830	2.888
#11	**1**	**Time of Concentration:**					**2.888**
#11	2	5. Nearly bare and untilled, and alluvial valley fans	1.08	59.00	5,468.00	1.030	1.474
#11	**2**	**Time of Concentration:**					**1.474**
#11	3	5. Nearly bare and untilled, and alluvial valley fans	0.89	50.00	5,647.00	0.940	1.668
#11	**3**	**Time of Concentration:**					**1.668**
#11	4	5. Nearly bare and untilled, and alluvial valley fans	1.48	47.00	3,181.00	1.210	0.730
		8. Large gullies, diversions, and low flowing streams	1.98	81.00	4,100.00	4.210	0.270
#11	**4**	**Time of Concentration:**					**1.000**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	778.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	3.74	98.00	2,620.00	5.800	0.125
#13	**1**	**Time of Concentration:**					**0.245**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	9.77	50.00	512.00	3.120	0.045
		8. Large gullies, diversions, and low flowing streams	3.65	87.00	2,386.00	5.720	0.115
#13	**2**	**Time of Concentration:**					**0.160**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	19.02	85.00	447.00	4.360	0.028
		8. Large gullies, diversions, and low flowing streams	3.12	82.00	2,627.00	5.300	0.137
#13	**3**	**Time of Concentration:**					**0.165**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.51	105.00	2,995.00	1.870	0.444
		8. Large gullies, diversions, and low flowing streams	0.72	60.00	8,278.00	2.550	0.901
#13	**4**	**Time of Concentration:**					**1.345**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#3	**1**	**Muskingum K:**					**0.510**
#3	2	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.00	3.490	0.510
#3	**2**	**Muskingum K:**					**0.510**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	3	8. Large gullies, diversions, and low flowing streams	1.36	87.00	6,414.03	3.490	0.510
#3	**3**	**Muskingum K:**					**0.510**
#3	4	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.00	4.440	0.176
#3	**4**	**Muskingum K:**					**0.176**
#3	5	8. Large gullies, diversions, and low flowing streams	2.20	62.00	2,822.00	4.440	0.176
#3	**5**	**Muskingum K:**					**0.176**
#3	6	8. Large gullies, diversions, and low flowing streams	0.84	35.00	4,143.48	2.750	0.418
#3	**6**	**Muskingum K:**					**0.418**
#4	1	8. Large gullies, diversions, and low flowing streams	1.76	98.00	5,553.00	3.980	0.387
#4	**1**	**Muskingum K:**					**0.387**
#4	2	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**2**	**Muskingum K:**					**0.534**
#4	3	8. Large gullies, diversions, and low flowing streams	1.90	151.00	7,950.00	4.130	0.534
#4	**3**	**Muskingum K:**					**0.534**
#4	4	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**4**	**Muskingum K:**					**0.389**
#4	5	8. Large gullies, diversions, and low flowing streams	1.49	76.00	5,117.00	3.650	0.389
#4	**5**	**Muskingum K:**					**0.389**
#4	6	8. Large gullies, diversions, and low flowing streams	1.50	66.00	4,388.00	3.670	0.332
#4	**6**	**Muskingum K:**					**0.332**
#4	7	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**7**	**Muskingum K:**					**0.183**
#4	8	8. Large gullies, diversions, and low flowing streams	1.29	29.00	2,252.00	3.400	0.183
#4	**8**	**Muskingum K:**					**0.183**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	1.30	68.00	5,236.00	1.130	1.287
#5	**1**	**Muskingum K:**					**1.287**
#7	1	8. Large gullies, diversions, and low flowing streams	1.22	13.00	1,067.00	3.310	0.089
#7	**1**	**Muskingum K:**					**0.089**
#7	2	8. Large gullies, diversions, and low flowing streams	1.22	13.00	1,067.00	3.310	0.089
#7	**2**	**Muskingum K:**					**0.089**
#8	1	8. Large gullies, diversions, and low flowing streams	1.06	25.00	2,356.04	3.090	0.211

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	**1**	**Muskingum K:**					**0.211**
#8	3	8. Large gullies, diversions, and low flowing streams	1.21	97.00	8,001.00	3.300	0.673
#8	**3**	**Muskingum K:**					**0.673**
#9	1	8. Large gullies, diversions, and low flowing streams	1.59	39.00	2,446.00	3.780	0.179
#9	**1**	**Muskingum K:**					**0.179**
#11	1	8. Large gullies, diversions, and low flowing streams	1.11	93.00	8,350.00	3.160	0.734
#11	**1**	**Muskingum K:**					**0.734**
#11	2	8. Large gullies, diversions, and low flowing streams	1.22	93.00	7,626.00	3.310	0.639
#11	**2**	**Muskingum K:**					**0.639**
#11	3	8. Large gullies, diversions, and low flowing streams	1.67	88.00	5,265.04	3.870	0.377
#11	**3**	**Muskingum K:**					**0.377**
#13	1	8. Large gullies, diversions, and low flowing streams	0.79	87.00	10,974.00	2.670	1.141
#13	**1**	**Muskingum K:**					**1.141**
#13	2	8. Large gullies, diversions, and low flowing streams	0.75	73.00	9,772.00	2.590	1.048
#13	**2**	**Muskingum K:**					**1.048**
#13	3	8. Large gullies, diversions, and low flowing streams	0.72	63.00	8,709.00	2.550	0.948
#13	**3**	**Muskingum K:**					**0.948**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	386.400	386.400	17.95	3.40	22.3	9,239	1.04	0.66
#11	1,459.300	1,845.700	36.98	16.31	63.0	8,152	2.78	1.24
#1	384.000	384.000	19.63	2.53	35.0	28,788	2.73	1.20
#8	224.900	608.900	27.62	4.26	44.7	20,968	3.99	1.82
#4	1,417.400	1,417.400	105.48	18.08	325.7	30,260	1.60	0.86
#7	669.200	2,086.600	130.23	24.78	368.7	25,084	2.22	1.19
#3	825.600	825.600	84.06	11.25	235.8	29,484	2.13	1.36
#2	798.200	798.200	33.66	5.39	89.9	32,611	1.46	0.68
#6	131.700	1,755.500	108.32	17.24	330.1	27,846	1.97	1.23
#10	208.400	4,659.400	252.75	50.49	790.4	24,804	2.03	1.16
#9	541.300	541.300	94.75	11.61	368.5	42,487	0.54	0.36
#12	0.000	7,046.400	315.21	78.41	1,221.9	32,533	2.42	1.05
#13	808.700	7,855.101	313.68	91.37	1,307.1	26,156	0.59	0.30

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	386.400	386.400	83.16	17.31	117.6	9,972	2.30	1.49
#11	1,459.300	1,845.700	199.75	84.72	394.2	10,287	4.01	1.73
#1	384.000	384.000	82.66	14.90	192.6	30,241	5.74	2.25
#8	224.900	608.900	149.37	24.61	266.1	63,299	18.89	2.93
#4	1,417.400	1,417.400	420.23	76.93	1,445.3	31,344	2.67	1.44
#7	669.200	2,086.600	564.56	109.89	1,711.7	25,157	3.50	1.96
#3	825.600	825.600	320.72	46.13	1,012.9	31,706	4.05	2.50
#2	798.200	798.200	147.88	30.91	445.8	34,689	2.81	1.07
#6	131.700	1,755.500	442.66	81.60	1,509.9	30,015	3.89	2.16
#10	208.400	4,659.400	1,086.64	230.83	3,681.4	25,250	3.53	2.01
#9	541.300	541.300	340.11	39.46	1,461.7	47,786	1.96	1.37
#12	0.000	7,046.400	1,369.85	355.02	5,537.2	34,205	4.49	1.86
#13	808.700	7,855.101	1,359.63	405.34	5,949.0	27,971	1.99	0.97

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5	386.400	386.400	124.17	26.30	182.0	10,210	2.65	1.74
#11	1,459.300	1,845.700	305.69	128.65	624.5	10,829	4.36	1.87
#1	384.000	384.000	121.54	23.24	302.0	30,311	6.47	2.54
#8	224.900	608.900	228.49	38.16	422.1	20,132	6.46	3.22
#4	1,417.400	1,417.400	609.14	112.97	2,160.7	31,731	3.00	1.63
#7	669.200	2,086.600	829.58	162.46	2,583.4	25,312	3.85	2.18
#3	825.600	825.600	460.83	67.32	1,502.8	32,415	4.62	2.84
#2	798.200	798.200	217.13	48.13	680.3	35,831	3.39	1.22
#6	131.700	1,755.500	643.48	122.77	2,271.3	30,703	4.49	2.43
#10	208.400	4,659.400	1,596.63	344.13	5,560.6	25,485	3.96	2.26
#9	541.300	541.300	478.94	55.19	2,125.0	49,328	2.42	1.71
#12	0.000	7,046.400	2,017.42	527.97	8,310.0	34,564	5.07	2.10
#13	808.700	7,855.101	2,001.72	600.34	8,936.1	28,482	2.48	1.20

APPENDIX 7-E

GEOCHEMICAL SIGNATURE SUMMARY

(12/93)

GEOCHEMICAL SIGNATURE SUMMARY

A geochemical analysis was completed in 1993 using eight (8) years of surface water monitoring data (1985-1992) to characterize the geochemical signature of the precipitation and irrigation water (NAPI wasteflow) which flow through Bitsui, Chinde, and Cottonwood Washes.

According to the surface water monitoring data base, all but one (1) monitoring station (CS-1) has received irrigation wastewater, and the data for Station CN-1 includes only one (1) irrigation wastewater flow.

The surface water monitoring data base indicates whether each sample is predominately irrigation wastewater (I), precipitation event (P), or a mixture (P/I). At the stations which normally receive irrigation wastewater flows, the precipitation flows would generally contain some contribution of irrigation wastewater.

A geochemical analysis was performed on the data from each gaging station using trilinear (Piper) diagrams. The data was first separated into three (3) groups: irrigation, precipitation event water or, a mixture. The mean concentration for each major anion and cation was converted from mg/l to meq/l and then into percent of total anions or cations (in meq/l) as shown in TABLES 1 through 7. The percentages of total anions (or cations) were then plotted on trilinear diagrams to allow possible differentiation between the irrigation wastewater and precipitation event water.

Trilinear diagrams for each surface water monitoring station are presented as FIGURES 1 through 7. While the diagrams show that the three (3) waters are distinguishable, they also show that at any given station, they are not substantially different types. FIGURES 1 through 4 show that the flows (irrigation and precipitation) from the Bitsui (Stations NB-1 and NB-2) and Chinde (Stations CD-1 and CD-2) watersheds are of the sodium sulfate type while the flows from the Cottonwood watershed (CN-1, CS-1 and CNS-1) are of sodium sulfate/sodium bicarbonate type. This difference might be explained by different salts being present in the soils of the different watersheds.

Mean total dissolved solids (TDS) values were calculated for all three (3) waters at each station to determine if any difference exists between the waters in absolute salt concentrations. TABLE 8 shows that there is no significant difference in TDS values between the irrigation and precipitation flows.

In conclusion, the available surface water monitoring data and the geochemical analyses indicate that while the irrigation and precipitation flows are geochemically distinguishable, they are not significantly different. It is believed that the three (3) waters are similar because they initially contain very little dissolved solids (salts) and have reached an equilibrium with the salts in the soils in the watersheds and the sediments in the watercourses. The source of the NAPI irrigation water is the Navajo Reservoir which has TDS levels of no more than a few hundred mg/l while rain water has virtually no dissolved solids.

TABLE 1
Station NB-1 Surface Water Data

Water Type[1]	Parameter	# of Observa-tions	Mg/L	Mean MEQ/L	% of Total
P	Na	12	474.13	20.62	
P	K	12	7.26	0.19	
P	Na + K			20.81	75.85
P	Mg	12	19.76	1.63	5.93
P	Ca	12	100.12	5.00	18.21
			Total	27.43	
P	HCO3	12	163.67	2.68	
P	CO3	11	0.00	0.00	
P	HCO3 + CO3			2.68	9.57
P	Cl	12	147.25	4.15	14.82
P	SO4	12	1017.17	21.19	75.61
			Total	28.03	
I	Na	1	127.00	5.52	
I	K	2	7.15	0.18	
I	Na + K			5.71	61.41
I	Mg	2	6.25	0.51	5.54
I	Ca	2	61.55	3.07	33.05
			Total	9.29	
I	HCO3	2	163.67	2.68	
I	CO3	2	0.00	0.00	
I	HCO3 + CO3			2.68	18.88
I	Cl	2	55.00	1.55	10.92
I	SO4	2	479.00	9.98	70.21
			Total	14.21	
P/I	Na	6	558.83	24.31	
P/I	K	6	9.68	0.23	
P/I	Na + K			24.54	73.65
P/I	Mg	6	29.68	2.44	7.32
P/I	Ca	6	127.15	6.34	19.03
			Total	33.32	
P/I	HCO3	6	171.83	2.82	
P/I	CO3	6	0.00	0.00	
P/I	HCO3 + CO3			2.82	9.79
P/I	Cl	6	151.83	4.28	14.86
P/I	SO4	6	1042.00	21.71	75.36
			Total	28.81	

[1] P = Sample from precipitation.
I = Sample from irrigation.
P/I = Samples are precipitation and irrigation combined.

TABLE 2
Station NB-2 Surface Water Data

Water Type[1]	Parameter	# of Observations	Mg/L	Mean MEQ/L	% of Total
P	Na	18	361.61	14.42	
P	K	18	8.47	0.22	
P	Na + K			14.64	81.94
P	Mg	18	10.18	0.84	4.69
P	Ca	18	47.88	2.39	13.37
			Total	17.87	
P	HCO3	18	157.11	2.58	
P	CO3	18	0.67	0.02	
P	HCO3 + CO3			2.60	15.34
P	Cl	18	54.50	1.54	9.08
P	SO4	18	614.44	12.80	75.58
			Total	16.94	
I	Na	3	297.67	12.95	
I	K	3	6.13	0.16	
I	Na + K			13.10	80.74
I	Mg	3	9.47	0.78	4.81
I	Ca	3	47.03	2.35	14.46
			Total	16.23	
I	HCO3	3	184.00	3.02	
I	CO3	3	8.00	0.27	
I	HCO3 + CO3			3.28	20.23
I	Cl	3	65.00	1.83	11.30
I	SO4	3	533.33	11.11	68.47
			Total	16.23	
P/I	Na	8	853.88	37.15	
P/I	K	8	10.41	0.27	
P/I	Na + K			37.42	74.63
P/I	Mg	8	41.95	3.46	6.90
P/I	Ca	8	185.59	9.26	18.47
			Total	50.14	
P/I	HCO3	8	222.75	3.65	
P/I	CO3	8	0.00	0.00	
P/I	HCO3 + CO3			3.65	8.43
P/I	Cl	8	294.00	8.29	19.15
P/I	SO4	8	1505.13	31.36	72.42
			Total	43.3	

[1] P = Sample from precipitation.
I = Sample from irrigation.
P/I = Samples are precipitation and irrigation combined.

TABLE 3
Station CD-1 Surface Water Data

Water Type[1]	Parameter	# of Observa-tions	Mg/L	Mean MEQ/L	% of Total
P	Na		256.64	11.16	
P	K	44	5.27	0.13	
P	Na + K			11.30	68.43
P	Mg	44	17.38	1.43	8.67
P	Ca	43	75.77	3.78	22.90
			Total	16.51	
P	HCO3	44	125.16	2.05	
P	CO3	46	0.00	0.00	
P	HCO3 + CO3			2.05	12.24
P	Cl	43	34.47	0.97	5.80
P	SO4	44	659.18	13.73	81.95
			Total	16.76	
I	Na		255.75	11.12	
I	K	59	4.23	0.11	
I	Na + K			11.23	65.81
I	Mg	58	19.28	1.59	9.31
I	Ca	59	85.10	4.25	24.88
			Total	17.07	
I	HCO3	59	124.90	2.05	
I	CO3	59	1.32	0.04	
I	HCO3 + CO3			2.09	11.87
I	Cl	60	33.95	0.96	5.44
I	SO4	57	699.35	14.57	82.69
			Total	17.62	
P/I	Na	22	382.5	16.64	
P/I	K	22	6.90	0.18	
P/I	Na + K			16.82	60.63
P/I	Mg	22	35.73	2.94	10.60
P/I	Ca	22	159.92	7.98	28.77
			Total	27.72	
P/I	HCO3	22	130.45	2.14	
P/I	CO3	22	0.00	0.00	
P/I	HCO3 + CO3			2.14	7.94
P/I	Cl	22	56.91	1.61	5.97
P/I	SO4	22	1113.41	23.20	86.09
			Total	26.95	

[1] P = Sample from precipitation.
I = Sample from irrigation.
P/I = Samples are precipitation and irrigation combined.

TABLE 4
Station CD-2 Surface Water Data

Water Type[1]	Parameter	# of Observa-tions	Mg/L	Mean MEQ/L	% of Total
P	Na	25	250.76	10.91	
P	K	25	7.60	0.19	
P	Na + K			11.10	68.60
P	Mg	25	15.07	1.24	7.67
P	Ca	26	76.98	3.84	23.73
			Total	16.18	
P	HCO3	25	136.56	2.24	
P	CO3	25	0.00	0.00	
P	HCO3 + CO3			2.24	13.72
P	Cl	25	71.80	2.03	12.41
P	SO4	25	578.80	12.06	73.88
			Total	16.32	
I	Na	20	196.90	8.56	
I	K	20	5.92	0.15	
I	Na + K			8.72	61.67
I	Mg	20	15.72	1.29	9.16
I	Ca	20	82.63	4.12	29.17
			Total	14.13	
I	HCO3	20	123.30	2.02	
I	CO3	20	0.60	0.02	
I	HCO3 + CO3			2.04	14.13
I	Cl	20	43.50	1.23	8.49
I	SO4	18	536.67	11.18	77.38
			Total	14.45	
P/I	Na	11	349.36	15.20	
P/I	K	11	7.86	0.20	
P/I	Na + K			15.40	60.63
P/I	Mg	11	25.32	2.09	8.23
P/I	Ca	11	158.48	7.91	31.14
			Total	25.40	
P/I	HCO3	11	135.73	2.23	
P/I	CO3	11	0.00	0.00	
P/I	HCO3 + CO3			2.23	10.55
P/I	Cl	11	90.73	2.56	12.12
P/I	SO4	11	784.18	16.34	77.33
			Total	21.13	

[1] P = Sample from precipitation.
I = Sample from irrigation.
P/I = Samples are precipitation and irrigation combined.

TABLE 5

Station CN-1 Surface Water Data

Water Type[1]	Parameter	# of Observa- tions	Mg/L	Mean MEQ/L	% of Total
P	Na	19	214.03	9.31	
P	K	19	8.31	0.21	
P	Na + K			9.52	77.04
P	Mg	18	7.90	0.65	5.27
P	Ca	19	43.82	2.19	17.69
			Total	12.36	
P	HCO3	19	162.26	2.66	
P	CO3	19	1.05	0.04	
P	HCO3 + CO3			2.70	22.21
P	Cl	19	11.84	0.33	2.75
P	SO4	19	436.95	9.10	75.03
			Total	12.13	
I	Na	1	70.10	3.05	
I	K	1	1.20	0.03	
I	Na + K			3.08	69.53
I	Mg	1	3.30	0.27	6.14
I	Ca	1	21.60	1.08	24.33
			Total	4.43	
I	HCO3	1	98.00	1.61	
I	CO3	1	0.00	0.00	
I	HCO3 + CO3			1.61	40.19
I	Cl	1	5.00	0.14	3.53
I	SO4	1	108.00	2.25	56.28
			Total	4.00	

[1] P = Sample from precipitation.
I = Sample from irrigation.

TABLE 6

Station CS-1 Surface Water Data

Water Type[1]	Parameter	# of Observa- tions	Mg/L	Mean MEQ/L	% of Total
P	Na	24	176.10	7.66	
P	K	24	173.13	4.43	
P	Na + K			12.09	84.87
P	Mg	24	5.01	0.41	2.90
P	Ca	24	34.93	1.74	12.24
			Total	14.24	
P	HCO3		173.13	2.84	
P	CO3		1.33	0.04	
P	HCO3 + CO3			2.88	28.98
P	Cl	24	12.42	0.35	3.52
P	SO4	24	322.25	6.71	67.50
			Total	9.95	
I	Na	0	0.00	0.00	
I	K	0	0.00	0.00	
I	Na + K			0.00	
I	Mg	0	0.00	0.00	
I	Ca	0	0.00	0.00	
			Total	0.00	
I	HCO3	0	0.00	0.00	
I	CO3	0	0.00	0.00	
I	HCO3 + CO3			0.00	
I	Cl	0	0.00	0.00	
I	SO4	0	0.00	0.00	
			Total	0.00	

[1] P = Sample from precipitation.
I = Sample from irrigation.

TABLE 7

Station CNS-1 Surface Water Data

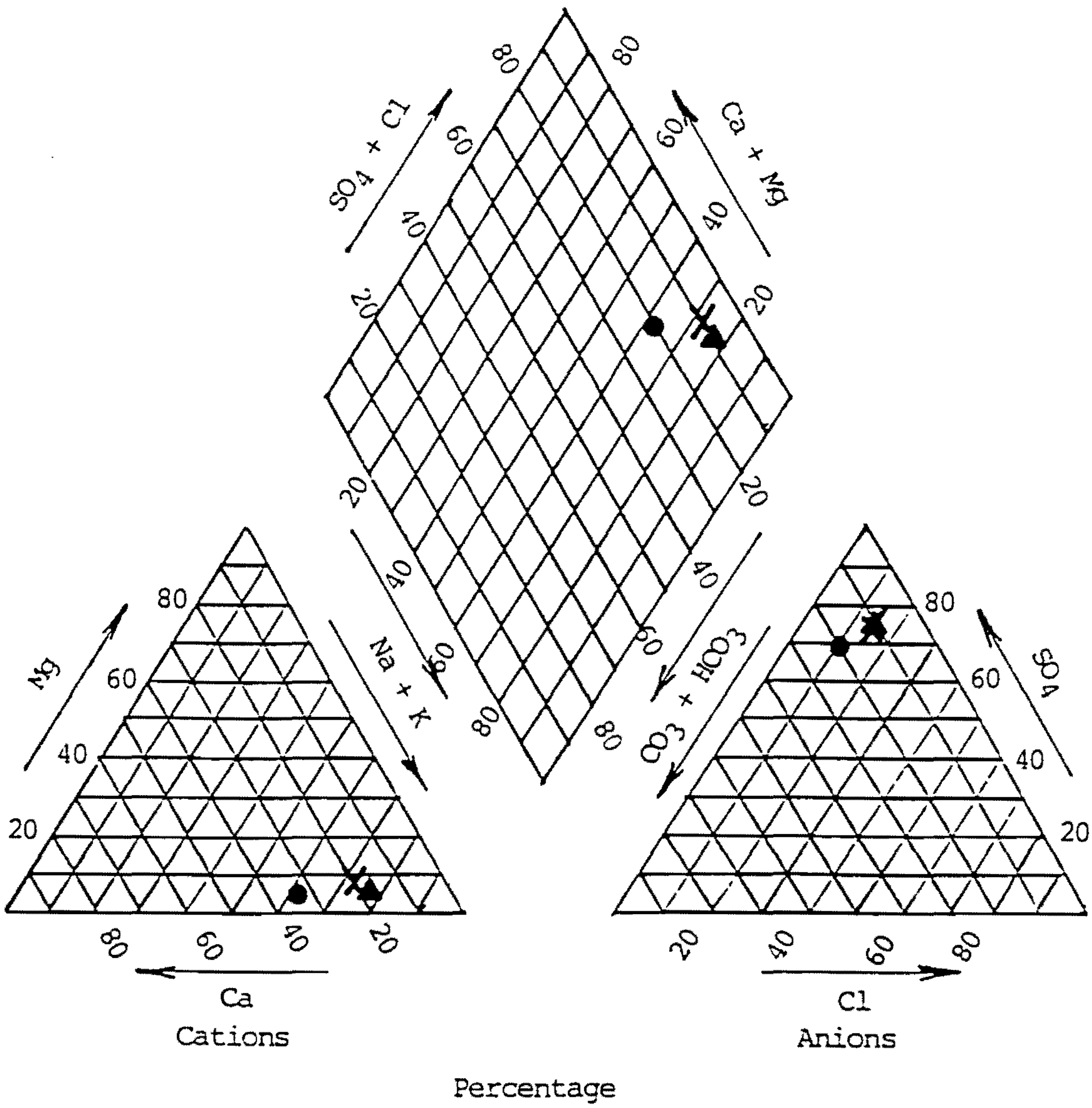
Water Type[1]	Parameter	# of Observa-tions	Mg/L	Mean MEQ/L	% of Total
P	Na	18	176.15	7.66	
P	K	18	6.60	0.17	
P	Na + K			7.83	75.13
P	Mg	18	4.98	0.41	3.94
P	Ca	18	43.72	2.18	20.93
			Total	10.42	
P	HCO3	18	161.22	2.64	
P	CO3	18	0.67	0.02	
P	HCO3 + CO3			2.67	25.73
P	Cl	18	12.94	0.37	3.52
P	SO4	18	351.78	7.33	70.75
			Total	10.36	
I	Na	2	154.75	6.73	
I	K	2	3.20	0.08	
I	Na + K			6.81	77.87
I	Mg	2	3.85	0.32	3.62
I	Ca	2	32.45	1.62	18.51
			Total	8.75	
I	HCO3	2	144.50	2.37	
I	CO3	2	0.00	0.00	
I	HCO3 + CO3			2.37	27.47
I	Cl	2	13.50	0.38	4.42
I	SO4	2	282.00	5.88	68.12
			Total	8.62	

[1] P = Sample from precipitation.
I = Sample from irrigation.

TABLE 8

Total Dissolved Solids Data
(mg/l)

Station	# of Obs.	Precip.	# of Obs.	Irrig.	# of Obs.	Precip./Irrig.
NB-1	12	1935.83	2	1030.00	6	2315.00
NB-2	17	1296.18	1	1940.00	8	3255.00
CD-1	42	1171.95	59	1201.86	22	1827.27
CD-2	24	1119.88	20	1004.50	11	1562.27
CN-1	17	935.00	1	290.00	0	NA
CS-1	19	693.89	0	NA	0	NA
CNS-1	12	794.58	2	612.50	0	NA



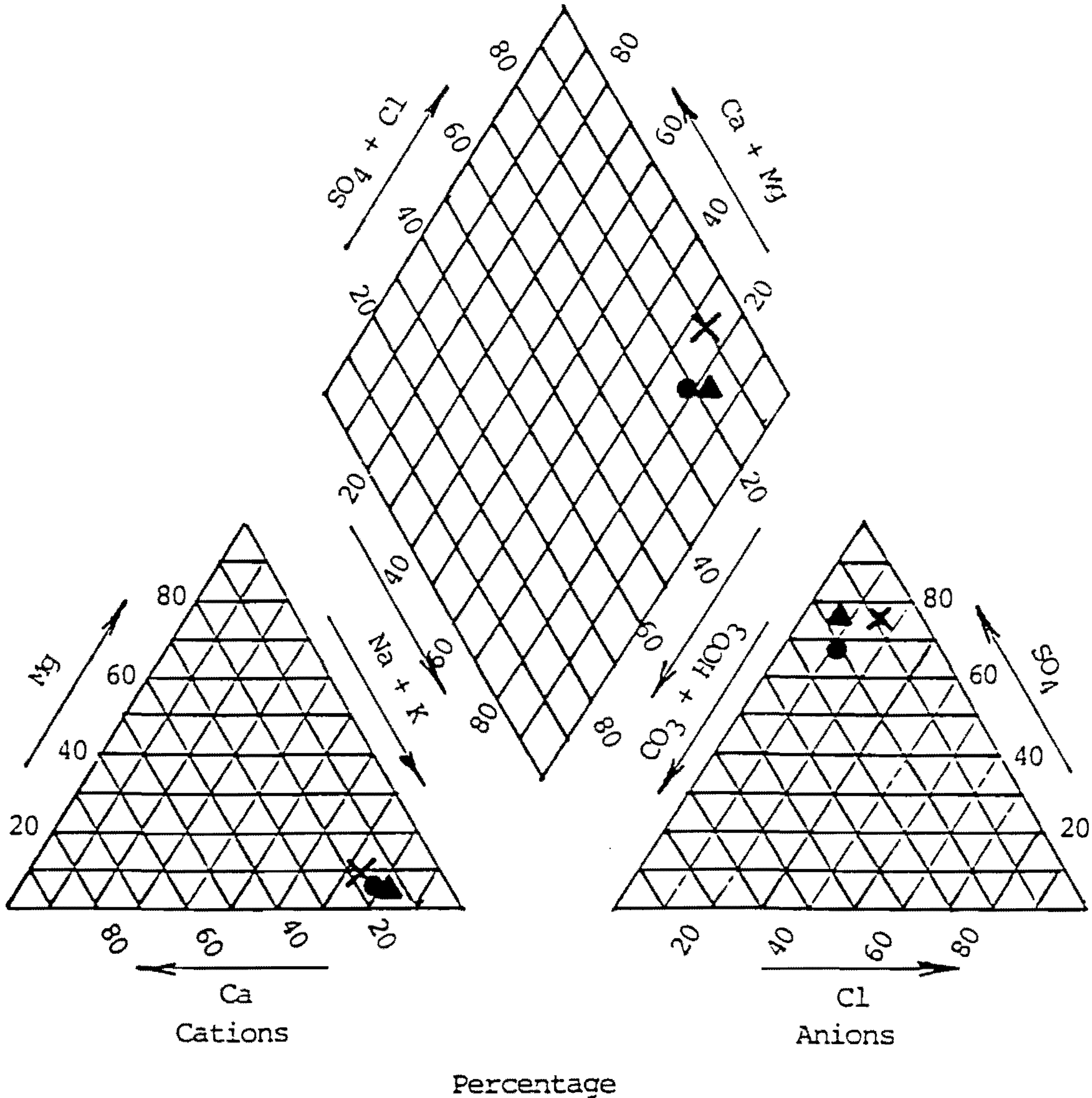
▲ Precipitation

● Irrigation

✕ P/I

FIGURE 1

Geochemical Analysis of
Station NB-1 Surface Water Data



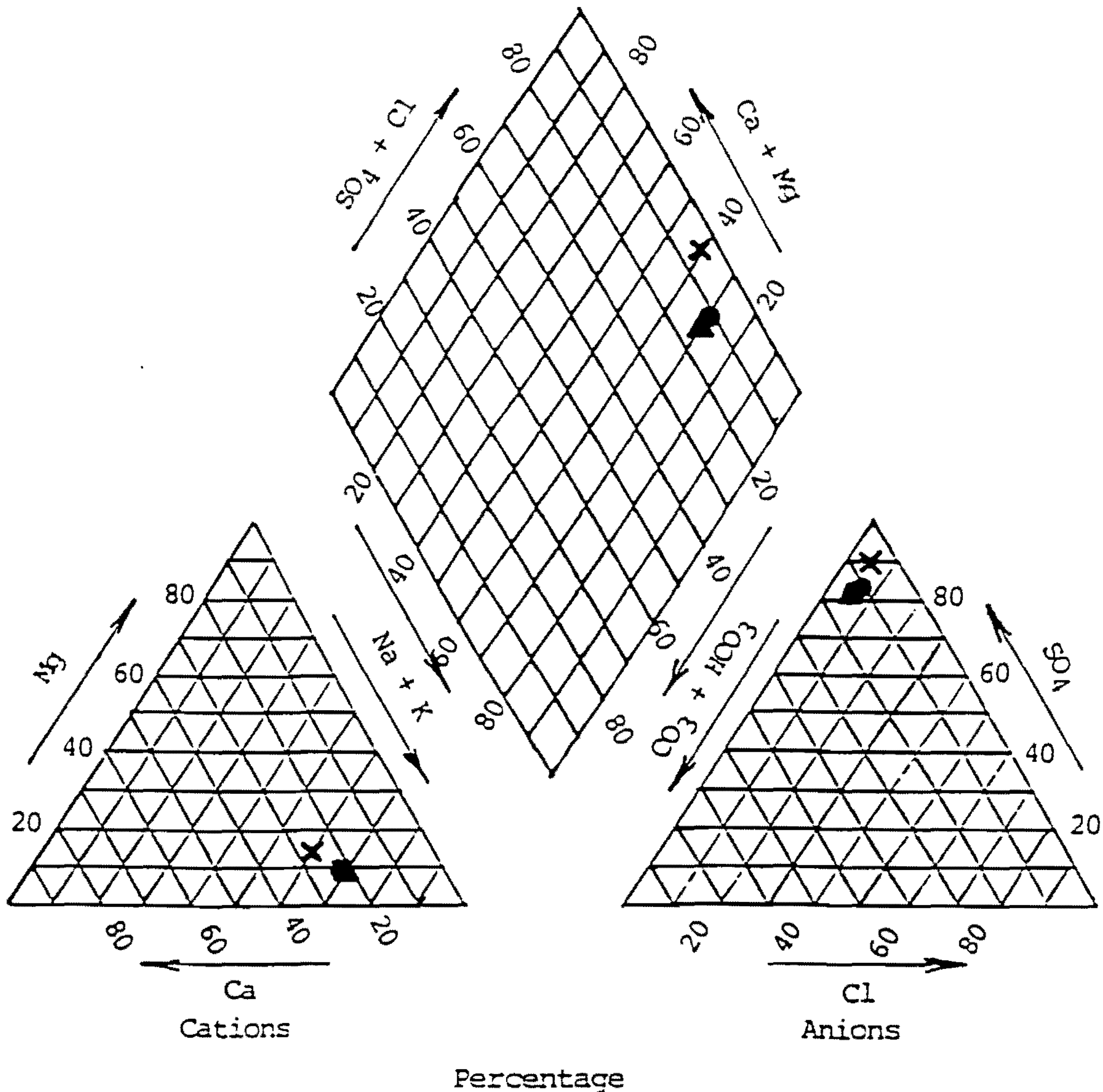
▲ Precipitation

● Irrigation

✕ P/I

FIGURE 2

Geochemical Analysis of
Station NB-2 Surface Water Data



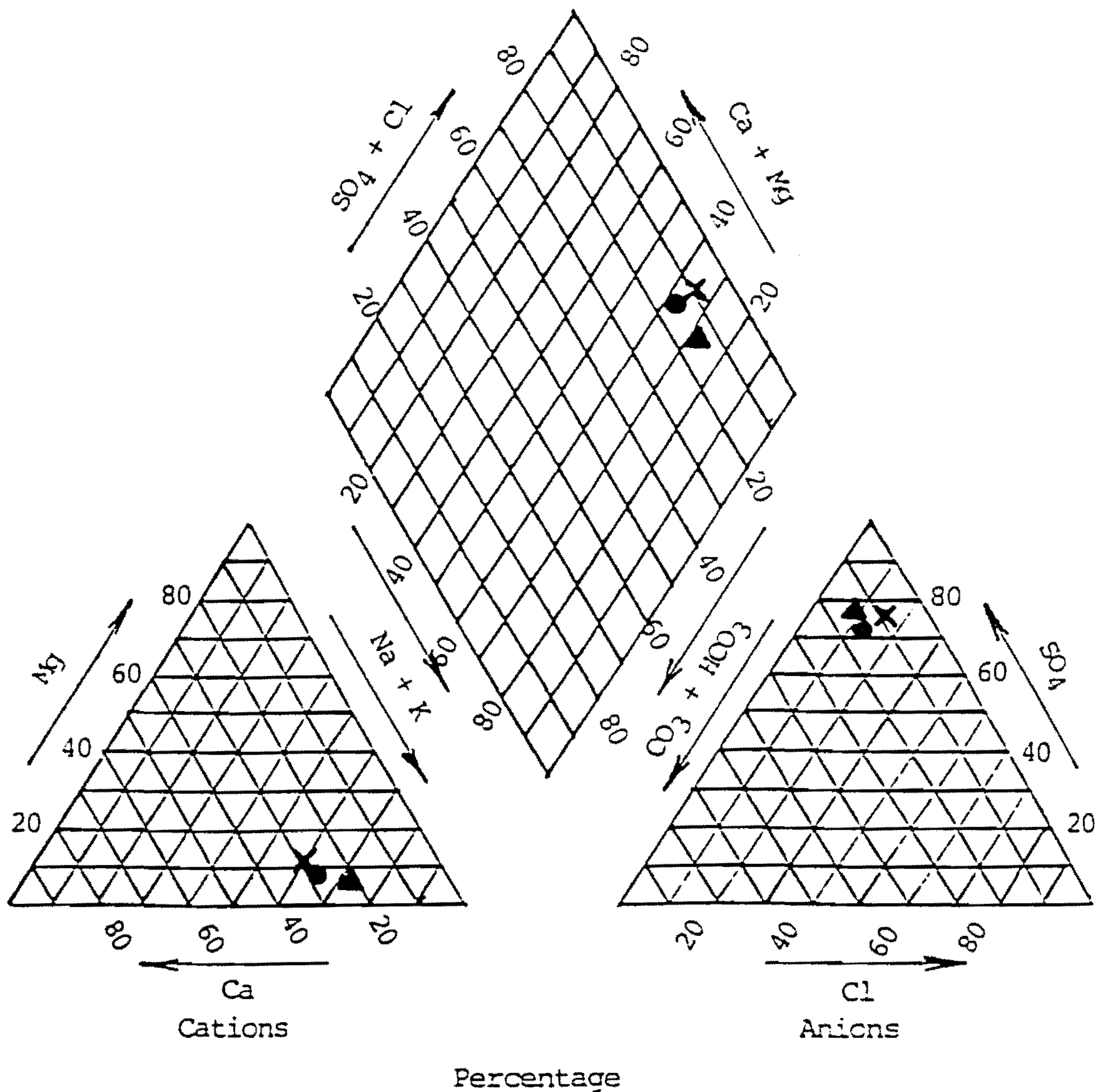
▲ Precipitation

● Irrigation

✕ P/I

FIGURE 3

Geochemical Analysis of
Station CD-1 Surface Water Data



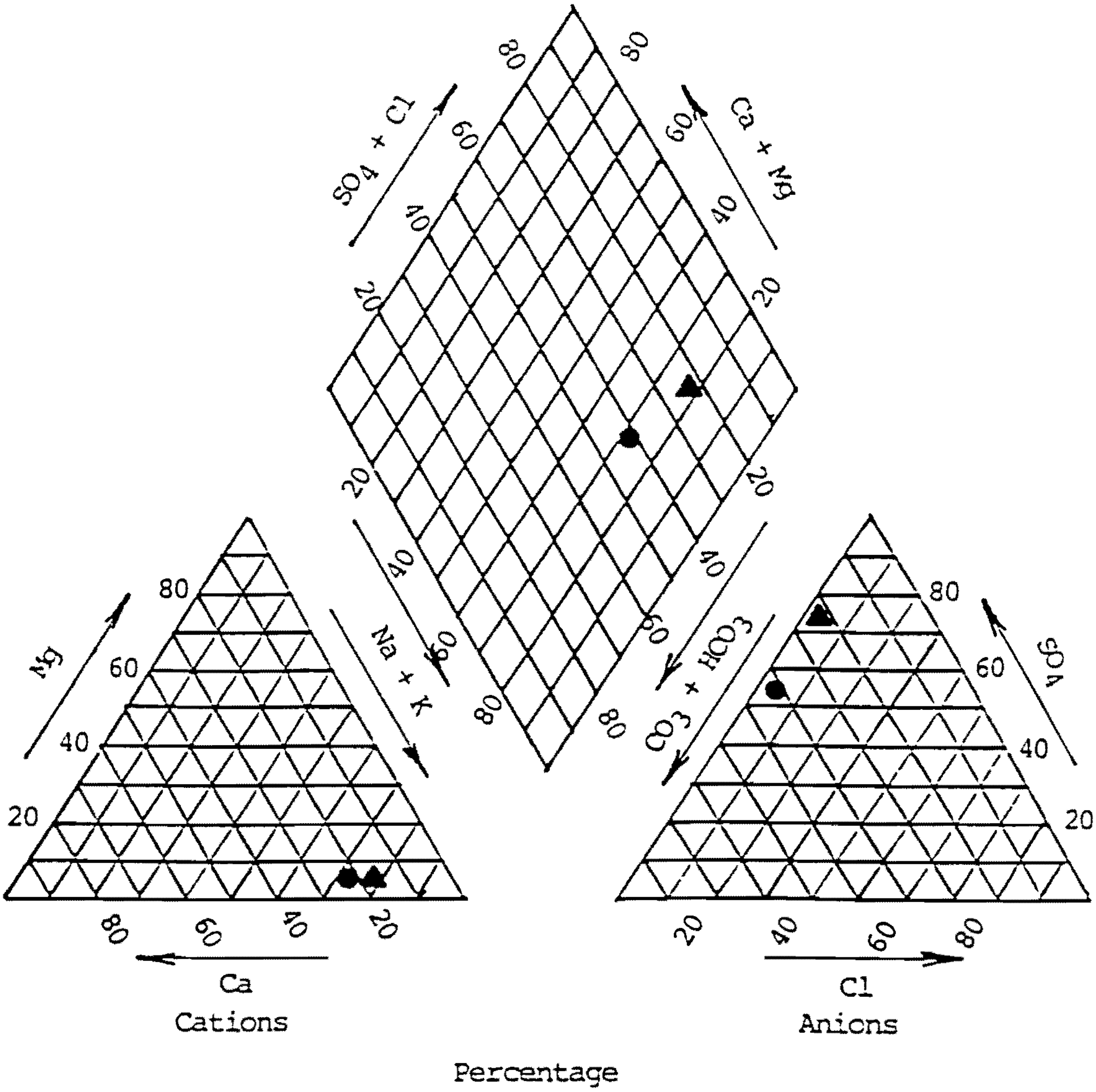
▲ Precipitation

● Irrigation

✕ P/I

FIGURE 4

Geochemical Analysis of
Station CD-2 Surface Water Data

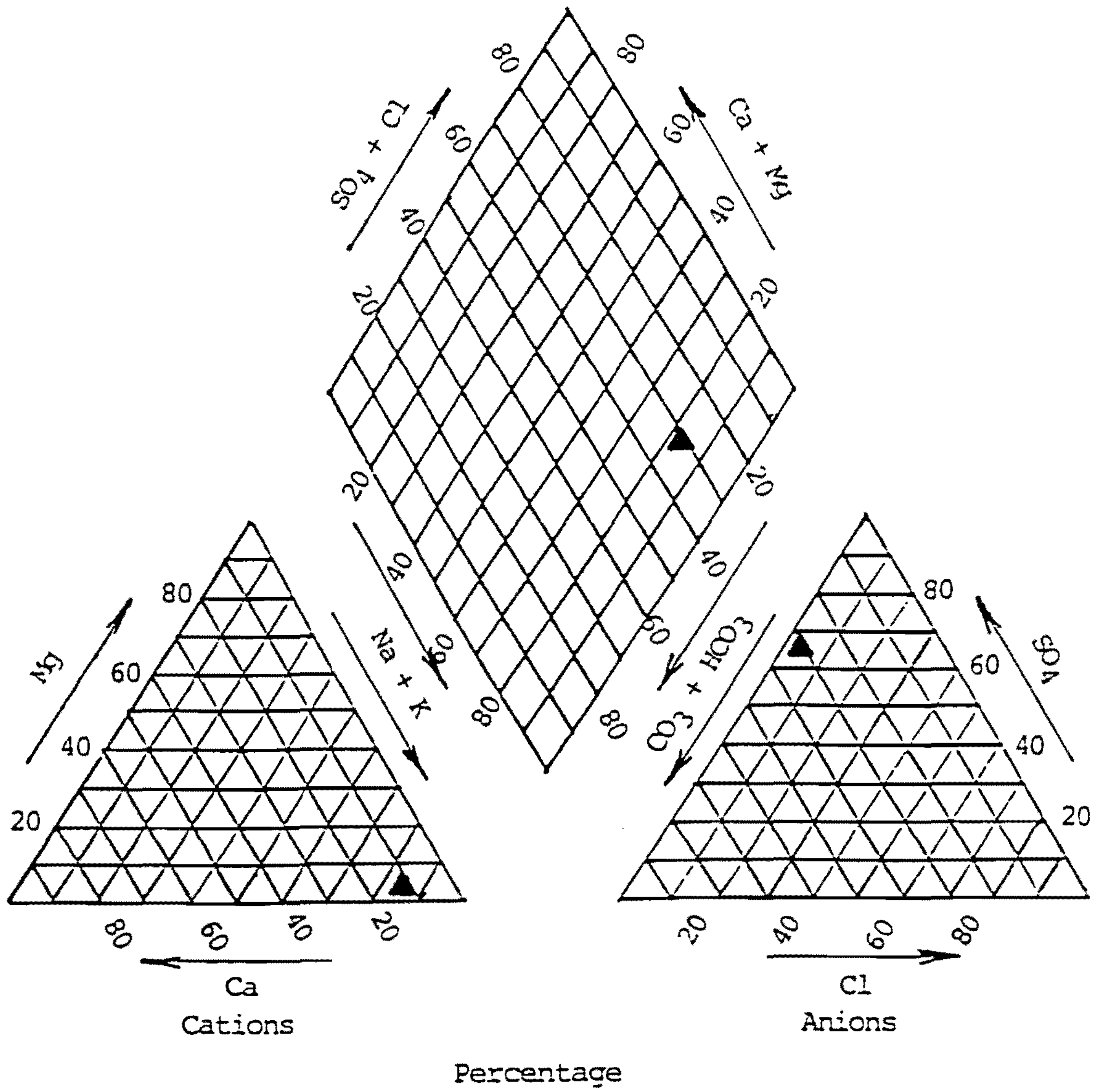


▲ Precipitation

● Irrigation

FIGURE 5

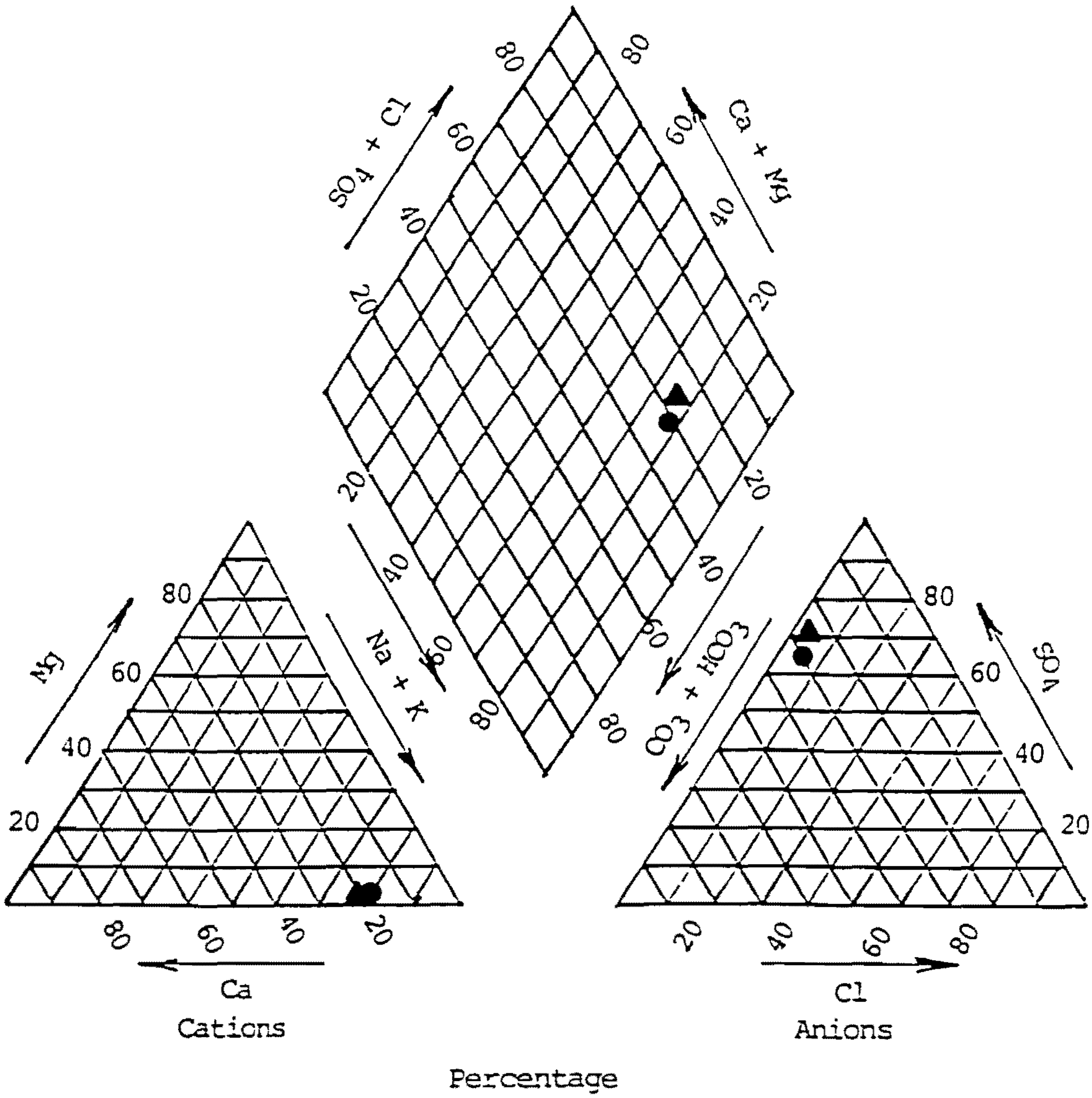
Geochemical Analysis of
Station CN-1 Surface Water Data



▲ Precipitation

FIGURE 6

Geochemical Analysis of
Station CS-1 Surface Water Data



▲ Precipitation

● Irrigation

FIGURE 7

Geochemical Analysis of
Station CNS-1 Surface Water Data

APPENDIX 7 - F

TOTAL SEDIMENT ANALYSIS PROCEDURE

DETERMINATION OF SUSPENDED CONCENTRATION BY EVAPORATION-RECOMMENDED LABORATORY PROCEDURE

1. Measure the volume of the entire sample (water plus sediment) to the nearest ml.
2. Measure the mass of the entire sample (water plus sediment) to the nearest mg. This value will not be used in the mg/ml concentration calculation but will be good to have for future computations, such as concentration in parts per million or back-calculation of the specific gravity.
3. Allow the sample to settle for at least 24 hours.
4. If colloidal material is in suspension add a small quantity of flocculating agent and allow enough time for the colloids to settle.
5. Decant the supernatant liquid to a point where a small amount (about 20 ml) of water remains with the sample. Be careful not to remove any of the sediment during decanting.
6. Wash the remaining sediment and water into an evaporation container.
7. Dry the contents of the dish in an oven at a temperature of 5 degrees C below the boiling point. If the contents are allowed to boil some of the sediment could be lost from the container.
8. Remove the evaporation container from the oven and place in a desiccator until cool, to avoid the reacquisition of moisture into the sample. The desiccator may not be necessary in an extremely arid environment.
9. Measure the gross and tare mass of the dried sample and compute the net mass of the sediment to the nearest 0.1 mg.
10. Compute the concentration by dividing the sediment mass in mg by the sample volume (as determined in step 1) in L.
11. Determine the particle size distribution of the sediment in the sample. Performing a washed sieve of the sediment analysis after steps 1 through 10 have been completed should make this determination. The sieve analysis procedure is described in ASTM standards C-117 and C-136. Determine the mass of the silt and clay fraction by measuring the dry mass of all sediment retained above the No. 230 (0.063 mm) sieve and subtracting it from the total sediment mass. Dividing the silt and clay mass by the total

sediment mass will give the percentage of the total sediment concentration attributable to silt and clay.

When this method is used, any dissolved solids in the sample will be included in the sediment mass. There are documented procedures for determining a dissolved solids correction, but we believe this will not be necessary given the sediment concentrations typical of these samples.

APPENDIX 7-G

CHINDE ARROYO PRE-MINE HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

September-04

Chinde Arroyo Pre-mine Hydrology and Sedimentology

The hydrology model and drainage subdivisions are presented on Exhibit 7-3.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	2.257	0.138	
Null	#2	==>	#3	0.484	0.354	
Null	#3	==>	#5	0.000	0.000	
Null	#4	==>	#5	0.000	0.000	
Null	#5	==>	#6	0.736	0.343	
Null	#6	==>	#7	0.505	0.313	
Null	#7	==>	#12	0.000	0.000	
Null	#8	==>	#11	0.421	0.362	
Null	#9	==>	#11	0.390	0.360	
Null	#10	==>	#11	0.378	0.343	
Null	#11	==>	#12	0.000	0.000	
Null	#12	==>	#13	0.378	0.332	
Null	#13	==>	#23	0.000	0.000	
Null	#14	==>	#15	0.821	0.337	
Null	#15	==>	#18	0.000	0.000	
Null	#16	==>	#17	1.675	0.310	
Null	#17	==>	#18	0.000	0.000	
Null	#18	==>	#21	0.314	0.334	
Null	#19	==>	#21	0.870	0.329	
Null	#20	==>	#21	1.002	0.331	
Null	#21	==>	#23	0.000	0.000	
Null	#22	==>	#21	0.988	0.335	
Null	#23	==>	#24	0.507	0.290	
Null	#24	==>	End	0.000	0.000	
Null	#25	==>	#7	0.420	0.337	
Null	#26	==>	#21	0.921	0.331	
Null	#27	==>	#4	1.069	0.340	
Null	#28	==>	#15	0.778	0.333	

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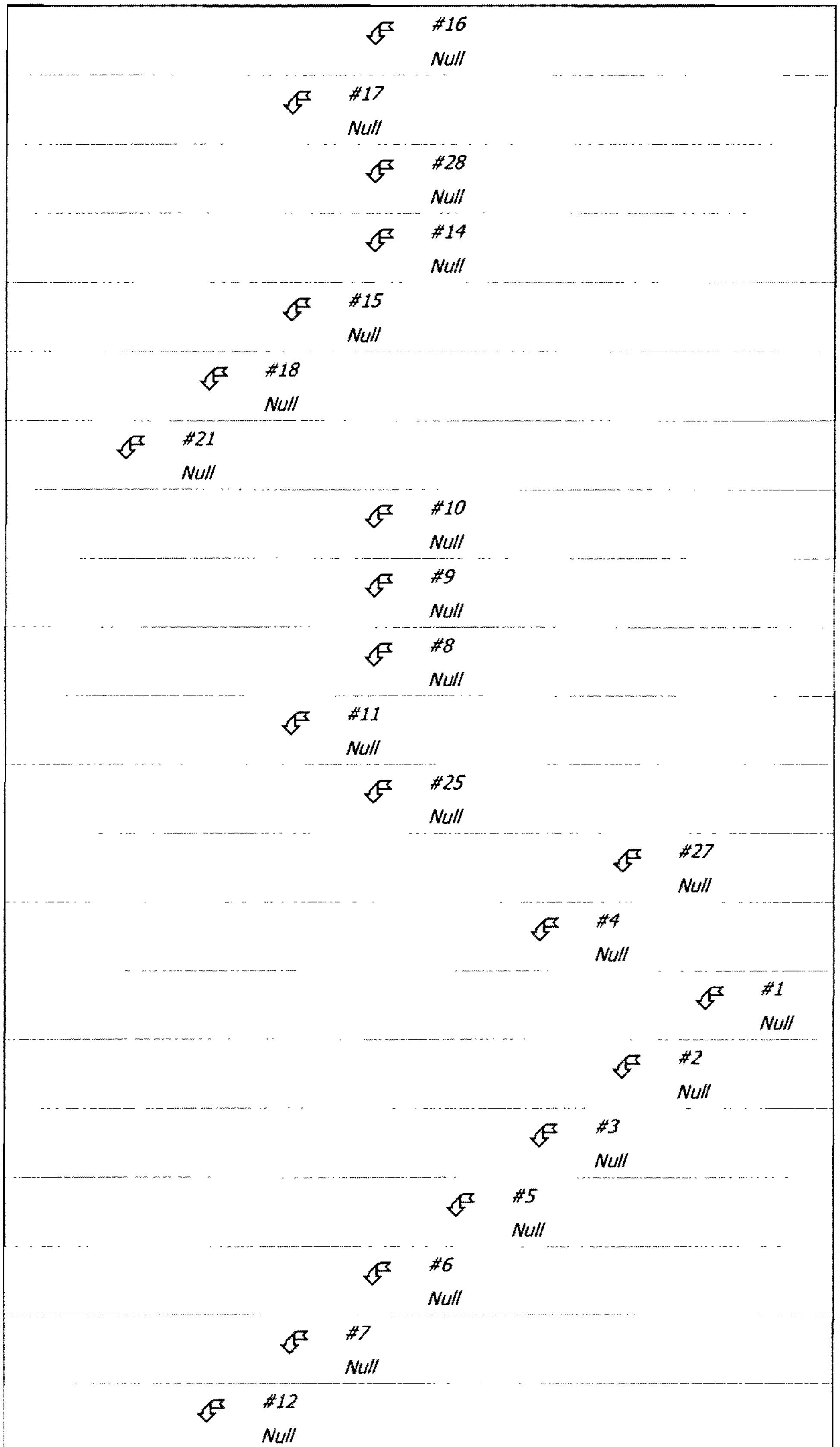
#20 *Null*
#19 *Null*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#24
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Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	5. Nearly bare and untilled, and alluvial valley fans	0.44	23.00	5,282.49	0.65	2.257
#1	**Muskingum K:**					**2.257**
#2	8. Large gullies, diversions, and low flowing streams	1.89	136.00	7,189.00	4.12	0.484
#2	**Muskingum K:**					**0.484**
#5	8. Large gullies, diversions, and low flowing streams	1.53	150.00	9,810.33	3.70	0.736
#5	**Muskingum K:**					**0.736**
#6	8. Large gullies, diversions, and low flowing streams	0.91	47.00	5,184.00	2.85	0.505
#6	**Muskingum K:**					**0.505**
#8	8. Large gullies, diversions, and low flowing streams	2.23	151.00	6,785.00	4.47	0.421
#8	**Muskingum K:**					**0.421**
#9	8. Large gullies, diversions, and low flowing streams	2.12	130.00	6,127.00	4.36	0.390
#9	**Muskingum K:**					**0.390**
#10	8. Large gullies, diversions, and low flowing streams	1.53	77.00	5,040.00	3.70	0.378
#10	**Muskingum K:**					**0.378**
#12	8. Large gullies, diversions, and low flowing streams	1.25	57.00	4,562.00	3.35	0.378
#12	**Muskingum K:**					**0.378**
#14	8. Large gullies, diversions, and low flowing streams	1.39	145.00	10,445.00	3.53	0.821
#14	**Muskingum K:**					**0.821**
#16	5. Nearly bare and untilled, and alluvial valley fans	0.80	33.00	4,101.41	0.89	1.280
	8. Large gullies, diversions, and low flowing streams	1.88	110.00	5,854.00	4.11	0.395
#16	**Muskingum K:**					**1.675**
#18	8. Large gullies, diversions, and low flowing streams	1.29	50.00	3,863.00	3.41	0.314
#18	**Muskingum K:**					**0.314**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#19	8. Large gullies, diversions, and low flowing streams	1.19	122.00	10,247.00	3.27	0.870
#19	**Muskingum K:**					**0.870**
#20	8. Large gullies, diversions, and low flowing streams	1.23	147.00	11,977.51	3.32	1.002
#20	**Muskingum K:**					**1.002**
#22	8. Large gullies, diversions, and low flowing streams	1.33	163.00	12,276.00	3.45	0.988
#22	**Muskingum K:**					**0.988**
#23	8. Large gullies, diversions, and low flowing streams	0.61	26.00	4,271.00	2.34	0.507
#23	**Muskingum K:**					**0.507**
#25	8. Large gullies, diversions, and low flowing streams	1.37	73.00	5,314.00	3.51	0.420
#25	**Muskingum K:**					**0.420**
#26	8. Large gullies, diversions, and low flowing streams	1.25	138.00	11,075.00	3.34	0.921
#26	**Muskingum K:**					**0.921**
#27	8. Large gullies, diversions, and low flowing streams	1.44	200.00	13,863.00	3.60	1.069
#27	**Muskingum K:**					**1.069**
#28	8. Large gullies, diversions, and low flowing streams	1.29	123.00	9,531.18	3.40	0.778
#28	**Muskingum K:**					**0.778**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#26	217.200	217.200	40.96	4.13	275.3	91,763	4.63	3.01
#22	163.500	163.500	23.86	2.81	140.5	67,654	1.31	0.87
#20	817.400	817.400	7.74	3.19	20.8	7,612	3.22	2.54
#19	451.700	451.700	18.34	4.37	106.1	29,219	0.00	0.00
#16	1,216.500	1,216.500	1.73	0.58	1.5	3,048	1.92	1.45
#17	1,238.300	2,454.800	7.58	4.98	32.8	19,524	8.32	2.71
#28	235.300	235.300	0.30	0.07	0.2	3,577	2.30	1.81
#14	6,692.200	6,692.200	20.25	15.13	100.3	16,047	1.51	0.55
#15	595.000	7,522.500	24.46	16.80	110.8	14,348	1.94	0.80
#18	146.200	10,123.500	28.72	22.03	145.5	17,272	3.57	1.24
#21	939.200	12,712.500	102.27	44.80	835.5	52,480	5.27	1.71
#10	86.900	86.900	19.01	1.65	135.0	115,081	8.72	5.52
#9	15.000	15.000	6.06	0.28	18.0	77,058	20.01	11.85
#8	24.100	24.100	9.74	0.46	25.6	68,327	17.74	10.50
#11	319.500	445.500	58.64	7.08	442.5	79,675	4.15	2.85
#25	373.200	373.200	23.37	4.23	152.5	45,283	0.00	0.00
#27	3,024.700	3,024.700	7.60	4.74	12.4	3,211	1.72	1.30
#4	2,965.700	5,990.400	23.19	12.51	48.4	4,876	2.52	1.78
#1	755.100	755.100	2.93	1.07	4.2	4,518	2.74	2.21
#2	2,360.500	3,115.600	10.59	7.15	18.4	2,959	1.29	0.97
#3	1,550.000	4,665.600	29.02	16.04	59.6	4,787	1.95	1.37
#5	0.000	10,656.000	49.85	28.56	108.0	4,762	2.17	1.55
#6	2,008.700	12,664.700	71.52	42.12	540.6	67,292	5.26	0.97
#7	215.800	13,253.700	82.23	50.40	868.5	58,345	3.18	0.89
#12	0.000	13,699.200	105.90	57.47	1,311.0	463,163	24.85	1.13
#13	258.600	13,957.800	109.38	60.02	1,354.6	64,614	1.94	0.63
#23	0.000	26,670.300	210.52	104.82	2,190.1	53,342	3.03	1.10
#24	459.200	27,129.500	215.45	109.05	2,252.1	50,262	2.05	0.78

Particle Size Distribution(s) at Each Structure

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	85.802%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	94.560%
0.0010	0.000%

Structure #20:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.857%
0.0500	56.019%
0.0020	36.248%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%

Size (mm)	In/Out
0.0020	100.000%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	44.768%
0.0500	25.369%
0.0020	16.415%
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	82.513%
0.0500	55.432%
0.0020	36.017%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	40.904%
0.0500	23.179%
0.0020	14.998%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	95.865%
0.0500	89.926%
0.0020	86.160%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	93.544%
0.0500	85.229%
0.0020	80.465%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	90.450%
0.0500	77.749%
0.0020	69.623%
0.0010	0.000%

Structure #21:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.123%
0.0500	91.375%
0.0020	82.506%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	78.968%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%

Size (mm)	In/Out
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.500%
0.0500	77.000%
0.0020	56.000%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.377%
0.0500	97.737%
0.0020	88.149%
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	69.139%
0.0500	39.179%
0.0020	25.351%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	74.076%
0.0500	41.976%
0.0020	27.161%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	50.796%
0.0500	28.784%
0.0020	18.625%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	89.195%
0.0500	53.972%
0.0020	34.923%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.680%
0.0500	58.253%
0.0020	37.693%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	86.551%

Size (mm)	In/Out
0.0500	50.959%
0.0020	32.974%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.983%
0.0500	91.873%
0.0020	88.173%
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.379%
0.0500	94.953%
0.0020	90.994%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	99.041%
0.0500	95.893%
0.0020	90.034%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.885%
0.0020	92.958%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	98.903%
0.0500	96.020%
0.0020	88.970%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	97.951%
0.0020	91.095%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#26	1	217.200	0.309	0.000	0.000	91.000	M	40.96	4.125
	Σ	**217.200**						**40.96**	**4.125**
#22	1	163.500	0.421	0.000	0.000	90.300	M	23.86	2.812
	Σ	**163.500**						**23.86**	**2.812**
#20	1	817.400	2.464	0.000	0.000	81.600	M	7.74	3.187
	Σ	**817.400**						**7.74**	**3.187**
#19	1	451.700	1.091	0.000	0.000	86.500	M	18.34	4.373
	Σ	**451.700**						**18.34**	**4.373**
#16	1	1,216.500	2.442	0.000	0.000	75.200	M	1.73	0.581
	Σ	**1,216.500**						**1.73**	**0.581**
#17	1	1,099.800	4.518	0.612	0.218	80.600	M	6.03	3.413
	2	138.500	0.433	0.000	0.000	84.700	M	6.40	0.990
	Σ	**2,454.800**						**7.58**	**4.984**
#28	1	235.300	1.177	0.000	0.000	74.400	M	0.30	0.069
	Σ	**235.300**						**0.30**	**0.069**
#14	1	2,999.900	6.028	5.514	0.260	77.600	M	5.82	3.987
	2	1,855.300	3.849	1.483	0.319	78.800	M	7.17	3.593
	3	727.900	1.449	0.000	0.000	85.400	M	20.25	5.872
	4	1,109.100	2.160	1.449	0.311	78.000	M	4.46	1.683
	Σ	**6,692.200**						**20.25**	**15.134**
#15	1	595.000	1.000	0.000	0.000	80.000	M	5.21	1.594
	Σ	**7,522.500**						**24.46**	**16.797**
#18	1	146.200	0.733	0.000	0.000	78.400	M	0.81	0.251
	Σ	**10,123.500**						**28.72**	**22.033**
#21	1	397.300	1.532	0.102	0.358	86.700	M	13.75	3.973
	2	465.700	1.196	0.102	0.358	85.200	M	13.79	3.630
	3	76.200	0.242	0.000	0.000	85.900	M	6.34	0.669
	Σ	**12,712.500**						**102.27**	**44.801**
#10	1	86.900	0.209	0.000	0.000	91.000	M	19.01	1.650
	Σ	**86.900**						**19.01**	**1.650**
#9	1	15.000	0.044	0.000	0.000	91.000	M	6.06	0.285

SEDCAD 4 for Windows

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**15.000**						**6.06**	**0.285**
#8	1	24.100	0.118	0.000	0.000	91.000	M	9.74	0.458
	Σ	**24.100**						**9.74**	**0.458**
#11	1	319.500	0.430	0.000	0.000	89.200	M	38.09	4.685
	Σ	**445.500**						**58.64**	**7.078**
#25	1	373.200	0.745	0.000	0.000	87.500	M	23.37	4.234
	Σ	**373.200**						**23.37**	**4.234**
#27	1	3,024.700	5.305	0.000	0.000	78.100	M	7.60	4.738
	Σ	**3,024.700**						**7.60**	**4.738**
#4	1	654.900	1.236	0.425	0.345	79.900	M	5.22	1.710
	2	699.700	1.078	0.425	0.345	78.500	M	3.77	1.240
	3	547.300	0.992	0.425	0.345	78.100	M	2.63	0.857
	4	1,063.800	1.514	0.000	0.000	81.400	M	11.81	3.969
	Σ	**5,990.400**						**23.19**	**12.514**
#1	1	755.100	1.922	0.000	0.000	77.800	M	2.93	1.073
	Σ	**755.100**						**2.93**	**1.073**
#2	1	1,327.000	2.969	3.034	0.146	77.200	M	3.70	1.532
	2	894.200	3.538	0.000	0.000	82.100	M	7.94	3.879
	3	139.300	1.214	0.000	0.000	82.600	M	2.30	0.670
	Σ	**3,115.600**						**10.59**	**7.155**
#3	1	1,550.000	2.670	0.000	0.000	83.500	M	21.08	8.890
	Σ	**4,665.600**						**29.02**	**16.044**
#5	Σ	**10,656.000**						**49.85**	**28.559**
#6	1	505.100	2.318	0.538	0.343	76.200	M	1.12	0.392
	2	638.400	4.584	0.359	0.337	78.800	M	2.19	1.236
	3	557.000	2.148	0.000	0.000	88.100	M	20.08	6.929
	4	308.200	0.324	0.272	0.356	89.900	M	47.84	5.004
	Σ	**12,664.700**						**71.52**	**42.120**
#7	1	215.800	0.400	0.000	0.000	90.900	M	35.65	4.041
	Σ	**13,253.700**						**82.23**	**50.395**
#12	Σ	**13,699.200**						**105.90**	**57.473**
#13	1	258.600	0.301	0.000	0.000	86.600	M	22.46	2.545
	Σ	**13,957.800**						**109.38**	**60.018**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#23	Σ	**26,670.300**						**210.52**	**104.819**
#24	1	459.200	0.465	0.000	0.000	86.200	M	28.98	4.234
	Σ	**27,129.500**						**215.45**	**109.053**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#26	1	0.209	75.00	14.70	0.3940	1.0000	1	275.3	91,763	4.63	3.01
	Σ							**275.3**	**91,763**	**4.63**	**3.01**
#22	1	0.205	75.00	13.40	0.3870	1.0000	1	140.5	67,654	1.31	0.87
	Σ							**140.5**	**67,654**	**1.31**	**0.87**
#20	1	0.183	200.00	3.90	0.3520	1.0000	3	20.8	7,612	3.22	2.54
	Σ							**20.8**	**7,612**	**3.22**	**2.54**
#19	1	0.187	125.00	9.00	0.3940	1.0000	1	106.1	29,219	0.00	0.00
	Σ							**106.1**	**29,219**	**0.00**	**0.00**
#16	1	0.120	400.00	1.90	0.3520	1.0000	3	1.5	3,048	1.92	1.45
	Σ							**1.5**	**3,048**	**1.92**	**1.45**
#17	1	0.231	300.00	3.00	0.3440	1.0000	3	20.5	7,309	2.79	2.12
	2	0.192	150.00	6.70	0.2880	1.0000	3	14.8	19,524	11.05	7.74
	Σ							**32.8**	**19,524**	**8.32**	**2.71**
#28	1	0.109	300.00	2.90	0.3650	1.0000	3	0.2	3,577	2.30	1.81
	Σ							**0.2**	**3,577**	**2.30**	**1.81**
#14	1	0.175	400.00	1.40	0.3310	1.0000	3	8.9	2,762	1.45	1.11
	2	0.175	300.00	2.20	0.3170	1.0000	3	12.3	4,151	2.29	1.74
	3	0.189	175.00	5.30	0.3530	1.0000	1	79.5	16,047	0.00	0.00
	4	0.256	300.00	2.20	0.3050	1.0000	3	8.7	5,993	3.60	2.85
	Σ							**100.3**	**16,047**	**1.51**	**0.55**
#15	1	0.161	200.00	3.90	0.3660	1.0000	3	10.3	7,143	3.75	3.14
	Σ							**110.8**	**14,348**	**1.94**	**0.80**
#18	1	0.152	175.00	5.00	0.3930	1.0000	3	1.9	7,850	4.87	4.32
	Σ							**145.5**	**17,272**	**3.57**	**1.24**
#21	1	0.224	175.00	5.10	0.3800	1.0000	1	63.3	19,015	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	2	0.192	175.00	5.70	0.3820	1.0000	3	57.7	18,885	9.16	7.07
	3	0.241	75.00	15.30	0.2480	1.0000	1	26.7	56,482	1.55	0.98
	Σ							**835.5**	**52,480**	**5.27**	**1.71**
#10	1	0.210	75.00	17.50	0.3990	1.0000	1	135.0	115,081	8.72	5.52
	Σ							**135.0**	**115,081**	**8.72**	**5.52**
#9	1	0.210	75.00	12.80	0.3990	1.0000	1	18.0	77,058	20.01	11.85
	Σ							**18.0**	**77,058**	**20.01**	**11.85**
#8	1	0.210	125.00	9.40	0.3990	1.0000	1	25.6	68,327	17.74	10.50
	Σ							**25.6**	**68,327**	**17.74**	**10.50**
#11	1	0.222	100.00	11.70	0.3910	1.0000	1	263.9	75,708	0.50	0.33
	Σ							**442.5**	**79,675**	**4.15**	**2.85**
#25	1	0.187	100.00	11.59	0.3780	1.0000	1	152.5	45,283	0.00	0.00
	Σ							**152.5**	**45,283**	**0.00**	**0.00**
#27	1	0.150	300.00	2.10	0.3220	1.0000	3	12.4	3,211	1.72	1.30
	Σ							**12.4**	**3,211**	**1.72**	**1.30**
#4	1	0.160	300.00	2.10	0.3320	1.0000	3	6.2	4,037	2.10	1.75
	2	0.130	200.00	3.80	0.3070	1.0000	3	5.0	4,277	2.62	2.26
	3	0.147	200.00	3.90	0.2900	1.0000	3	3.6	4,436	2.73	2.39
	4	0.121	175.00	4.50	0.2900	1.0000	3	21.3	6,107	2.85	2.31
	Σ							**48.4**	**4,876**	**2.52**	**1.78**
#1	1	0.144	300.00	3.00	0.3260	1.0000	3	4.2	4,518	2.74	2.21
	Σ							**4.2**	**4,518**	**2.74**	**2.21**
#2	1	0.142	300.00	2.30	0.3360	1.0000	3	4.7	3,714	2.23	1.70
	2	0.167	400.00	1.30	0.3480	1.0000	3	9.9	3,049	1.15	0.88
	3	0.180	400.00	1.60	0.3370	1.0000	3	2.3	3,966	1.89	1.50
	Σ							**18.4**	**2,959**	**1.29**	**0.97**
#3	1	0.179	300.00	2.20	0.3420	1.0000	3	41.2	5,456	2.16	1.69
	Σ							**59.6**	**4,787**	**1.95**	**1.37**
#5	Σ							**108.0**	**4,762**	**2.17**	**1.55**
#6	1	0.170	200.00	3.70	0.3350	1.0000	3	1.8	5,608	3.57	2.74
	2	0.176	175.00	4.10	0.3370	1.0000	3	6.7	6,586	3.52	2.66
	3	0.196	100.00	11.80	0.3770	1.0000	1	197.7	33,891	0.00	0.00
	4	0.203	100.00	11.60	0.3800	1.0000	1	273.3	74,350	2.93	1.94

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**540.6**	**67,292**	**5.26**	**0.97**
#7	1	0.210	125.00	9.34	0.3950	1.0000	1	175.5	59,279	1.72	1.14
	Σ							**868.5**	**58,345**	**3.18**	**0.89**
#12	Σ							**1,311.0**	**463,163**	**24.85**	**1.13**
#13	1	0.230	75.00	12.00	0.2560	1.0000	1	82.4	45,369	0.68	0.44
	Σ							**1,354.6**	**64,614**	**1.94**	**0.63**
#23	Σ							**2,190.1**	**53,342**	**3.03**	**1.10**
#24	1	0.233	125.00	8.70	0.2550	1.0000	1	103.0	32,211	0.00	0.00
	Σ							**2,252.1**	**50,262**	**2.05**	**0.78**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.19	120.00	2,312.00	2.270	0.282
		8. Large gullies, diversions, and low flowing streams	1.85	100.00	5,414.00	4.070	0.369
		5. Nearly bare and untilled, and alluvial valley fans	1.65	97.00	5,861.00	1.280	1.271
#1	**1**	**Time of Concentration:**					**1.922**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	4.27	115.00	2,694.00	2.060	0.363
		8. Large gullies, diversions, and low flowing streams	2.37	100.00	4,211.00	4.620	0.253
		5. Nearly bare and untilled, and alluvial valley fans	1.10	97.00	8,811.00	1.040	2.353
#2	**1**	**Time of Concentration:**					**2.969**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	0.63	63.00	10,064.00	0.790	3.538
#2	**2**	**Time of Concentration:**					**3.538**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	1.24	60.00	4,853.00	1.110	1.214
#2	**3**	**Time of Concentration:**					**1.214**
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.32	140.00	10,633.45	1.140	2.590
		8. Large gullies, diversions, and low flowing streams	5.53	113.00	2,042.03	7.050	0.080
#3	**1**	**Time of Concentration:**					**2.670**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#4	1	5. Nearly bare and untilled, and alluvial valley fans	1.72	60.00	3,483.00	1.310	0.738
		8. Large gullies, diversions, and low flowing streams	1.45	94.00	6,477.00	3.610	0.498
#4	**1**	**Time of Concentration:**					**1.236**
#4	2	5. Nearly bare and untilled, and alluvial valley fans	6.55	122.00	1,863.00	2.550	0.202
		8. Large gullies, diversions, and low flowing streams	1.44	164.00	11,361.00	3.600	0.876
#4	**2**	**Time of Concentration:**					**1.078**
#4	3	5. Nearly bare and untilled, and alluvial valley fans	5.52	95.00	1,722.00	2.340	0.204
		8. Large gullies, diversions, and low flowing streams	2.05	249.00	12,174.00	4.290	0.788
#4	**3**	**Time of Concentration:**					**0.992**
#4	4	5. Nearly bare and untilled, and alluvial valley fans	6.83	145.00	2,123.00	2.610	0.225
		8. Large gullies, diversions, and low flowing streams	1.80	336.00	18,657.00	4.020	1.289
#4	**4**	**Time of Concentration:**					**1.514**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	1.39	128.00	9,201.00	1.170	2.184
		8. Large gullies, diversions, and low flowing streams	3.50	95.00	2,715.00	5.610	0.134
#6	**1**	**Time of Concentration:**					**2.318**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	0.88	130.00	14,812.00	0.930	4.424
		8. Large gullies, diversions, and low flowing streams	4.79	182.00	3,801.00	6.560	0.160
#6	**2**	**Time of Concentration:**					**4.584**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	0.74	37.00	5,027.00	0.850	1.642
		8. Large gullies, diversions, and low flowing streams	2.80	256.00	9,143.00	5.010	0.506
#6	**3**	**Time of Concentration:**					**2.148**
#6	4	8. Large gullies, diversions, and low flowing streams	5.14	90.00	1,752.00	6.790	0.071
		8. Large gullies, diversions, and low flowing streams	3.43	174.00	5,073.00	5.550	0.253
#6	**4**	**Time of Concentration:**					**0.324**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	12.45	63.00	506.00	3.520	0.039
		8. Large gullies, diversions, and low flowing streams	1.91	103.00	5,392.00	4.140	0.361
#7	**1**	**Time of Concentration:**					**0.400**
#8	1	5. Nearly bare and untilled, and alluvial valley fans	2.65	15.00	565.00	1.620	0.096
		9. Small streams flowing bankfull	5.06	82.00	1,620.00	20.240	0.022

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#8	**1**	**Time of Concentration:**					**0.118**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	6.06	12.00	198.00	2.460	0.022
		8. Large gullies, diversions, and low flowing streams	8.78	62.00	706.00	8.890	0.022
#9	**1**	**Time of Concentration:**					**0.044**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	8.40	63.00	750.00	2.890	0.072
		8. Large gullies, diversions, and low flowing streams	4.59	146.00	3,184.00	6.420	0.137
#10	**1**	**Time of Concentration:**					**0.209**
#11	1	5. Nearly bare and untilled, and alluvial valley fans	14.84	38.00	256.00	3.850	0.018
		8. Large gullies, diversions, and low flowing streams	2.21	146.00	6,606.00	4.450	0.412
#11	**1**	**Time of Concentration:**					**0.430**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	19.00	53.00	279.00	4.350	0.017
		8. Large gullies, diversions, and low flowing streams	3.60	210.00	5,831.00	5.690	0.284
#13	**1**	**Time of Concentration:**					**0.301**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	0.99	213.00	21,485.00	0.990	6.028
#14	**1**	**Time of Concentration:**					**6.028**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	1.44	240.00	16,629.00	1.200	3.849
#14	**2**	**Time of Concentration:**					**3.849**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	2.29	45.00	1,966.00	1.510	0.361
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	0.94	20.00	2,124.00	0.970	0.608
#14	**3**	**Time of Concentration:**					**1.449**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	1.79	185.00	10,345.00	1.330	2.160
#14	**4**	**Time of Concentration:**					**2.160**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	3.28	65.00	1,983.00	1.810	0.304
		8. Large gullies, diversions, and low flowing streams	1.29	110.00	8,530.00	3.400	0.696
#15	**1**	**Time of Concentration:**					**1.000**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	1.18	112.00	9,497.00	1.080	2.442
#16	**1**	**Time of Concentration:**					**2.442**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	0.64	80.00	12,462.00	0.800	4.327

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.04	60.00	2,946.00	4.280	0.191
#17	**1**	**Time of Concentration:**					**4.518**
#17	2	5. Nearly bare and untilled, and alluvial valley fans	4.83	165.00	3,419.00	2.190	0.433
#17	**2**	**Time of Concentration:**					**0.433**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	10.99	80.00	728.00	3.310	0.061
		8. Large gullies, diversions, and low flowing streams	1.48	130.00	8,808.00	3.640	0.672
#18	**1**	**Time of Concentration:**					**0.733**
#19	1	5. Nearly bare and untilled, and alluvial valley fans	6.02	55.00	914.00	2.450	0.103
		8. Large gullies, diversions, and low flowing streams	2.59	160.00	6,167.00	4.830	0.354
		5. Nearly bare and untilled, and alluvial valley fans	1.41	38.00	2,695.00	1.180	0.634
#19	**1**	**Time of Concentration:**					**1.091**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	1.12	93.00	8,290.00	1.050	2.193
		8. Large gullies, diversions, and low flowing streams	3.40	184.00	5,404.00	5.530	0.271
#20	**1**	**Time of Concentration:**					**2.464**
#21	1	8. Large gullies, diversions, and low flowing streams	7.18	125.00	1,741.00	8.030	0.060
		5. Nearly bare and untilled, and alluvial valley fans	1.02	40.00	3,904.00	1.010	1.073
		8. Large gullies, diversions, and low flowing streams	1.06	47.00	4,430.00	3.080	0.399
#21	**1**	**Time of Concentration:**					**1.532**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.87	124.00	3,207.00	1.960	0.454
		8. Large gullies, diversions, and low flowing streams	1.03	84.00	8,127.00	3.040	0.742
#21	**2**	**Time of Concentration:**					**1.196**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	4.80	62.00	1,291.00	2.190	0.163
		8. Large gullies, diversions, and low flowing streams	6.45	140.00	2,172.00	7.610	0.079
#21	**3**	**Time of Concentration:**					**0.242**
#22	1	5. Nearly bare and untilled, and alluvial valley fans	4.23	55.00	1,300.00	2.050	0.176
		8. Large gullies, diversions, and low flowing streams	3.29	158.00	4,808.00	5.430	0.245
#22	**1**	**Time of Concentration:**					**0.421**
#24	1	5. Nearly bare and untilled, and alluvial valley fans	4.21	45.00	1,070.00	2.050	0.144

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	3.18	196.00	6,172.00	5.340	0.321
#24	**1**	**Time of Concentration:**					**0.465**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	3.15	52.00	1,653.05	1.770	0.259
		8. Large gullies, diversions, and low flowing streams	3.05	280.00	9,168.00	5.240	0.486
#25	**1**	**Time of Concentration:**					**0.745**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	9.72	75.00	772.00	3.110	0.068
		8. Large gullies, diversions, and low flowing streams	3.52	172.00	4,892.00	5.620	0.241
#26	**1**	**Time of Concentration:**					**0.309**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	1.17	241.00	20,629.00	1.080	5.305
#27	**1**	**Time of Concentration:**					**5.305**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	1.66	62.00	3,744.00	1.280	0.812
		8. Large gullies, diversions, and low flowing streams	1.92	105.00	5,466.00	4.150	0.365
#28	**1**	**Time of Concentration:**					**1.177**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	1	5. Nearly bare and untilled, and alluvial valley fans	0.50	38.00	7,646.00	0.700	3.034
#2	**1**	**Muskingum K:**					**3.034**
#4	1	8. Large gullies, diversions, and low flowing streams	1.59	92.00	5,787.00	3.780	0.425
#4	**1**	**Muskingum K:**					**0.425**
#4	2	8. Large gullies, diversions, and low flowing streams	1.59	92.00	5,787.00	3.780	0.425
#4	**2**	**Muskingum K:**					**0.425**
#4	3	8. Large gullies, diversions, and low flowing streams	1.59	92.00	5,787.00	3.780	0.425
#4	**3**	**Muskingum K:**					**0.425**
#6	1	8. Large gullies, diversions, and low flowing streams	1.54	111.00	7,218.00	3.720	0.538
#6	**1**	**Muskingum K:**					**0.538**
#6	2	8. Large gullies, diversions, and low flowing streams	1.37	62.00	4,531.00	3.500	0.359
#6	**2**	**Muskingum K:**					**0.359**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	0.97	143.00	14,748.00	0.980	4.180

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.34	10.00	747.00	1.150	0.180
		8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,592.00	3.840	0.549
		5. Nearly bare and untilled, and alluvial valley fans	0.95	20.00	2,116.00	0.970	0.605
#14	**1**	**Muskingum K:**					**5.514**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	1.34	10.00	747.04	1.150	0.180
		8. Large gullies, diversions, and low flowing streams	1.65	125.00	7,592.00	3.840	0.549
		5. Nearly bare and untilled, and alluvial valley fans	0.82	20.00	2,446.00	0.900	0.754
#14	**2**	**Muskingum K:**					**1.483**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	2.29	45.00	1,966.00	1.510	0.361
		8. Large gullies, diversions, and low flowing streams	1.60	105.00	6,562.00	3.790	0.480
		5. Nearly bare and untilled, and alluvial valley fans	0.94	20.00	2,124.00	0.970	0.608
#14	**4**	**Muskingum K:**					**1.449**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	1.73	50.00	2,887.00	1.310	0.612
#17	**1**	**Muskingum K:**					**0.612**
#21	1	8. Large gullies, diversions, and low flowing streams	2.03	32.00	1,575.00	4.270	0.102
#21	**1**	**Muskingum K:**					**0.102**
#21	2	8. Large gullies, diversions, and low flowing streams	2.03	32.00	1,575.11	4.270	0.102
#21	**2**	**Muskingum K:**					**0.102**

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#26	217.200	217.200	108.07	10.51	800.4	102,305	7.46	4.95
#22	163.500	163.500	67.11	7.43	432.1	77,791	3.74	2.51
#20	817.400	817.400	41.80	15.82	131.2	9,921	4.15	3.20
#19	451.700	451.700	70.66	14.41	440.5	38,200	0.00	0.00
#16	1,216.500	1,216.500	26.11	10.56	33.8	3,753	1.53	1.20
#17	1,238.300	2,454.800	60.08	33.30	241.1	27,582	11.14	2.68
#28	235.300	235.300	6.29	1.81	7.2	4,581	2.20	1.75
#14	6,692.200	6,692.200	103.52	97.12	574.0	20,962	1.45	0.41
#15	595.000	7,522.500	109.88	108.55	633.2	16,412	1.65	0.58
#18	146.200	10,123.500	168.88	143.80	898.5	19,535	3.78	1.17
#21	939.200	12,712.500	379.30	220.29	3,336.6	49,801	6.77	1.91
#10	86.900	86.900	48.55	4.21	385.5	124,001	11.44	7.49
#9	15.000	15.000	14.02	0.73	48.6	75,590	19.63	12.54
#8	24.100	24.100	22.52	1.17	69.0	67,021	17.40	11.11
#11	319.500	445.500	171.53	19.23	1,380.1	89,066	6.48	4.56
#25	373.200	373.200	83.14	13.10	584.3	57,323	0.00	0.00
#27	3,024.700	3,024.700	61.09	38.87	129.3	4,060	1.16	0.89
#4	2,965.700	5,990.400	181.03	85.95	431.1	7,229	3.08	1.91
#1	755.100	755.100	27.28	9.34	49.7	6,285	2.73	2.13
#2	2,360.500	3,115.600	73.72	45.81	164.1	3,933	1.43	1.16
#3	1,550.000	4,665.600	129.93	82.51	358.2	5,967	2.24	1.48
#5	0.000	10,656.000	290.73	168.46	789.3	6,589	2.66	1.70
#6	2,008.700	12,664.700	376.89	216.65	2,418.8	74,907	12.19	1.65
#7	215.800	13,253.700	405.11	240.10	3,520.6	64,972	7.78	1.59
#12	0.000	13,699.200	423.38	259.33	4,900.7	76,781	8.17	1.82
#13	258.600	13,957.800	429.95	267.67	5,079.8	70,467	5.76	1.40
#23	0.000	26,670.300	702.12	487.95	8,416.4	53,357	5.51	1.63
#24	459.200	27,129.500	714.58	502.19	8,656.9	50,387	4.16	1.30

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#26	217.200	217.200	153.43	14.88	1,183.1	106,078	8.49	5.66
#22	163.500	163.500	97.22	10.63	649.8	81,426	4.65	3.14
#20	817.400	817.400	71.98	26.42	237.1	10,819	4.68	3.57
#19	451.700	451.700	111.15	21.92	717.8	41,110	0.00	0.00
#16	1,216.500	1,216.500	54.52	21.15	75.3	4,231	1.73	1.34
#17	1,238.300	2,454.800	112.96	59.50	451.2	29,638	12.28	2.85
#28	235.300	235.300	14.41	3.75	17.1	5,465	2.66	2.05
#14	6,692.200	6,692.200	184.03	171.42	1,034.6	22,771	1.93	0.51
#15	595.000	7,522.500	193.46	191.83	1,147.4	17,283	1.99	0.68
#18	146.200	10,123.500	304.51	254.85	1,648.8	20,265	4.26	1.31
#21	939.200	12,712.500	598.22	372.17	5,480.0	49,641	7.54	2.08
#10	86.900	86.900	68.66	5.95	568.5	128,056	12.62	8.33
#9	15.000	15.000	19.08	1.03	70.2	75,205	19.53	12.77
#8	24.100	24.100	30.65	1.65	99.6	66,678	17.31	11.32
#11	319.500	445.500	250.69	27.75	2,087.8	92,416	7.40	5.26
#25	373.200	373.200	128.36	19.59	933.5	61,317	0.00	0.00
#27	3,024.700	3,024.700	112.14	70.82	254.2	4,389	1.29	0.98
#4	2,965.700	5,990.400	336.67	152.63	836.5	8,131	3.58	2.14
#1	755.100	755.100	52.74	17.17	101.0	7,055	3.16	2.43
#2	2,360.500	3,115.600	133.45	80.70	313.3	4,340	1.61	1.27
#3	1,550.000	4,665.600	213.31	139.64	633.1	6,422	2.42	1.54
#5	0.000	10,656.000	512.13	292.27	1,469.7	7,365	3.04	1.86
#6	2,008.700	12,664.700	651.03	368.09	4,015.7	77,431	14.35	1.83
#7	215.800	13,253.700	690.79	402.35	5,717.5	68,279	9.46	1.78
#12	0.000	13,699.200	715.89	430.10	7,805.3	80,011	9.83	2.01
#13	258.600	13,957.800	724.14	442.74	8,110.8	73,508	7.31	1.64
#23	0.000	26,670.300	1,148.02	814.92	13,590.8	54,734	6.60	1.84
#24	459.200	27,129.500	1,154.68	836.68	13,925.8	52,850	5.12	1.48

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	Badland Premining	Badland Postmining	LoamySand Premining	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	100.000%
0.1000	83.500%	75.900%	30.000%	26.500%
0.0500	77.000%	70.000%	17.000%	14.000%
0.0020	56.000%	47.000%	11.000%	11.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#26	217.200	217.200	216.50	21.06	1,742.7	109,754	9.48	6.35
#22	163.500	163.500	139.61	15.19	971.8	84,928	5.53	3.73
#20	817.400	817.400	120.48	42.97	415.4	11,743	5.26	3.98
#19	451.700	451.700	172.44	33.01	1,154.6	44,050	0.00	0.00
#16	1,216.500	1,216.500	105.20	39.27	153.9	4,707	1.99	1.53
#17	1,238.300	2,454.800	203.45	102.11	815.1	31,546	13.51	3.08
#28	235.300	235.300	29.91	7.10	36.8	6,368	3.22	2.42
#14	6,692.200	6,692.200	314.68	291.29	1,816.1	24,473	2.48	0.62
#15	595.000	7,522.500	330.71	326.28	2,030.3	18,199	2.38	0.79
#18	146.200	10,123.500	527.55	434.47	2,941.8	21,058	4.79	1.47
#21	939.200	12,712.500	930.98	612.73	8,915.9	49,473	8.27	2.26
#10	86.900	86.900	96.52	8.43	835.7	131,991	14.46	9.60
#9	15.000	15.000	25.92	1.45	101.2	74,997	19.47	13.01
#8	24.100	24.100	41.65	2.34	143.7	66,493	17.26	11.53
#11	319.500	445.500	364.52	39.93	3,138.1	95,694	8.43	6.04
#25	373.200	373.200	194.63	29.08	1,470.6	64,958	0.00	0.00
#27	3,024.700	3,024.700	196.66	123.04	474.3	4,726	1.45	1.11
#4	2,965.700	5,990.400	595.82	260.25	1,547.2	8,999	4.10	2.40
#1	755.100	755.100	96.46	30.02	193.7	7,830	3.64	2.76
#2	2,360.500	3,115.600	231.44	136.89	583.6	4,782	1.87	1.43
#3	1,550.000	4,665.600	343.82	229.79	1,100.6	6,877	2.65	1.65
#5	0.000	10,656.000	872.77	490.04	2,647.8	8,139	3.47	2.05
#6	2,008.700	12,664.700	1,093.67	608.13	6,651.1	79,534	16.84	2.08
#7	215.800	13,253.700	1,148.58	658.01	9,258.1	71,513	11.48	2.03
#12	0.000	13,699.200	1,182.70	697.94	12,396.2	82,918	11.78	2.27
#13	258.600	13,957.800	1,192.93	716.96	12,902.9	76,114	9.10	1.94
#23	0.000	26,670.300	1,876.55	1,329.69	21,818.8	54,912	7.63	2.08
#24	459.200	27,129.500	1,885.94	1,362.60	22,398.4	52,542	6.13	1.75

APPENDIX 7-H

COTTONWOOD ARROYO PRE-MINING HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

NOV 2004

Cottonwood Arroyo Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is shown on Exhibit 7-4.

Revised November 2004

AAY/LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

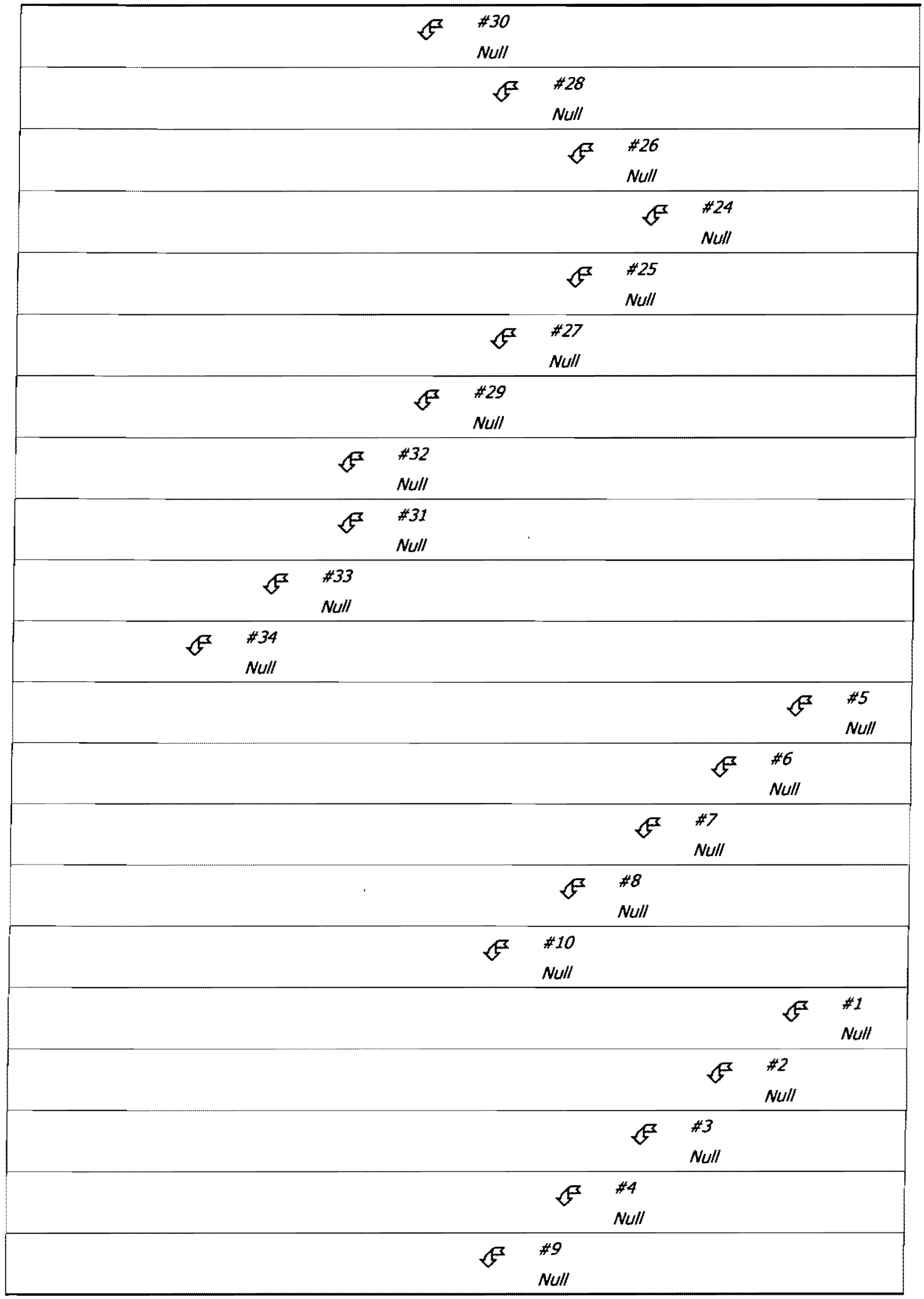
Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.961	0.307	
Null	#2	==>	#3	0.068	0.331	
Null	#3	==>	#4	0.000	0.000	
Null	#4	==>	#9	0.718	0.281	
Null	#5	==>	#6	1.205	0.328	
Null	#6	==>	#7	0.189	0.304	
Null	#7	==>	#8	0.000	0.000	
Null	#8	==>	#10	0.989	0.300	
Null	#9	==>	#11	0.000	0.000	
Null	#10	==>	#11	0.000	0.000	
Null	#11	==>	#21	0.495	0.453	
Null	#12	==>	#13	0.076	0.330	
Null	#13	==>	#14	3.790	0.314	
Null	#14	==>	#16	1.198	0.286	
Null	#15	==>	#16	1.198	0.286	
Null	#16	==>	#20	0.911	0.280	
Null	#17	==>	#19	0.000	0.000	
Null	#18	==>	#19	0.000	0.000	
Null	#19	==>	#20	0.915	0.252	
Null	#20	==>	#22	0.000	0.000	
Null	#21	==>	#22	0.000	0.000	
Null	#22	==>	#23	0.811	0.247	
Null	#23	==>	#35	0.000	0.000	
Null	#24	==>	#25	0.964	0.340	
Null	#25	==>	#27	1.454	0.333	
Null	#26	==>	#27	1.454	0.333	
Null	#27	==>	#29	0.800	0.323	
Null	#28	==>	#29	0.800	0.323	
Null	#29	==>	#32	0.479	0.298	
Null	#30	==>	#32	0.479	0.298	
Null	#31	==>	#33	0.000	0.000	
Null	#32	==>	#33	0.000	0.000	
Null	#33	==>	#34	1.372	0.293	Inlet to North Fork Diversion
Null	#34	==>	#35	0.000	0.000	
Null	#35	==>	#36	0.735	0.251	
Null	#36	==>	#37	3.388	0.246	
Null	#37	==>	End	0.000	0.000	



#30
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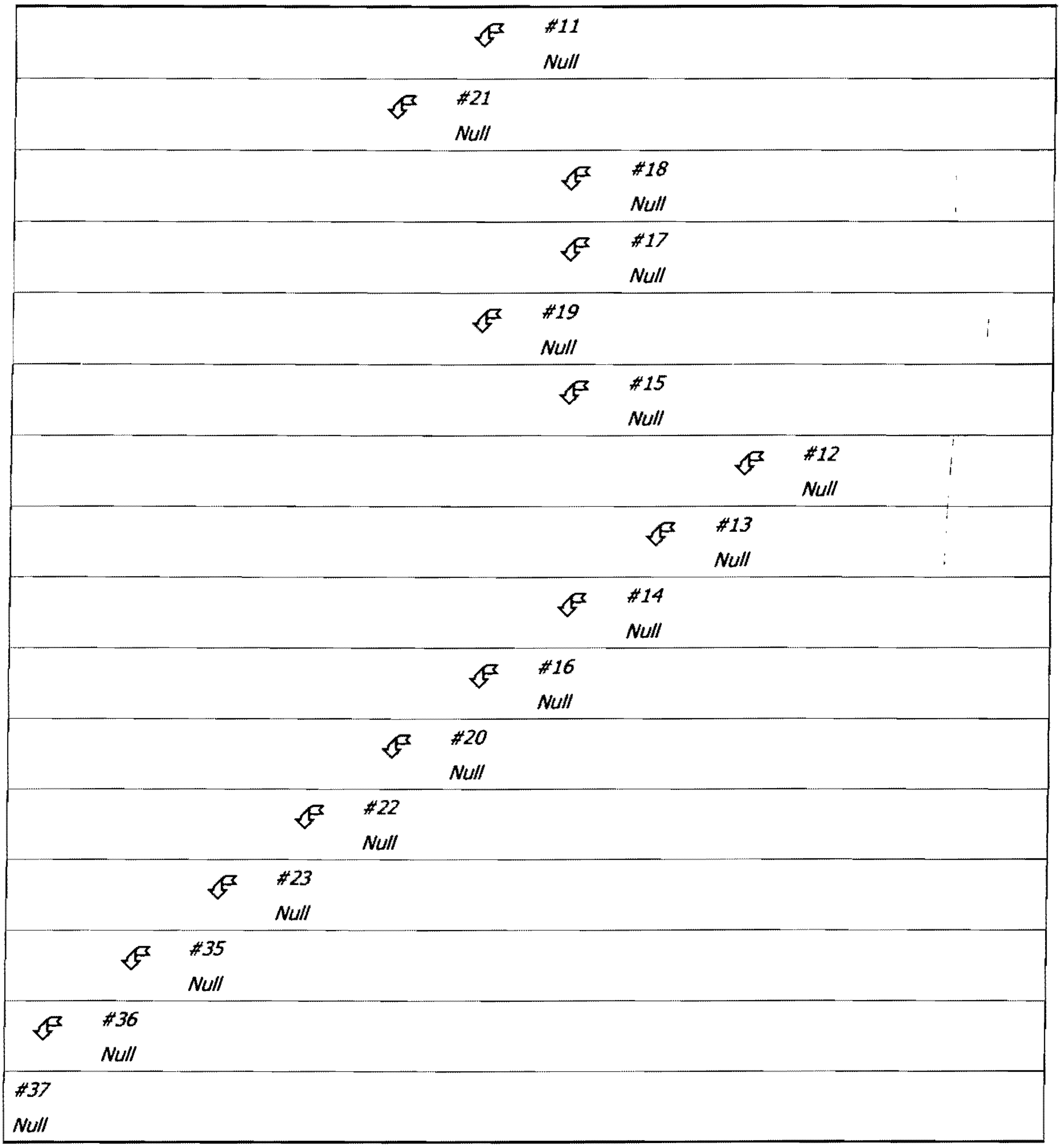


Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	0.81	76.00	9,347.00	2.70	0.961
#1	**Muskingum K:**					**0.961**
#2	8. Large gullies, diversions, and low flowing streams	1.23	10.00	814.00	3.32	0.068

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	**Muskingum K:**					**0.068**
#3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.00	0.000
#3	**Muskingum K:**					**0.000**
#4	8. Large gullies, diversions, and low flowing streams	0.53	30.00	5,637.00	2.18	0.718
#4	**Muskingum K:**					**0.718**
#5	8. Large gullies, diversions, and low flowing streams	1.17	165.00	14,065.00	3.24	1.205
#5	**Muskingum K:**					**1.205**
#6	8. Large gullies, diversions, and low flowing streams	0.78	14.00	1,799.25	2.64	0.189
#6	**Muskingum K:**					**0.189**
#8	8. Large gullies, diversions, and low flowing streams	0.72	65.00	9,046.00	2.54	0.989
#8	**Muskingum K:**					**0.989**
#11	8. Large gullies, diversions, and low flowing streams	30.00	8,801.00	29,336.66	16.43	0.495
#11	**Muskingum K:**					**0.495**
#12	8. Large gullies, diversions, and low flowing streams	1.21	11.00	906.00	3.30	0.076
#12	**Muskingum K:**					**0.076**
#13	8. Large gullies, diversions, and low flowing streams	0.92	363.00	39,301.00	2.88	3.790
#13	**Muskingum K:**					**3.790**
#14	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#14	**Muskingum K:**					**1.198**
#15	8. Large gullies, diversions, and low flowing streams	0.58	57.00	9,834.00	2.28	1.198
#15	**Muskingum K:**					**1.198**
#16	8. Large gullies, diversions, and low flowing streams	0.52	37.00	7,084.00	2.16	0.911
#16	**Muskingum K:**					**0.911**
#19	8. Large gullies, diversions, and low flowing streams	0.33	19.00	5,699.00	1.73	0.915
#19	**Muskingum K:**					**0.915**
#22	8. Large gullies, diversions, and low flowing streams	0.31	15.00	4,852.00	1.66	0.811
#22	**Muskingum K:**					**0.811**
#24	8. Large gullies, diversions, and low flowing streams	1.46	184.00	12,568.00	3.62	0.964
#24	**Muskingum K:**					**0.964**
#25	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.00	3.39	1.454
#25	**Muskingum K:**					**1.454**

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#26	8. Large gullies, diversions, and low flowing streams	1.28	228.00	17,755.62	3.39	1.454
#26	**Muskingum K:**					**1.454**
#27	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#27	**Muskingum K:**					**0.800**
#28	8. Large gullies, diversions, and low flowing streams	1.07	96.00	8,938.00	3.10	0.800
#28	**Muskingum K:**					**0.800**
#29	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#29	**Muskingum K:**					**0.479**
#30	8. Large gullies, diversions, and low flowing streams	0.70	30.00	4,313.00	2.50	0.479
#30	**Muskingum K:**					**0.479**
#33	8. Large gullies, diversions, and low flowing streams	0.65	77.00	11,910.00	2.41	1.372
#33	**Muskingum K:**					**1.372**
#35	8. Large gullies, diversions, and low flowing streams	0.33	15.00	4,554.00	1.72	0.735
#35	**Muskingum K:**					**0.735**
#36	8. Large gullies, diversions, and low flowing streams	0.30	60.00	20,005.00	1.64	3.388
#36	**Muskingum K:**					**3.388**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	0.20	0.04	0.1	3,489	2.23	1.76
#28	1,217.900	1,217.900	127.50	21.24	835.0	55,232	0.00	0.00
#26	2,486.400	2,486.400	5.44	2.30	8.0	4,125	2.21	1.71
#24	8,061.800	8,061.800	6.64	4.91	10.9	2,959	1.50	0.83
#25	1,015.700	9,077.500	25.38	9.08	42.9	12,153	6.59	2.22
#27	1,783.700	13,347.600	51.42	18.56	137.5	15,235	7.87	3.16
#29	966.000	15,531.500	173.24	56.11	1,685.8	54,091	2.34	1.21
#32	293.700	16,301.600	178.81	63.51	1,820.6	49,624	0.00	0.00
#31	957.100	957.100	135.01	21.90	696.1	44,322	0.36	0.27
#33	0.000	17,258.700	243.60	85.41	2,516.7	45,965	0.10	0.06
#34	932.500	18,191.200	256.20	100.46	2,488.2	37,036	0.00	0.00
#5	2,023.000	2,023.000	171.21	25.48	525.7	36,251	4.57	2.35
#6	1,743.200	3,766.200	212.42	50.66	1,043.3	32,875	0.14	0.09
#7	2,395.300	6,161.500	387.09	107.77	3,278.7	43,897	0.02	0.01
#8	0.000	6,161.500	387.09	107.77	3,278.7	43,897	0.02	0.01
#10	1,053.200	7,214.700	408.03	127.09	3,317.5	40,841	0.02	0.01
#1	2,411.100	2,411.100	102.40	20.83	476.0	29,702	2.79	1.87
#2	1,497.000	3,908.100	165.97	52.28	878.5	25,017	0.11	0.07
#3	862.700	4,770.800	217.82	65.55	1,019.7	20,174	0.09	0.07
#4	0.000	4,770.800	217.82	65.55	1,019.7	20,174	0.09	0.07
#9	425.500	5,196.300	225.97	73.29	1,044.6	18,449	0.00	0.00
#11	0.000	12,411.000	567.35	200.38	4,362.1	33,759	0.01	0.01
#21	1,080.800	13,491.800	591.22	213.76	4,471.1	33,227	0.00	0.00
#18	848.500	848.500	63.40	12.69	114.4	15,153	0.00	0.00
#17	182.200	182.200	46.10	4.57	42.5	12,532	0.29	0.20
#19	0.000	1,030.700	106.20	17.26	156.9	13,552	0.09	0.06
#15	1,992.700	1,992.700	132.09	26.73	728.7	39,320	1.81	1.15
#12	3,494.500	3,494.500	29.47	7.70	70.0	11,169	5.66	4.05
#13	2,720.700	6,215.200	61.66	14.45	155.8	13,100	6.78	4.67
#14	5,096.800	11,312.000	166.07	70.54	1,409.1	70,149	0.51	0.14
#16	876.500	14,181.200	302.67	118.67	2,646.8	45,066	0.95	0.44
#20	681.900	15,893.800	327.56	151.79	2,970.8	35,398	0.67	0.35
#22	0.000	29,385.600	870.59	365.55	7,441.9	32,736	0.25	0.15
#23	752.900	30,138.500	867.57	373.82	7,479.9	32,486	0.09	0.05
#35	0.000	48,329.700	1,063.48	474.27	9,968.1	31,053	0.06	0.04
#36	891.700	49,221.400	1,061.83	479.56	9,987.3	31,441	0.00	0.00

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#37	2,208.500	51,429.900	1,054.87	495.47	10,054.1	32,208	0.13	0.08

Particle Size Distribution(s) at Each Structure

Structure #30:

Size (mm)	In/Out
2.0000	100.000%
0.1000	42.445%
0.0500	24.052%
0.0020	15.563%
0.0010	0.000%

Structure #28:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #26:

Size (mm)	In/Out
2.0000	100.000%
0.1000	69.288%
0.0500	39.263%
0.0020	25.406%
0.0010	0.000%

Structure #24:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.595%
0.0500	43.404%

Size (mm)	In/Out
0.0020	28.085%
0.0010	0.000%

Structure #25:

Size (mm)	In/Out
2.0000	100.000%
0.1000	67.534%
0.0500	38.270%
0.0020	24.763%
0.0010	0.000%

Structure #27:

Size (mm)	In/Out
2.0000	100.000%
0.1000	74.181%
0.0500	42.036%
0.0020	27.200%
0.0010	0.000%

Structure #29:

Size (mm)	In/Out
2.0000	100.000%
0.1000	97.910%
0.0500	95.289%
0.0020	93.701%
0.0010	0.000%

Structure #32:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #31:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.680%
0.0010	0.000%

Structure #33 (Inlet to North Fork Diversion):

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.358%
0.0010	0.000%

Structure #34:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #5:

Size (mm)	In/Out
2.0000	100.000%
0.1000	92.799%
0.0500	86.859%
0.0020	80.969%
0.0010	0.000%

Structure #6:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%

Size (mm)	In/Out
0.0500	100.000%
0.0020	98.782%
0.0010	0.000%

Structure #7:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.884%
0.0010	0.000%

Structure #8:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.884%
0.0010	0.000%

Structure #10:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.861%
0.0010	0.000%

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	96.864%
0.0500	89.757%
0.0020	86.391%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.739%
0.0010	0.000%

Structure #3:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.705%
0.0010	0.000%

Structure #4:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.705%
0.0010	0.000%

Structure #9:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #11:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%

Size (mm)	In/Out
0.0500	100.000%
0.0020	99.894%
0.0010	0.000%

Structure #21:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #18:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #17:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	93.383%
0.0010	0.000%

Structure #19:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	98.206%
0.0010	0.000%

Structure #15:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	95.316%
0.0020	92.912%
0.0010	0.000%

Structure #12:

Size (mm)	In/Out
2.0000	100.000%
0.1000	76.847%
0.0500	43.547%
0.0020	28.177%
0.0010	0.000%

Structure #13:

Size (mm)	In/Out
2.0000	100.000%
0.1000	73.953%
0.0500	41.907%
0.0020	27.116%
0.0010	0.000%

Structure #14:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	97.939%
0.0010	0.000%

Structure #16:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%

Size (mm)	In/Out
0.0500	98.723%
0.0020	95.648%
0.0010	0.000%

Structure #20:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	98.893%
0.0020	96.060%
0.0010	0.000%

Structure #22:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.558%
0.0020	98.427%
0.0010	0.000%

Structure #23:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.239%
0.0010	0.000%

Structure #35:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	99.429%
0.0010	0.000%

Structure #36:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #37:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	99.581%
0.0020	99.384%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#30	1	476.400	1.131	0.000	0.000	73.100	M	0.20	0.043
	Σ	**476.400**						**0.20**	**0.043**
#28	1	772.300	0.657	0.523	0.334	90.400	M	106.00	13.472
	2	445.600	0.587	0.000	0.000	90.400	M	65.74	7.773
	Σ	**1,217.900**						**127.50**	**21.244**
#26	1	447.600	2.192	0.000	0.000	74.200	M	0.34	0.114
	2	2,038.800	3.000	0.000	0.000	77.000	M	5.10	2.186
	Σ	**2,486.400**						**5.44**	**2.300**
#24	1	2,607.500	5.367	2.377	0.305	75.200	M	2.02	1.246
	2	2,331.900	4.813	2.431	0.304	74.700	M	1.48	0.833
	3	1,758.500	2.231	1.788	0.297	76.200	M	3.66	1.366
	4	1,363.900	2.618	0.000	0.000	77.000	M	3.63	1.463
	Σ	**8,061.800**						**6.64**	**4.907**
#25	1	515.200	0.990	0.342	0.357	78.200	M	3.32	0.833
	2	130.500	0.787	0.342	0.357	78.100	M	0.89	0.204
	3	370.000	0.516	0.000	0.000	85.700	M	25.34	3.140
	Σ	**9,077.500**						**25.38**	**9.084**
#27	1	354.400	0.612	1.233	0.337	83.100	M	11.81	1.882
	2	305.200	0.529	1.054	0.328	84.000	M	14.02	1.922
	3	289.800	0.692	0.551	0.328	75.500	M	0.59	0.162
	4	253.000	0.361	0.551	0.328	79.400	M	3.26	0.579
	5	581.300	0.980	0.000	0.000	82.300	M	12.58	2.629
	Σ	**13,347.600**						**51.42**	**18.559**
#29	1	508.800	0.409	0.416	0.312	89.500	M	80.63	7.795
	2	233.200	0.521	0.291	0.312	91.600	M	44.78	4.818
	3	224.000	0.467	0.000	0.000	90.000	M	35.63	3.690
	Σ	**15,531.500**						**173.24**	**56.106**
#32	1	293.700	0.576	0.000	0.000	93.000	M	65.60	7.363
	Σ	**16,301.600**						**178.81**	**63.512**
#31	1	431.100	0.588	0.450	0.336	91.500	M	75.71	8.782
	2	325.800	0.432	0.149	0.327	93.000	M	85.40	8.167
	3	200.200	0.373	0.000	0.000	92.900	M	55.57	4.950
	Σ	**957.100**						**135.01**	**21.900**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#33	Σ	**17,258.700**						**243.60**	**85.412**
#34	1	91.700	0.244	0.965	0.300	92.300	M	28.02	2.088
	2	105.200	0.256	0.965	0.300	93.000	M	34.57	2.637
	3	735.600	0.885	0.000	0.000	88.900	M	65.22	10.319
	Σ	**18,191.200**						**256.20**	**100.456**
#5	1	503.600	0.618	0.000	0.000	87.600	M	44.56	5.802
	2	406.500	0.388	0.501	0.350	84.800	M	27.28	2.956
	3	439.600	0.342	0.681	0.347	87.800	M	57.48	5.224
	4	162.600	0.280	0.681	0.347	86.000	M	16.74	1.451
	5	294.100	0.375	1.021	0.348	92.000	M	71.65	6.423
	6	216.600	0.272	1.018	0.348	90.100	M	46.35	3.619
	Σ	**2,023.000**						**171.21**	**25.475**
#6	1	149.100	0.331	0.000	0.000	92.600	M	41.87	3.538
	2	245.000	0.529	0.192	0.328	88.100	M	26.07	3.048
	3	276.200	0.450	0.461	0.319	89.500	M	41.36	4.232
	4	158.400	0.380	1.385	0.185	93.000	M	44.23	3.971
	5	206.200	0.402	0.796	0.320	89.400	M	32.46	3.113
	6	414.000	0.430	1.066	0.323	87.200	M	42.38	4.482
	7	294.300	0.535	1.066	0.323	86.400	M	22.70	2.804
	Σ	**3,766.200**						**212.42**	**50.662**
#7	1	731.700	1.274	0.000	0.000	93.000	M	96.39	18.343
	2	445.800	1.043	0.000	0.000	93.000	M	67.76	11.176
	3	270.800	0.804	0.000	0.000	93.000	M	49.02	6.789
	4	78.900	0.267	1.035	0.328	93.000	M	25.53	1.978
	5	154.900	0.310	1.071	0.326	93.000	M	47.40	3.883
	6	101.400	0.288	1.164	0.328	92.900	M	31.46	2.507
	7	117.700	0.298	1.344	0.329	92.200	M	32.72	2.643
	8	494.100	0.518	1.344	0.329	91.300	M	90.89	9.788
	Σ	**6,161.500**						**387.09**	**107.768**
#8	1	0.000	0.000	0.000	0.000	1.000	0.00	0.000	
	Σ	**6,161.500**						**387.09**	**107.768**
#10	1	355.500	1.286	0.000	0.000	93.000	M	46.51	8.912
	2	307.100	1.282	0.668	0.305	83.200	M	7.05	1.663
	3	147.300	1.245	0.517	0.303	90.600	M	13.65	2.644
	4	126.400	0.585	0.517	0.303	93.000	M	27.97	3.169
	5	116.900	1.179	0.621	0.305	93.000	M	16.29	2.931
	Σ	**7,214.700**						**408.03**	**127.086**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	557.400	0.941	0.000	0.000	83.600	M	16.72	3.258
	2	169.600	1.616	0.677	0.333	93.000	M	18.75	4.252
	3	636.400	1.842	0.729	0.333	81.000	M	6.98	2.169
	4	223.400	0.846	1.005	0.336	84.100	M	7.97	1.433
	5	77.700	0.330	1.392	0.341	81.400	M	2.25	0.290
	6	746.600	0.678	1.392	0.341	88.200	M	69.45	9.430
	Σ	**2,411.100**						**102.40**	**20.831**
#2	1	257.000	0.423	0.000	0.000	93.000	M	68.09	6.443
	2	180.500	0.562	0.478	0.281	91.800	M	34.14	3.834
	3	200.700	0.687	0.574	0.283	93.000	M	40.21	5.031
	4	438.600	0.811	0.574	0.283	93.000	M	78.94	10.995
	5	420.200	1.247	0.801	0.293	88.000	M	25.21	5.148
	Σ	**3,908.100**						**165.97**	**52.283**
#3	1	172.600	0.443	0.000	0.000	93.000	M	44.66	4.327
	2	311.200	0.890	0.000	0.000	88.900	M	27.49	4.365
	3	378.900	0.632	0.209	0.314	87.900	M	34.90	4.572
	Σ	**4,770.800**						**217.82**	**65.547**
#4	Σ	**4,770.800**						**217.82**	**65.547**
#9	1	425.500	0.830	0.000	0.000	90.700	M	52.76	7.746
	Σ	**5,196.300**						**225.97**	**73.293**
#11	Σ	**12,411.000**						**567.35**	**200.379**
#21	1	272.800	0.819	0.000	0.000	86.900	M	17.75	2.816
	2	230.500	0.388	0.694	0.266	89.200	M	35.79	3.380
	3	181.100	0.289	0.877	0.256	91.300	M	44.96	3.588
	4	396.400	0.939	0.877	0.256	86.100	M	20.22	3.595
	Σ	**13,491.800**						**591.22**	**213.758**
#18	1	301.700	0.652	0.000	0.000	93.000	M	62.47	7.563
	2	546.800	0.768	0.561	0.320	86.300	M	32.97	5.125
	Σ	**848.500**						**63.40**	**12.688**
#17	1	182.200	0.462	0.000	0.000	93.000	M	46.10	4.568
	Σ	**182.200**						**46.10**	**4.568**
#19	Σ	**1,030.700**						**106.20**	**17.256**
#15	1	437.400	0.803	0.000	0.000	91.300	M	60.86	8.665
	2	549.000	0.637	0.654	0.327	91.300	M	88.81	10.876
	3	1,006.300	1.023	0.768	0.331	84.700	M	36.49	7.189

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
	Σ	**1,992.700**						**132.09**	**26.730**
#12	1	517.800	0.791	0.000	0.000	81.900	M	11.30	2.153
	2	229.000	0.571	0.043	0.418	80.100	M	3.43	0.629
	3	592.700	0.706	0.044	0.417	81.500	M	12.26	2.261
	4	1,806.900	1.542	0.487	0.362	76.700	M	5.34	1.726
	5	348.100	0.618	0.487	0.362	80.000	4.94	0.932	
	Σ	**3,494.500**						**29.47**	**7.702**
#13	1	411.600	0.725	0.000	0.000	79.700	M	5.01	1.021
	2	636.400	0.774	0.322	0.336	80.700	M	10.16	2.023
	3	319.000	0.575	0.685	0.318	85.500	M	19.58	2.617
	4	231.700	0.314	0.923	0.328	80.400	M	4.67	0.685
	5	1,122.000	1.308	0.923	0.328	74.700	M	1.29	0.401
	Σ	**6,215.200**						**61.66**	**14.448**
#14	1	405.900	0.384	0.000	0.000	90.800	M	81.84	7.494
	2	411.100	0.452	0.707	0.308	90.700	M	74.57	7.483
	3	787.400	0.658	0.975	0.307	91.400	M	126.78	15.818
	4	144.200	0.341	1.716	0.310	86.200	M	13.94	1.330
	5	343.800	0.289	1.970	0.312	86.500	M	38.50	3.329
	6	392.800	0.806	2.107	0.316	81.900	M	8.49	1.634
	7	528.200	0.518	2.544	0.316	87.200	M	48.43	5.718
	8	890.900	1.253	2.544	0.316	83.500	M	22.13	5.109
	9	741.400	1.076	3.047	0.316	84.800	M	26.61	5.391
	10	451.100	0.916	3.354	0.316	83.900	M	14.69	2.789
	Σ	**11,312.000**						**166.07**	**70.543**
#16	1	329.600	0.641	0.000	0.000	93.000	M	68.96	8.263
	2	348.400	0.542	0.509	0.286	92.500	M	74.85	8.154
	3	198.500	0.266	0.943	0.279	93.000	M	64.31	4.976
	Σ	**14,181.200**						**302.67**	**118.666**
#20	1	296.300	0.667	0.000	0.000	91.700	M	49.57	6.207
	2	385.600	0.713	0.476	0.440	93.000	M	75.43	9.666
	Σ	**15,893.800**						**327.56**	**151.795**
#22	**Σ**	**29,385.600**						**870.59**	**365.552**
#23	1	442.400	0.960	0.000	0.000	85.300	M	18.91	3.508
	2	310.500	0.538	0.559	0.291	89.500	M	41.66	4.757
	Σ	**30,138.500**						**867.57**	**373.818**
#35	**Σ**	**48,329.700**						**1,063.48**	**474.274**

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#36	1	298.200	0.987	0.000	0.000	85.000	M	11.77	2.246
	2	196.800	0.441	0.000	0.000	87.900	M	22.54	2.375
	3	396.700	0.433	0.166	0.372	78.300	M	3.48	0.662
	Σ	**49,221.400**						**1,061.83**	**479.556**
#37	1	744.000	1.756	0.000	0.000	84.800	M	19.52	5.410
	2	296.000	0.439	1.780	0.243	87.800	M	33.37	3.517
	3	237.700	0.333	1.649	0.246	85.500	M	20.26	1.950
	4	561.400	1.502	1.780	0.243	84.100	M	14.17	3.601
	5	369.400	0.817	2.236	0.284	81.600	M	7.35	1.440
	Σ	**51,429.900**						**1,054.87**	**495.474**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#30	1	0.095	200.00	3.80	0.3720	1.0000	2	0.1	3,489	2.23	1.76
	Σ							**0.1**	**3,489**	**2.23**	**1.76**
#28	1	0.187	100.00	10.10	0.3750	1.0000	3	555.9	52,723	0.00	0.00
	2	0.196	100.00	10.20	0.3930	1.0000	3	348.4	58,373	0.00	0.00
	Σ							**835.0**	**55,232**	**0.00**	**0.00**
#26	1	0.155	400.00	1.40	0.3480	1.0000	2	0.2	2,448	1.53	1.18
	2	0.155	300.00	2.40	0.3340	1.0000	2	7.8	4,238	2.26	1.74
	Σ							**8.0**	**4,125**	**2.21**	**1.71**
#24	1	0.128	300.00	2.30	0.3360	1.0000	2	2.7	2,661	1.33	1.00
	2	0.136	300.00	2.70	0.3440	1.0000	2	2.3	3,360	1.86	1.39
	3	0.107	300.00	2.30	0.3330	1.0000	2	3.3	2,811	1.56	1.23
	4	0.163	400.00	1.60	0.3210	1.0000	2	3.9	3,194	1.73	1.35
	Σ							**10.9**	**2,959**	**1.50**	**0.83**
#25	1	0.125	400.00	1.90	0.3440	1.0000	2	2.6	3,677	1.96	1.55
	2	0.124	300.00	2.60	0.3280	1.0000	2	0.7	3,754	2.08	1.63
	3	0.122	175.00	4.90	0.2660	1.0000	2	28.7	12,170	6.76	4.66
	Σ							**42.9**	**12,153**	**6.59**	**2.22**
#27	1	0.127	175.00	5.90	0.3160	1.0000	2	20.7	13,801	7.09	5.20
	2	0.122	150.00	7.50	0.2920	1.0000	2	23.8	15,793	8.49	6.12
	3	0.070	125.00	8.40	0.3270	1.0000	2	0.7	4,438	2.66	2.32

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.097	125.00	9.60	0.3170	1.0000	2	6.0	12,370	6.54	5.00
	5	0.126	125.00	8.90	0.3290	1.0000	2	35.7	16,624	7.78	5.85
	Σ							**137.5**	**15,235**	**7.87**	**3.16**
#29	1	0.190	125.00	9.80	0.3930	1.0000	3	387.3	64,968	0.38	0.26
	2	0.203	125.00	8.90	0.3940	1.0000	3	197.0	53,216	0.00	0.00
	3	0.193	125.00	8.40	0.3940	1.0000	3	129.6	47,000	0.00	0.00
	Σ							**1,685.8**	**54,091**	**2.34**	**1.21**
#32	1	0.210	150.00	7.70	0.3990	1.0000	3	289.6	51,320	0.00	0.00
	Σ							**1,820.6**	**49,624**	**0.00**	**0.00**
#31	1	0.204	125.00	8.70	0.3620	1.0000	3	329.8	48,526	0.00	0.00
	2	0.210	150.00	7.30	0.3990	1.0000	3	338.0	54,451	1.63	1.12
	3	0.210	175.00	4.50	0.3980	1.0000	3	136.5	37,227	1.56	1.06
	Σ							**696.1**	**44,322**	**0.36**	**0.27**
#33	Σ							**2,516.7**	**45,965**	**0.10**	**0.06**
#34	1	0.189	175.00	4.60	0.2250	1.0000	3	29.8	18,628	1.29	0.90
	2	0.206	175.00	5.10	0.3620	1.0000	3	73.8	36,250	2.51	1.76
	3	0.176	175.00	4.20	0.2510	1.0000	3	111.6	13,883	0.00	0.00
	Σ							**2,488.2**	**37,036**	**0.00**	**0.00**
#5	1	0.149	75.00	12.50	0.3230	1.0000	3	165.7	37,263	0.00	0.00
	2	0.133	75.00	15.80	0.3190	1.0000	2	102.5	45,635	26.07	18.02
	3	0.103	100.00	11.00	0.2030	1.0000	3	78.2	20,017	0.17	0.12
	4	0.093	75.00	13.80	0.2130	1.0000	2	20.6	19,161	11.51	7.80
	5	0.123	100.00	11.00	0.1370	1.0000	3	80.0	16,445	0.58	0.40
	6	0.149	75.00	14.70	0.1990	1.0000	3	98.7	35,948	1.74	1.20
	Σ							**525.7**	**36,251**	**4.57**	**2.35**
#6	1	0.208	175.00	4.30	0.3980	1.0000	3	91.6	35,102	1.73	1.16
	2	0.183	175.00	5.40	0.3910	1.0000	3	69.3	29,853	0.00	0.00
	3	0.188	150.00	7.60	0.3900	1.0000	3	141.7	44,004	0.00	0.00
	4	0.210	150.00	6.30	0.3990	1.0000	3	135.6	42,816	1.77	1.28
	5	0.185	125.00	8.10	0.3860	1.0000	3	99.0	41,472	0.28	0.20
	6	0.104	100.00	11.30	0.2240	1.0000	3	69.9	20,288	0.00	0.00
	7	0.164	100.00	11.20	0.3740	1.0000	3	98.6	44,820	0.00	0.00
	Σ							**1,043.3**	**32,875**	**0.14**	**0.09**
#7	1	0.208	150.00	7.80	0.3780	1.0000	3	568.9	38,847	0.00	0.00
	2	0.209	100.00	10.20	0.3940	1.0000	3	464.2	52,246	0.00	0.00
	3	0.210	150.00	6.70	0.3990	1.0000	3	205.7	38,872	0.00	0.00

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	4	0.210	100.00	11.50	0.3990	1.0000	3	122.7	79,219	5.29	3.71
	5	0.210	150.00	7.10	0.3990	1.0000	3	156.1	51,819	2.96	2.08
	6	0.209	150.00	7.90	0.3990	1.0000	3	107.1	54,958	3.37	2.37
	7	0.206	75.00	15.50	0.3990	1.0000	3	201.7	96,052	5.25	3.72
	8	0.202	75.00	14.50	0.3980	1.0000	3	669.7	85,902	0.00	0.00
	Σ							**3,278.7**	**43,897**	**0.02**	**0.01**
#8	1	0.000	0.00	0.00	0.0000	1.0000	0	0.0	1	0.00	0.00
	Σ							**3,278.7**	**43,897**	**0.02**	**0.01**
#10	1	0.190	300.00	2.70	0.1930	1.0000	3	46.3	6,587	0.00	0.00
	2	0.153	200.00	3.50	0.3610	1.0000	2	10.6	7,825	3.48	2.62
	3	0.189	200.00	3.70	0.3190	1.0000	3	22.9	10,906	0.00	0.00
	4	0.190	300.00	2.10	0.1940	1.0000	3	15.6	6,459	0.00	0.00
	5	0.201	300.00	2.00	0.3030	1.0000	3	17.5	7,554	0.00	0.00
	Σ							**3,317.5**	**40,841**	**0.02**	**0.01**
#1	1	0.157	150.00	6.80	0.3830	1.0000	2	54.3	20,582	9.89	7.35
	2	0.210	150.00	6.60	0.3990	1.0000	3	91.1	26,615	0.00	0.00
	3	0.149	200.00	3.90	0.3870	1.0000	2	14.2	7,833	3.10	2.38
	4	0.169	175.00	4.70	0.3950	1.0000	2	19.1	16,624	8.23	6.06
	5	0.157	100.00	10.10	0.3940	1.0000	2	6.6	28,074	15.42	11.39
	6	0.175	75.00	12.60	0.2840	1.0000	3	290.9	39,015	0.00	0.00
	Σ							**476.0**	**29,702**	**2.79**	**1.87**
#2	1	0.190	150.00	7.90	0.1930	1.0000	3	123.1	25,644	0.82	0.56
	2	0.184	175.00	4.80	0.2010	1.0000	3	42.3	14,436	0.00	0.00
	3	0.202	200.00	3.90	0.3220	1.0000	3	68.3	17,482	0.00	0.00
	4	0.203	150.00	7.40	0.3220	1.0000	3	301.9	34,875	0.00	0.00
	5	0.181	175.00	5.10	0.3710	1.0000	3	81.0	19,571	0.00	0.00
	Σ							**878.5**	**25,017**	**0.11**	**0.07**
#3	1	0.190	175.00	5.20	0.1930	1.0000	3	56.3	17,538	0.48	0.33
	2	0.177	175.00	4.20	0.2560	1.0000	3	43.6	12,816	0.00	0.00
	3	0.166	175.00	4.30	0.2290	1.0000	3	43.8	12,524	0.00	0.00
	Σ							**1,019.7**	**20,174**	**0.09**	**0.07**
#4	Σ							**1,019.7**	**20,174**	**0.09**	**0.07**
#9	1	0.189	175.00	4.44	0.1970	1.0000	3	74.9	12,497	0.00	0.00
	Σ							**1,044.6**	**18,449**	**0.00**	**0.00**
#11	Σ							**4,362.1**	**33,759**	**0.01**	**0.01**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#21	1	0.177	175.00	4.44	0.2560	1.0000	3	28.1	12,793	0.00	0.00
	2	0.184	175.00	5.81	0.2210	1.0000	3	53.4	20,771	0.18	0.13
	3	0.185	300.00	2.70	0.2180	1.0000	3	30.0	10,952	0.56	0.39
	4	0.175	300.00	2.66	0.2690	1.0000	3	22.1	7,715	0.00	0.00
	Σ							**4,471.1**	**33,227**	**0.00**	**0.00**
#18	1	0.193	300.00	2.80	0.2200	1.0000	3	59.6	10,362	0.00	0.00
	2	0.173	175.00	4.70	0.3880	1.0000	3	86.9	21,485	0.00	0.00
	Σ							**114.4**	**15,153**	**0.00**	**0.00**
#17	1	0.196	300.00	2.60	0.2600	1.0000	3	42.5	12,532	0.29	0.20
	Σ							**42.5**	**12,532**	**0.29**	**0.20**
#19	Σ							**156.9**	**13,552**	**0.09**	**0.06**
#15	1	0.201	125.00	8.20	0.3960	1.0000	3	284.0	41,954	0.00	0.00
	2	0.161	100.00	11.40	0.3060	1.0000	3	372.2	43,886	0.00	0.00
	3	0.118	100.00	10.20	0.2850	1.0000	2	104.7	18,046	8.67	6.42
	Σ							**728.7**	**39,320**	**1.81**	**1.15**
#12	1	0.124	150.00	6.30	0.3070	1.0000	2	20.4	11,661	5.67	4.23
	2	0.132	200.00	3.60	0.3500	1.0000	2	3.5	6,903	3.51	2.63
	3	0.136	175.00	5.00	0.3330	1.0000	2	22.6	12,336	6.09	4.54
	4	0.188	200.00	3.40	0.3570	1.0000	2	11.0	7,280	4.16	3.35
	5	0.228	175.00	4.10	0.3640	1.0000	2	12.6	16,394	8.29	6.26
	Σ							**70.0**	**11,169**	**5.66**	**4.05**
#13	1	0.128	150.00	6.90	0.3390	1.0000	2	10.6	12,556	6.27	4.76
	2	0.130	175.00	5.70	0.3300	1.0000	2	20.5	12,360	6.02	4.53
	3	0.191	175.00	6.00	0.2890	1.0000	2	46.2	22,620	12.32	8.80
	4	0.122	175.00	5.10	0.3460	1.0000	2	6.4	11,408	6.15	4.62
	5	0.137	175.00	4.20	0.3530	1.0000	2	2.2	6,078	3.78	3.16
	Σ							**155.8**	**13,100**	**6.78**	**4.67**
#14	1	0.196	100.00	10.20	0.3980	1.0000	3	390.8	70,290	1.68	1.13
	2	0.193	150.00	6.70	0.4020	1.0000	3	254.4	44,287	0.26	0.18
	3	0.169	75.00	13.80	0.3240	1.0000	3	675.2	54,052	0.00	0.00
	4	0.114	100.00	11.00	0.2980	1.0000	3	26.7	25,596	0.00	0.00
	5	0.078	100.00	10.10	0.1830	1.0000	3	29.3	11,302	0.14	0.10
	6	0.084	150.00	7.10	0.2700	1.0000	2	9.9	7,446	3.61	2.71
	7	0.087	100.00	10.00	0.1840	1.0000	3	48.3	10,687	0.00	0.00
	8	0.126	150.00	6.70	0.2740	1.0000	2	46.3	11,063	4.96	3.74
	9	0.117	150.00	7.30	0.2600	1.0000	2	50.6	11,548	5.49	4.11

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	10	0.115	125.00	8.50	0.2610	1.0000	2	27.1	11,936	5.79	4.34
	Σ							**1,409.1**	**70,149**	**0.51**	**0.14**
#16	1	0.200	200.00	3.30	0.3000	1.0000	3	96.3	15,320	0.00	0.00
	2	0.204	150.00	6.00	0.3630	1.0000	3	229.8	36,609	0.07	0.05
	3	0.210	150.00	6.10	0.3990	1.0000	3	184.0	47,468	3.18	2.24
	Σ							**2,646.8**	**45,066**	**0.95**	**0.44**
#20	1	0.186	175.00	4.80	0.2130	1.0000	3	73.2	15,471	0.00	0.00
	2	0.194	200.00	3.80	0.2330	1.0000	3	94.9	12,766	0.00	0.00
	Σ							**2,970.8**	**35,398**	**0.67**	**0.35**
#22	Σ							**7,441.9**	**32,736**	**0.25**	**0.15**
#23	1	0.172	175.00	4.20	0.2810	1.0000	3	33.4	11,905	0.00	0.00
	2	0.185	150.00	6.00	0.2160	1.0000	3	66.0	18,149	0.00	0.00
	Σ							**7,479.9**	**32,486**	**0.09**	**0.05**
#35	Σ							**9,968.1**	**31,053**	**0.06**	**0.04**
#36	1	0.190	175.00	5.94	0.2830	1.0000	3	30.8	17,048	0.00	0.00
	2	0.180	125.00	9.92	0.2410	1.0000	3	57.7	32,827	0.00	0.00
	3	0.151	300.00	2.63	0.3890	1.0000	2	3.9	7,166	4.05	3.10
	Σ							**9,987.3**	**31,441**	**0.00**	**0.00**
#37	1	0.196	200.00	3.80	0.3980	1.0000	2	55.5	12,520	5.18	3.91
	2	0.193	175.00	5.40	0.4020	1.0000	3	93.4	33,384	0.00	0.00
	3	0.173	150.00	7.11	0.2770	1.0000	3	37.8	24,351	0.00	0.00
	4	0.171	150.00	6.52	0.2990	1.0000	2	42.8	14,476	6.23	4.70
	5	0.078	400.00	1.20	0.1830	1.0000	2	1.2	1,055	0.51	0.39
	Σ							**10,054.1**	**32,208**	**0.13**	**0.08**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.65	50.00	1,369.00	1.910	0.199
		8. Large gullies, diversions, and low flowing streams	1.57	157.00	10,030.00	3.750	0.742
#1	**1**	**Time of Concentration:**					**0.941**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	6.63	70.00	1,056.00	2.570	0.114

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		5. Nearly bare and untilled, and alluvial valley fans	1.98	150.00	7,573.00	1.400	1.502
#1	**2**	**Time of Concentration:**					**1.616**
#1	3	5. Nearly bare and untilled, and alluvial valley fans	1.65	117.00	7,070.00	1.280	1.534
		8. Large gullies, diversions, and low flowing streams	2.43	126.00	5,188.00	4.670	0.308
#1	**3**	**Time of Concentration:**					**1.842**
#1	4	5. Nearly bare and untilled, and alluvial valley fans	5.77	260.00	4,506.00	2.400	0.521
		8. Large gullies, diversions, and low flowing streams	2.84	168.00	5,924.00	5.050	0.325
#1	**4**	**Time of Concentration:**					**0.846**
#1	5	5. Nearly bare and untilled, and alluvial valley fans	19.93	180.00	903.00	4.460	0.056
		8. Large gullies, diversions, and low flowing streams	3.30	178.00	5,393.00	5.450	0.274
#1	**5**	**Time of Concentration:**					**0.330**
#1	6	5. Nearly bare and untilled, and alluvial valley fans	13.43	105.00	782.00	3.660	0.059
		8. Large gullies, diversions, and low flowing streams	2.62	283.00	10,822.00	4.850	0.619
#1	**6**	**Time of Concentration:**					**0.678**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	6.84	70.00	1,024.00	2.610	0.108
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,325.00	3.810	0.315
#2	**1**	**Time of Concentration:**					**0.423**
#2	2	5. Nearly bare and untilled, and alluvial valley fans	5.56	45.00	810.00	2.350	0.095
		8. Large gullies, diversions, and low flowing streams	0.86	40.00	4,663.00	2.770	0.467
#2	**2**	**Time of Concentration:**					**0.562**
#2	3	5. Nearly bare and untilled, and alluvial valley fans	5.89	50.00	849.00	2.420	0.097
		8. Large gullies, diversions, and low flowing streams	1.17	80.00	6,862.00	3.230	0.590
#2	**3**	**Time of Concentration:**					**0.687**
#2	4	5. Nearly bare and untilled, and alluvial valley fans	12.63	95.00	752.00	3.550	0.058
		8. Large gullies, diversions, and low flowing streams	1.40	135.00	9,630.00	3.550	0.753
#2	**4**	**Time of Concentration:**					**0.811**
#2	5	5. Nearly bare and untilled, and alluvial valley fans	11.02	70.00	635.00	3.320	0.053
		8. Large gullies, diversions, and low flowing streams	0.46	40.00	8,732.00	2.030	1.194
#2	**5**	**Time of Concentration:**					**1.247**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	10.00	805.00	1.110	0.201
		8. Large gullies, diversions, and low flowing streams	1.33	40.00	3,017.00	3.450	0.242
#3	**1**	**Time of Concentration:**					**0.443**
#3	2	5. Nearly bare and untilled, and alluvial valley fans	0.68	10.00	1,478.00	0.820	0.500
		8. Large gullies, diversions, and low flowing streams	1.78	100.00	5,622.00	4.000	0.390
#3	**2**	**Time of Concentration:**					**0.890**
#3	3	5. Nearly bare and untilled, and alluvial valley fans	4.66	70.00	1,501.00	2.150	0.193
		8. Large gullies, diversions, and low flowing streams	1.17	60.00	5,126.00	3.240	0.439
#3	**3**	**Time of Concentration:**					**0.632**
#5	1	5. Nearly bare and untilled, and alluvial valley fans	19.06	285.00	1,495.00	4.360	0.095
		8. Large gullies, diversions, and low flowing streams	2.64	242.00	9,174.00	4.870	0.523
#5	**1**	**Time of Concentration:**					**0.618**
#5	2	5. Nearly bare and untilled, and alluvial valley fans	14.27	105.00	736.00	3.770	0.054
		8. Large gullies, diversions, and low flowing streams	4.08	297.00	7,279.00	6.050	0.334
#5	**2**	**Time of Concentration:**					**0.388**
#5	3	5. Nearly bare and untilled, and alluvial valley fans	8.27	35.00	423.00	2.870	0.040
		8. Large gullies, diversions, and low flowing streams	3.44	208.00	6,049.00	5.560	0.302
#5	**3**	**Time of Concentration:**					**0.342**
#5	4	5. Nearly bare and untilled, and alluvial valley fans	14.58	85.00	583.00	3.810	0.042
		8. Large gullies, diversions, and low flowing streams	4.53	248.00	5,473.00	6.380	0.238
#5	**4**	**Time of Concentration:**					**0.280**
#5	5	5. Nearly bare and untilled, and alluvial valley fans	5.07	70.00	1,382.00	2.250	0.170
		8. Large gullies, diversions, and low flowing streams	3.89	170.00	4,375.00	5.910	0.205
#5	**5**	**Time of Concentration:**					**0.375**
#5	6	5. Nearly bare and untilled, and alluvial valley fans	12.48	90.00	721.00	3.530	0.056
		8. Large gullies, diversions, and low flowing streams	5.16	274.00	5,308.02	6.810	0.216
#5	**6**	**Time of Concentration:**					**0.272**
#6	1	5. Nearly bare and untilled, and alluvial valley fans	5.36	75.00	1,399.00	2.310	0.168

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.41	66.00	2,742.00	4.650	0.163
#6	**1**	**Time of Concentration:**					**0.331**
#6	2	5. Nearly bare and untilled, and alluvial valley fans	3.39	80.00	2,359.00	1.840	0.356
		8. Large gullies, diversions, and low flowing streams	2.63	80.00	3,039.00	4.860	0.173
#6	**2**	**Time of Concentration:**					**0.529**
#6	3	5. Nearly bare and untilled, and alluvial valley fans	4.60	34.00	739.00	2.140	0.095
		8. Large gullies, diversions, and low flowing streams	2.33	136.00	5,845.00	4.570	0.355
#6	**3**	**Time of Concentration:**					**0.450**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	6.06	85.00	1,402.00	2.460	0.158
		8. Large gullies, diversions, and low flowing streams	2.52	96.00	3,810.00	4.760	0.222
#6	**4**	**Time of Concentration:**					**0.380**
#6	5	5. Nearly bare and untilled, and alluvial valley fans	7.24	70.00	967.00	2.690	0.099
		8. Large gullies, diversions, and low flowing streams	2.34	117.00	5,003.00	4.580	0.303
#6	**5**	**Time of Concentration:**					**0.402**
#6	6	5. Nearly bare and untilled, and alluvial valley fans	31.83	183.00	575.00	5.640	0.028
		8. Large gullies, diversions, and low flowing streams	3.38	270.00	7,990.00	5.510	0.402
#6	**6**	**Time of Concentration:**					**0.430**
#6	7	5. Nearly bare and untilled, and alluvial valley fans	23.08	325.00	1,408.00	4.800	0.081
		8. Large gullies, diversions, and low flowing streams	2.88	240.00	8,327.00	5.090	0.454
#6	**7**	**Time of Concentration:**					**0.535**
#7	1	5. Nearly bare and untilled, and alluvial valley fans	11.42	90.00	788.00	3.370	0.064
		8. Large gullies, diversions, and low flowing streams	1.46	230.00	15,769.00	3.620	1.210
#7	**1**	**Time of Concentration:**					**1.274**
#7	2	5. Nearly bare and untilled, and alluvial valley fans	10.97	60.00	547.00	3.310	0.045
		8. Large gullies, diversions, and low flowing streams	1.61	220.00	13,660.00	3.800	0.998
#7	**2**	**Time of Concentration:**					**1.043**
#7	3	5. Nearly bare and untilled, and alluvial valley fans	6.40	60.00	938.00	2.520	0.103
		8. Large gullies, diversions, and low flowing streams	1.72	171.00	9,931.00	3.930	0.701
#7	**3**	**Time of Concentration:**					**0.804**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#7	4	5. Nearly bare and untilled, and alluvial valley fans	19.23	80.00	416.00	4.380	0.026
		8. Large gullies, diversions, and low flowing streams	2.45	100.00	4,083.00	4.690	0.241
#7	**4**	**Time of Concentration:**					**0.267**
#7	5	5. Nearly bare and untilled, and alluvial valley fans	6.09	67.00	1,101.00	2.460	0.124
		8. Large gullies, diversions, and low flowing streams	2.51	80.00	3,184.00	4.750	0.186
#7	**5**	**Time of Concentration:**					**0.310**
#7	6	5. Nearly bare and untilled, and alluvial valley fans	5.93	63.00	1,062.00	2.430	0.121
		8. Large gullies, diversions, and low flowing streams	2.74	82.00	2,993.00	4.960	0.167
#7	**6**	**Time of Concentration:**					**0.288**
#7	7	5. Nearly bare and untilled, and alluvial valley fans	7.97	65.00	816.00	2.820	0.080
		8. Large gullies, diversions, and low flowing streams	3.48	153.00	4,400.00	5.590	0.218
#7	**7**	**Time of Concentration:**					**0.298**
#7	8	5. Nearly bare and untilled, and alluvial valley fans	6.60	50.00	758.00	2.560	0.082
		8. Large gullies, diversions, and low flowing streams	4.66	473.00	10,157.00	6.470	0.436
#7	**8**	**Time of Concentration:**					**0.518**
#9	1	5. Nearly bare and untilled, and alluvial valley fans	3.35	90.00	2,687.00	1.830	0.407
		8. Large gullies, diversions, and low flowing streams	0.58	20.00	3,463.00	2.270	0.423
#9	**1**	**Time of Concentration:**					**0.830**
#10	1	5. Nearly bare and untilled, and alluvial valley fans	1.24	41.00	3,317.00	1.110	0.830
		8. Large gullies, diversions, and low flowing streams	0.70	29.00	4,125.00	2.510	0.456
#10	**1**	**Time of Concentration:**					**1.286**
#10	2	5. Nearly bare and untilled, and alluvial valley fans	2.25	125.00	5,554.00	1.500	1.028
		8. Large gullies, diversions, and low flowing streams	2.13	85.00	3,997.00	4.370	0.254
#10	**2**	**Time of Concentration:**					**1.282**
#10	3	5. Nearly bare and untilled, and alluvial valley fans	1.39	68.00	4,904.00	1.170	1.164
		8. Large gullies, diversions, and low flowing streams	4.73	90.00	1,904.00	6.520	0.081
#10	**3**	**Time of Concentration:**					**1.245**
#10	4	5. Nearly bare and untilled, and alluvial valley fans	3.76	51.00	1,357.00	1.930	0.195

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.65	22.00	3,385.00	2.410	0.390
#10	**4**	**Time of Concentration:**					**0.585**
#10	5	5. Nearly bare and untilled, and alluvial valley fans	1.63	88.00	5,391.16	1.270	1.179
#10	**5**	**Time of Concentration:**					**1.179**
#12	1	5. Nearly bare and untilled, and alluvial valley fans	4.50	75.00	1,667.00	2.120	0.218
		8. Large gullies, diversions, and low flowing streams	1.85	155.00	8,400.00	4.070	0.573
#12	**1**	**Time of Concentration:**					**0.791**
#12	2	5. Nearly bare and untilled, and alluvial valley fans	2.99	50.00	1,674.03	1.720	0.270
		8. Large gullies, diversions, and low flowing streams	1.67	70.00	4,201.17	3.870	0.301
#12	**2**	**Time of Concentration:**					**0.571**
#12	3	5. Nearly bare and untilled, and alluvial valley fans	4.04	57.00	1,411.00	2.000	0.195
		8. Large gullies, diversions, and low flowing streams	1.55	107.00	6,884.00	3.740	0.511
#12	**3**	**Time of Concentration:**					**0.706**
#12	4	5. Nearly bare and untilled, and alluvial valley fans	2.23	84.00	3,771.04	1.490	0.703
		8. Large gullies, diversions, and low flowing streams	1.62	186.00	11,515.60	3.810	0.839
#12	**4**	**Time of Concentration:**					**1.542**
#12	5	5. Nearly bare and untilled, and alluvial valley fans	3.68	53.00	1,442.00	1.910	0.209
		8. Large gullies, diversions, and low flowing streams	1.95	120.00	6,155.00	4.180	0.409
#12	**5**	**Time of Concentration:**					**0.618**
#13	1	5. Nearly bare and untilled, and alluvial valley fans	4.62	62.00	1,342.00	2.140	0.174
		8. Large gullies, diversions, and low flowing streams	1.91	157.00	8,225.00	4.140	0.551
#13	**1**	**Time of Concentration:**					**0.725**
#13	2	5. Nearly bare and untilled, and alluvial valley fans	2.91	50.00	1,717.00	1.700	0.280
		8. Large gullies, diversions, and low flowing streams	2.28	183.00	8,039.00	4.520	0.494
#13	**2**	**Time of Concentration:**					**0.774**
#13	3	5. Nearly bare and untilled, and alluvial valley fans	6.18	95.00	1,537.00	2.480	0.172
		8. Large gullies, diversions, and low flowing streams	2.13	135.00	6,347.00	4.370	0.403
#13	**3**	**Time of Concentration:**					**0.575**
#13	4	5. Nearly bare and untilled, and alluvial valley fans	3.17	10.00	315.00	1.780	0.049

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.30	100.00	4,344.00	4.550	0.265
#13	**4**	**Time of Concentration:**					**0.314**
#13	5	5. Nearly bare and untilled, and alluvial valley fans	3.10	70.00	2,255.00	1.760	0.355
		8. Large gullies, diversions, and low flowing streams	1.23	140.00	11,392.00	3.320	0.953
#13	**5**	**Time of Concentration:**					**1.308**
#14	1	5. Nearly bare and untilled, and alluvial valley fans	10.59	63.00	595.00	3.250	0.050
		8. Large gullies, diversions, and low flowing streams	2.60	151.00	5,808.00	4.830	0.334
#14	**1**	**Time of Concentration:**					**0.384**
#14	2	5. Nearly bare and untilled, and alluvial valley fans	7.28	67.00	920.00	2.690	0.095
		8. Large gullies, diversions, and low flowing streams	2.17	123.00	5,670.00	4.410	0.357
#14	**2**	**Time of Concentration:**					**0.452**
#14	3	5. Nearly bare and untilled, and alluvial valley fans	21.46	150.00	699.00	4.630	0.041
		8. Large gullies, diversions, and low flowing streams	3.10	364.00	11,728.00	5.280	0.617
#14	**3**	**Time of Concentration:**					**0.658**
#14	4	5. Nearly bare and untilled, and alluvial valley fans	3.39	35.00	1,032.00	1.840	0.155
		8. Large gullies, diversions, and low flowing streams	2.97	103.00	3,470.00	5.160	0.186
#14	**4**	**Time of Concentration:**					**0.341**
#14	5	5. Nearly bare and untilled, and alluvial valley fans	28.15	125.00	444.00	5.300	0.023
		8. Large gullies, diversions, and low flowing streams	4.18	246.00	5,886.00	6.130	0.266
#14	**5**	**Time of Concentration:**					**0.289**
#14	6	5. Nearly bare and untilled, and alluvial valley fans	3.18	40.00	1,257.00	1.780	0.196
		8. Large gullies, diversions, and low flowing streams	2.29	228.00	9,963.00	4.530	0.610
#14	**6**	**Time of Concentration:**					**0.806**
#14	7	5. Nearly bare and untilled, and alluvial valley fans	16.72	100.00	598.00	4.080	0.040
		8. Large gullies, diversions, and low flowing streams	2.81	243.00	8,649.00	5.020	0.478
#14	**7**	**Time of Concentration:**					**0.518**
#14	8	5. Nearly bare and untilled, and alluvial valley fans	1.70	47.00	2,765.00	1.300	0.590
		8. Large gullies, diversions, and low flowing streams	2.44	274.00	11,208.00	4.690	0.663
#14	**8**	**Time of Concentration:**					**1.253**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#14	9	5. Nearly bare and untilled, and alluvial valley fans	2.87	105.00	3,657.00	1.690	0.601
		8. Large gullies, diversions, and low flowing streams	2.43	194.00	7,991.00	4.670	0.475
#14	**9**	**Time of Concentration:**					**1.076**
#14	10	5. Nearly bare and untilled, and alluvial valley fans	2.75	80.00	2,907.00	1.650	0.489
		8. Large gullies, diversions, and low flowing streams	2.41	172.00	7,149.00	4.650	0.427
#14	**10**	**Time of Concentration:**					**0.916**
#15	1	5. Nearly bare and untilled, and alluvial valley fans	12.80	54.00	422.00	3.570	0.032
		8. Large gullies, diversions, and low flowing streams	1.68	181.00	10,781.00	3.880	0.771
#15	**1**	**Time of Concentration:**					**0.803**
#15	2	5. Nearly bare and untilled, and alluvial valley fans	44.22	260.00	588.00	6.640	0.024
		8. Large gullies, diversions, and low flowing streams	2.45	254.00	10,354.00	4.690	0.613
#15	**2**	**Time of Concentration:**					**0.637**
#15	3	5. Nearly bare and untilled, and alluvial valley fans	10.04	85.00	847.00	3.160	0.074
		8. Large gullies, diversions, and low flowing streams	2.34	366.00	15,663.00	4.580	0.949
#15	**3**	**Time of Concentration:**					**1.023**
#16	1	5. Nearly bare and untilled, and alluvial valley fans	4.17	15.00	360.00	2.040	0.049
		8. Large gullies, diversions, and low flowing streams	1.42	108.00	7,618.00	3.570	0.592
#16	**1**	**Time of Concentration:**					**0.641**
#16	2	5. Nearly bare and untilled, and alluvial valley fans	8.70	62.00	713.00	2.940	0.067
		8. Large gullies, diversions, and low flowing streams	1.99	144.00	7,241.00	4.230	0.475
#16	**2**	**Time of Concentration:**					**0.542**
#16	3	5. Nearly bare and untilled, and alluvial valley fans	6.88	32.00	465.00	2.620	0.049
		8. Large gullies, diversions, and low flowing streams	2.29	81.00	3,543.00	4.530	0.217
#16	**3**	**Time of Concentration:**					**0.266**
#17	1	5. Nearly bare and untilled, and alluvial valley fans	9.37	65.00	694.00	3.060	0.062
		8. Large gullies, diversions, and low flowing streams	1.19	56.00	4,712.00	3.270	0.400
#17	**1**	**Time of Concentration:**					**0.462**
#18	1	5. Nearly bare and untilled, and alluvial valley fans	9.00	60.00	667.00	2.990	0.061

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	0.97	61.00	6,287.00	2.950	0.591
#18	**1**	**Time of Concentration:**					**0.652**
#18	2	5. Nearly bare and untilled, and alluvial valley fans	2.47	33.00	1,336.00	1.570	0.236
		8. Large gullies, diversions, and low flowing streams	2.01	164.00	8,154.00	4.250	0.532
#18	**2**	**Time of Concentration:**					**0.768**
#20	1	5. Nearly bare and untilled, and alluvial valley fans	11.87	45.00	379.00	3.440	0.030
		8. Large gullies, diversions, and low flowing streams	0.75	45.00	5,969.00	2.600	0.637
#20	**1**	**Time of Concentration:**					**0.667**
#20	2	5. Nearly bare and untilled, and alluvial valley fans	5.40	45.00	833.00	2.320	0.099
		8. Large gullies, diversions, and low flowing streams	1.30	98.00	7,547.00	3.410	0.614
#20	**2**	**Time of Concentration:**					**0.713**
#21	1	5. Nearly bare and untilled, and alluvial valley fans	4.09	60.00	1,467.00	2.020	0.201
		8. Large gullies, diversions, and low flowing streams	0.93	60.00	6,433.00	2.890	0.618
#21	**1**	**Time of Concentration:**					**0.819**
#21	2	5. Nearly bare and untilled, and alluvial valley fans	3.50	50.00	1,430.00	1.860	0.213
		8. Large gullies, diversions, and low flowing streams	2.15	60.00	2,785.00	4.400	0.175
#21	**2**	**Time of Concentration:**					**0.388**
#21	3	5. Nearly bare and untilled, and alluvial valley fans	1.70	15.00	881.00	1.300	0.188
		9. Small streams flowing bankfull	1.49	60.00	4,014.00	11.000	0.101
#21	**3**	**Time of Concentration:**					**0.289**
#21	4	5. Nearly bare and untilled, and alluvial valley fans	2.21	40.00	1,811.02	1.480	0.339
		8. Large gullies, diversions, and low flowing streams	0.84	50.00	5,949.54	2.750	0.600
#21	**4**	**Time of Concentration:**					**0.939**
#23	1	5. Nearly bare and untilled, and alluvial valley fans	2.44	65.00	2,660.01	1.560	0.473
		8. Large gullies, diversions, and low flowing streams	0.33	10.00	3,017.50	1.720	0.487
#23	**1**	**Time of Concentration:**					**0.960**
#23	2	5. Nearly bare and untilled, and alluvial valley fans	3.49	60.00	1,718.01	1.860	0.256
		8. Large gullies, diversions, and low flowing streams	1.66	65.00	3,926.06	3.860	0.282
#23	**2**	**Time of Concentration:**					**0.538**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	1	5. Nearly bare and untilled, and alluvial valley fans	1.71	430.00	25,118.00	1.300	5.367
#24	**1**	**Time of Concentration:**					**5.367**
#24	2	5. Nearly bare and untilled, and alluvial valley fans	1.84	430.00	23,393.00	1.350	4.813
#24	**2**	**Time of Concentration:**					**4.813**
#24	3	5. Nearly bare and untilled, and alluvial valley fans	1.82	155.00	8,498.00	1.350	1.748
		8. Large gullies, diversions, and low flowing streams	0.84	40.00	4,771.00	2.740	0.483
#24	**3**	**Time of Concentration:**					**2.231**
#24	4	5. Nearly bare and untilled, and alluvial valley fans	1.24	50.00	4,042.00	1.110	1.011
		8. Large gullies, diversions, and low flowing streams	0.49	60.00	12,150.00	2.100	1.607
#24	**4**	**Time of Concentration:**					**2.618**
#25	1	5. Nearly bare and untilled, and alluvial valley fans	0.51	10.00	1,950.00	0.710	0.762
		8. Large gullies, diversions, and low flowing streams	1.81	60.00	3,322.00	4.030	0.228
#25	**1**	**Time of Concentration:**					**0.990**
#25	2	5. Nearly bare and untilled, and alluvial valley fans	1.11	25.00	2,254.00	1.050	0.596
		8. Large gullies, diversions, and low flowing streams	2.36	75.00	3,178.00	4.600	0.191
#25	**2**	**Time of Concentration:**					**0.787**
#25	3	5. Nearly bare and untilled, and alluvial valley fans	3.23	30.00	929.00	1.790	0.144
		8. Large gullies, diversions, and low flowing streams	2.45	154.00	6,297.00	4.690	0.372
#25	**3**	**Time of Concentration:**					**0.516**
#26	1	5. Nearly bare and untilled, and alluvial valley fans	1.20	103.00	8,602.00	1.090	2.192
#26	**1**	**Time of Concentration:**					**2.192**
#26	2	5. Nearly bare and untilled, and alluvial valley fans	1.23	120.00	9,780.00	1.100	2.469
		8. Large gullies, diversions, and low flowing streams	2.18	184.00	8,454.00	4.420	0.531
#26	**2**	**Time of Concentration:**					**3.000**
#27	1	5. Nearly bare and untilled, and alluvial valley fans	4.32	50.00	1,158.02	2.070	0.155
		8. Large gullies, diversions, and low flowing streams	2.53	198.00	7,838.16	4.760	0.457
#27	**1**	**Time of Concentration:**					**0.612**
#27	2	5. Nearly bare and untilled, and alluvial valley fans	5.26	30.00	570.00	2.290	0.069
		8. Large gullies, diversions, and low flowing streams	3.15	278.00	8,822.00	5.320	0.460

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#27	**2**	**Time of Concentration:**					**0.529**
#27	3	5. Nearly bare and untilled, and alluvial valley fans	16.33	80.00	490.00	4.040	0.033
		8. Large gullies, diversions, and low flowing streams	2.15	225.00	10,443.00	4.400	0.659
#27	**3**	**Time of Concentration:**					**0.692**
#27	4	5. Nearly bare and untilled, and alluvial valley fans	12.43	65.00	523.00	3.520	0.041
		8. Large gullies, diversions, and low flowing streams	3.49	225.00	6,454.00	5.600	0.320
#27	**4**	**Time of Concentration:**					**0.361**
#27	5	5. Nearly bare and untilled, and alluvial valley fans	9.40	25.00	266.00	3.060	0.024
		8. Large gullies, diversions, and low flowing streams	2.32	364.00	15,700.00	4.560	0.956
#27	**5**	**Time of Concentration:**					**0.980**
#28	1	5. Nearly bare and untilled, and alluvial valley fans	5.25	40.00	762.00	2.290	0.092
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**1**	**Time of Concentration:**					**0.657**
#28	2	5. Nearly bare and untilled, and alluvial valley fans	25.86	105.00	406.00	5.080	0.022
		8. Large gullies, diversions, and low flowing streams	2.96	310.00	10,479.34	5.150	0.565
#28	**2**	**Time of Concentration:**					**0.587**
#29	1	5. Nearly bare and untilled, and alluvial valley fans	11.58	30.00	259.00	3.400	0.021
		8. Large gullies, diversions, and low flowing streams	3.61	288.00	7,976.00	5.700	0.388
#29	**1**	**Time of Concentration:**					**0.409**
#29	2	5. Nearly bare and untilled, and alluvial valley fans	8.06	40.00	496.00	2.830	0.048
		8. Large gullies, diversions, and low flowing streams	2.90	252.00	8,693.55	5.100	0.473
#29	**2**	**Time of Concentration:**					**0.521**
#29	3	5. Nearly bare and untilled, and alluvial valley fans	7.25	25.00	345.00	2.690	0.035
		8. Large gullies, diversions, and low flowing streams	2.26	158.00	7,001.00	4.500	0.432
#29	**3**	**Time of Concentration:**					**0.467**
#30	1	5. Nearly bare and untilled, and alluvial valley fans	4.93	35.00	710.00	2.220	0.088
		8. Large gullies, diversions, and low flowing streams	1.67	243.00	14,540.00	3.870	1.043
#30	**1**	**Time of Concentration:**					**1.131**
#31	1	5. Nearly bare and untilled, and alluvial valley fans	2.91	15.00	515.00	1.700	0.084

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
		8. Large gullies, diversions, and low flowing streams	2.74	247.00	9,006.00	4.960	0.504
#31	**1**	**Time of Concentration:**					**0.588**
#31	2	5. Nearly bare and untilled, and alluvial valley fans	7.46	25.00	335.00	2.730	0.034
		8. Large gullies, diversions, and low flowing streams	2.18	138.00	6,335.00	4.420	0.398
#31	**2**	**Time of Concentration:**					**0.432**
#31	3	5. Nearly bare and untilled, and alluvial valley fans	3.84	20.00	521.00	1.950	0.074
		8. Large gullies, diversions, and low flowing streams	2.24	108.00	4,826.00	4.480	0.299
#31	**3**	**Time of Concentration:**					**0.373**
#32	1	5. Nearly bare and untilled, and alluvial valley fans	3.48	22.00	632.00	1.860	0.094
		8. Large gullies, diversions, and low flowing streams	1.56	101.00	6,494.00	3.740	0.482
#32	**1**	**Time of Concentration:**					**0.576**
#34	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	25.00	779.00	1.790	0.120
		8. Large gullies, diversions, and low flowing streams	2.80	63.00	2,251.00	5.010	0.124
#34	**1**	**Time of Concentration:**					**0.244**
#34	2	5. Nearly bare and untilled, and alluvial valley fans	5.75	40.00	696.00	2.390	0.080
		8. Large gullies, diversions, and low flowing streams	23.00	2,100.00	9,130.43	14.380	0.176
#34	**2**	**Time of Concentration:**					**0.256**
#34	3	5. Nearly bare and untilled, and alluvial valley fans	2.67	40.00	1,500.00	1.630	0.255
		8. Large gullies, diversions, and low flowing streams	1.28	98.00	7,675.00	3.380	0.630
#34	**3**	**Time of Concentration:**					**0.885**
#36	1	5. Nearly bare and untilled, and alluvial valley fans	3.21	105.00	3,274.00	1.790	0.508
		8. Large gullies, diversions, and low flowing streams	0.21	5.00	2,367.00	1.370	0.479
#36	**1**	**Time of Concentration:**					**0.987**
#36	2	5. Nearly bare and untilled, and alluvial valley fans	5.50	140.00	2,547.00	2.340	0.302
		8. Large gullies, diversions, and low flowing streams	1.58	30.00	1,897.00	3.770	0.139
#36	**2**	**Time of Concentration:**					**0.441**
#36	3	5. Nearly bare and untilled, and alluvial valley fans	1.72	20.00	1,166.00	1.300	0.249
		8. Large gullies, diversions, and low flowing streams	2.31	70.00	3,029.00	4.560	0.184
#36	**3**	**Time of Concentration:**					**0.433**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	1	5. Nearly bare and untilled, and alluvial valley fans	4.68	129.00	2,754.05	2.160	0.354
		8. Large gullies, diversions, and low flowing streams	0.16	10.00	6,108.73	1.210	1.402
#37	**1**	**Time of Concentration:**					**1.756**
#37	2	5. Nearly bare and untilled, and alluvial valley fans	7.32	90.00	1,229.00	2.700	0.126
		8. Large gullies, diversions, and low flowing streams	1.62	70.00	4,309.01	3.820	0.313
#37	**2**	**Time of Concentration:**					**0.439**
#37	3	5. Nearly bare and untilled, and alluvial valley fans	8.10	100.00	1,234.00	2.840	0.120
		8. Large gullies, diversions, and low flowing streams	2.66	100.00	3,763.21	4.890	0.213
#37	**3**	**Time of Concentration:**					**0.333**
#37	4	5. Nearly bare and untilled, and alluvial valley fans	5.09	90.00	1,768.03	2.250	0.218
		8. Large gullies, diversions, and low flowing streams	0.36	30.00	8,326.39	1.800	1.284
#37	**4**	**Time of Concentration:**					**1.502**
#37	5	5. Nearly bare and untilled, and alluvial valley fans	0.81	20.00	2,466.09	0.900	0.761
		8. Large gullies, diversions, and low flowing streams	4.06	50.00	1,231.01	6.040	0.056
#37	**5**	**Time of Concentration:**					**0.817**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	1.29	107.00	8,294.00	3.400	0.677
#1	**2**	**Muskingum K:**					**0.677**
#1	3	8. Large gullies, diversions, and low flowing streams	1.27	113.00	8,880.00	3.380	0.729
#1	**3**	**Muskingum K:**					**0.729**
#1	4	8. Large gullies, diversions, and low flowing streams	1.35	171.00	12,634.00	3.490	1.005
#1	**4**	**Muskingum K:**					**1.005**
#1	5	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**5**	**Muskingum K:**					**1.392**
#1	6	8. Large gullies, diversions, and low flowing streams	1.49	274.00	18,349.00	3.660	1.392
#1	**6**	**Muskingum K:**					**1.392**
#2	2	8. Large gullies, diversions, and low flowing streams	0.53	20.00	3,756.00	2.180	0.478

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	**2**	**Muskingum K:**					**0.478**
#2	3	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**3**	**Muskingum K:**					**0.574**
#2	4	8. Large gullies, diversions, and low flowing streams	0.55	25.00	4,570.00	2.210	0.574
#2	**4**	**Muskingum K:**					**0.574**
#2	5	8. Large gullies, diversions, and low flowing streams	0.65	45.00	6,955.00	2.410	0.801
#2	**5**	**Muskingum K:**					**0.801**
#3	3	8. Large gullies, diversions, and low flowing streams	0.92	20.00	2,168.00	2.880	0.209
#3	**3**	**Muskingum K:**					**0.209**
#5	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#5	**1**	**Muskingum K:**					**0.000**
#5	2	8. Large gullies, diversions, and low flowing streams	1.75	125.00	7,149.00	3.960	0.501
#5	**2**	**Muskingum K:**					**0.501**
#5	3	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**3**	**Muskingum K:**					**0.681**
#5	4	8. Large gullies, diversions, and low flowing streams	1.65	155.00	9,418.00	3.840	0.681
#5	**4**	**Muskingum K:**					**0.681**
#5	5	8. Large gullies, diversions, and low flowing streams	1.67	239.00	14,273.00	3.880	1.021
#5	**5**	**Muskingum K:**					**1.021**
#5	6	8. Large gullies, diversions, and low flowing streams	1.68	239.00	14,223.00	3.880	1.018
#5	**6**	**Muskingum K:**					**1.018**
#6	2	8. Large gullies, diversions, and low flowing streams	1.16	26.00	2,241.00	3.230	0.192
#6	**2**	**Muskingum K:**					**0.192**
#6	3	8. Large gullies, diversions, and low flowing streams	1.00	50.00	4,987.00	3.000	0.461
#6	**3**	**Muskingum K:**					**0.461**
#6	4	5. Nearly bare and untilled, and alluvial valley fans	1.00	50.00	4,987.00	1.000	1.385
#6	**4**	**Muskingum K:**					**1.385**
#6	5	8. Large gullies, diversions, and low flowing streams	1.02	89.00	8,685.00	3.030	0.796
#6	**5**	**Muskingum K:**					**0.796**
#6	6	8. Large gullies, diversions, and low flowing streams	1.06	126.00	11,860.00	3.090	1.066
#6	**6**	**Muskingum K:**					**1.066**

SEDCAD 4 for Windows

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#6	7	8. Large gullies, diversions, and low flowing streams	1.06	126.00	11,860.00	3.090	1.066
#6	**7**	**Muskingum K:**					**1.066**
#7	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**1**	**Muskingum K:**					**0.000**
#7	2	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#7	**2**	**Muskingum K:**					**0.000**
#7	4	8. Large gullies, diversions, and low flowing streams	1.16	140.00	12,037.00	3.230	1.035
#7	**4**	**Muskingum K:**					**1.035**
#7	5	8. Large gullies, diversions, and low flowing streams	1.14	140.00	12,307.69	3.190	1.071
#7	**5**	**Muskingum K:**					**1.071**
#7	6	8. Large gullies, diversions, and low flowing streams	1.17	158.00	13,546.00	3.230	1.164
#7	**6**	**Muskingum K:**					**1.164**
#7	7	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**7**	**Muskingum K:**					**1.344**
#7	8	8. Large gullies, diversions, and low flowing streams	1.18	187.00	15,784.00	3.260	1.344
#7	**8**	**Muskingum K:**					**1.344**
#10	3	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**3**	**Muskingum K:**					**0.517**
#10	4	8. Large gullies, diversions, and low flowing streams	0.76	37.00	4,861.00	2.610	0.517
#10	**4**	**Muskingum K:**					**0.517**
#10	5	8. Large gullies, diversions, and low flowing streams	0.79	47.00	5,956.00	2.660	0.621
#10	**5**	**Muskingum K:**					**0.621**
#12	2	8. Large gullies, diversions, and low flowing streams	8.24	111.00	1,347.00	8.610	0.043
#12	**2**	**Muskingum K:**					**0.043**
#12	3	8. Large gullies, diversions, and low flowing streams	8.01	109.00	1,360.00	8.490	0.044
#12	**3**	**Muskingum K:**					**0.044**
#12	4	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**4**	**Muskingum K:**					**0.487**
#12	5	8. Large gullies, diversions, and low flowing streams	2.24	176.00	7,866.00	4.480	0.487
#12	**5**	**Muskingum K:**					**0.487**
#13	2	8. Large gullies, diversions, and low flowing streams	1.34	54.00	4,025.00	3.470	0.322

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#13	**2**	**Muskingum K:**					**0.322**
#13	3	8. Large gullies, diversions, and low flowing streams	0.98	72.00	7,333.00	2.970	0.685
#13	**3**	**Muskingum K:**					**0.685**
#13	4	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**4**	**Muskingum K:**					**0.923**
#13	5	8. Large gullies, diversions, and low flowing streams	1.18	127.00	10,806.00	3.250	0.923
#13	**5**	**Muskingum K:**					**0.923**
#14	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#14	**1**	**Muskingum K:**					**0.000**
#14	2	8. Large gullies, diversions, and low flowing streams	0.83	58.00	6,957.00	2.730	0.707
#14	**2**	**Muskingum K:**					**0.707**
#14	3	8. Large gullies, diversions, and low flowing streams	0.81	77.00	9,480.00	2.700	0.975
#14	**3**	**Muskingum K:**					**0.975**
#14	4	8. Large gullies, diversions, and low flowing streams	0.86	147.00	17,117.00	2.770	1.716
#14	**4**	**Muskingum K:**					**1.716**
#14	5	8. Large gullies, diversions, and low flowing streams	0.88	175.00	19,934.00	2.810	1.970
#14	**5**	**Muskingum K:**					**1.970**
#14	6	8. Large gullies, diversions, and low flowing streams	0.95	211.00	22,155.00	2.920	2.107
#14	**6**	**Muskingum K:**					**2.107**
#14	7	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**7**	**Muskingum K:**					**2.544**
#14	8	8. Large gullies, diversions, and low flowing streams	0.96	257.00	26,835.00	2.930	2.544
#14	**8**	**Muskingum K:**					**2.544**
#14	9	8. Large gullies, diversions, and low flowing streams	0.95	307.00	32,146.59	2.930	3.047
#14	**9**	**Muskingum K:**					**3.047**
#14	10	8. Large gullies, diversions, and low flowing streams	0.96	339.00	35,382.00	2.930	3.354
#14	**10**	**Muskingum K:**					**3.354**
#15	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#15	**1**	**Muskingum K:**					**0.000**
#15	2	8. Large gullies, diversions, and low flowing streams	1.14	86.00	7,535.00	3.200	0.654
#15	**2**	**Muskingum K:**					**0.654**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#15	3	8. Large gullies, diversions, and low flowing streams	1.25	115.00	9,236.00	3.340	0.768
#15	**3**	**Muskingum K:**					**0.768**
#16	2	8. Large gullies, diversions, and low flowing streams	0.58	24.00	4,161.00	2.270	0.509
#16	**2**	**Muskingum K:**					**0.509**
#16	3	8. Large gullies, diversions, and low flowing streams	0.51	37.00	7,269.00	2.140	0.943
#16	**3**	**Muskingum K:**					**0.943**
#17	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#17	**1**	**Muskingum K:**					**0.000**
#18	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#18	**1**	**Muskingum K:**					**0.000**
#18	2	8. Large gullies, diversions, and low flowing streams	1.02	62.00	6,103.00	3.020	0.561
#18	**2**	**Muskingum K:**					**0.561**
#20	2	8. Large gullies, diversions, and low flowing streams	17.00	3,605.00	21,205.88	12.360	0.476
#20	**2**	**Muskingum K:**					**0.476**
#21	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#21	**1**	**Muskingum K:**					**0.000**
#21	2	8. Large gullies, diversions, and low flowing streams	0.41	20.00	4,824.00	1.930	0.694
#21	**2**	**Muskingum K:**					**0.694**
#21	3	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**3**	**Muskingum K:**					**0.877**
#21	4	8. Large gullies, diversions, and low flowing streams	0.36	20.00	5,626.00	1.780	0.877
#21	**4**	**Muskingum K:**					**0.877**
#23	1	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#23	**1**	**Muskingum K:**					**0.000**
#23	2	8. Large gullies, diversions, and low flowing streams	0.63	30.00	4,771.75	2.370	0.559
#23	**2**	**Muskingum K:**					**0.559**
#24	1	8. Large gullies, diversions, and low flowing streams	0.79	180.00	22,769.00	2.660	2.377
#24	**1**	**Muskingum K:**					**2.377**
#24	2	8. Large gullies, diversions, and low flowing streams	0.78	180.00	23,111.00	2.640	2.431
#24	**2**	**Muskingum K:**					**2.431**
#24	4	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#24	**4**	**Muskingum K:**					**0.000**
#25	1	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**1**	**Muskingum K:**					**0.342**
#25	2	8. Large gullies, diversions, and low flowing streams	1.99	104.00	5,220.00	4.230	0.342
#25	**2**	**Muskingum K:**					**0.342**
#25	3	8. Large gullies, diversions, and low flowing streams	0.00	0.00	0.00	0.000	0.000
#25	**3**	**Muskingum K:**					**0.000**
#27	1	8. Large gullies, diversions, and low flowing streams	1.38	216.00	15,629.00	3.520	1.233
#27	**1**	**Muskingum K:**					**1.233**
#27	2	8. Large gullies, diversions, and low flowing streams	1.17	144.00	12,301.00	3.240	1.054
#27	**2**	**Muskingum K:**					**1.054**
#27	3	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**3**	**Muskingum K:**					**0.551**
#27	4	8. Large gullies, diversions, and low flowing streams	1.18	76.00	6,454.00	3.250	0.551
#27	**4**	**Muskingum K:**					**0.551**
#28	1	8. Large gullies, diversions, and low flowing streams	1.30	84.00	6,445.17	3.420	0.523
#28	**1**	**Muskingum K:**					**0.523**
#29	1	8. Large gullies, diversions, and low flowing streams	0.88	37.00	4,210.00	2.810	0.416
#29	**1**	**Muskingum K:**					**0.416**
#29	2	8. Large gullies, diversions, and low flowing streams	0.88	26.00	2,949.00	2.810	0.291
#29	**2**	**Muskingum K:**					**0.291**
#31	1	8. Large gullies, diversions, and low flowing streams	1.35	76.00	5,639.00	3.480	0.450
#31	**1**	**Muskingum K:**					**0.450**
#31	2	8. Large gullies, diversions, and low flowing streams	1.15	20.00	1,734.00	3.220	0.149
#31	**2**	**Muskingum K:**					**0.149**
#34	1	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**1**	**Muskingum K:**					**0.965**
#34	2	8. Large gullies, diversions, and low flowing streams	0.73	65.00	8,900.00	2.560	0.965
#34	**2**	**Muskingum K:**					**0.965**
#36	3	8. Large gullies, diversions, and low flowing streams	2.71	80.00	2,957.00	4.930	0.166
#36	**3**	**Muskingum K:**					**0.166**

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#37	2	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**2**	**Muskingum K:**					**1.780**
#37	3	8. Large gullies, diversions, and low flowing streams	0.31	30.00	9,800.71	1.650	1.649
#37	**3**	**Muskingum K:**					**1.649**
#37	4	8. Large gullies, diversions, and low flowing streams	0.29	30.00	10,319.91	1.610	1.780
#37	**4**	**Muskingum K:**					**1.780**
#37	5	8. Large gullies, diversions, and low flowing streams	0.56	100.00	17,956.54	2.230	2.236
#37	**5**	**Muskingum K:**					**2.236**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	12.85	2.98	14.2	5,823	2.63	1.99
#28	1,217.900	1,217.900	348.89	55.85	2,523.5	62,288	0.15	0.11
#26	2,486.400	2,486.400	65.87	26.07	120.8	5,583	1.83	1.40
#24	8,061.800	8,061.800	94.58	74.22	230.2	4,450	0.94	0.63
#25	1,015.700	9,077.500	103.41	93.53	318.0	14,973	4.39	0.98
#27	1,783.700	13,347.600	236.67	153.83	991.6	20,940	9.20	2.46
#29	966.000	15,531.500	535.73	253.00	5,701.3	61,577	5.53	1.88
#32	293.700	16,301.600	553.89	272.97	6,197.3	56,019	2.91	1.10
#31	957.100	957.100	333.75	52.17	1,885.7	48,387	1.13	0.87
#33	0.000	17,258.700	646.50	325.15	8,083.0	50,209	2.27	1.07
#34	932.500	18,191.200	673.81	365.64	7,938.8	43,736	0.10	0.05
#5	2,023.000	2,023.000	506.93	74.88	1,865.9	42,293	7.10	3.81
#6	1,743.200	3,766.200	630.69	145.20	3,523.1	37,902	0.66	0.41
#7	2,395.300	6,161.500	1,047.30	279.30	9,564.4	49,059	0.35	0.24
#8	0.000	6,161.500	1,047.30	279.30	9,564.4	49,059	0.35	0.24
#10	1,053.200	7,214.700	1,090.14	327.89	9,682.3	45,852	0.08	0.05
#1	2,411.100	2,411.100	349.94	69.75	1,801.7	33,350	5.15	3.43
#2	1,497.000	3,908.100	424.36	146.48	2,640.6	27,235	0.18	0.12
#3	862.700	4,770.800	559.86	182.72	3,083.2	21,895	0.16	0.12
#4	0.000	4,770.800	559.86	182.72	3,083.2	21,895	0.16	0.12
#9	425.500	5,196.300	582.11	202.77	3,149.7	20,044	0.00	0.00
#11	0.000	12,411.000	1,509.13	530.66	12,832.0	37,776	0.05	0.03
#21	1,080.800	13,491.800	1,551.27	570.36	13,036.8	37,249	0.00	0.00
#18	848.500	848.500	169.02	34.58	389.3	20,552	0.10	0.06
#17	182.200	182.200	108.99	10.55	110.0	13,892	0.66	0.46
#19	0.000	1,030.700	255.08	45.13	499.3	18,671	0.27	0.18
#15	1,992.700	1,992.700	386.36	75.98	2,270.9	44,345	3.76	2.31
#12	3,494.500	3,494.500	193.05	50.42	599.6	16,055	7.95	5.41
#13	2,720.700	6,215.200	371.99	90.19	1,206.7	16,565	8.59	5.98
#14	5,096.800	11,312.000	509.48	261.94	4,722.7	77,966	2.13	0.45
#16	876.500	14,181.200	826.28	387.78	8,321.9	51,231	2.33	0.89
#20	681.900	15,893.800	880.92	470.50	9,269.5	40,305	1.67	0.76
#22	0.000	29,385.600	2,341.22	1,040.86	22,306.4	36,837	0.63	0.35
#23	752.900	30,138.500	2,329.13	1,066.54	22,484.5	36,491	0.39	0.21
#35	0.000	48,329.700	2,891.62	1,432.18	30,423.3	34,531	0.29	0.17
#36	891.700	49,221.400	2,879.06	1,452.79	30,602.1	34,619	0.22	0.13

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#37	2,208.500	51,429.900	2,841.01	1,511.75	30,643.5	34,186	0.24	0.14

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	30.89	6.52	36.1	6,848	3.20	2.38
#28	1,217.900	1,217.900	503.94	79.78	3,785.9	64,830	0.47	0.33
#26	2,486.400	2,486.400	129.71	49.77	252.2	6,132	2.13	1.63
#24	8,061.800	8,061.800	187.84	146.37	496.8	4,961	1.10	0.72
#25	1,015.700	9,077.500	192.60	178.46	630.7	15,775	4.34	0.96
#27	1,783.700	13,347.600	390.94	285.23	1,879.5	22,553	9.85	2.51
#29	966.000	15,531.500	811.81	427.10	8,961.2	64,027	7.06	2.14
#32	293.700	16,301.600	841.49	456.97	9,765.4	58,352	4.76	1.61
#31	957.100	957.100	468.62	72.36	2,769.5	49,912	1.43	1.11
#33	0.000	17,258.700	933.80	529.33	12,534.9	52,484	3.67	1.56
#34	932.500	18,191.200	970.74	587.63	12,305.4	46,096	0.84	0.37
#5	2,023.000	2,023.000	759.22	110.62	2,932.3	44,396	8.02	4.36
#6	1,743.200	3,766.200	937.84	213.01	5,461.3	39,588	0.96	0.60
#7	2,395.300	6,161.500	1,511.91	398.19	14,212.4	50,892	0.57	0.38
#8	0.000	6,161.500	1,511.91	398.19	14,212.4	50,892	0.57	0.38
#10	1,053.200	7,214.700	1,570.05	466.98	14,398.1	47,738	0.30	0.18
#1	2,411.100	2,411.100	539.70	107.13	2,889.3	34,591	5.99	4.00
#2	1,497.000	3,908.100	639.70	214.44	4,165.5	27,962	0.19	0.13
#3	862.700	4,770.800	796.58	266.87	4,723.0	22,166	0.06	0.04
#4	0.000	4,770.800	796.58	266.87	4,723.0	22,166	0.06	0.04
#9	425.500	5,196.300	828.60	295.38	4,815.5	20,316	0.00	0.00
#11	0.000	12,411.000	2,176.63	762.36	19,213.6	39,288	0.18	0.11
#21	1,080.800	13,491.800	2,235.06	821.13	19,523.7	38,583	0.02	0.01
#18	848.500	848.500	254.46	50.10	629.1	22,480	0.17	0.11
#17	182.200	182.200	150.01	14.49	157.1	14,384	0.80	0.55
#19	0.000	1,030.700	355.05	64.59	786.2	20,520	0.35	0.23
#15	1,992.700	1,992.700	573.85	111.38	3,464.8	46,177	4.79	2.91
#12	3,494.500	3,494.500	342.58	89.19	1,127.7	17,435	8.75	5.92
#13	2,720.700	6,215.200	652.52	158.89	2,263.5	17,685	9.32	6.50
#14	5,096.800	11,312.000	855.51	416.05	7,583.6	80,737	4.22	0.86
#16	876.500	14,181.200	1,197.97	596.11	12,952.2	53,843	3.54	1.29
#20	681.900	15,893.800	1,271.46	712.74	14,387.9	42,602	2.57	1.11
#22	0.000	29,385.600	3,381.04	1,533.87	33,911.6	38,305	0.99	0.54
#23	752.900	30,138.500	3,362.72	1,572.38	33,862.8	37,629	0.49	0.27
#35	0.000	48,329.700	4,201.38	2,160.00	46,168.3	35,467	0.51	0.29
#36	891.700	49,221.400	4,181.96	2,192.96	46,497.7	35,889	0.48	0.27

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#37	2,208.500	51,429.900	4,120.23	2,285.39	46,505.5	35,872	0.33	0.18

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#30	476.400	476.400	65.84	12.83	80.6	7,897	3.88	2.84
#28	1,217.900	1,217.900	724.22	113.81	5,661.4	67,335	0.79	0.57
#26	2,486.400	2,486.400	239.85	89.42	491.1	6,676	2.47	1.87
#24	8,061.800	8,061.800	347.67	268.91	989.6	5,442	1.32	0.85
#25	1,015.700	9,077.500	355.36	321.00	1,205.4	16,415	4.43	0.99
#27	1,783.700	13,347.600	632.57	503.04	3,430.7	23,910	10.45	2.60
#29	966.000	15,531.500	1,224.41	705.70	14,034.2	67,171	8.70	2.38
#32	293.700	16,301.600	1,271.84	750.71	15,388.5	60,689	6.75	2.11
#31	957.100	957.100	658.11	100.59	4,029.6	51,481	1.68	1.31
#33	0.000	17,258.700	1,380.10	851.30	19,418.1	54,967	5.21	2.04
#34	932.500	18,191.200	1,400.95	935.07	18,855.2	47,523	1.45	0.59
#5	2,023.000	2,023.000	1,134.33	162.68	4,633.8	46,042	9.29	5.15
#6	1,743.200	3,766.200	1,388.71	311.34	8,463.0	41,364	1.61	1.00
#7	2,395.300	6,161.500	2,178.26	567.73	21,139.2	52,813	0.89	0.60
#8	0.000	6,161.500	2,178.26	567.73	21,139.2	52,813	0.89	0.60
#10	1,053.200	7,214.700	2,258.75	665.29	21,434.0	49,680	0.62	0.39
#1	2,411.100	2,411.100	823.47	163.06	4,586.2	35,752	6.80	4.55
#2	1,497.000	3,908.100	957.23	313.42	6,458.5	28,518	0.20	0.13
#3	862.700	4,770.800	1,132.66	389.11	7,079.3	22,325	0.06	0.05
#4	0.000	4,770.800	1,132.66	389.11	7,079.3	22,325	0.06	0.05
#9	425.500	5,196.300	1,179.29	429.61	7,217.3	20,594	0.00	0.00
#11	0.000	12,411.000	3,137.48	1,094.90	28,651.3	40,760	0.38	0.23
#21	1,080.800	13,491.800	3,219.23	1,181.47	29,124.9	39,690	0.09	0.06
#18	848.500	848.500	380.92	72.50	1,005.9	24,282	0.23	0.15
#17	182.200	182.200	206.29	19.96	224.8	14,878	0.93	0.64
#19	0.000	1,030.700	494.85	92.45	1,230.7	22,297	0.42	0.27
#15	1,992.700	1,992.700	849.14	162.79	5,262.2	48,014	5.90	3.57
#12	3,494.500	3,494.500	584.36	151.76	2,044.5	18,768	9.60	6.47
#13	2,720.700	6,215.200	1,103.87	269.77	4,088.5	18,975	10.18	7.04
#14	5,096.800	11,312.000	1,402.27	652.61	12,213.4	83,135	7.75	1.54
#16	876.500	14,181.200	1,733.22	910.28	20,206.7	56,264	5.41	1.90
#20	681.900	15,893.800	1,832.17	1,074.96	22,378.1	44,766	3.96	1.66
#22	0.000	29,385.600	4,878.63	2,256.43	51,503.0	39,619	1.57	0.85
#23	752.900	30,138.500	4,851.70	2,313.77	51,418.6	38,933	0.97	0.52
#35	0.000	48,329.700	6,100.87	3,248.84	70,273.8	36,433	0.97	0.54
#36	891.700	49,221.400	6,070.96	3,300.71	70,855.0	36,966	0.86	0.47

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#37	2,208.500	51,429.900	5,975.88	3,443.60	70,804.8	36,850	0.70	0.37

APPENDIX 7-I

COTTONWOOD ARROYO
AUTOMATED SAMPLERS

TOTAL SEDIMENT LABORATORY DATA

STATIONS CN-1, CNS-1, AND CS-1
1997 - 1999

COTTONWOOD ARROYO
CN-1 SEDIMENT DATA 1997-1999

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
0397W0160	cn-1-02	7/23/97		12	168,400									
0397W0160	cn-1-03	7/23/97		10	147,300									
0397W0160	cn-1-04	7/23/97		15	162,600									
0397W0166	CN-1 02	8/3/97		86	268,000									
0397W0166	CN-1 03	8/3/97		100	95,700									
0397W0200	CN-1 #3	9/13/97		71	128,000									
0397W0201	CN-1 #5	9/13/97		109	115,000									
0397W0201	CN-1 #6	9/13/97		80	129,000									
0397W0201	CN-1 #12	9/13/97		137	256,000									
0397W0201	CN-1 #18	9/13/97		115	208,000									
0397W0201	CN-1 #15	9/13/97		405	226,000									
0397W0204	CN-1 #5	9/15/97		34	106,000									
0397W0204	CN-1 #8	9/15/97		42	69,900									
0397W0204	CN-1 #11	9/15/97		24	69,700									
0397W0214	CN-1 #13	9/21/97		33	87,300									
0397W0214	CN-1 #14	9/21/97		33	85,800									
0397W0270	CN-1 #4	11/12/97		43	31,700									
0397W0270	CN-1 #5	11/12/97		59	29,500									
0397W0270	CN-1 #7	11/12/97		73	32,200									
W04782	CN-1 #2	8/20/98	1708	80	142,200	22	26	52	C	0	0.3	1.8	40	58
W04783	CN-1 #3	8/20/98	1712	50	121,000	22	24	54	C	0	0.2	1.1	54	45
W04784	CN-1 #5	8/20/98	0106	50	53,720	20	27	53	C	0.3	0.3	0.3	31	68
W04785	CN-1 #6	8/20/98	0110	50	53,210	20	22	58	C	0	0	1.0	21	78
W04786	CN-1 #7	8/20/98	0118	50	54,170	24	23	53	C	0	0	1.4	30	68
W04853	CN-1 #2	8/21/98	1654	350	97,100	38	27	35	CL	0	0.1	2.2	65	33
W04854	CN-1 #3	8/21/98	1658	525	91,780	36	25	39	CL	0	0	4.4	88	8
W04855	CN-1 #4	8/21/98	1704	850	115,100	36	25	39	CL	0	0.3	7.6	57	35

COTTONWOOD ARROYO
CN-1 SEDIMENT DATA 1997-1999

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W04856	CN-1 #5	8/21/98	1710	1,000	149,400	32	25	43	C	0	1.2	8.5	52	38
W05786	CN-1	09/30/98	1540	210	117,000	43	20	37	CL	0	1.5	45	37	16
W05787	CN-1	09/29/98	1546	380	118,000	34	24	42	C	0.02	4.4	19	70	6.1
W05788	CN-1	09/29/98	1552	601	131,000	32	23	45	C	0.03	4.3	14	56	25
W05789	CN-1	09/29/98	1558	550	137,000	34	22	44	C	1.2	11	16	50	22
W05790	CN-1	09/29/98	1604	500	148,000	27	25	48	C	0.85	6.4	13	61	19
S06273	CN-1 #2	10/25/98	2026	45	39,900	18	35	47	C	0	0.71	9.2	28	62
S06274	CN-1 #3	10/25/98	2030	53	40,100	10	36	54	C	0.89	0.44	3.6	23	72
S06275	CN-1 #4	10/25/98	2036	73	45,600	15	30	55	C	0	0.17	5.9	30	64
S06276	CN-1 #5	10/25/98	2044	89	45,200	12	32	56	C	0	0.42	5.0	30	65
S06277	CN-1 #6	10/25/98	2050	76	46,600	15	29	56	C	0.20	1.6	6.4	32	60
S06278	CN-1 #7	10/25/98	2056	78	46,600	15	27	58	C	0	0.27	2.7	25	72
S06279	CN-1 #8	10/25/98	2102	58	44,800									
W03418	CN-1#4	07/03/99	1418	41	108,000	34	24	42	C	0	0.16	3.2	64	33
W03419	CN-1#11	07/03/99	1500	16	200,400	33	27	40	C	0	0.07	3.4	67	29
W03420	CN-1#16	07/03/99	1530	10	210,900	38	28	34	CL	0	0.03	4.0	73	23
W03421	CN-1#20	07/03/99	1554	3	152,200	28	33	39	CL	0	0	3.7	54	42
W03602	CN-1 #3	07/15/99	1352	62	201,600	28	30	42	C	0	0.21	4.4	51	44
W03603	CN-1 #5	07/15/99	1404	98	223,800	36	28	36	CL	0	0.34	6.8	74	19
W03604	CN-1 #7	07/15/99	1416	63	231,500	42	26	32	CL	0	0.18	6.2	61	32
W03605	CN-1 #8	07/15/99	1422	44	213,400	38	29	33	CL	0	0.06	8.0	69	23
W03967	CN-1 #4	07/29/99	0128	27	38,500	15	27	58	C	20	0	13	47	20

COTTONWOOD ARROYO
CN-1 SEDIMENT DATA 1997-1999

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W03968	CN-1 #6	07/29/99	0220	247	225,800	30	34	36	CL	0.13	1.6	9.8	60	28
W03969	CN-1 #9	07/29/99	0238	90	206,000	28	40	32	CL	0.05	0.66	5.2	62	32
W03970	CN-1 #12	07/29/99	0256	22	201,400	33	34	33	CL	0.03	0.74	5.6	61	33
W03994	CN-1 #1	08/02/99	1540	155	112,400	43	22	35	CL	0.17	2.1	10	57	31
W04000	CN-1 #3	08/02/99	1550*	525	81,900	36	23	41	C	0.73	3.3	10	59	27
W04001	CN-1 #5	08/02/99	1602	325	73,600	32	23	45	C	0.90	8.6	14	46	30
W04002	CN-1 #9	08/02/99	1626	80	50,900	30	18	52	C	0	0.66	6.7	63	29
W04003	CN-1 #14	08/02/99	1656	20	66,300	24	23	53	C	0	0.22	7.8	65	27
W04031	CN-1 #5	8/3/99	1356*	160	175,800	33	32	35	CL	0	1.10	7.4	58	34
W04032	CN-1 #12	8/3/99	1654	105	53,800	35	24	41	C	0	0.49	9.2	53	37
W04033	CN-1 #14	8/3/99	1706*	270	59,000	41	20	39	CL	0	2.10	13.0	57	28
W04034	CN-1 #18	8/3/99	1730	65	52,700	37	22	41	C	0	0.22	7.6	56	36
W04130	CN-1 #5	08/05/99	1744	610	108,000	36	27	37	CL	0.32	2.1	13	54	30
W04131	CN-1 #9	08/05/99	1808*	1,320	142,500	42	25	33	CL	0.33	6.2	29	51	13
W04132	CN-1 #18	08/05/99	1902	865	169,500	40	25	35	CL	0	0.62	10	62	28
W04133	CN-1 #23	08/05/99	1932	500	164,100	46	25	29	SCL	0	0.38	9.9	72	18
W04247	CN-1 #2	08/08/99	2036*	150	187,000	28	30	42	C	0.03	6.8	38	24	31
W04248	CN-1 #3	08/08/99	2042	134	175,600	26	32	42	C	0	3.1	35	32	30
W04249	CN-1 #4	08/08/99	2048	95	175,200	22	34	44	C	0.06	4.4	19	45	31
W04250	CN-1 #5	08/08/99	2054	57	200,600	30	30	40	C	0.10	3.1	30	39	28
W04287	CN-1 #6	08/15/99	0310	54	46,100	29	23	48	C	0	0.46	4.6	50	45
W04288	CN-1 #11	08/15/99	0340*	135	130,300	22	34	44	C	0.05	0.59	4.2	45	50

COTTONWOOD ARROYO
CN-1 SEDIMENT DATA 1997-1999

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W04289	CN-1 #14	08/15/99	0358	76	144,500	21	37	42	C	0	0.53	4.7	40	55
W04290	CN-1 #17	08/15/99	0416	47	123,200	24	34	42	C	0	0.52	6.5	48	45
W04452	CN-1 #7	08/24/99	1938	320	68,000	32	25	43	C	0.14	1.1	8.6	54	37
W04453	CN-1 #9	08/24/99	1950*	710	142,300	48	22	30	SCL	0.10	0.91	13	62	24
W04454	CN-1 #18	08/24/99	2044*	380	139,100	46	24	30	SCL	0.23	3.8	13	56	26
W04455	CN-1 #24	08/24/99	2120	150	134,000	44	27	29	CL	0.05	0.14	4.5	69	26
W04496	CN-1 #3	08/26/99	1936	125	59,400	43	21	36	CL	0	0.14	4.4	62	34
W04497	CN-1 #8	08/26/99	2016*	590	215,000	50	21	29	SCL	0.04	0.45	17	62	21
W04498	CN-1 #13	08/26/99	2046	160	136,000	42	26	32	CL	0.02	0.05	0.90	63	36
W04499	CN-1 #21	08/26/99	2134	30	108,400	40	28	32	CL	0.03	0.06	1.6	54	44
W04515	CN-1 #5	08/27/99	1552*	435	119,100	46	20	34	SCL	0	0.29	7.4	67	26
W04516	CN-1 #7	08/27/99	1604	287	109,400	40	22	38	CL	0	0.34	7.2	67	26
W04517	CN-1 #10	08/27/99	1622*	465	169,300	40	26	34	CL	0.02	0.84	17	60	22
W04518	CN-1 #14	08/27/99	1646	155	144,000	34	31	35	CL	0	0.14	2.9	60	37
W04519	CN-1 #2	08/29/99	1242*	265	152,600	36	26	38	CL	0.08	5.8	37	35	22
W04520	CN-1 #9	08/29/99	0124*	155	113,200	32	32	36	CL	0	0.29	5.4	56	38
W04521	CN-1 #13	08/29/99	0148	120	122,200	40	27	33	CL	0	0.18	5.2	60	35
W04522	CN-1 #19	08/29/99	0224	40	98,400	38	26	36	CL	0	0.08	4.2	61	35
W04598	CN-1 #2	09/02/99	1402*	28	108,000	36	28	36	CL	0	0.25	5.0	60	35
W04599	CN-1 #3	09/02/99	1408	29	116,300	36	30	34	CL	0	0.18	6.5	62	32
W04600	CN-1 #4	09/02/99	1414	24	110,100	34	32	34	CL	0	0.23	6.7	63	30
				Ave.	123,097	32	27	41		0	1	10	53	35

COTTONWOOD ARROYO
CS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
0397W0169	CS-1 #5	8/2/97		1350	61,400									
0397W0169	CS-1 #9	8/2/97		2910	95,400									
0397W0169	CS-1 #10	8/2/97		2575	99,400									
0397W0189	CS-1 #7	8/31/97		75	46,200									
0397W0189	CS-1 #9	8/31/97		47	46,500									
W04788	CS-1	8/21/98	0916	240	79,000	16	25	59	C	0	0.6	2.4	43	54
W04789	CS-1	8/21/98	0924	860	76,290	16	21	63	C	0	0	0.8	27	73
W04790	CS-1	8/21/98	0934	640	70,190	12	21	67	C	0	0	3.3	30	67
W04791	CS-1	8/21/98	0944	560	135,700	18	25	57	C	0	0.2	1.4	45	53
W04792	CS-1	8/21/98	0954	340	68,060	12	21	67	C	0	0	3.2	32	65
W04793	CS-1	8/21/98	1004	480	67,810	12	21	67	C	0	0	4.3	87	9
W04794	CS-1	8/21/98	1014	600	77,210	14	21	65	C	0	0	11	22	67
W04795	CS-1	8/21/98	1024	340	78,420	14	19	67	C	0	5.6	5.6	33	56
W04796	CS-1	8/21/98	1034	350	74,630	12	19	69	C	0	0	14	29	57
W04797	CS-1	8/21/98	1044	320	78,780	14	21	65	C	0	0	1.0	35	64
W02597	CS-1#2	05/23/99	1540	90	122,900	16	34	50	C	0	0.37	0.46	42	57
W02598	CS-1#3	05/23/99	1546*	195	140,300	25	31	44	C	0	1.1	11	53	35
W02599	CS-1#4	05/23/99	1552	162	73,100	21	39	40	C	0	0.30	3.6	48	48
W02600	CS-1#5	05/23/99	1558	125	58,700	21	38	41	C	0	0.27	1.5	40	58
W02601	CS-1#6	05/23/99	1604	125	55,100	19	39	42	C	0	0.42	1.5	42	56
W02602	CS-1#7	05/23/99	1610	90	55,900	20	38	42	C	0	0.63	2.1	43	54
W02603	CS-1#8	05/23/99	1616	65	62,700	22	36	42	C	0	0.32	1.8	45	53
W02604	CS-1#9	05/23/99	1622	55	52,100	18	34	48	C	0	0	1.4	40	58

COTTONWOOD ARROYO
CS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand	Silt	Clay	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W02605	CS-1#10	05/23/99	1632	35	55,100	20	32	48	C	0	0.16	2.1	44	54
W03754	CS-1 #13	7/23/99	2120*	260	54,100	22	33	45	C	0	0.39	1.7	46	52
W03755	CS-1 #17	7/23/99	2144	130	62,300	19	31	50	C	0	0	2.4	41	57
W03756	CS-1 #21	7/23/99	2208	175	114,200	18	34	48	C	0	0.32	3.0	55	41
W03757	CS-1 #24	7/23/99	2226	65	126,000	20	35	45	C	0	0.14	2.4	50	47
W03996	CS-1 #3	08/02/99	1604	815	63,500	36	29	35	CL	1.9	8.2	12	42	36
W03997	CS-1 #5	08/02/99	1616*	1115	51,700	30	27	43	C	2.1	6.9	12	47	31
W03998	CS-1 #7	08/02/99	1628	540	44,600	33	23	44	C	0.17	2.1	12	51	34
W03999	CS-1 #10	08/02/99	1646	60	50,600	25	28	47	C	0.31	1.4	4.3	47	47
W04035	CS-1 #3	08/03/99	1502	35	143,200	34	36	30	CL	0	0.14	1.7	67	31
W04036	CS-1 #9	08/03/99	1700	625	58,800	36	29	35	CL	2.9	6.3	10	49	31
W04037	CS-1 #13	08/03/99	1724*	1750	48,200	29	31	40	C	0.46	2.0	5.2	51	40
W04038	CS-1 #23	08/03/99	1824	1120	127,900	26	29	45	C	0	0	3.3	58	38
W04134	CS-1 #7	08/05/99	1812	3100	74,500	32	26	42	C	0	0.24	4.9	61	34
W04135	CS-1 #13	08/05/99	1848	3500	97,600	22	29	49	C	0	0	3.5	51	46
W04136	CS-1 #17	08/05/99	1912	3400	112,100	20	31	49	C	0	0.26	5.1	46	49
W04137	CS-1 #23	08/05/99	1948	3300	116,600	26	33	41	C	0	0.09	4.3	57	39
				Ave.	79,420	21	29	50		0	1	5	46	48

COTTONWOOD ARROYO
CNS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand 29	Silt 28	Clay 43	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
0397W01895	CNS-1 #4	8/31/97		52	68,100									
0397W01896	CNS-1 #7	8/31/97		118	74,100									
0397W01897	CNS-1 #15	8/31/97		66	78,700									
0397W02044	CNS-1 #2	9/15/97		65	57,000									
0397W02045	CNS-1 #3	9/15/97		79	61,700									
0397W02046	CNS-1 #19	9/15/97		53	61,700									
0397W02140	CNS-1 #5	9/21/97		86	59,900									
0397W02141	CNS-1 #8	9/21/97		112	93,600									
0397W02142	CNS-1 #10	9/21/97		82	86,500									
0397W02713	CNS-1 #8	11/12/97		186	47,200									
0397W02714	CNS-1 #11	11/12/97		137	33,200									
0397W02715	CNS-1 #14	11/12/97		152	29,800									
W04763	CNS-1 #3	8/21/98	0136	630	175,400	21	29	50	C	0.1	0.4	3.0	53	44
W04764	CNS-1 #4	8/21/98	0142	860	193,800	23	28	49	C	0.1	0.5	7.5	65	27
W04765	CNS-1 #5	8/21/98	0148	585	176,500	21	28	51	C	0.1	0.3	6.4	55	39
W04767	CNS-1 #7	8/21/98	0200	740	162,500	21	28	51	C	0	0.1	5.4	60	34
W04768	CNS-1 #8	8/21/98	0206	600	161,500	23	28	49	C	0.1	0.3	3.6	52	44
W04769	CNS-1 #9	8/21/98	0212	540	146,900	21	30	49	C	0.1	0.2	2.2	52	45
W04770	CNS-1 #10	8/21/98	0218	560	139,500	21	28	51	C	0.1	0.3	1.7	44	54
W04771	CNS-1 #11	8/21/98	0224	450	131,200	20	29	51	C	0.1	0.1	1.6	42	56
W04772	CNS-1 #12	8/21/98	0230	400	120,800	19	28	53	C	0.7	0.4	2.2	44	53
W04773	CNS-1 #13	8/21/98	0236	405	96,570	15	26	59	C	0	2.9	8.8	35	53
W04774	CNS-1 #14	8/21/98	0242	440	107,300	17	32	51	C	0.5	0.5	1.0	26	72
W04775	CNS-1 #15	8/21/98	0248	510	119,600	13	38	49	C	0.1	0.7	6.8	51	41

COTTONWOOD ARROYO
CNS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand 29	Silt 28	Clay 43	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W04776	CNS-1 #16	8/21/98	0254	640	117,800	21	28	51	C	0.2	0.4	4.3	44	51
W04777	CNS-1 #17	8/21/98	0300	850	133,100	27	25	48	C	1.5	4.7	13	52	29
W04778	CNS-1 #18	8/21/98	0306	605	140,500	28	26	46	C	1.9	4.4	14	48	31
W04779	CNS-1 #19	8/21/98	0312	525	145,600	24	26	50	C	1.8	5.2	16	47	29
W04780	CNS-1 #20	8/21/98	0318	900	130,000	22	27	51	C	1.3	2.6	6.9	44	45
W04781	CNS-1 #21	8/21/98	0324	730	131,200	26	26	48	C	0.7	2.2	9.5	51	36
W04840	CNS-1 #2	8/21/98	1628	300	83,160	30	30	40	CL	0	0.6	10	73	16
W04841	CNS-1 #3	8/21/98	1634	465	76,600	26	32	42	C	0.3	1.1	3.0	39	57
W04842	CNS-1 #4	8/21/98	1640	650	91,860	36	25	39	CL	0.6	3.8	11	44	40
W04843	CNS-1 #12	8/21/98	1728	300	82,390	19	29	52	C	0.3	0.6	4.1	48	47
W04844	CNS-1 #13	8/21/98	1734	290	99,500	26	26	48	C	0	0	4.5	49	47
W04845	CNS-1 #14	8/21/98	1740	240	93,800	24	27	49	C	0	0.6	3.6	47	49
W04846	CNS-1 #15	8/21/98	1746	165	83,880	22	28	50	C	0	0	2.3	45	52
W04847	CNS-1 #16	8/21/98	1752	115	79,030	20	27	53	C	0	0	1.1	30	69
W04848	CNS-1 #17	8/21/98	1758	105	71,320	16	29	55	C	0	0	0	26	73
W04849	CNS-1 #18	8/21/98	1804	85	67,540	16	29	55	C	0	0	0.7	15	84
W04850	CNS-1 #19	8/21/98	1810	45	67,690	16	29	55	C	0	0	0	18	81
W04851	CNS-1 #20	8/21/98	1816	40	66,680	14	30	56	C	0	0.1	0	23	76
W04852	CNS-1 #21	8/21/98	1822	40	64,020	16	27	57	C	0	0.3	0.9	31	68
W05770	CNS-1	09/30/98	1454	220	55,300	33	32	35	SIC	0.20	1.4	5.7	43	49
W05771	CNS-1	09/30/98	1500	260	47,100	27	34	39	CL	0	0.49	2.7	46	51
W05772	CNS-1	09/30/98	1506	320	53,700	25	33	42	C	0	0.52	3.6	45	50
W05773	CNS-1	09/30/98	1512	370	52,600	21	34	45	C	0.43	0.85	4.7	44	50
W05774	CNS-1	09/30/98	1518	440	60,400	19	34	47	C	0.32	0.16	3.0	45	50

COTTONWOOD ARROYO
CNS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand 29	Silt 28	Clay 43	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W05775	CNS-1	09/30/98	1524	530	57,000	19	33	48	C	0.15	0.46	1.7	38	60
W05776	CNS-1	09/30/98	1530	320	61,500	19	31	50	C	0.60	0.40	1.6	43	55
W05777	CNS-1	09/30/98	1536	370	69,600	17	31	52	C	0.43	0.58	3.2	42	53
W05778	CNS-1	09/30/98	1542	420	68,000	18	28	54	C	0.19	0.38	2.5	42	54
W05779	CNS-1	09/30/98	1548	520	63,500	16	30	54	C	0.55	0.55	3.0	32	64
W05780	CNS-1	09/30/98	1554	440	61,000	15	31	54	C	0.34	0.34	3.4	30	66
W05781	CNS-1	09/30/98	1600	510	60,300	16	29	55	C	0	0.08	2.3	38	59
W05782	CNS-1	09/30/98	1606	350	61,200	18	27	55	C	0	0	4.6	51	44
W05783	CNS-1	09/30/98	1612	260	58,700	17	28	55	C	0	0.02	1.8	39	59
W05784	CNS-1	09/30/98	1618	160	60,800	16	29	55	C	0	0.37	3.1	40	56
W05785	CNS-1	09/30/98	1624	170	57,700	16	28	56	C	0	0.20	3.1	41	56
S06255	CNS-1 #2	10/25/98	2004	75	43,800									
S06256	CNS-1 #3	10/25/98	2010	90	49,800									
S06257	CNS-1 #4	10/25/98	2016	105	51,000									
S06258	CNS-1 #5	10/25/98	2222	120	58,400									
S06259	CNS-1 #6	10/25/98	2028	130	57,900									
S06260	CNS-1 #7	10/25/98	2034	135	55,500									
S06261	CNS-1 #8	10/25/98	2040	135	54,400									
S06262	CNS-1 #9	10/25/98	2046	130	54,400									
S06263	CNS-1 #10	10/25/98	2052	125	56,900									
S06264	CNS-1 #11	10/25/98	2058	140	56,100									
S06265	CNS-1 #12	10/25/98	2104	125	53,400									
S06266	CNS-1 #13	10/25/98	2110	145	56,100									
S06267	CNS-1 #14	10/25/98	2116	140	53,400									

COTTONWOOD ARROYO
CNS-1 1997-1999 Sediment Data

Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand 29	Silt 28	Clay 43	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
S06268	CNS-1 #15	10/25/98	2122	150	58,700									
S06269	CNS-1 #16	10/25/98	2128	180	63,000									
S06270	CNS-1 #17	10/25/98	2134	160	66,900									
S06271	CNS-1 #18	10/25/98	2140	190	68,300									
S06272	CNS-1 #19	10/25/98	2146	160	68,000									
W06621	CNS-1	11/9/98	0306	31	35,000	21	40	38	CL	0.09	1.8	10	41	47
W06622	CNS-1	11/9/98	0312	40	38,800	29	31	39	CL	0.52	3.1	14	48	35
W06623	CNS-1	11/9/98	0320	42	39,000	28	33	39	CL	0	1.4	10	55	34
W06624	CNS-1	11/9/98	0324	60	39,100	28	32	40	C	0.06	2.5	11	46	40
W06625	CNS-1	11/9/98	0330	57	40,400	29	30	40	C	0.29	1.2	7.7	49	42
W06626	CNS-1	11/9/98	0336	93	42,600	31	28	41	C	0.04	2.0	11	48	38
W06627	CNS-1	11/9/98	0342	95	43,000	29	29	42	C	0.17	1.0	6.4	54	39
W06628	CNS-1	11/9/98	0348	100	44,300	31	27	42	C	0.04	1.6	9.2	52	37
W06629	CNS-1	11/9/98	0354	77	45,700	35	22	42	C	0.14	1.5	8.6	50	39
W06630	CNS-1	11/9/98	0400	125	46,600	31	23	45	C	0.22	1.7	6.2	52	40
W06631	CNS-1	11/9/98	0406	120	47,000	35	23	42	C	0.47	1.8	8.3	52	37
W06632	CNS-1	11/9/98	0412	134	51,700	36	21	43	C	0.03	2.0	7.4	52	38
W06633	CNS-1	11/9/98	0418	157	56,900	37	21	42	C	0.05	1.5	7.7	58	33
W06634	CNS-1	11/9/98	0424	164	61,900	40	18	42	C	0.66	3.6	12	55	29
W06635	CNS-1	11/9/98	0430	157	67,900	41	18	41	C	0.38	2.7	12	54	31
W06636	CNS-1	11/9/98	0436	142	67,000	37	19	44	C	0.14	2.1	13	56	29
W02143	CNS-2	4/22/99	1506	37	142,500	48	22	30	SCL	0	0.01	1.3	78	21
W02144	CNS-3	4/22/99	1512	47	150,400	52	20	28	SCL	0	0.03	1.7	79	19
W02145	CNS-4	4/22/99	1516	65	129,700	48	22	30	SCL	0	0.03	2.1	81	17

COTTONWOOD ARROYO
CNS-1 1997-1999 Sediment Data

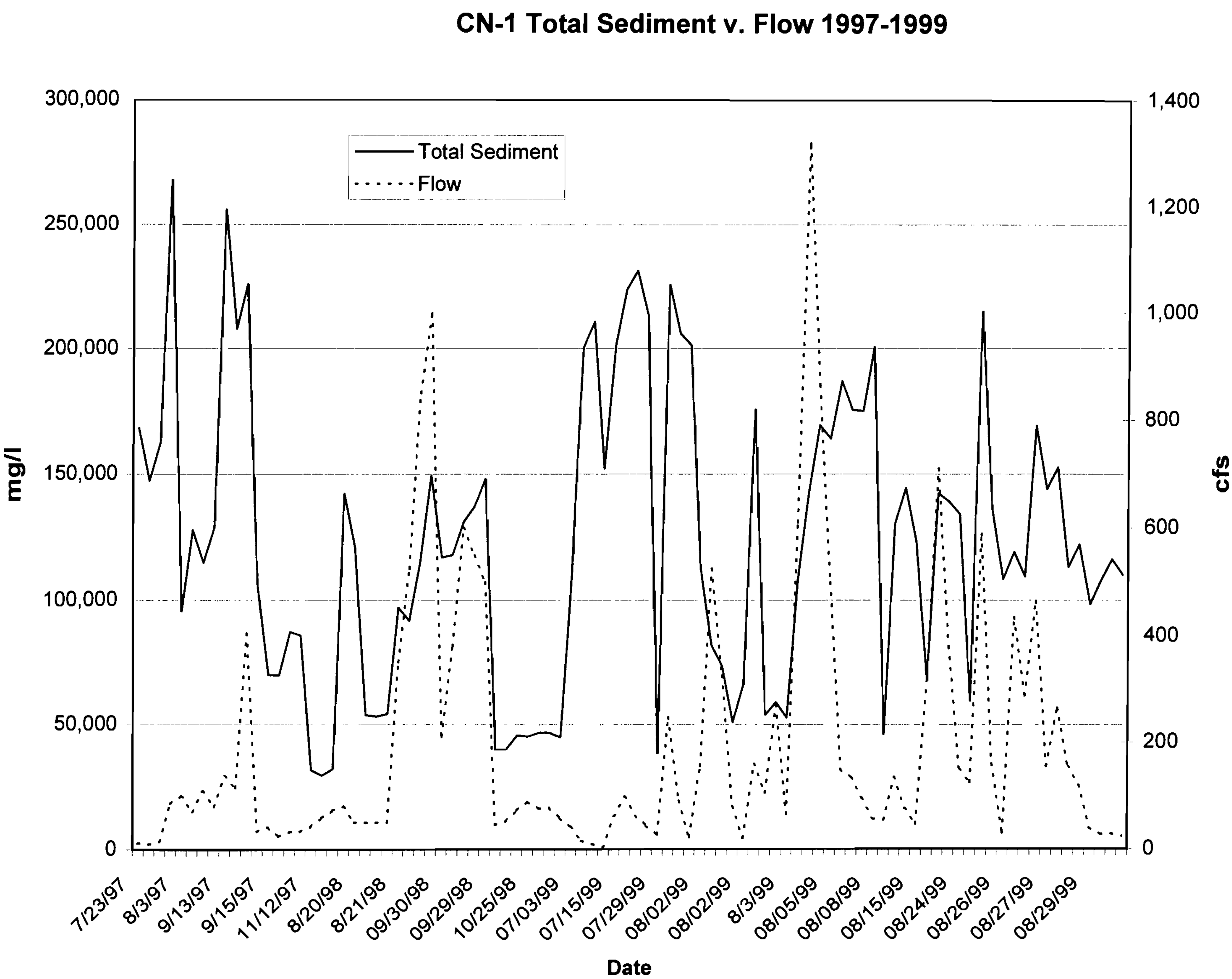
Lab ID	Sample ID	Date Sampled	Time Sampled	Flow	Total Sediment	Sand 29	Silt 28	Clay 43	Texture	very coarse sand	coarse sand	medium sand	fine sand	very fine sand
				cfs	mg/L	%	%	%	%	%	%	%	%	%
W02146	CNS-5	4/22/99	1522	75	143,200	54	20	26	SCL	0	0.03	8.6	69	22
W02147	CNS-6	4/22/99	1528	76	149,000	58	16	26	SCL	0	0.01	1.5	74	25
W02148	CNS-7	4/22/99	1534	53	132,100	48	18	34	SCL	0	0.03	1.5	72	27
W02149	CNS-8	4/22/99	1540	76	131,400	52	18	30	SCL	0	0.00	2.0	72	26
W02150	CNS-9	4/22/99	1546	58	124,900	52	18	30	SCL	0	0.03	1.7	65	33
W02151	CNS-10	4/22/99	1552	61	130,300	54	18	28	SCL	0	0.05	2.9	79	18
W02152	CNS-11	4/22/99	1558	74	146,700	59	16	25	SCL	0	0.11	5.5	75	19
W02153	CNS-12	4/22/99	1604	54	133,800	56	18	26	SCL	0	0.06	3.0	72	25
W02154	CNS-13	4/22/99	1610	60	144,300	58	14	28	SCL	0	0.12	9.5	70	21
W03422	CNS-1#3	07/03/99	1440	305	126,900	52	26	22	SCL	0	0.27	1.8	63	35
W03423	CNS-1#5	07/03/99	1452	340	150,900	46	26	28	SCL	0	0.74	2.9	59	38
W03424	CNS-1#7	07/03/99	1504	295	87,600	39	27	34	CL	0	0.69	4.3	58	37
W03425	CNS-1#24	07/03/99	1646	230	105,700	16	36	48	C	0	0	0.32	39	60
W03758	CNS-1 #2	7/23/99	2014	120	52,200	34	35	31	CL	0.83	0.50	2.0	35	62
W03759	CNS-1 #3	7/23/99	2018	310	69,800	44	28	28	CL	2.0	3.7	7.9	44	42
W03760	CNS-1 #4	7/23/99	2024	500	68,500	40	28	32	CL	3.2	5.0	6.0	43	35
W03971	CNS-1 #2	07/29/99	0256	51	56,400	24	32	44	C	0.47	2.8	7.8	26	63
W03972	CNS-1 #3	07/29/99	0300	64	130,900	28	31	41	C	0.91	2.1	2.6	39	56
W03973	CNS-1 #4	07/29/99	0306	57	182,800	30	35	35	CL	0.19	0.61	1.6	54	44
W03974	CNS-1 #6	07/29/99	0318	32	147,700	24	38	38	CL	0.07	0.41	1.4	44	55
W03995	CNS-1 #1	08/02/99	1610	650	106,300	38	25	37	CL	0.31	0.80	2.9	52	44
W04004	CNS-1 #2	08/02/99	1616	1,150	40,300	23	27	50	C	0.13	0.27	1.3	35	64
W04005	CNS-1 #3	08/02/99	1620	1,230	42,000	23	28	49	C	0.02	0.49	2.5	39	58
W04039	CNS-1 #7	08/03/99	1458	65	134,300	24	34	42	C	0	0.21	2.1	51	46
W04040	CNS-1 #12	08/03/99	1528	60	126,600	30	35	35	CL	0.09	0.75	5.3	58	36
W04041	CNS-1 #18	08/03/99	1604	35	91,600	26	35	39	CL	0.23	2.3	7.9	44	46
W04042	CNS-1 #23	08/03/99	1654	640	56,600	42	24	34	CL	1.9	7.8	15	44	30
				Ave.	85,247	29	28	43		0	1	5	49	44

APPENDIX 7-J

COTTONWOOD ARROYO
AUTOMATED SAMPLERS

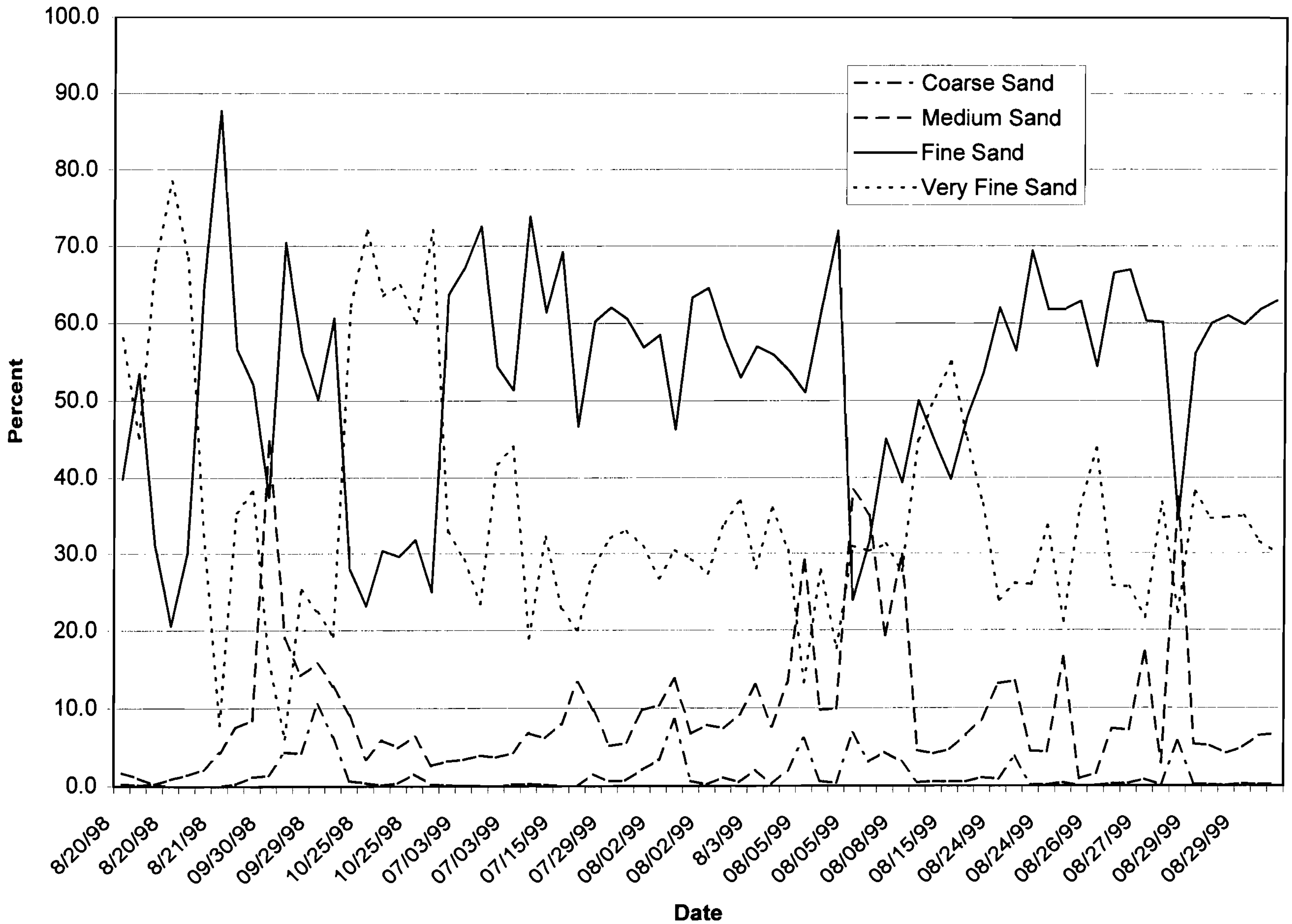
TOTAL SEDIMENT GRAPHS
PARTICLE SIZE DISTRIBUTION GRAPHS
TEXTURE GRAPHS

STATIONS CN-1, CNS-1, AND CS-1
1997 - 1999

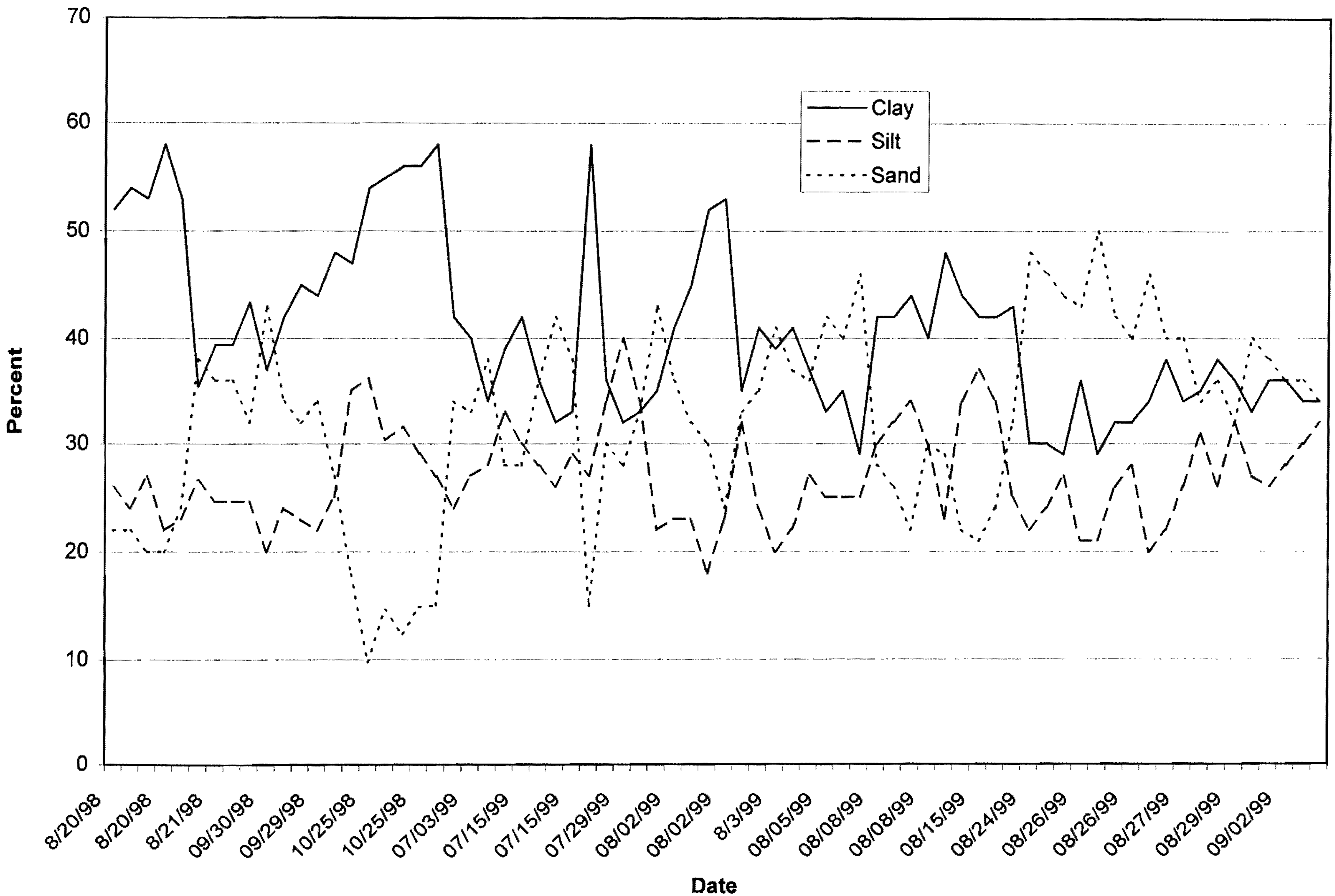


CN-1 Total Sediment v. Flow 1997-1999
Total Sediment
Flow
mg/l
cfs
Date
300,000
250,000
200,000
150,000
100,000
50,000
0
1,400
1,200
1,000
800
600
400
200
0
7/23/97
8/3/97
9/13/97
9/15/97
11/12/97
8/20/98
8/21/98
09/30/98
09/29/98
10/25/98
07/03/99
07/15/99
07/29/99
08/02/99
08/02/99
8/3/99
08/05/99
08/08/99
08/15/99
08/24/99
08/26/99
08/27/99
08/29/99

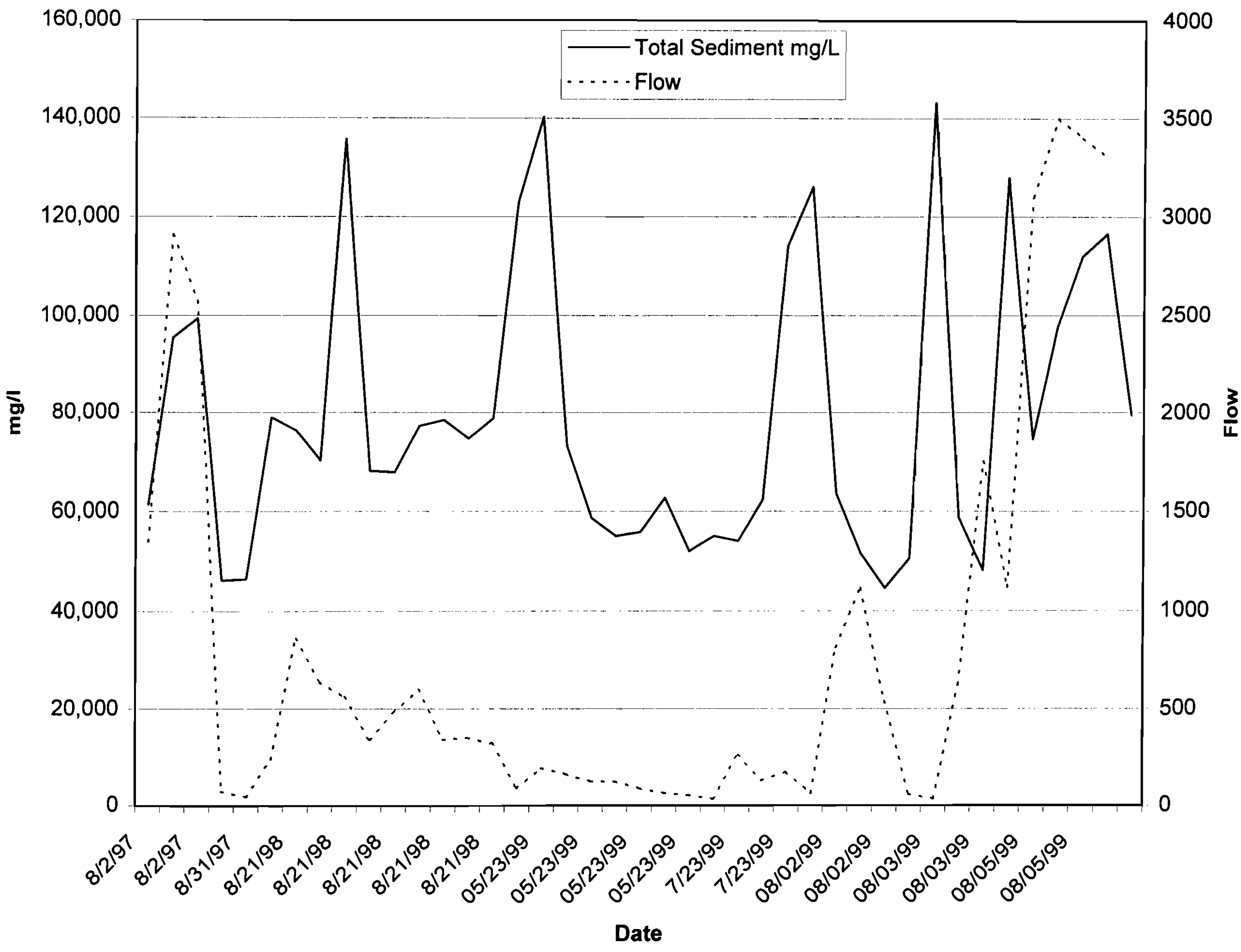
CN-1 Particle Size Distribution 1997-1999

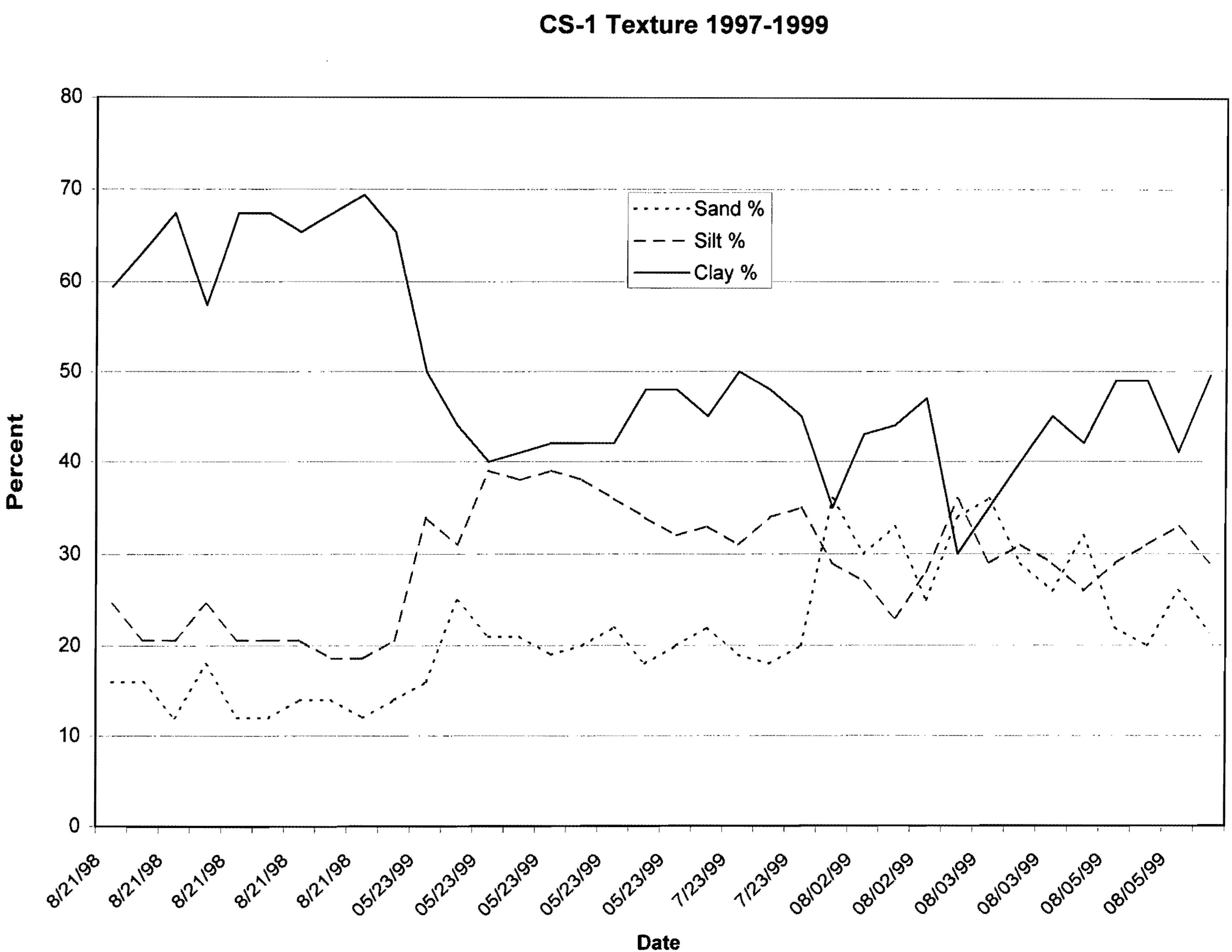


CN-1 Texture 1997-1999

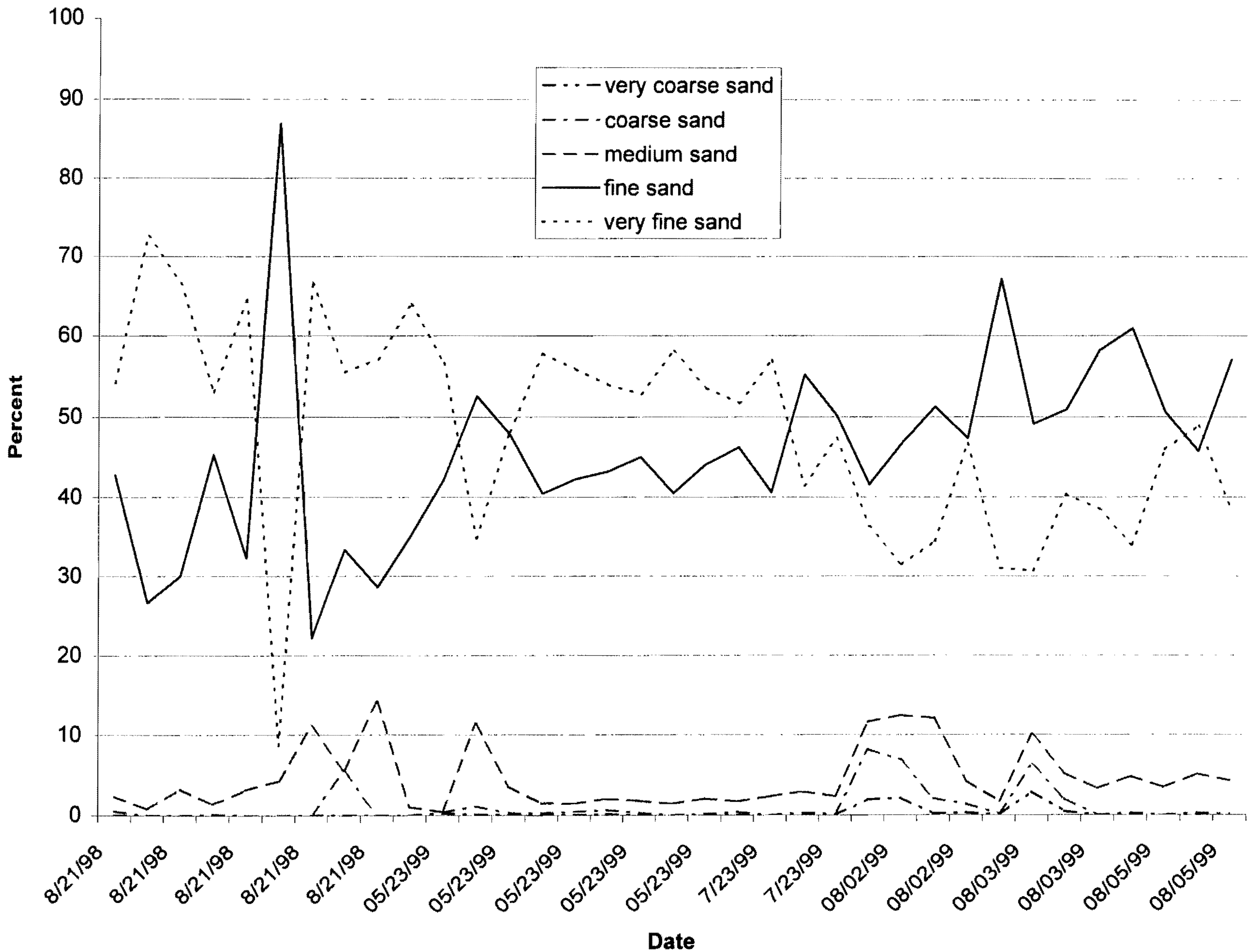


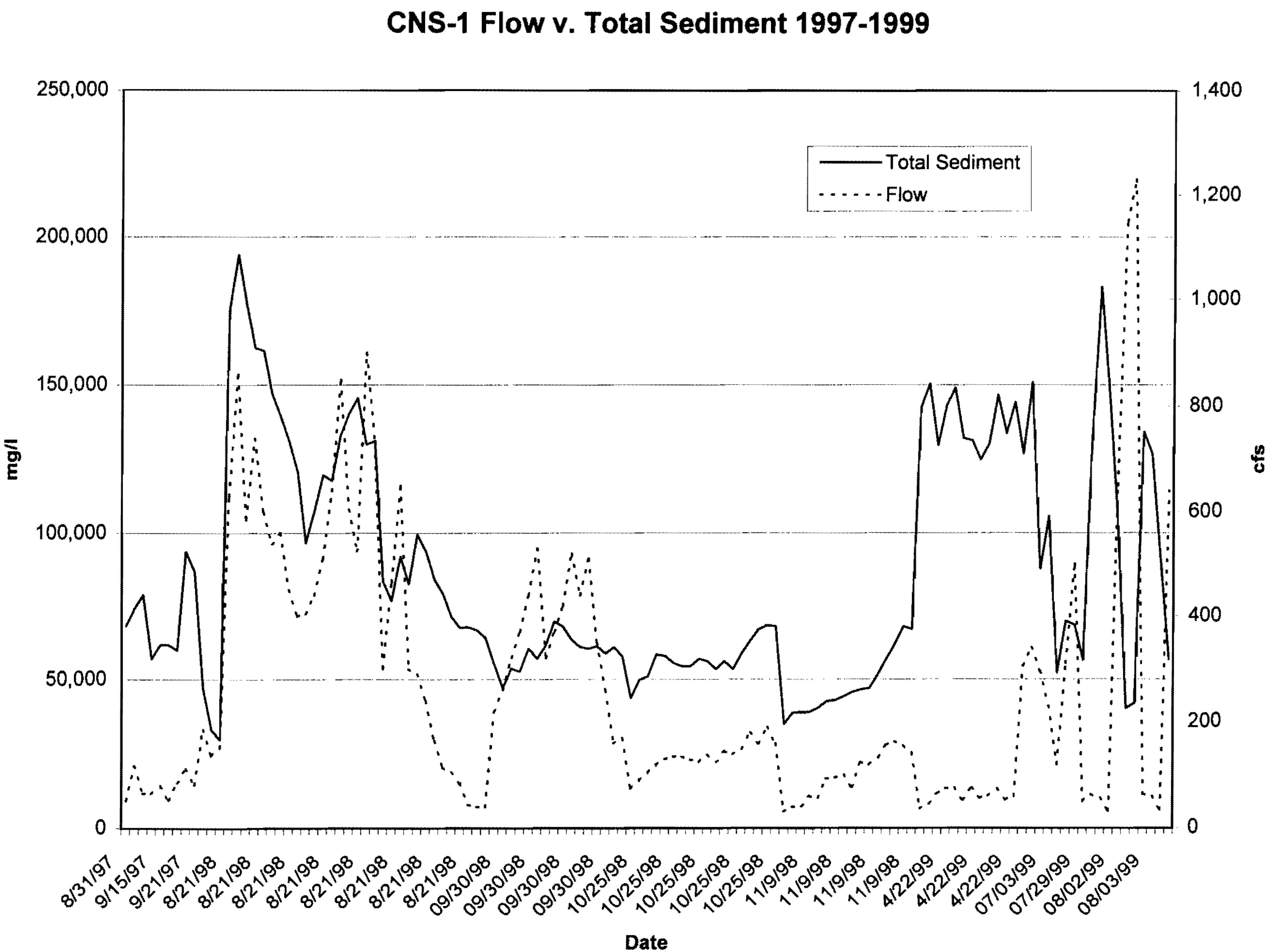
CS-1 Flow v. Total Sediment 1997-1999



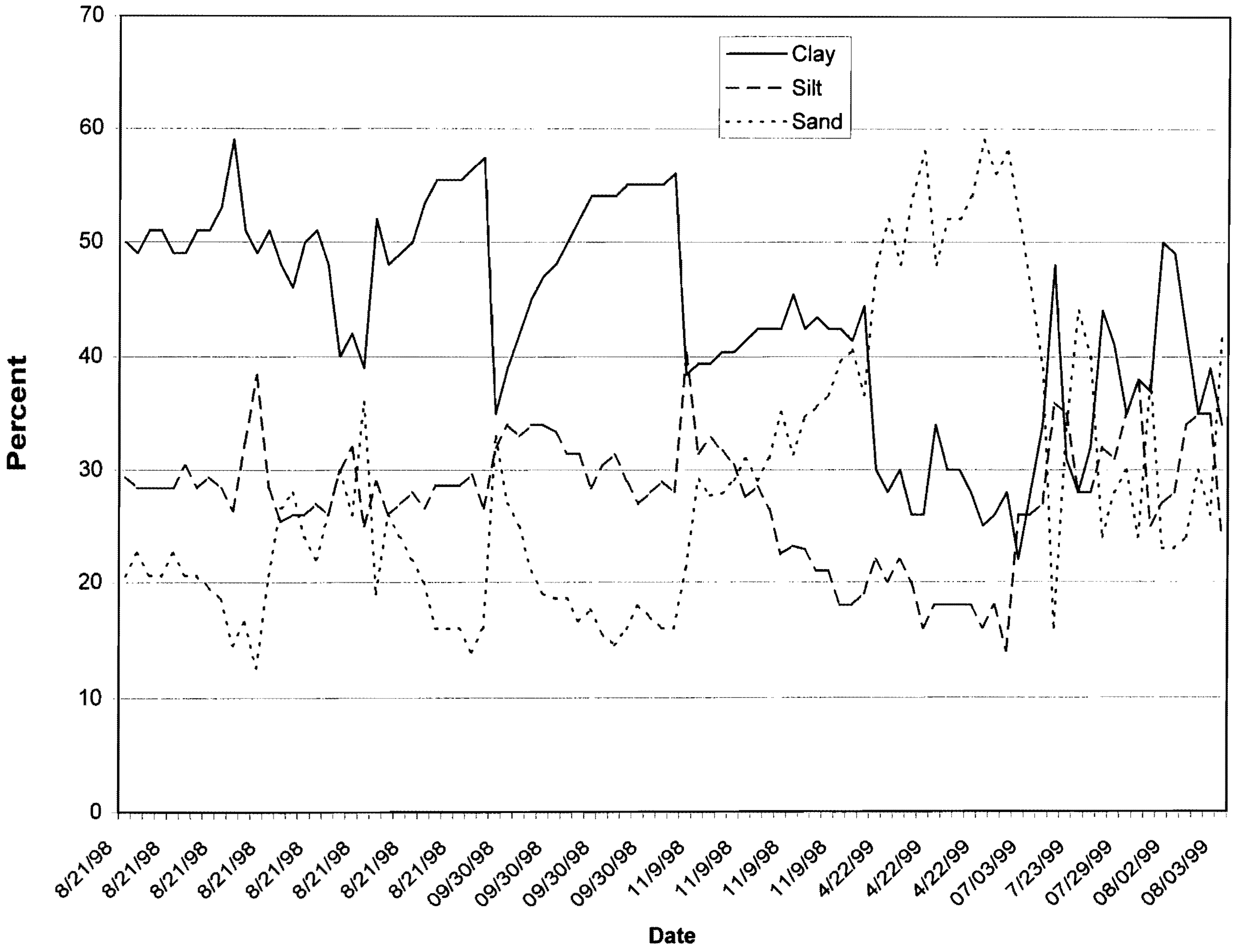

CS-1 Texture 1997-1999
Sand %
Silt %
Clay %
Percent
80
70
60
50
40
30
20
10
0
8/21/98
8/21/98
8/21/98
8/21/98
8/21/98
05/23/99
05/23/99
05/23/99
05/23/99
05/23/99
7/23/99
7/23/99
08/02/99
08/02/99
08/03/99
08/03/99
08/05/99
08/05/99
Date

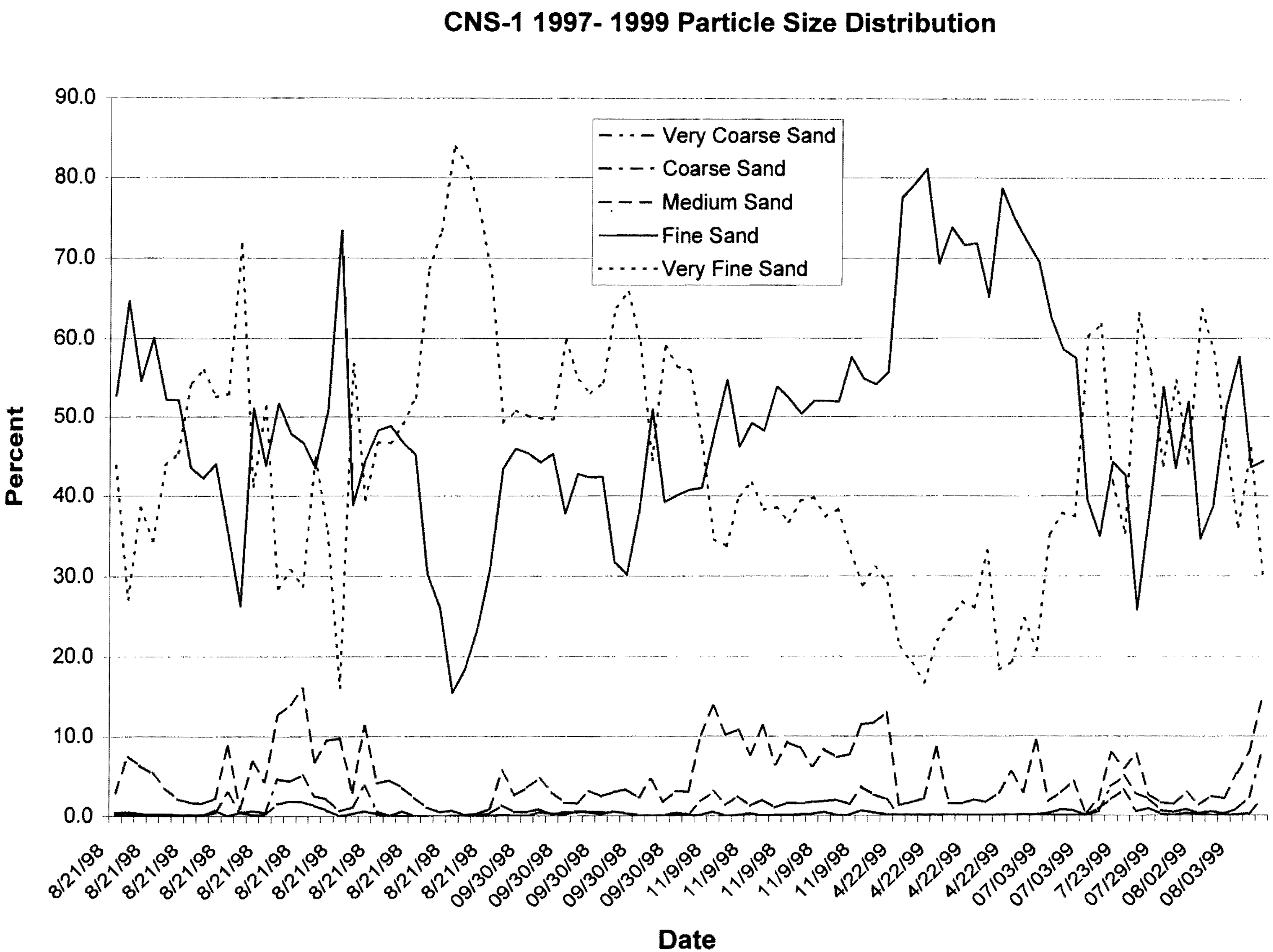
CS-1 Particle Size Distribution




CNS-1 Flow v. Total Sediment 1997-1999
Total Sediment
Flow
mg/l
cfs
Date
250,000
200,000
150,000
100,000
50,000
0
1,400
1,200
1,000
800
600
400
200
0
8/31/97
9/15/97
9/21/97
8/21/98
8/21/98
8/21/98
8/21/98
8/21/98
8/21/98
8/21/98
8/21/98
09/30/98
09/30/98
09/30/98
09/30/98
10/25/98
10/25/98
10/25/98
10/25/98
10/25/98
11/9/98
11/9/98
11/9/98
11/9/98
4/22/99
4/22/99
4/22/99
07/03/99
07/29/99
08/02/99
08/03/99

CNS-1 Texture 1997-1999





CNS-1 1997- 1999 Particle Size Distribution
Very Coarse Sand
Coarse Sand
Medium Sand
Fine Sand
Very Fine Sand
Percent
Date
90.0
80.0
70.0
60.0
50.0
40.0
30.0
20.0
10.0
0.0
8/21/98
09/30/98
11/9/98
4/22/99
07/03/99
7/23/99
07/29/99
08/02/99
08/03/99

APPENDIX 7-K

COTTONWOOD ARROYO
AUTOMATED SAMPLERS
CHEMISTRY DATA

STATISTICAL REPORT
TRILINEAR GRAPH
TOTAL DISSOLVED SOLIDS GRAPH
TOTAL SUSPENDED SOLIDS GRAPH

STATIONS CN-1, CNS-1, AND CS-1
1997 - 1999

Quality Statistics for Stream Stations

Station: CN-1

		Mean	Std Dev	Coef Var	Range	Maximum Value	Minimum Value	Max Value Found	Min Value Found	# of Samp
Field pH	(S.U.)	8.49				8.60	8.40	11/12/97	09/01/97	2
Field Temperature	(deg C)	16.5	12.0	73	17.0	25.0	8.0	09/01/97	11/12/97	2
Field Conductivity	(umho/cm)	1	0	0	0	1	1	09/01/97	09/01/97	2
pH (Lab)	(S.U.)	7.99				8.70	7.50	08/02/99	07/15/99	28
Conductivity (Lab)	(umho/cm)	1298	770	59	2780	3350	570	08/29/99	08/03/97	28
TDS (180 deg C)	(mg/l)	976	624	64	2360	2780	420	08/29/99	07/23/97	27
Total Suspended Solids	(mg/l)	114919.2	77695.7	68	371600.0	386000.0	14400.0	07/15/99	05/23/99	26
Total Alk. as CaCO3	(mg/l)	137.89	80.71	59	453.00	475.00	22.00	08/15/99	08/08/99	27
Total Hardness as CaCO3	(mg/l)	175.65	134.88	77	491.00	542.00	51.00	08/29/99	09/15/97	27
Boron	(mg/l)	0.07	0.05	62	0.22	0.24	0.03	10/25/98	09/13/97	27
Fluoride	(mg/l)	0.83	0.32	38	1.23	1.66	0.43	09/01/97	05/23/99	27
SAR		11.00			0.00	11.00	11.00	09/01/97	09/01/97	1
Total Phosphorus	(mg/l)	96.80			0.00	96.80	96.80	09/01/97	09/01/97	1
Bicarbonate as HCO3	(mg/l)	167.70	98.69	59	554.00	580.00	26.00	08/15/99	08/08/99	27
Carbonate as CO3	(mg/l)	0.65	0.55	85	2.50	3.00	0.50	09/30/98	07/23/97	27
Hydroxide as OH	(mg/l)	0.50	0.00	0	0.00	0.50	0.50	07/23/97	07/23/97	26
Chloride	(mg/l)	29.37	18.18	62	69.00	77.00	8.00	09/02/99	09/13/97	27
Sulfate	(mg/l)	515.15	428.38	83	1710.00	1760.00	50.00	08/29/99	08/15/99	27
Calcium	(mg/l)	57.73	46.66	81	163.40	179.00	15.60	08/29/99	09/15/97	27
Magnesium	(mg/l)	7.61	8.33	109	29.10	30.40	1.30	08/26/99	09/02/99	27
Total Potassium	(mg/l)									0
Sodium	(mg/l)	239.74	145.79	61	547.00	649.00	102.00	08/29/99	07/23/97	27
Major Cations	(meq/l)	14.08	8.68	62	32.84	39.25	6.41	08/29/99	07/23/97	27
Major Anions	(meq/l)	14.31	8.71	61	33.13	39.52	6.39	08/29/99	07/23/97	27
Charge Balance	(percent)	2.14	2.63	123	13.59	13.68	0.09	09/01/97	08/15/99	27
Lab Determined Anions	(meq/l)	14.37	8.82	61	33.06	39.43	6.37	08/29/99	07/23/97	27
Lab Determined Ion Balance	(percent)	2.14	2.67	125	13.56	13.60	0.04	09/01/97	08/15/99	26
Arsenic	(mg/l)	0.003			0.000	0.003	0.003	09/01/97	09/01/97	1
Barium	(mg/l)	0.030			0.000	0.030	0.030	09/01/97	09/01/97	1
Cadmium	(mg/l)	0.0005			0.0000	0.0005	0.0005	09/01/97	09/01/97	1
Chromium	(mg/l)	0.0050			0.0000	0.0050	0.0050	09/01/97	09/01/97	1
Iron	(mg/l)	3.586	8.387	234	37.190	37.200	0.010	08/03/97	11/09/98	28
Lead	(mg/l)	0.003			0.000	0.003	0.003	09/01/97	09/01/97	1
Manganese	(mg/l)	0.168	0.304	182	1.165	1.170	0.005	08/03/97	09/01/97	27
Selenium	(mg/l)	0.006	0.008	127	0.030	0.032	0.003	08/27/99	07/23/97	28
Silver	(mg/l)	0.005			0.000	0.005	0.005	09/01/97	09/01/97	1
Zinc	(mg/l)	0.013			0.000	0.013	0.013	09/01/97	09/01/97	1
Total Iron	(mg/l)	669.57	1072.57	160	4349.99	4350.00	0.01	08/08/99	09/21/97	27
Total Manganese	(mg/l)	14.48	20.22	140	86.82	86.90	0.08	08/08/99	07/29/99	27

Below detection: calculate using half of detection limit.

Quality Statistics for Stream Stations

Station: CS-1

		Mean	Std Dev	Coef Var	Range	Maximum Value	Minimum Value	Max Value Found	Min Value Found	# of Samp
Field pH	(S.U.)	8.68				9.00	8.50	11/12/97	09/01/97	2
Field Temperature	(deg C)	12.5	6.4	51	9.0	17.0	8.0	09/01/97	11/12/97	2
Field Conductivity	(umho/cm)	1	0	0	0	1	1	09/01/97	09/01/97	2
pH (Lab)	(S.U.)	8.14				8.80	7.80	08/02/99	05/23/99	11
Conductivity (Lab)	(umho/cm)	1728	3187	184	11559	11809	250	08/05/99	08/21/98	12
TDS (180 deg C)	(mg/l)	652	190	29	570	910	340	05/23/99	08/02/99	12
Total Suspended Solids	(mg/l)	74009.1	57440.1	78	199900.0	216000.0	16100.0	08/03/99	05/23/99	11
Total Alk. as CaCO3	(mg/l)	156.42	69.34	44	216.00	265.00	49.00	09/01/97	11/09/98	12
Total Hardness as CaCO3	(mg/l)	131.13	62.23	47	191.50	237.00	45.50	04/22/99	08/02/99	12
Boron	(mg/l)	0.14	0.29	202	1.03	1.05	0.03	10/26/98	11/12/97	12
Fluoride	(mg/l)	0.68	0.35	51	1.21	1.23	0.03	11/09/98	04/22/99	12
SAR										0
Total Phosphorus	(mg/l)									0
Bicarbonate as HCO3	(mg/l)	189.25	85.16	45	269.00	323.00	54.00	09/01/97	11/09/98	12
Carbonate as CO3	(mg/l)	1.13	1.13	101	2.50	3.00	0.50	10/26/98	08/02/97	12
Hydroxide as OH	(mg/l)	0.50	0.00	0	0.00	0.50	0.50	08/02/97	08/02/97	11
Chloride	(mg/l)	21.25	11.82	56	30.00	40.00	10.00	05/23/99	10/26/98	12
Sulfate	(mg/l)	279.92	117.63	42	361.00	464.00	103.00	05/23/99	08/02/99	12
Calcium	(mg/l)	43.40	24.27	56	69.90	84.80	14.90	07/23/99	11/09/98	12
Magnesium	(mg/l)	5.46	3.24	59	10.00	11.00	1.00	10/26/98	11/12/97	12
Total Potassium	(mg/l)									0
Sodium	(mg/l)	166.18	52.42	32	161.80	258.00	96.20	08/21/98	08/02/99	12
Major Cations	(meq/l)	10.02	2.84	28	8.86	14.04	5.18	08/21/98	08/02/99	12
Major Anions	(meq/l)	9.56	2.77	29	8.17	12.87	4.70	08/21/98	08/02/99	12
Charge Balance	(percent)	2.96	2.29	77	5.87	5.95	0.08	09/01/97	08/03/99	12
Lab Determined Anions	(meq/l)	9.55	2.78	29	8.21	12.90	4.69	08/21/98	08/02/99	12
Lab Determined Ion Balance	(percent)	2.99	2.34	78	5.93	6.01	0.08	09/01/97	08/03/99	12
Arsenic	(mg/l)									0
Barium	(mg/l)									0
Cadmium	(mg/l)									0
Chromium	(mg/l)									0
Iron	(mg/l)	7.538	12.983	172	41.690	41.700	0.010	08/02/97	07/23/99	12
Lead	(mg/l)									0
Manganese	(mg/l)	0.436	0.801	184	2.815	2.820	0.005	08/02/97	11/09/98	12
Selenium	(mg/l)	0.003	0.001	27	0.003	0.005	0.003	07/23/99	08/02/97	12
Silver	(mg/l)									0
Zinc	(mg/l)									0
Total Iron	(mg/l)	540.17	795.53	147	2186.23	2190.00	3.77	08/05/99	07/23/99	12
Total Manganese	(mg/l)	11.01	13.94	127	40.19	40.30	0.11	08/05/99	07/23/99	11

Below detection: calculate using half of detection limit.

Quality Statistics for Stream Stations

Station: CNS-1

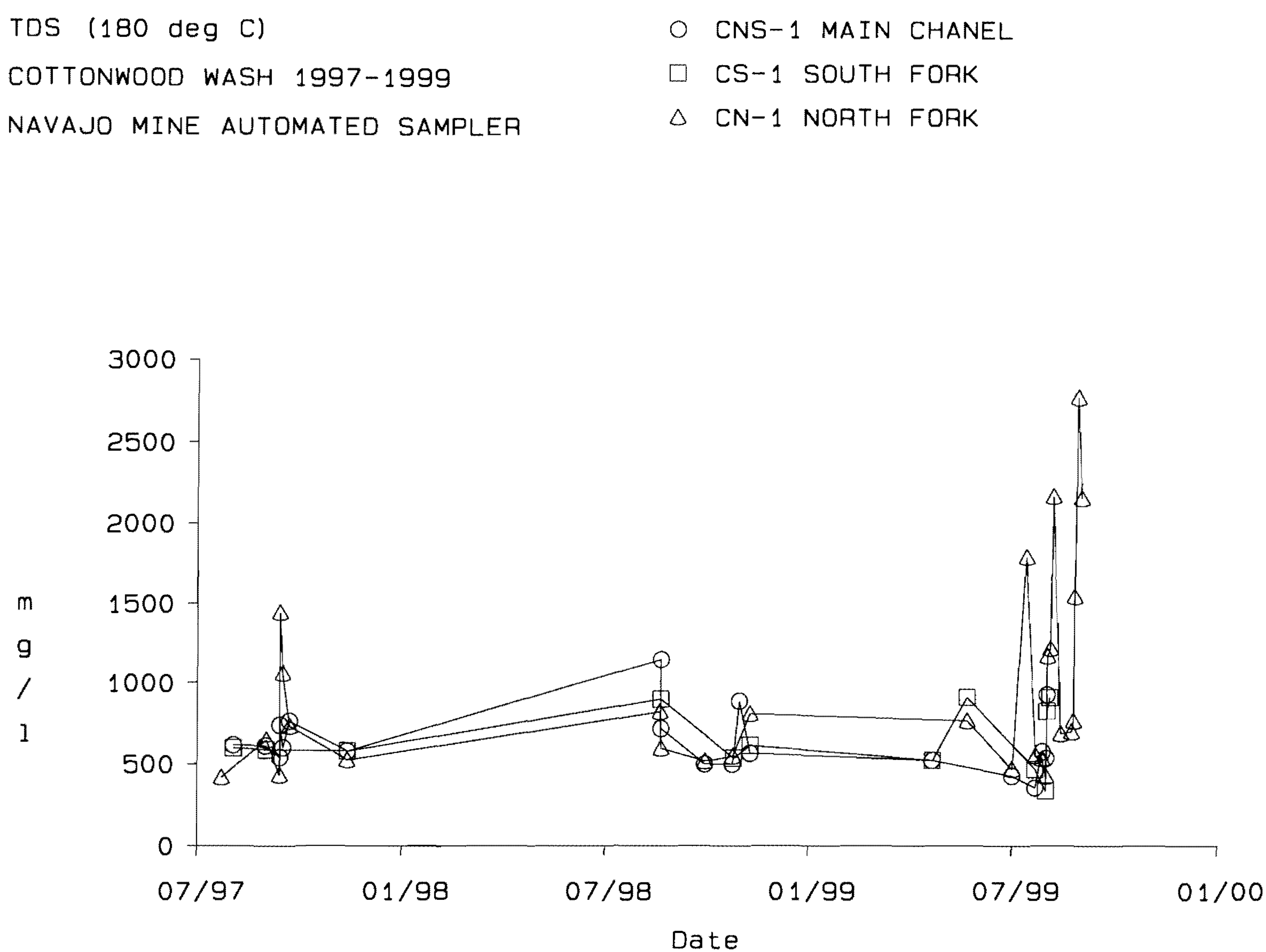
		Mean	Std Dev	Coef Var	Range	Maximum Value	Minimum Value	Max Value Found	Min Value Found	# of Samp
Field pH	(S.U.)	8.25				8.90	8.00	11/12/97	08/31/97	2
Field Temperature	(deg C)	12.5	7.8	62	11.0	18.0	7.0	08/31/97	11/12/97	2
Field Conductivity	(umho/cm)	1	0	0	0	1	1	08/31/97	08/31/97	2
pH (Lab)	(S.U.)	8.17				8.60	7.80	11/12/97	07/03/99	19
Conductivity (Lab)	(umho/cm)	861	269	31	1000	1590	590	08/21/98	07/23/99	19
TDS (180 deg C)	(mg/l)	639	189	30	790	1150	360	08/21/98	07/23/99	19
Total Suspended Solids	(mg/l)	97282.4	35178.2	36	120200.0	169000.0	48800.0	08/02/97	11/09/98	17
Total Alk. as CaCO3	(mg/l)	164.84	56.07	34	192.00	282.00	90.00	09/13/97	07/29/99	19
Total Hardness as CaCO3	(mg/l)	114.82	51.11	45	202.00	245.00	43.00	08/21/98	11/12/97	19
Boron	(mg/l)	0.08	0.08	98	0.37	0.39	0.03	10/25/98	09/13/97	18
Fluoride	(mg/l)	0.74	0.22	29	0.96	0.98	0.03	08/21/98	04/22/99	19
SAR										0
Total Phosphorus	(mg/l)									0
Bicarbonate as HCO3	(mg/l)	191.66	82.53	43	342.50	343.00	0.50	09/13/97	09/13/97	19
Carbonate as CO3	(mg/l)	6.84	22.95	335	99.50	100.00	0.50	08/03/99	08/02/97	19
Hydroxide as OH	(mg/l)	7.94	24.36	307	99.50	100.00	0.50	08/03/99	08/02/97	18
Chloride	(mg/l)	16.89	10.54	62	41.00	47.00	6.00	08/21/98	09/30/98	19
Sulfate	(mg/l)	276.74	157.33	57	668.00	718.00	50.00	08/21/98	09/30/98	19
Calcium	(mg/l)	38.92	17.80	46	68.70	83.30	14.60	08/21/98	11/12/97	19
Magnesium	(mg/l)	4.22	2.05	48	7.40	8.80	1.40	08/21/98	11/12/97	19
Total Potassium	(mg/l)									0
Sodium	(mg/l)	169.37	58.88	35	244.00	332.00	88.00	08/21/98	07/23/99	19
Major Cations	(meq/l)	9.79	3.23	33	12.74	19.50	6.76	08/21/98	11/12/97	19
Major Anions	(meq/l)	9.53	3.37	35	13.73	20.08	6.35	08/21/98	11/12/97	19
Charge Balance	(percent)	3.57	2.89	81	11.95	12.04	0.09	08/31/97	07/23/99	19
Lab Determined Anions	(meq/l)	9.53	3.37	35	13.73	20.10	6.37	08/21/98	11/12/97	19
Lab Determined Ion Balance	(percent)	3.57	2.89	81	11.93	12.00	0.07	08/31/97	07/23/99	19
Arsenic	(mg/l)									0
Barium	(mg/l)									0
Cadmium	(mg/l)									0
Chromium	(mg/l)									0
Iron	(mg/l)	6.651	8.565	129	34.290	34.300	0.010	08/31/97	07/03/99	18
Lead	(mg/l)									0
Manganese	(mg/l)	0.337	0.430	128	1.345	1.350	0.005	08/21/98	11/09/98	19
Selenium	(mg/l)	0.003	0.001	22	0.003	0.005	0.003	10/31/98	08/02/97	19
Silver	(mg/l)									0
Zinc	(mg/l)									0
Total Iron	(mg/l)	181.55	381.42	210	1569.93	1570.00	0.07	08/02/99	07/23/99	19
Total Manganese	(mg/l)	5.84	6.21	106	22.04	22.10	0.06	08/02/99	07/23/99	19

Below detection: calculate using half of detection limit.

TDS (180 deg C)

COTTONWOOD WASH 1997-1999

NAVAJO MINE AUTOMATED SAMPLER



TOTAL SUSPENDED SOLIDS

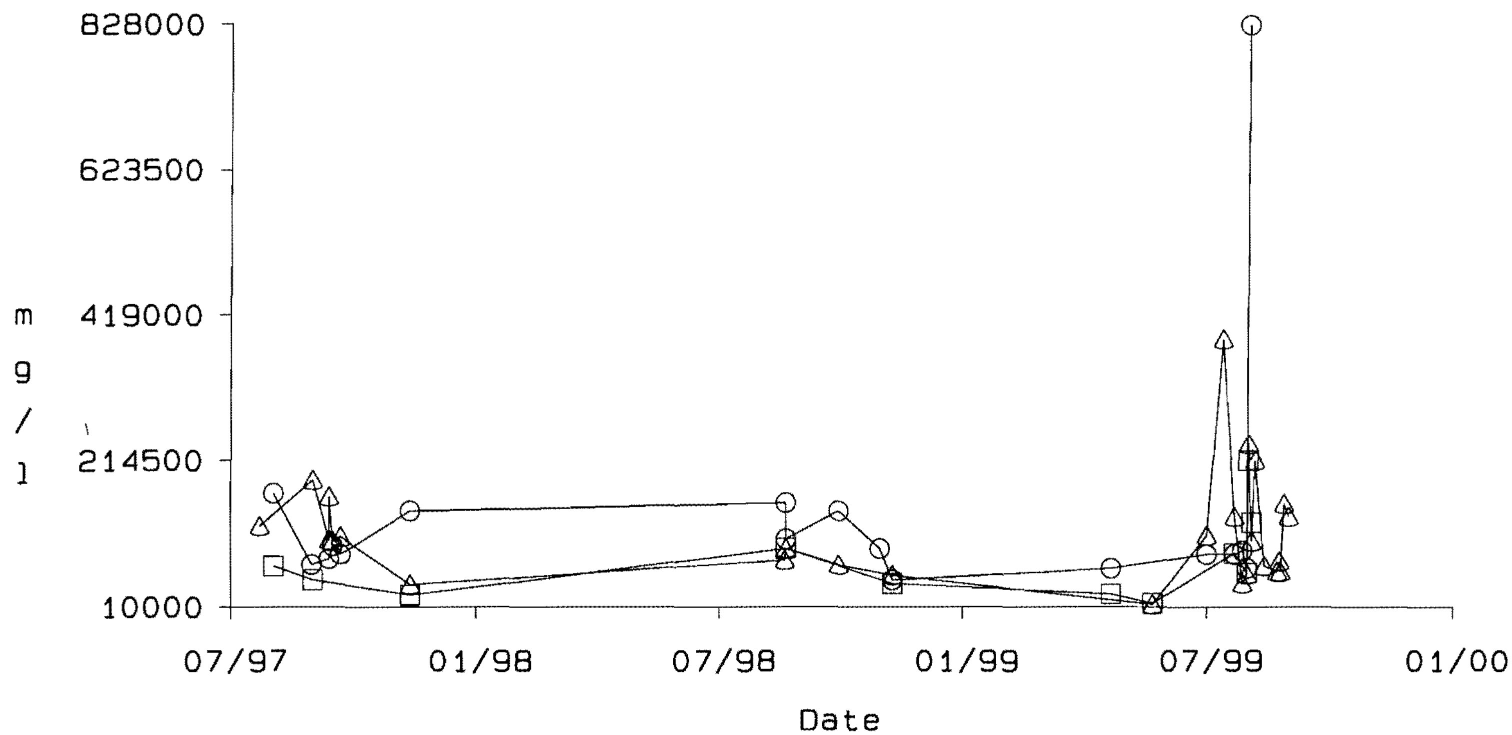
COTTONWOOD WASH 1997-1999

NAVAJO MINE AUTOMATED SAMPLER

○ CNS-1 MAIN CHANNEL

□ CS-1 SOUTH FORK

△ CN-1 NORTH FORK



PIPER TRILINEAR DIAGRAM

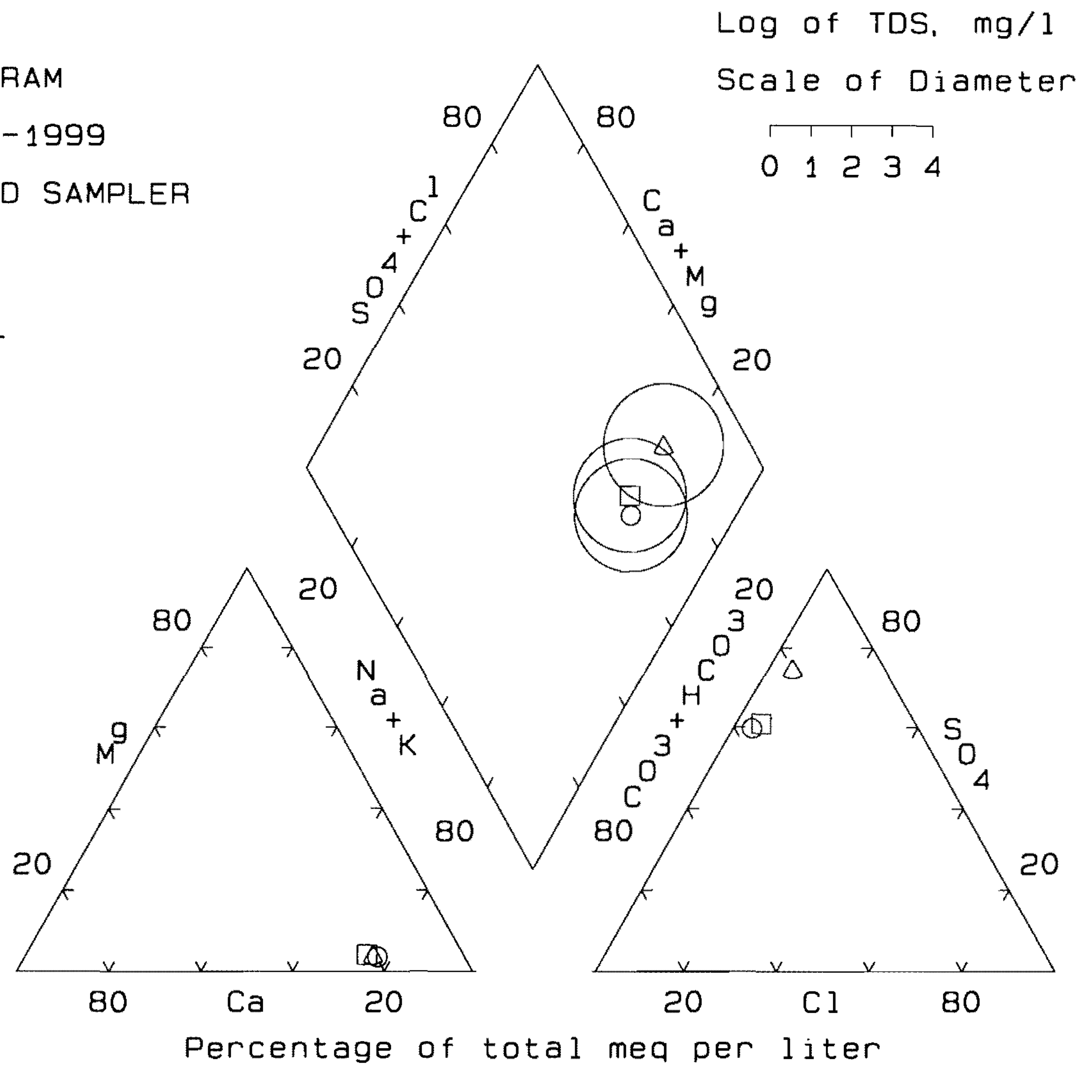
COTTONWOOD WASH 1997-1999

NAVAJO MINE AUTOMATED SAMPLER

○ CNS-1 MAIN CHANNEL

□ CS-1 SOUTH FORK

△ CN-1 NORTH FORK

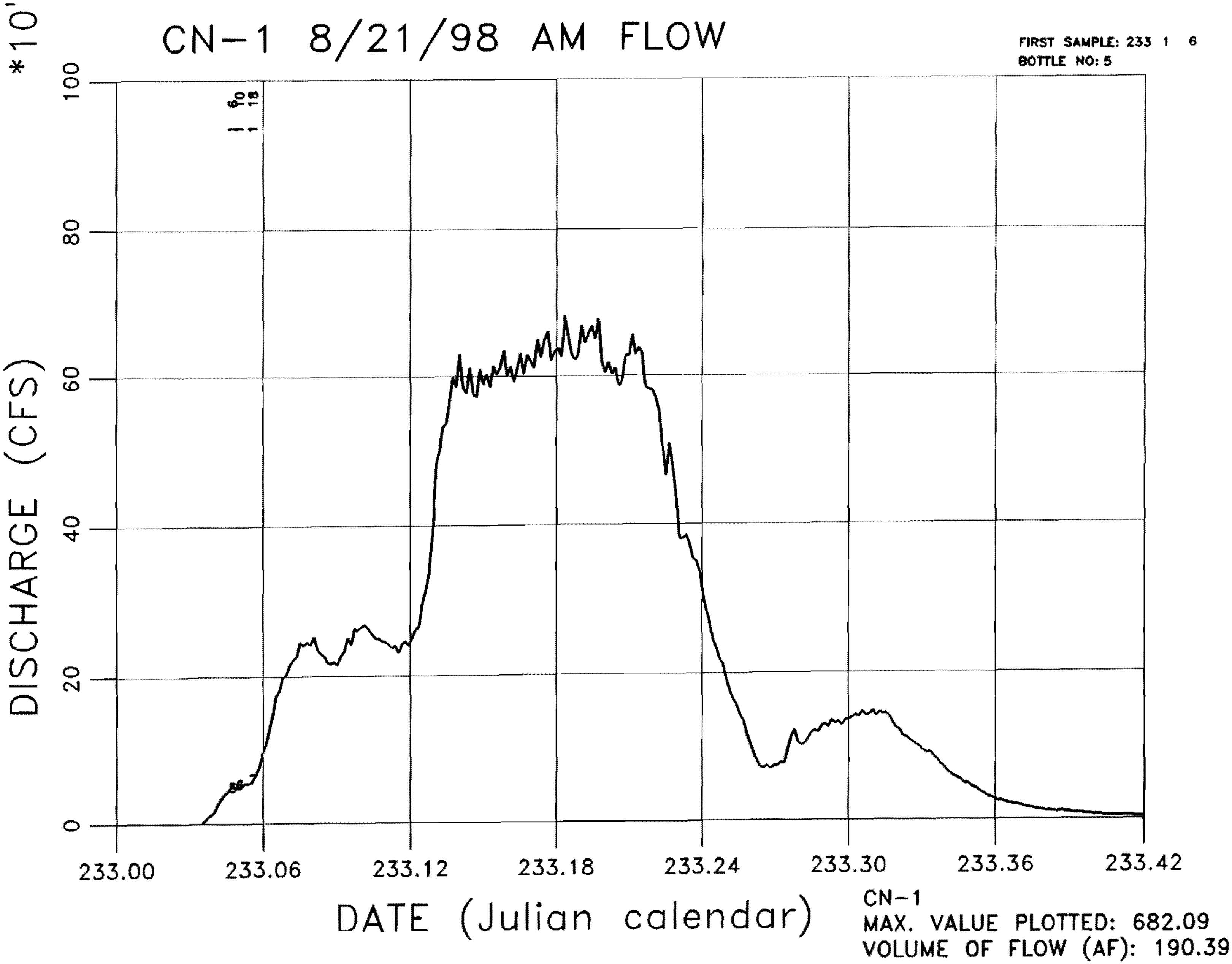


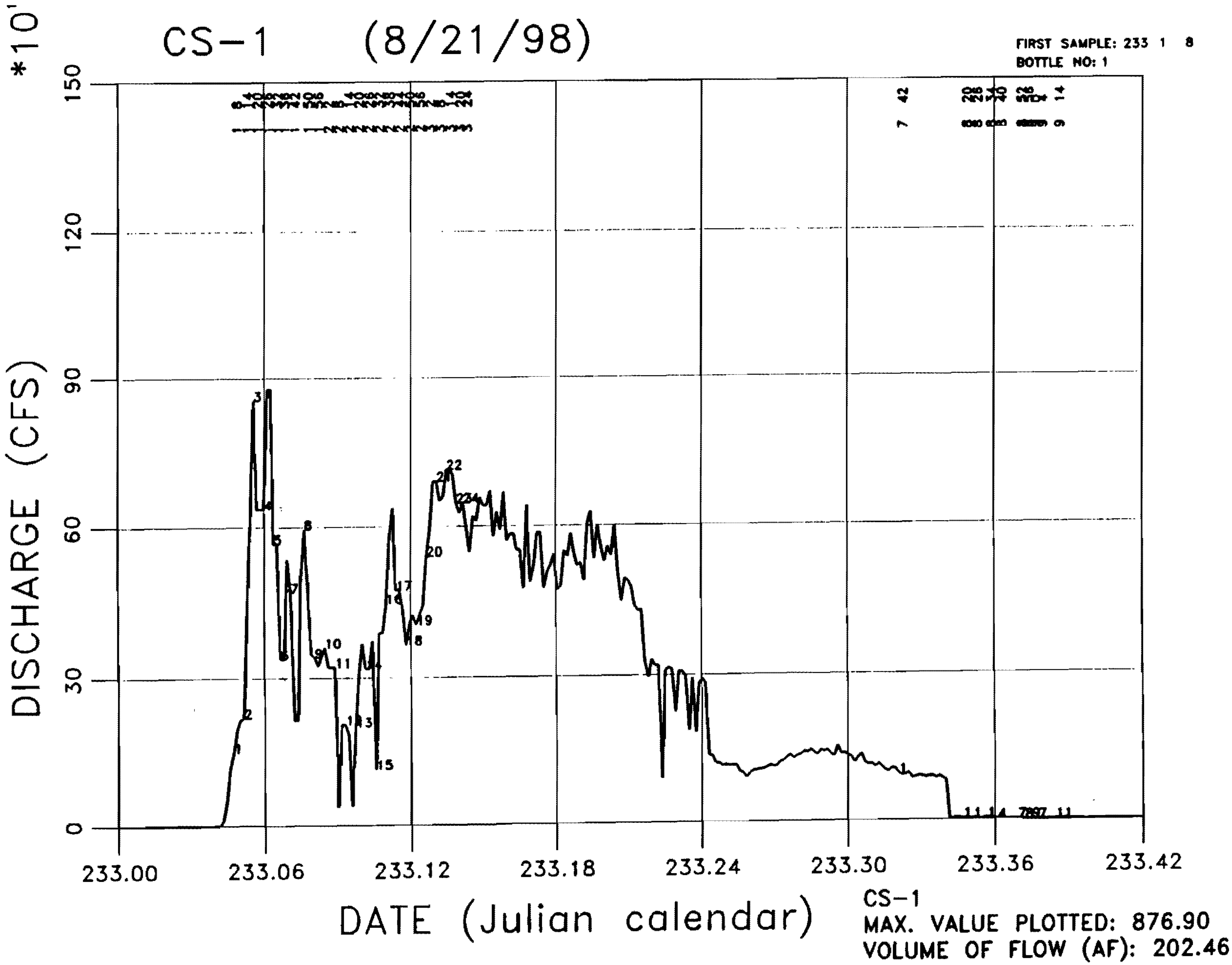
APPENDIX 7-L

COTTONWOOD ARROYO
STORM HYDROGRAPHS

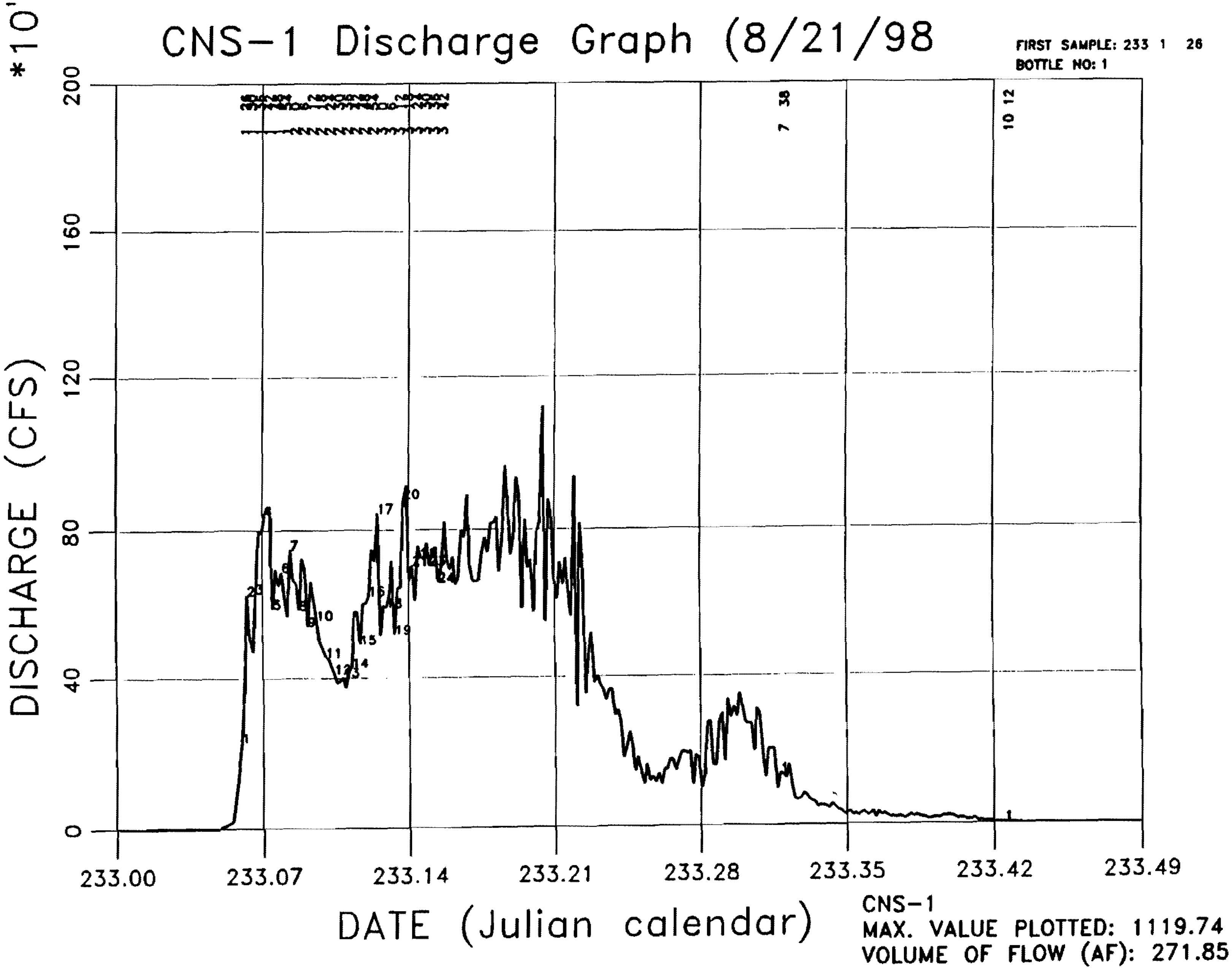
AUGUST 21, 1998
APRIL 22, 1998
AUGUST 2, 1999
AUGUST 3, 1999

STATIONS CN-1, CNS-1, AND CS-1

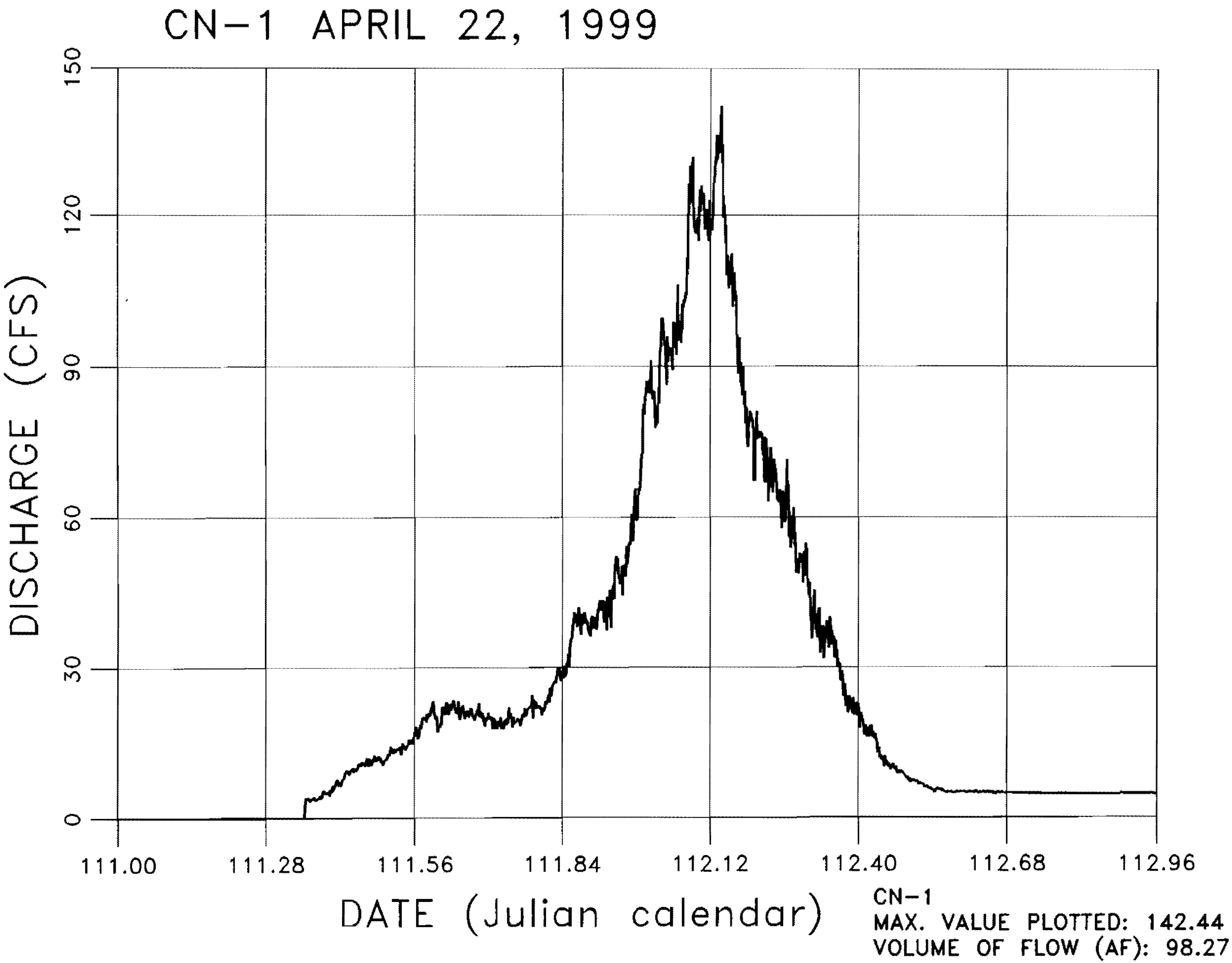

CN-1 8/21/98 AM FLOW
FIRST SAMPLE: 233 1 6
BOTTLE NO: 5
*10'
DISCHARGE (CFS)
0
20
40
60
80
100
233.00
233.06
233.12
233.18
233.24
233.30
233.36
233.42
DATE (Julian calendar)
CN-1
MAX. VALUE PLOTTED: 682.09
VOLUME OF FLOW (AF): 190.39

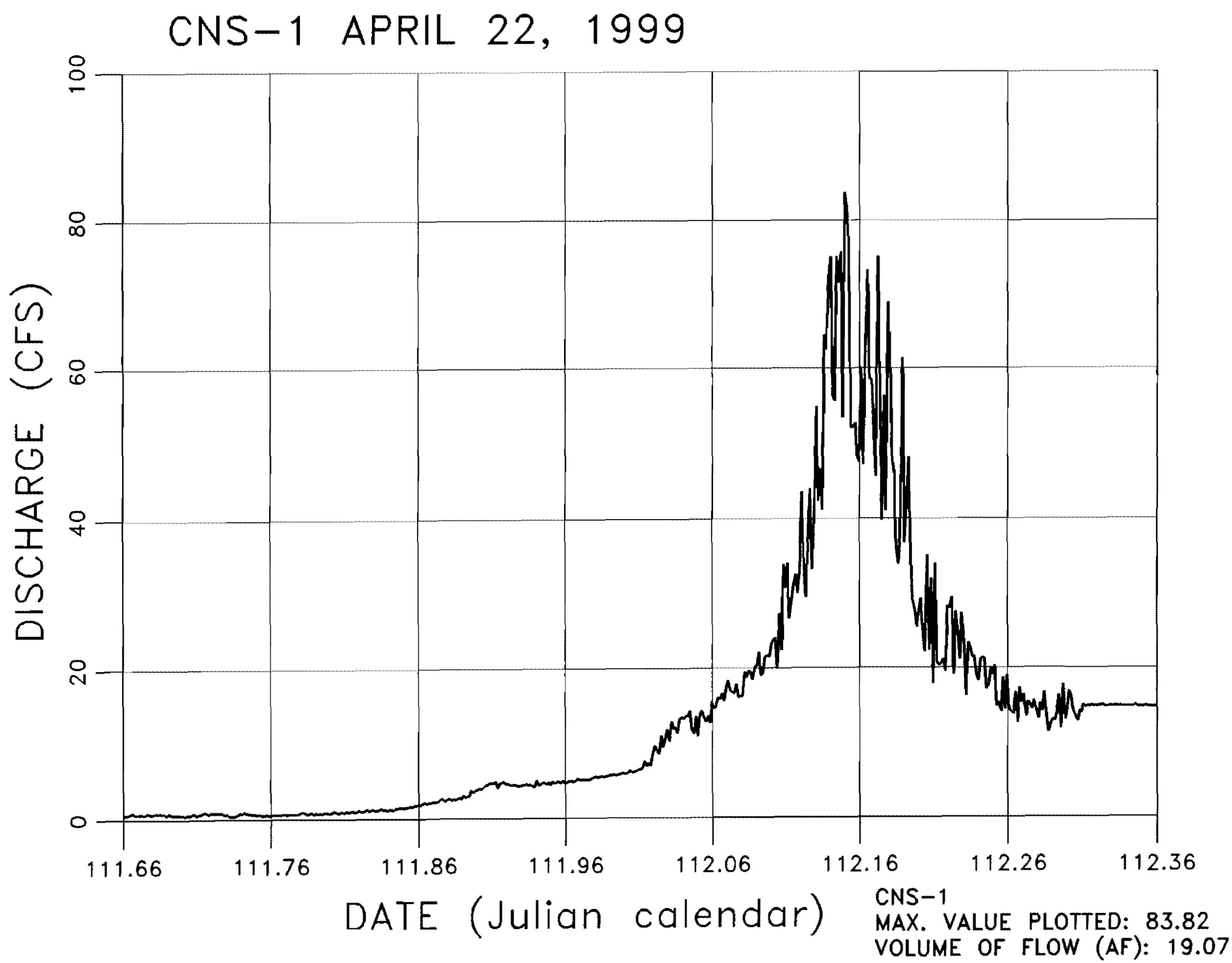


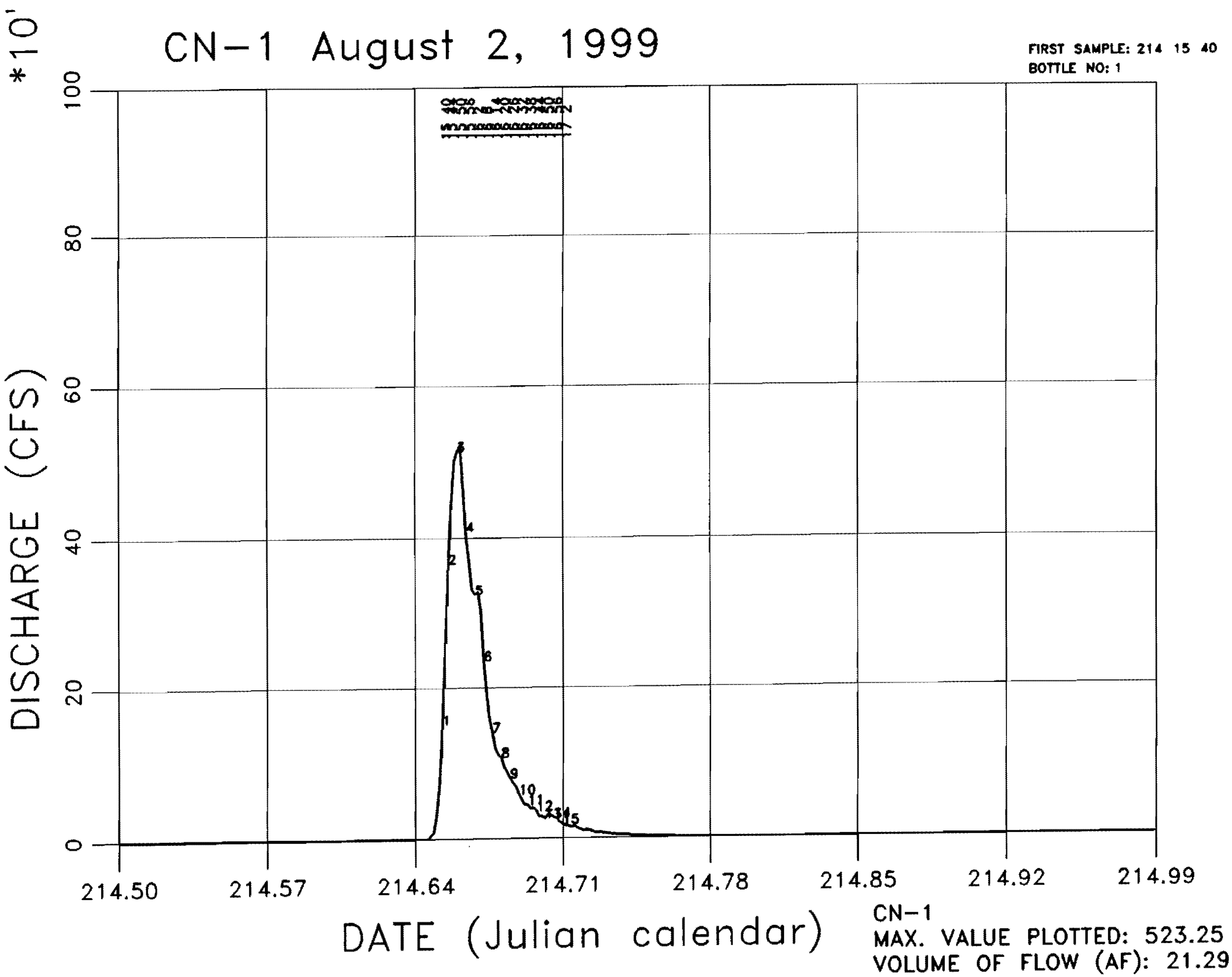
CS-1 (8/21/98)
FIRST SAMPLE: 233 1 8
BOTTLE NO: 1
*10'
DISCHARGE (CFS)
DATE (Julian calendar)
0
30
60
90
120
150
233.00
233.06
233.12
233.18
233.24
233.30
233.36
233.42
CS-1
MAX. VALUE PLOTTED: 876.90
VOLUME OF FLOW (AF): 202.46



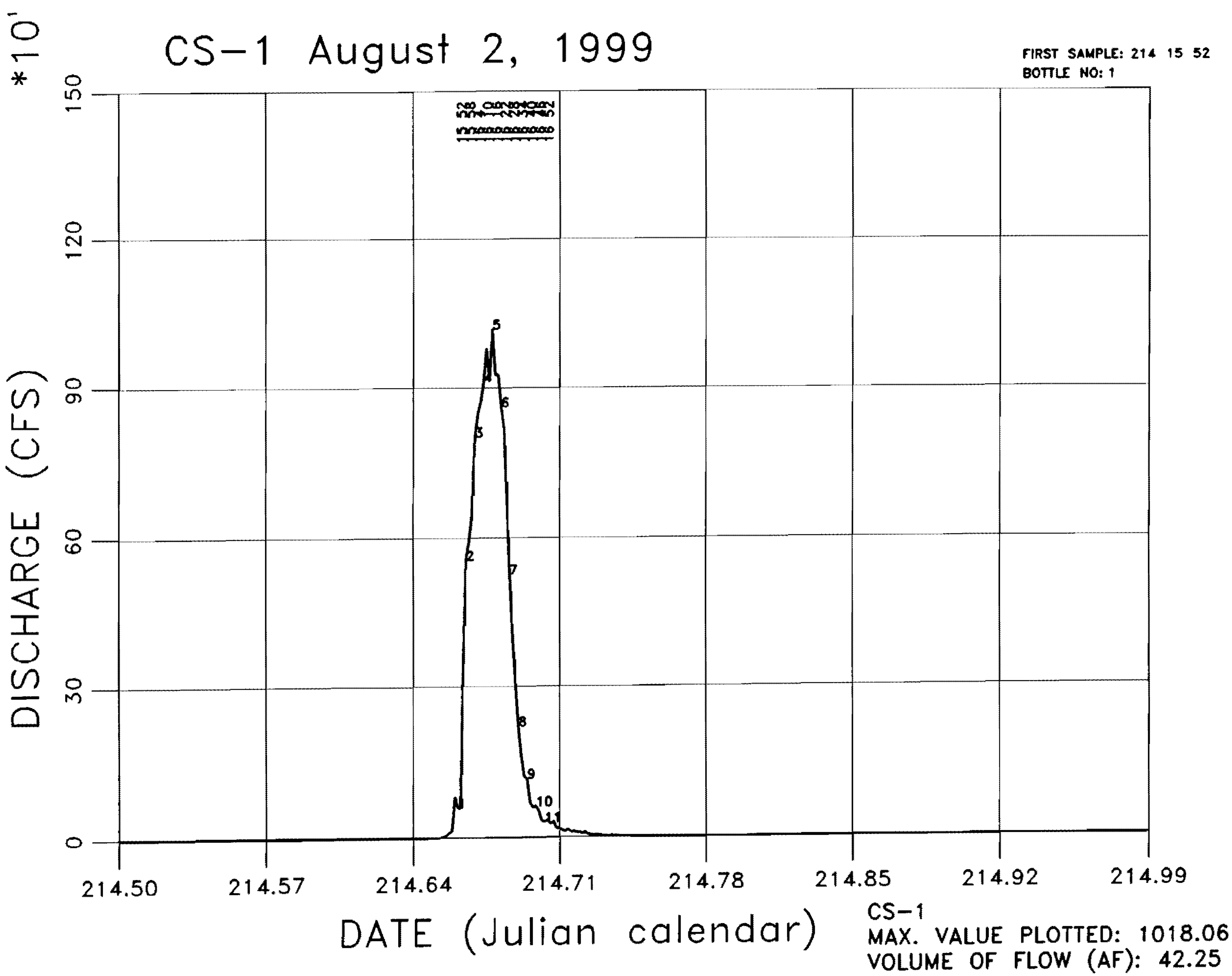
CNS-1 Discharge Graph (8/21/98)
FIRST SAMPLE: 233 1 26
BOTTLE NO: 1
*10'
DISCHARGE (CFS)
0
40
80
120
160
200
233.00
233.07
233.14
233.21
233.28
233.35
233.42
233.49
DATE (Julian calendar)
CNS-1
MAX. VALUE PLOTTED: 1119.74
VOLUME OF FLOW (AF): 271.85


CN-1 APRIL 22, 1999
DISCHARGE (CFS)
150
120
90
60
30
0
111.00
111.28
111.56
111.84
112.12
112.40
112.68
112.96
DATE (Julian calendar)
CN-1
MAX. VALUE PLOTTED: 142.44
VOLUME OF FLOW (AF): 98.27

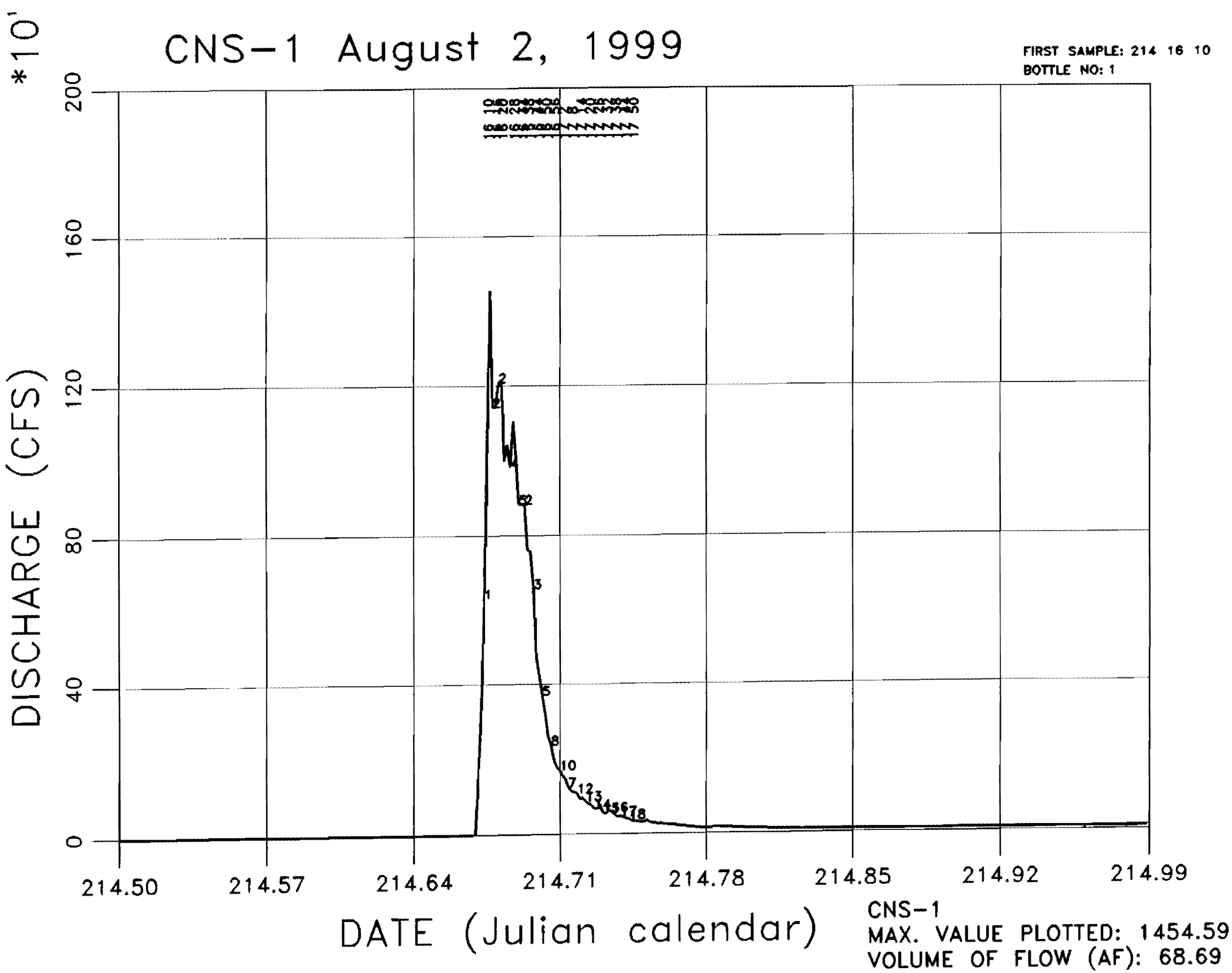

CNS-1 APRIL 22, 1999
DISCHARGE (CFS)
100
80
60
40
20
0
111.66
111.76
111.86
111.96
112.06
112.16
112.26
112.36
DATE (Julian calendar)
CNS-1
MAX. VALUE PLOTTED: 83.82
VOLUME OF FLOW (AF): 19.07



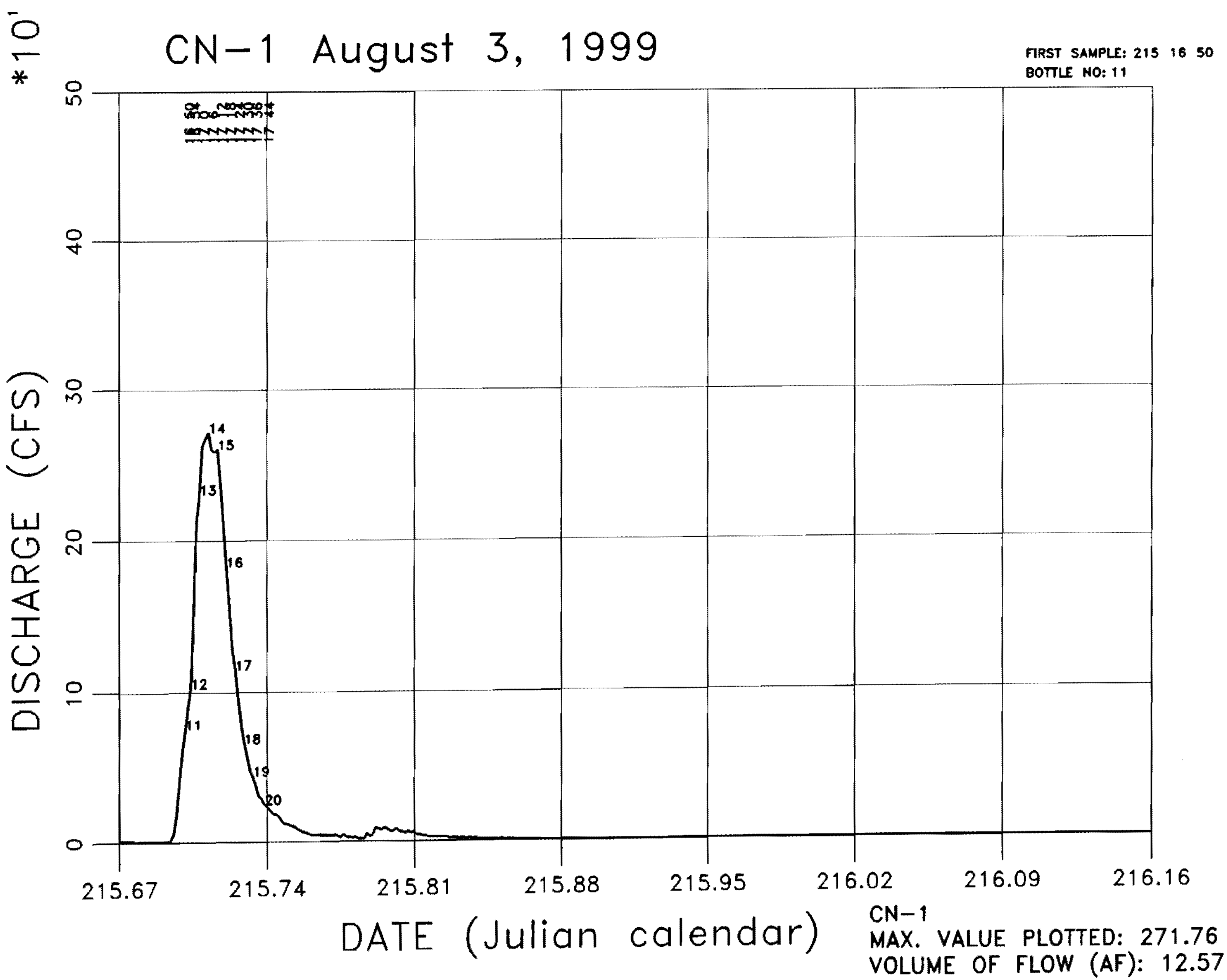
CN-1 August 2, 1999
FIRST SAMPLE: 214 15 40
BOTTLE NO: 1
*10'
DISCHARGE (CFS)
0
20
40
60
80
100
214.50
214.57
214.64
214.71
214.78
214.85
214.92
214.99
DATE (Julian calendar)
CN-1
MAX. VALUE PLOTTED: 523.25
VOLUME OF FLOW (AF): 21.29

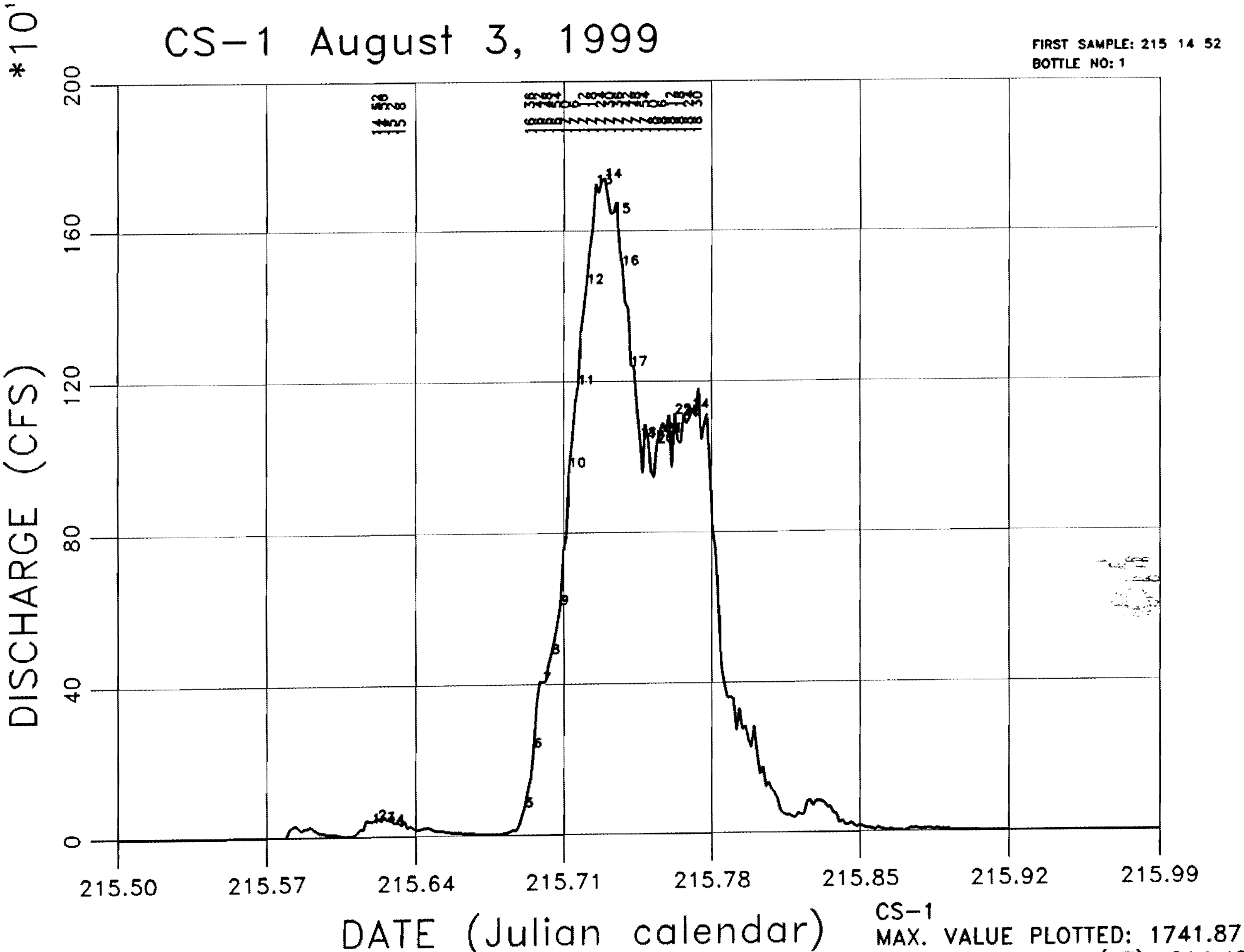


CS-1 August 2, 1999
FIRST SAMPLE: 214 15 52
BOTTLE NO: 1
*10¹
DISCHARGE (CFS)
150
120
90
60
30
0
214.50
214.57
214.64
214.71
214.78
214.85
214.92
214.99
DATE (Julian calendar)
CS-1
MAX. VALUE PLOTTED: 1018.06
VOLUME OF FLOW (AF): 42.25

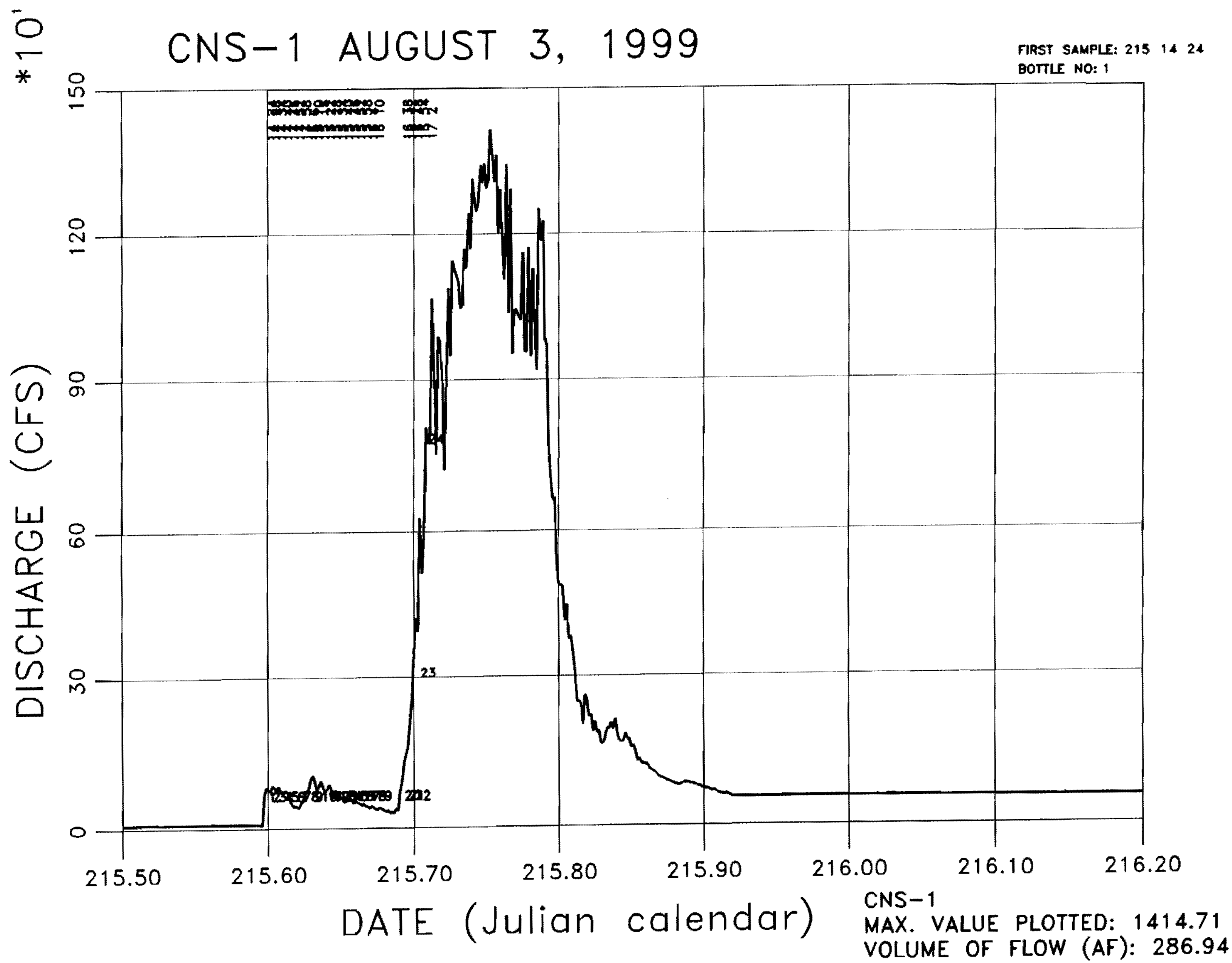


CNS-1 August 2, 1999
FIRST SAMPLE: 214 16 10
BOTTLE NO: 1
*10'
DISCHARGE (CFS)
200
160
120
80
40
0
214.50
214.57
214.64
214.71
214.78
214.85
214.92
214.99
DATE (Julian calendar)
CNS-1
MAX. VALUE PLOTTED: 1454.59
VOLUME OF FLOW (AF): 68.69


CN-1 August 3, 1999
FIRST SAMPLE: 215 16 50
BOTTLE NO: 11
*10¹
DISCHARGE (CFS)
0
10
20
30
40
50
11
12
13
14
15
16
17
18
19
20
215.67
215.74
215.81
215.88
215.95
216.02
216.09
216.16
DATE (Julian calendar)
CN-1
MAX. VALUE PLOTTED: 271.76
VOLUME OF FLOW (AF): 12.57



CS-1
MAX. VALUE PLOTTED: 1741.87
VOLUME OF FLOW (AF): 214.49



CNS-1 AUGUST 3, 1999
FIRST SAMPLE: 215 14 24
BOTTLE NO: 1
*10¹
DISCHARGE (CFS)
150
120
90
60
30
0
215.50
215.60
215.70
215.80
215.90
216.00
216.10
216.20
DATE (Julian calendar)
CNS-1
MAX. VALUE PLOTTED: 1414.71
VOLUME OF FLOW (AF): 286.94

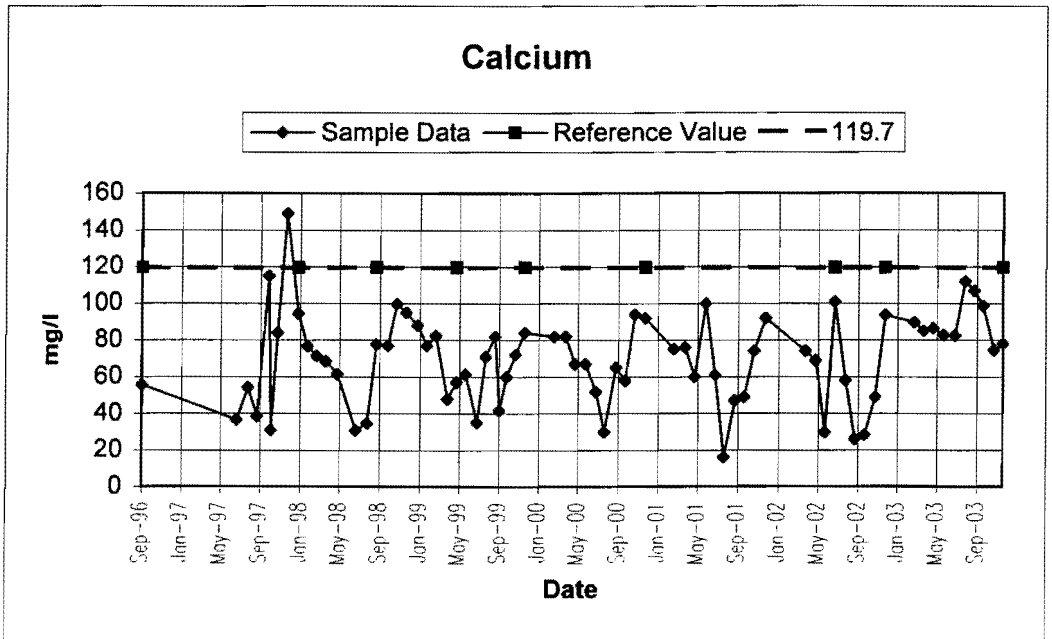
APPENDIX 7-M

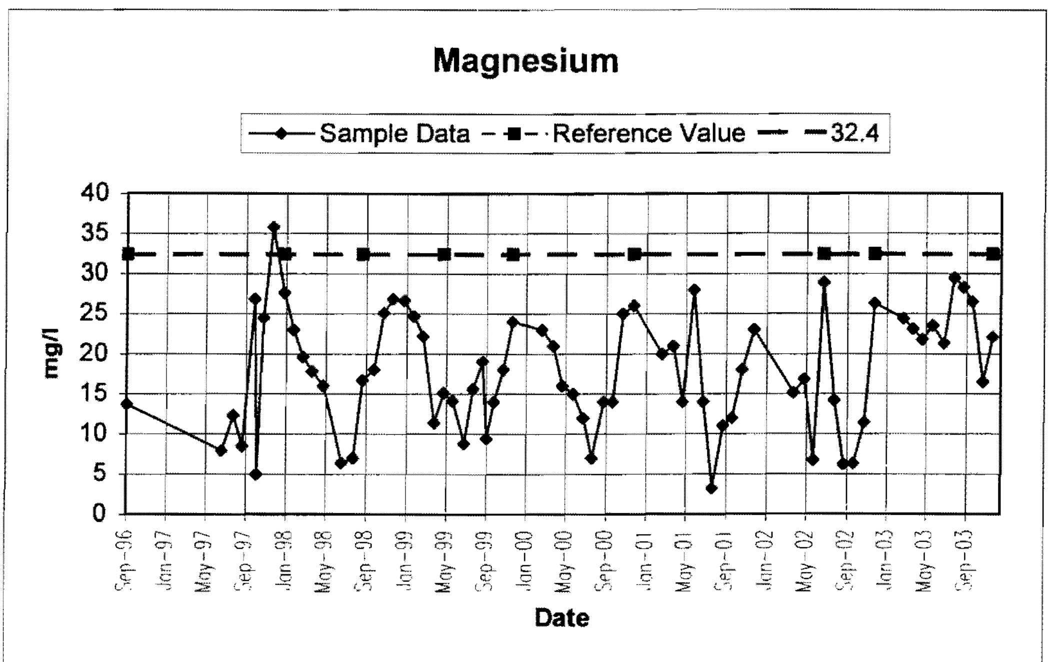
SURFACE WATER QUALITY MONITORING DATA ANALYSIS

FOR STATIONS CD-1 & CD-2

1996-2003

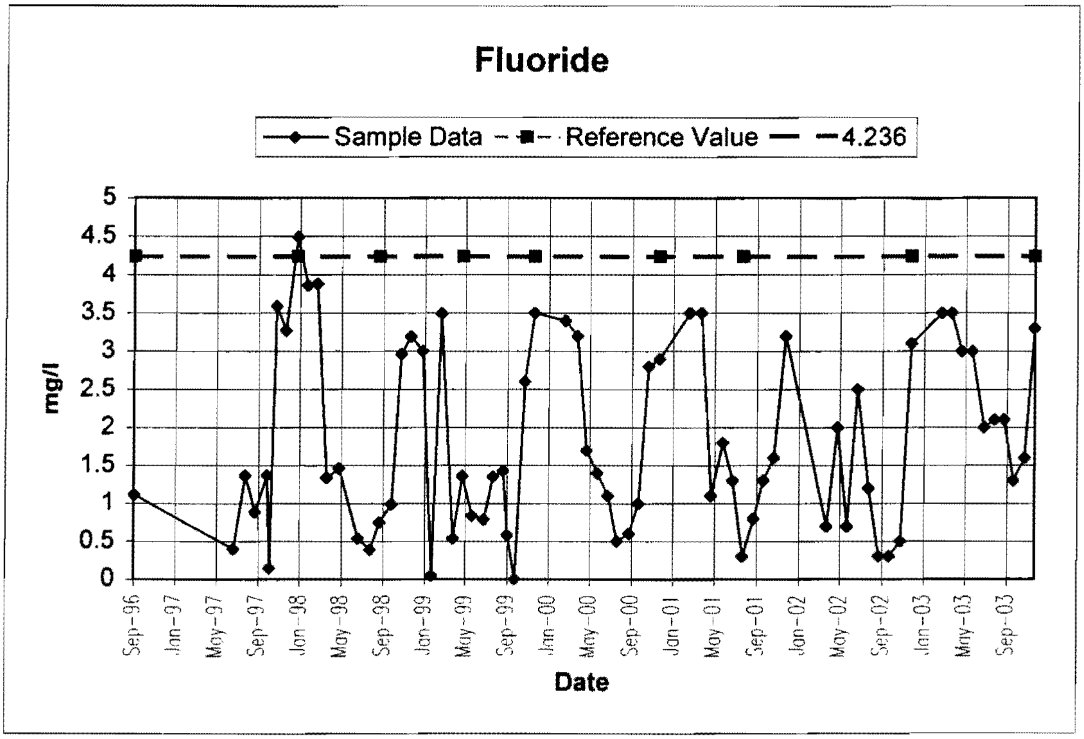
SURFACE WATER MONITORING DATA

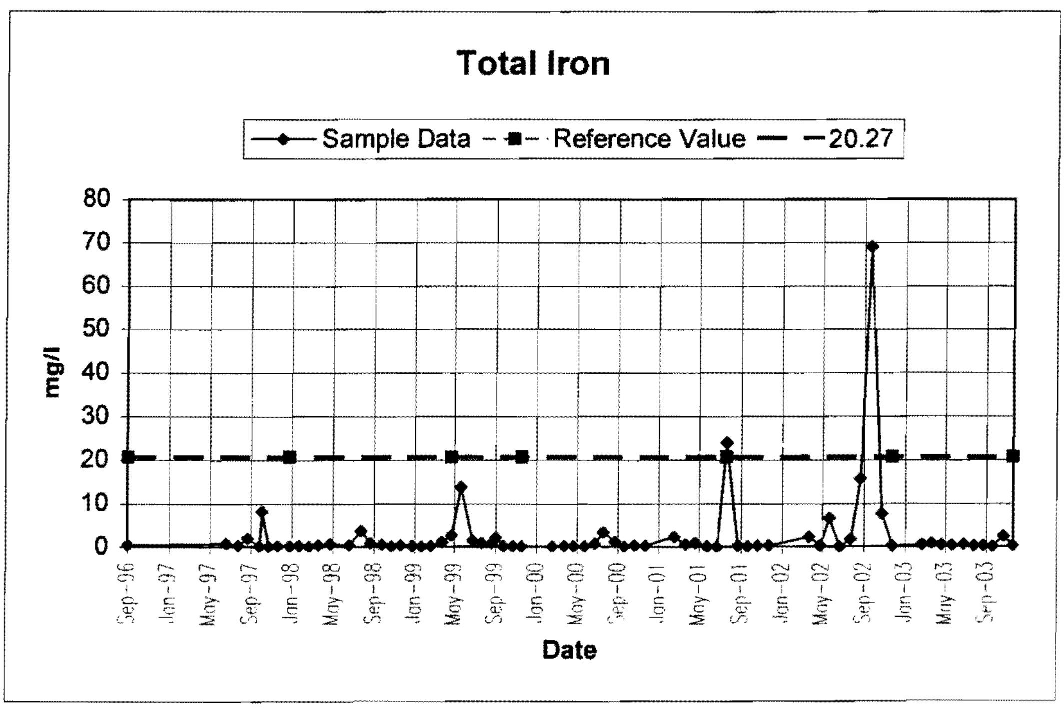




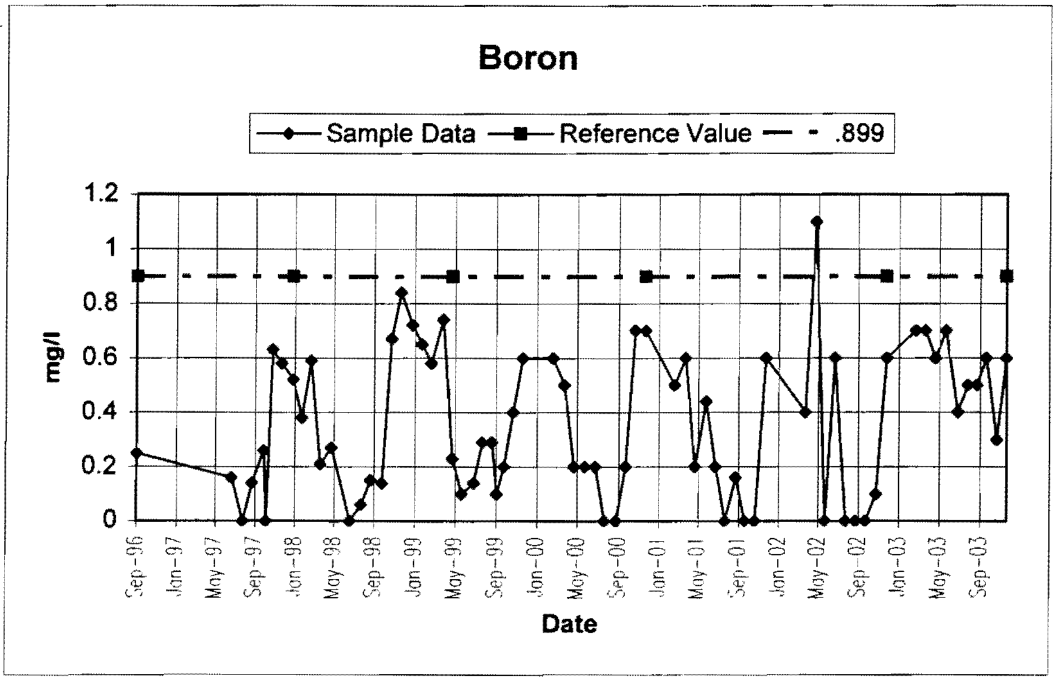
(5/04)

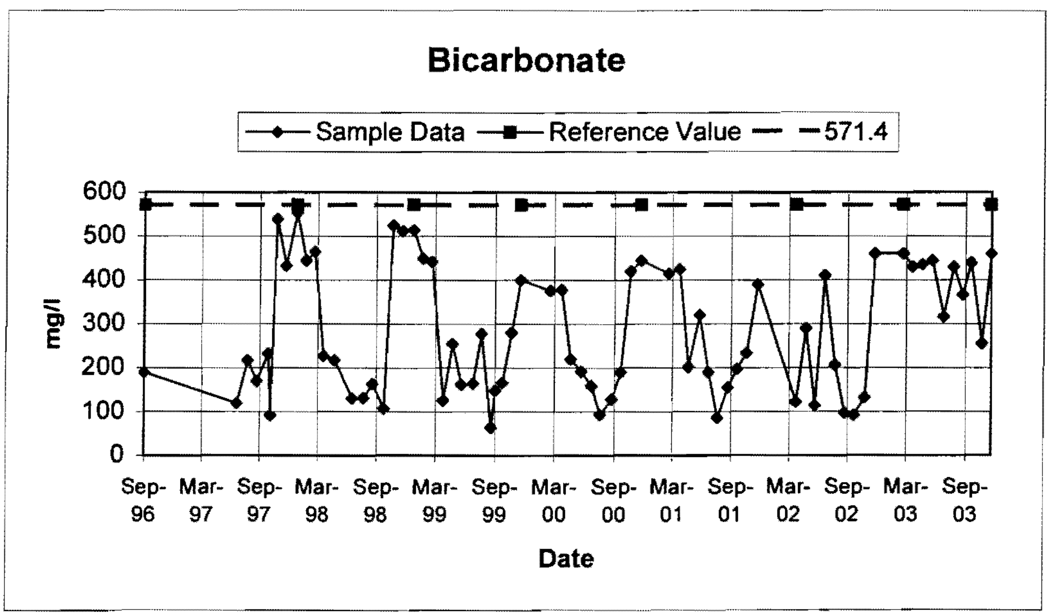
SURFACE WATER MONITORING DATA



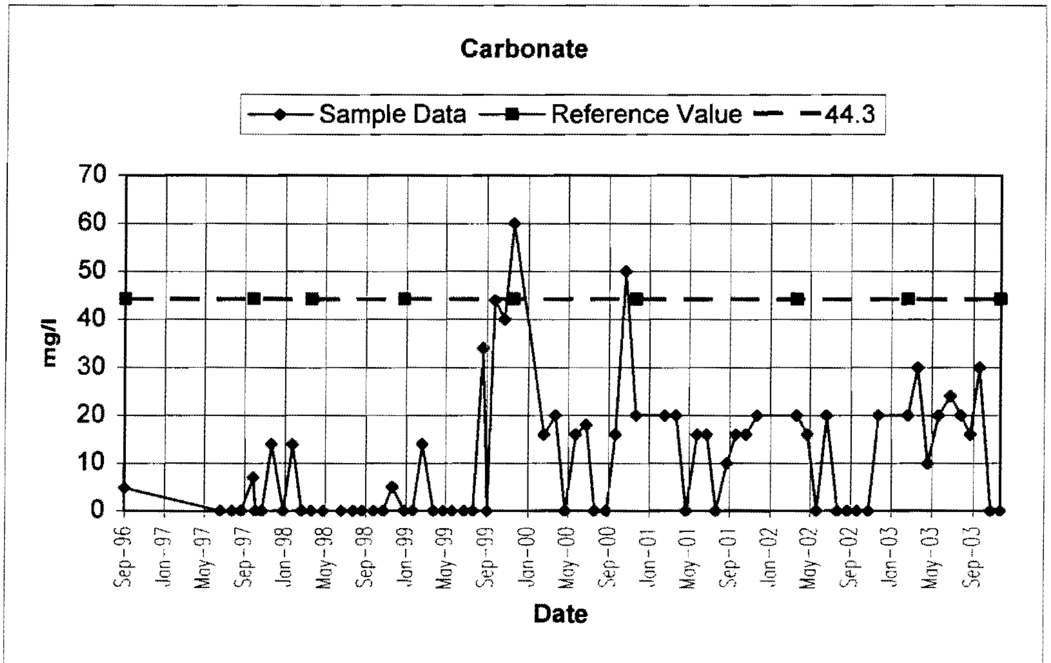


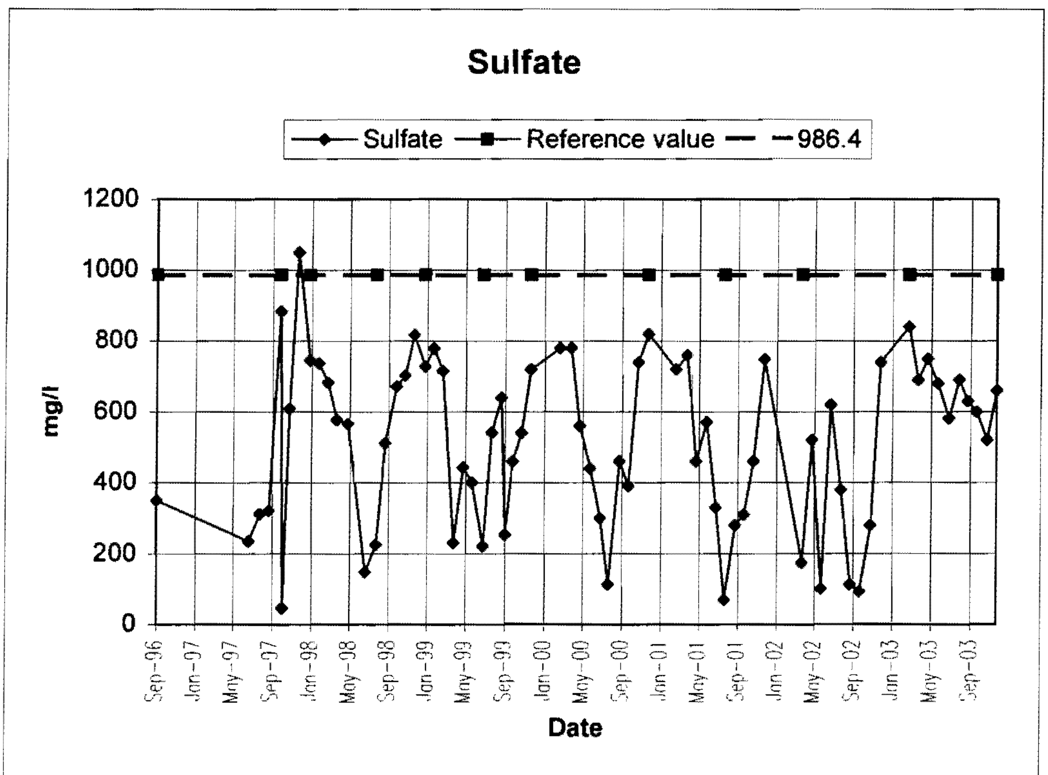
(5/04)


Boron
Sample Data
Reference Value
.899
1.2
1
0.8
0.6
0.4
0.2
0
mg/l
Sep-96
Jan-97
May-97
Sep-97
Jan-98
May-98
Sep-98
Jan-99
May-99
Sep-99
Jan-00
May-00
Sep-00
Jan-01
May-01
Sep-01
Jan-02
May-02
Sep-02
Jan-03
May-03
Sep-03
Date

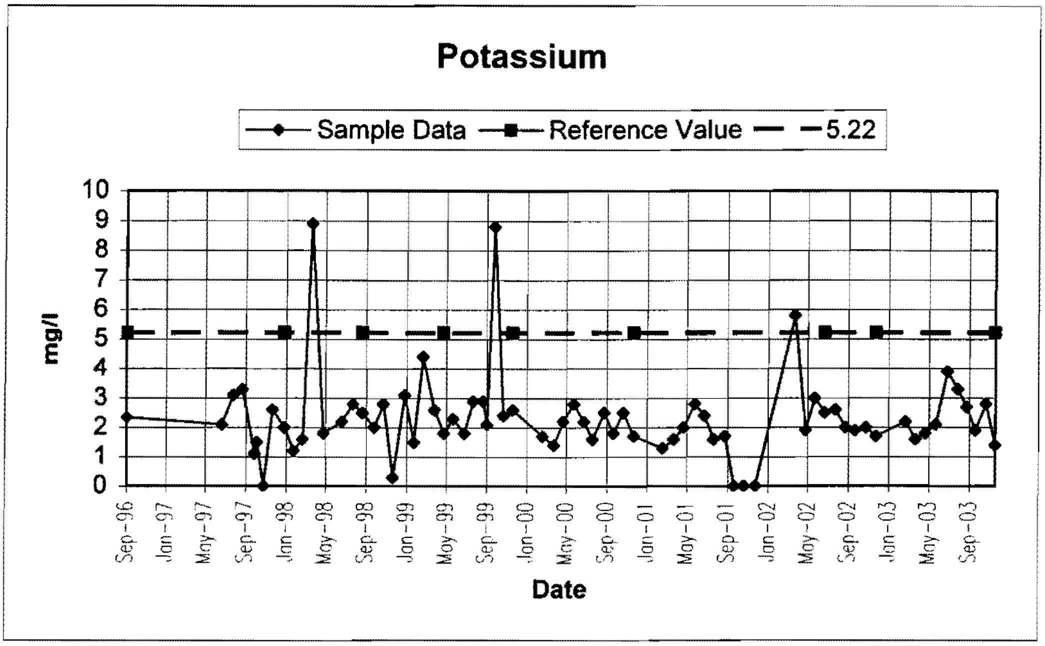

Bicarbonate
Sample Data
Reference Value
571.4
600
500
400
300
200
100
0
mg/l
Sep-96
Mar-97
Sep-97
Mar-98
Sep-98
Mar-99
Sep-99
Mar-00
Sep-00
Mar-01
Sep-01
Mar-02
Sep-02
Mar-03
Sep-03
Date

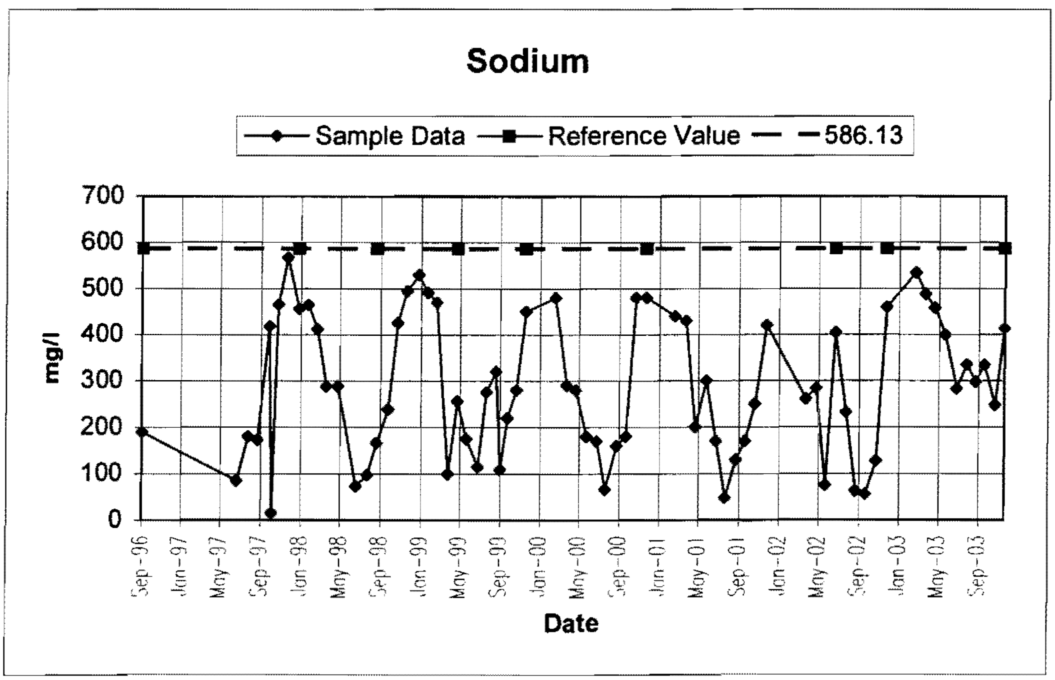
SURFACE WATER MONITORING DATA



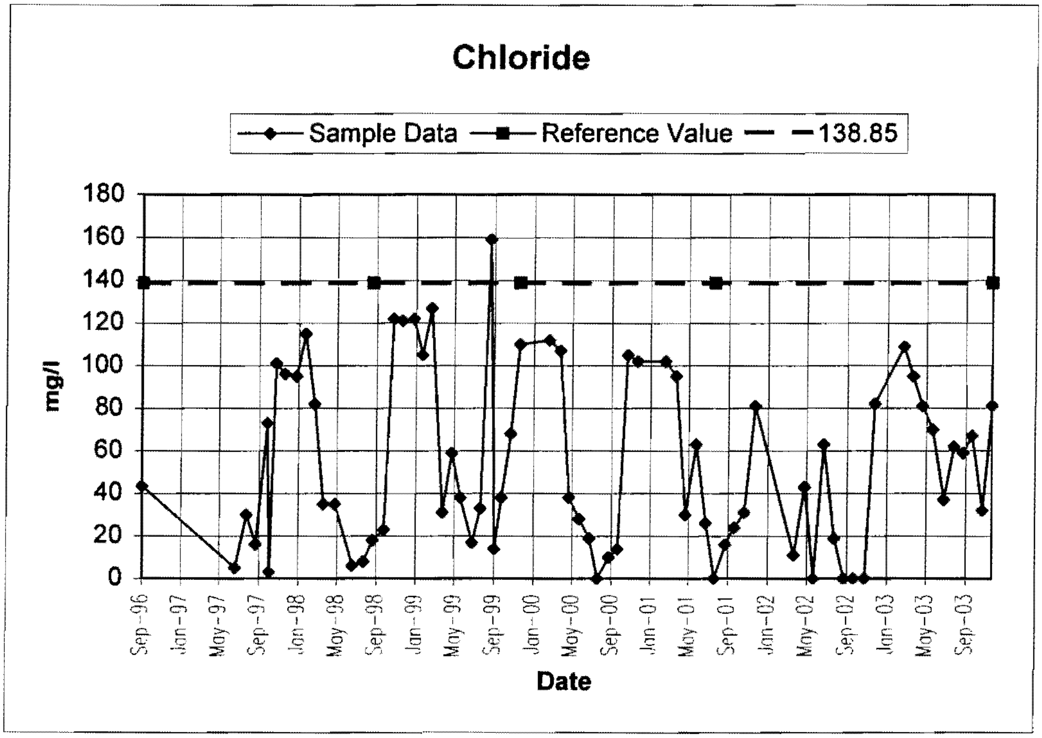


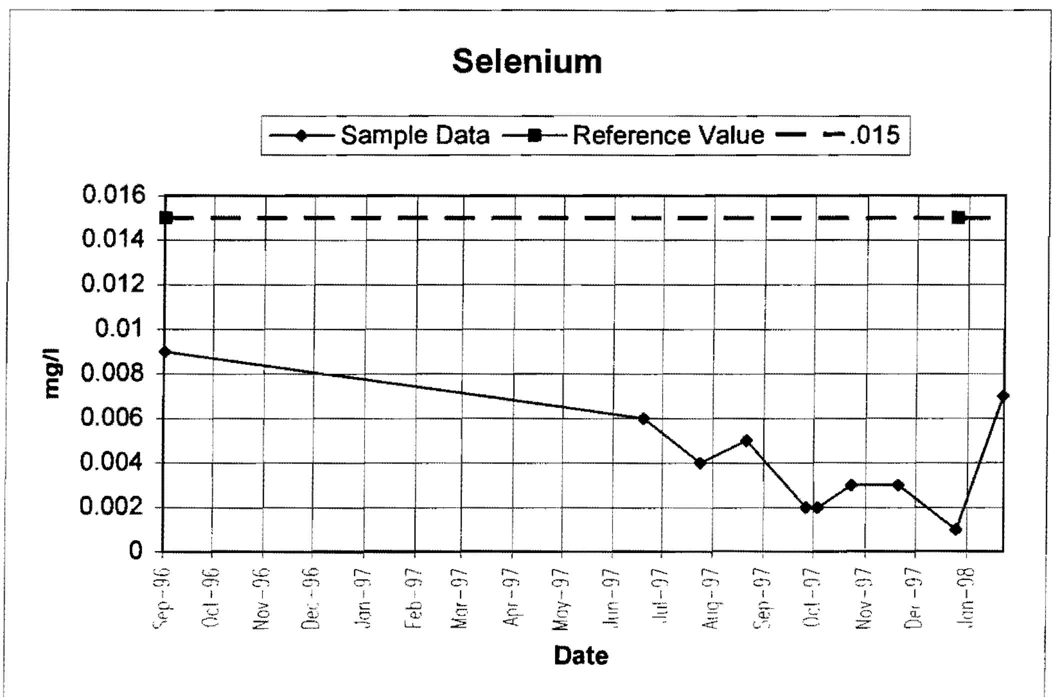
SURFACE WATER MONITORING DATA





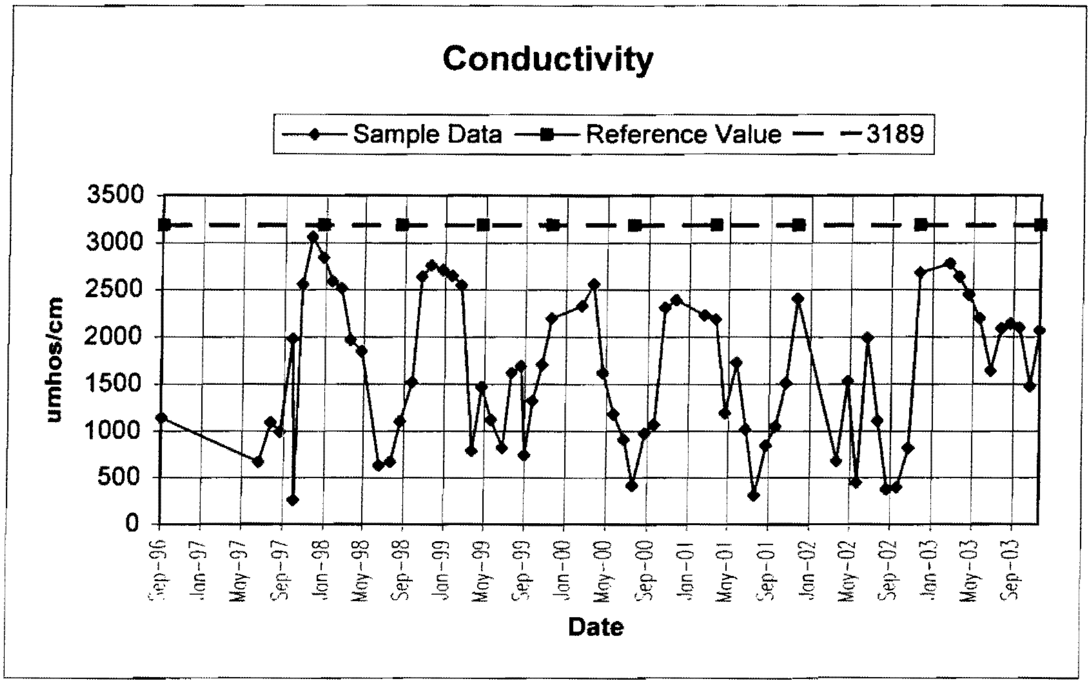
SURFACE WATER MONITORING DATA

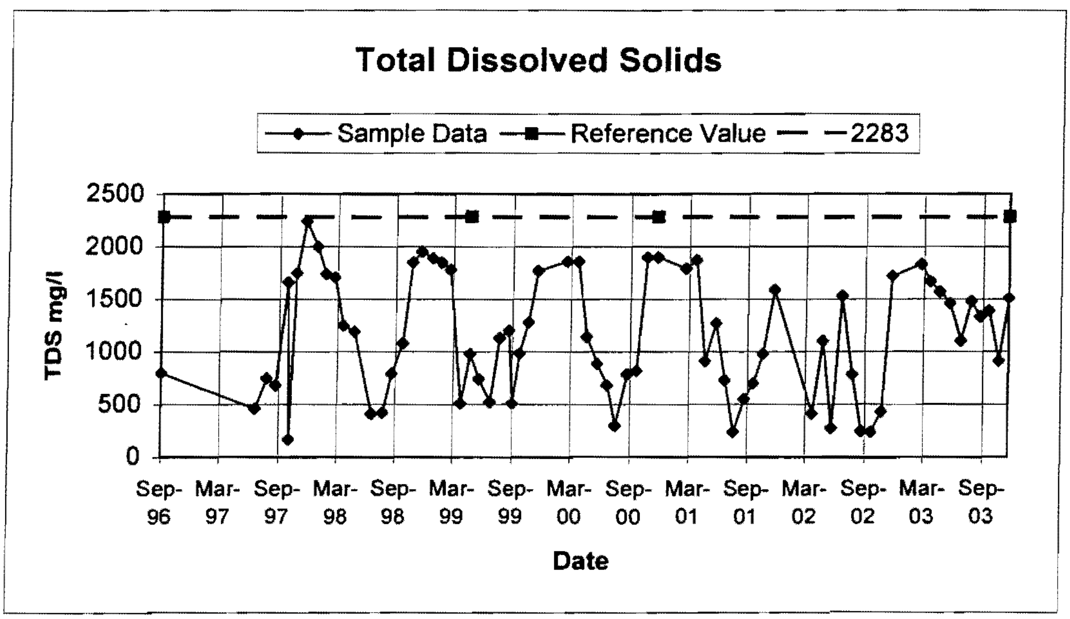




(5/04)

SURFACE WATER MONITORING DATA





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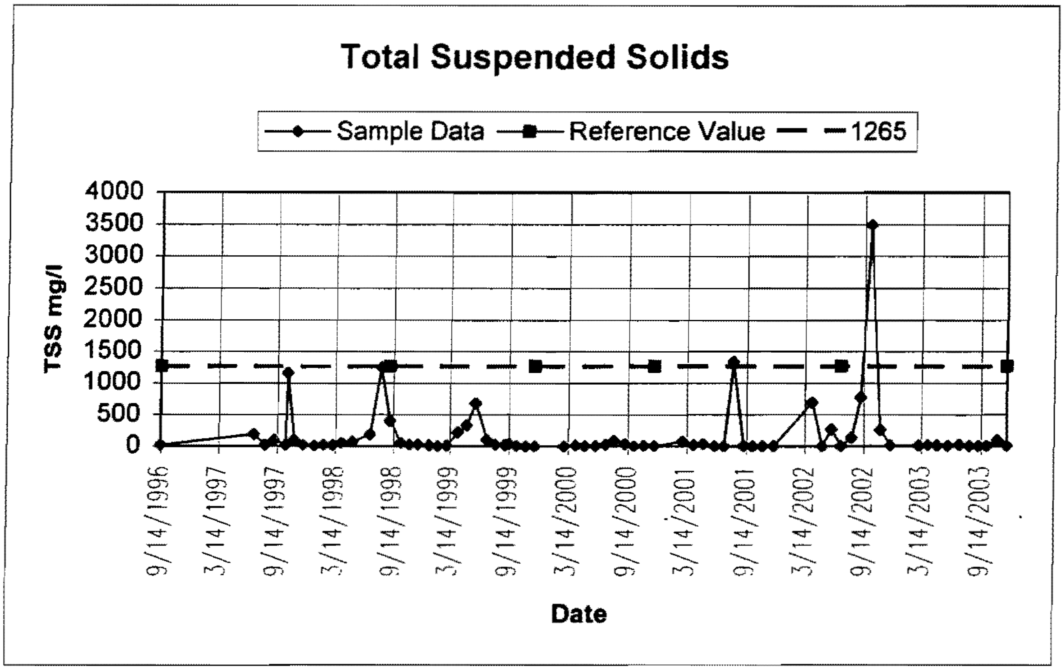
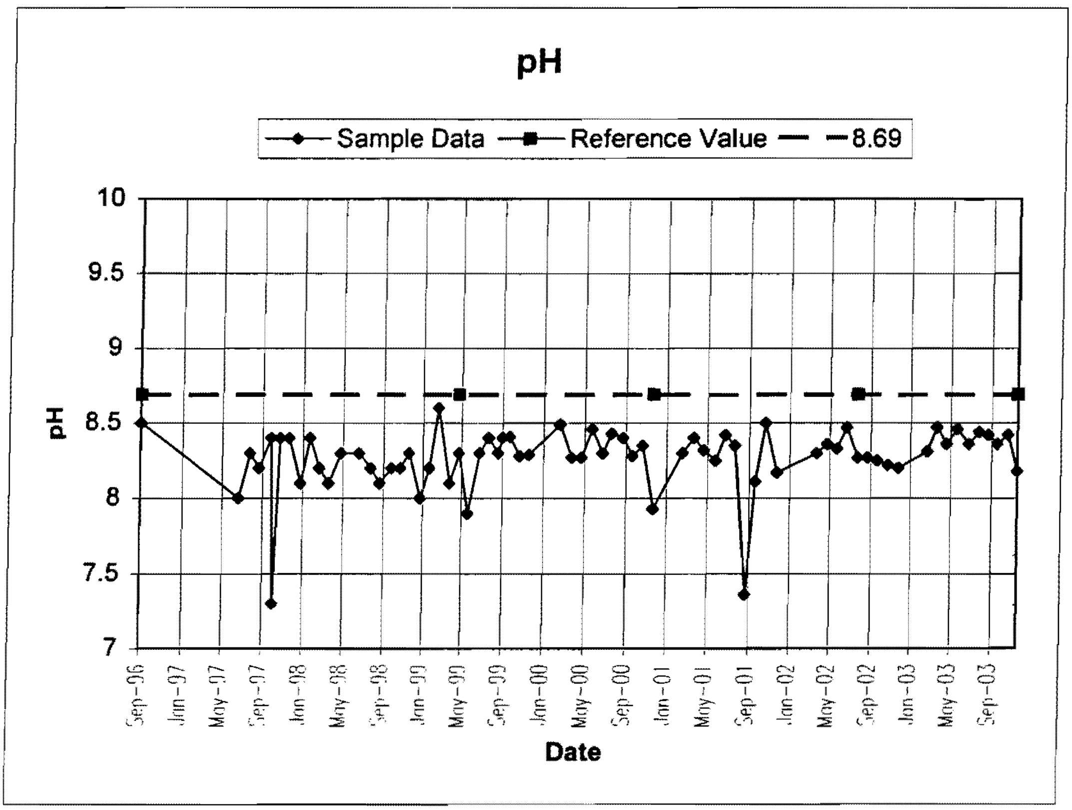
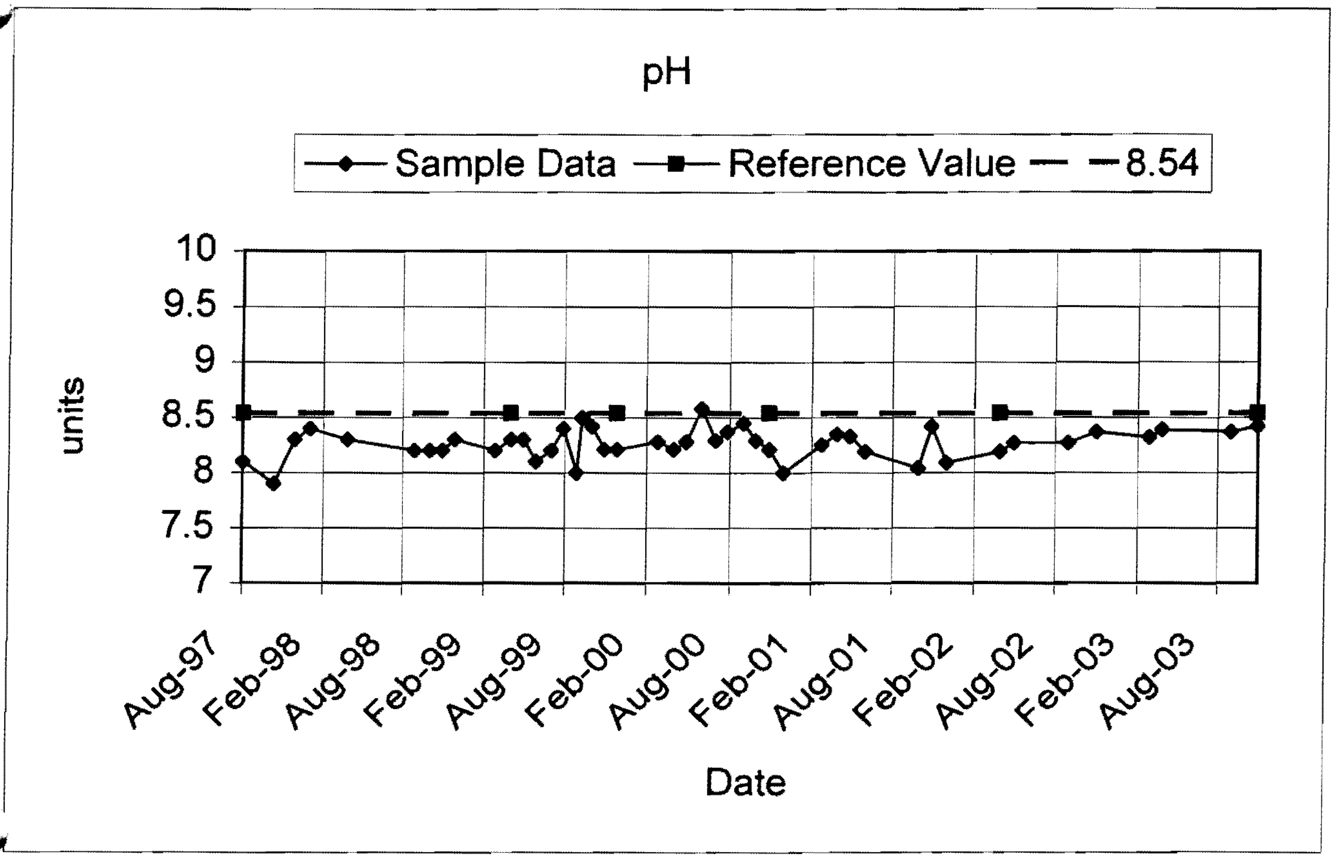
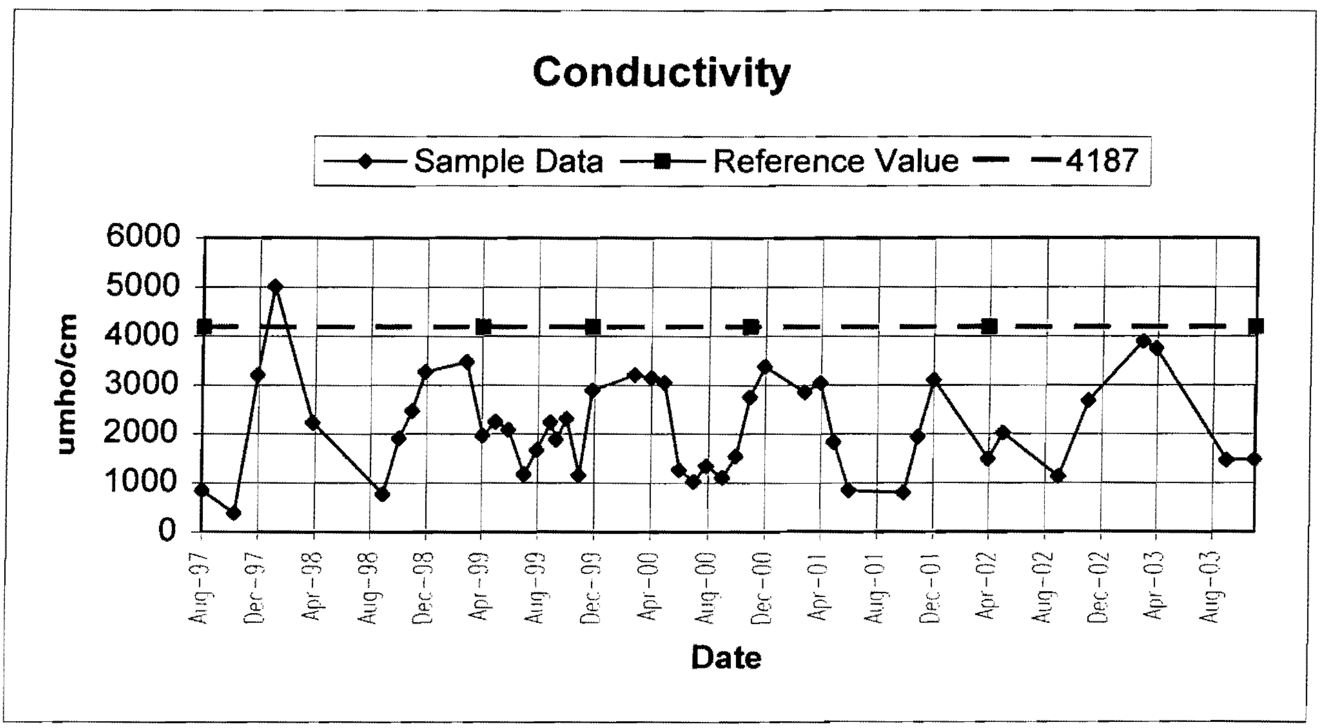


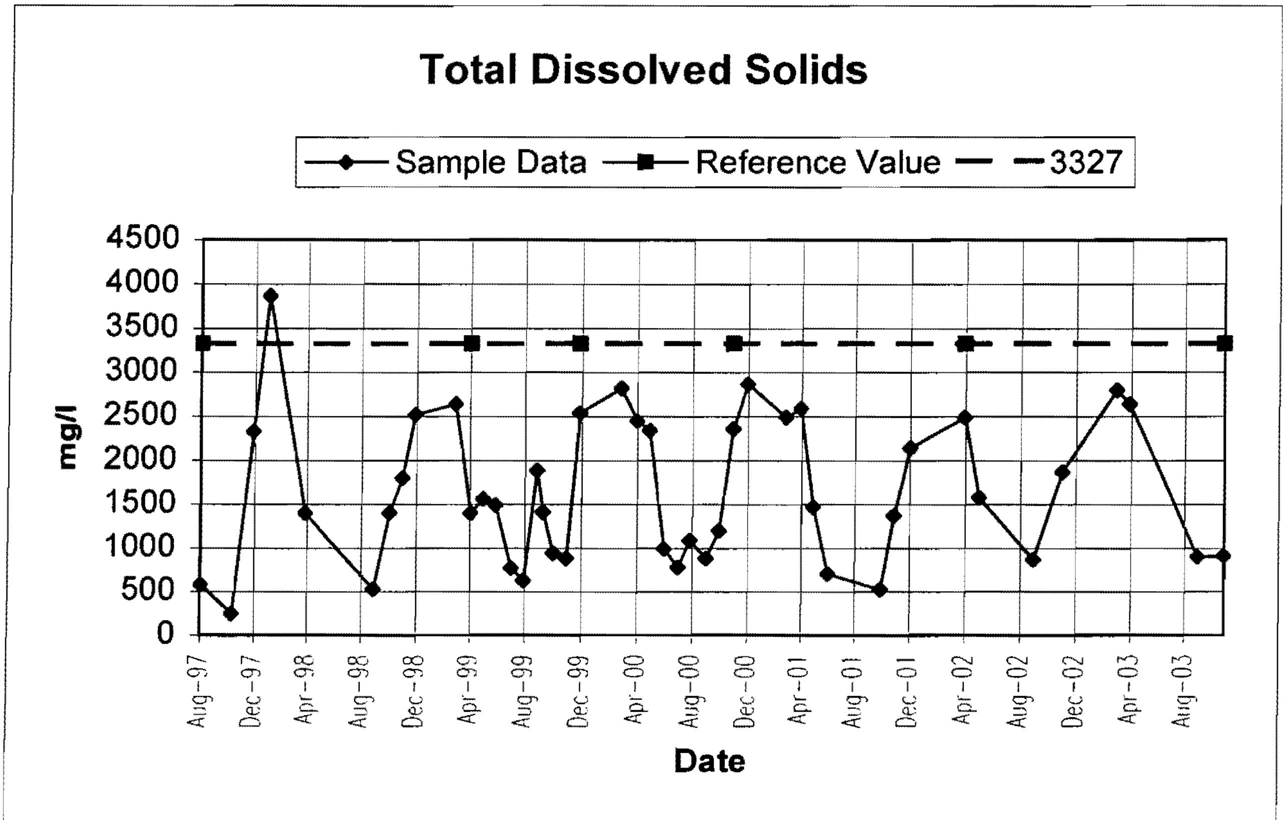


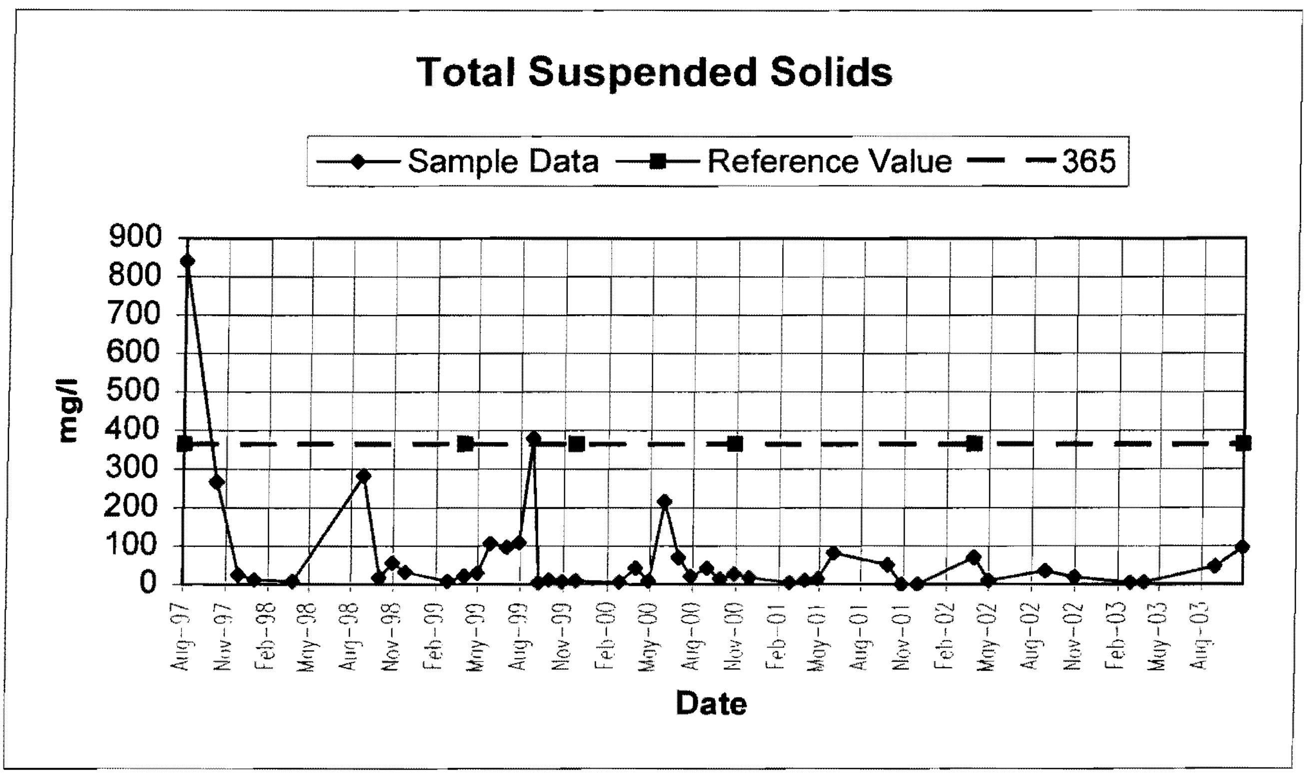
SURFACE WATER MONITORING DATA



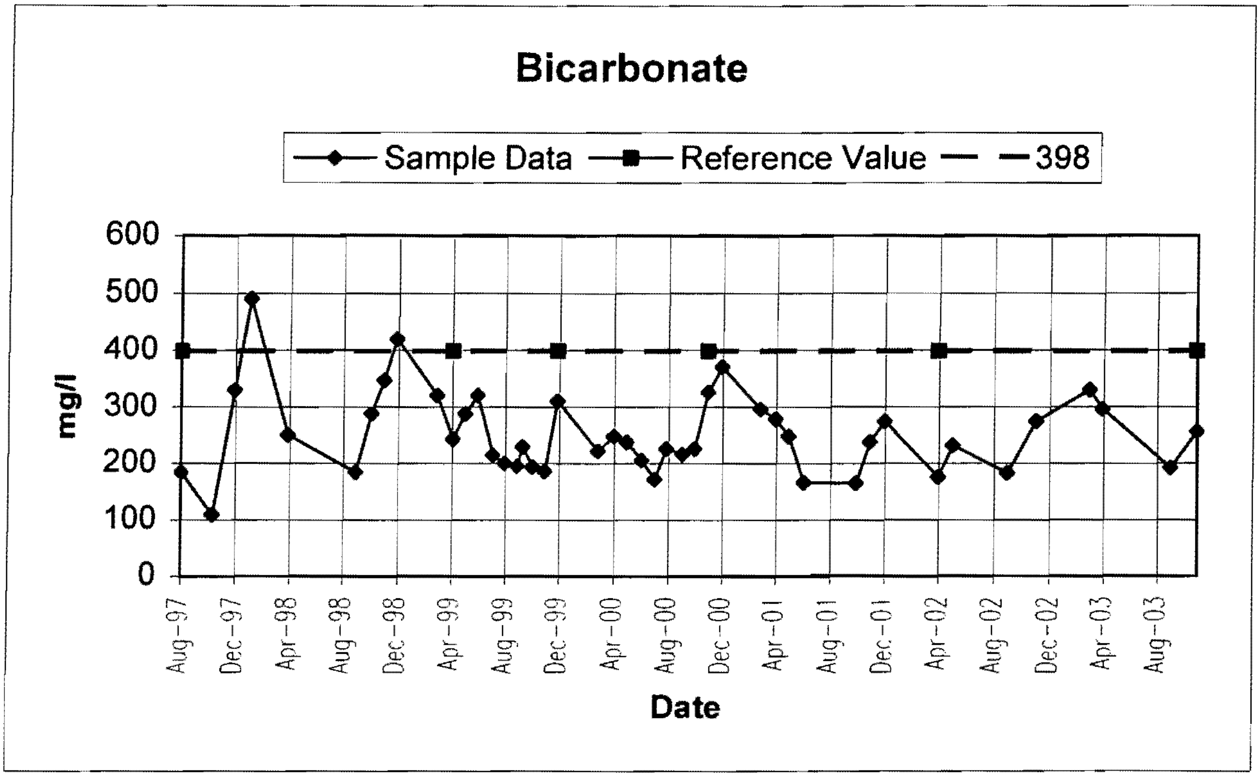


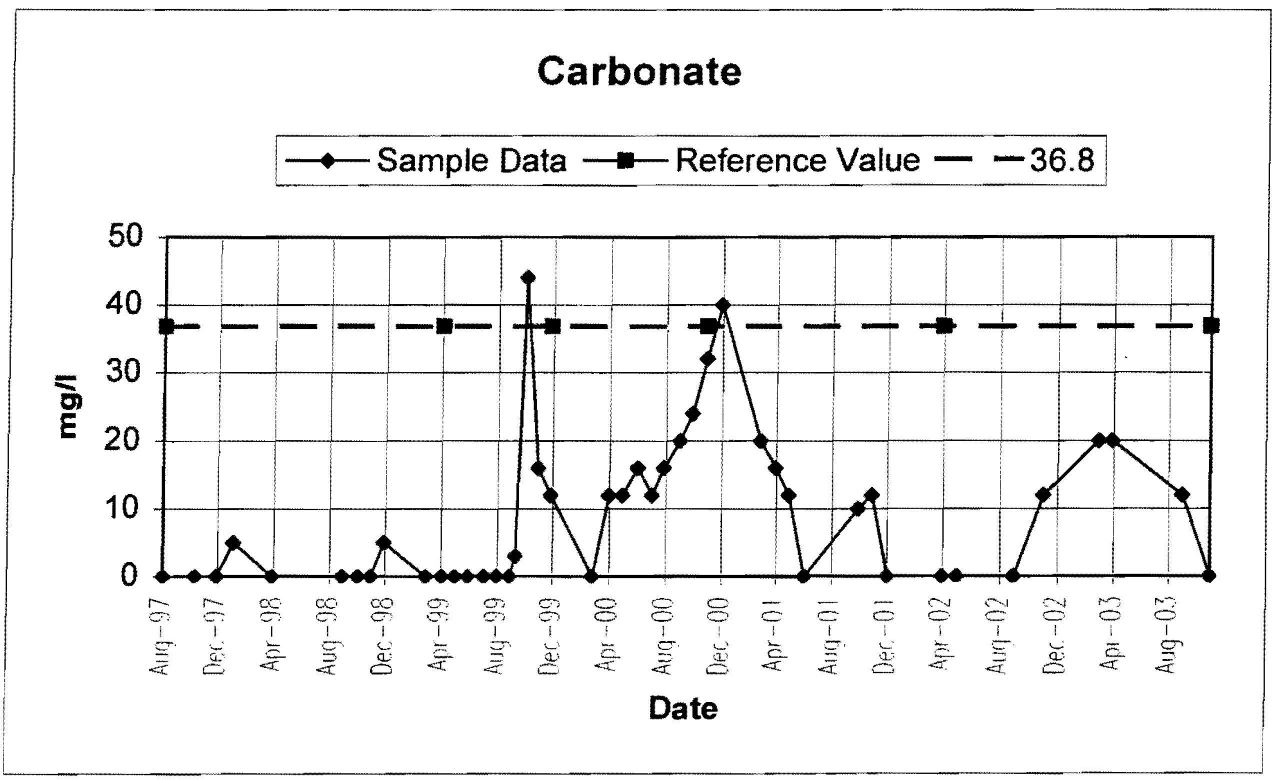
SURFACE WATER MONITORING DATA



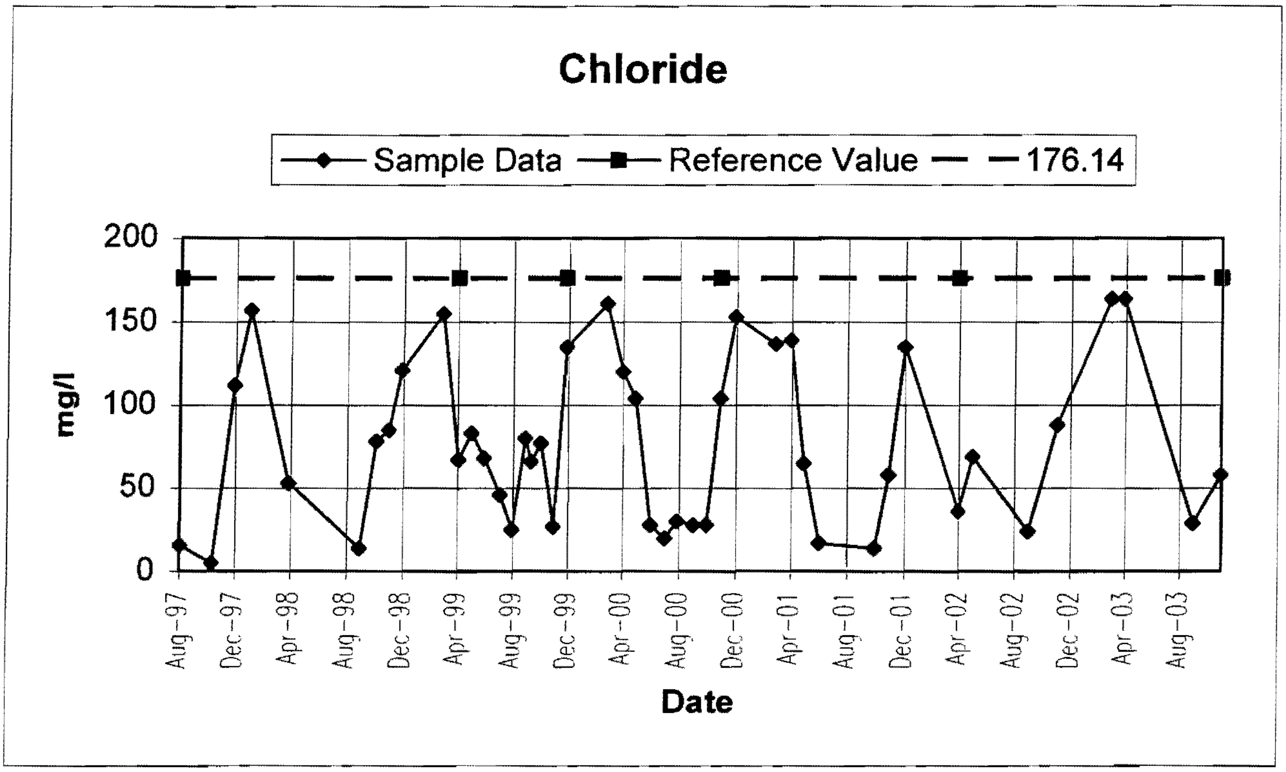


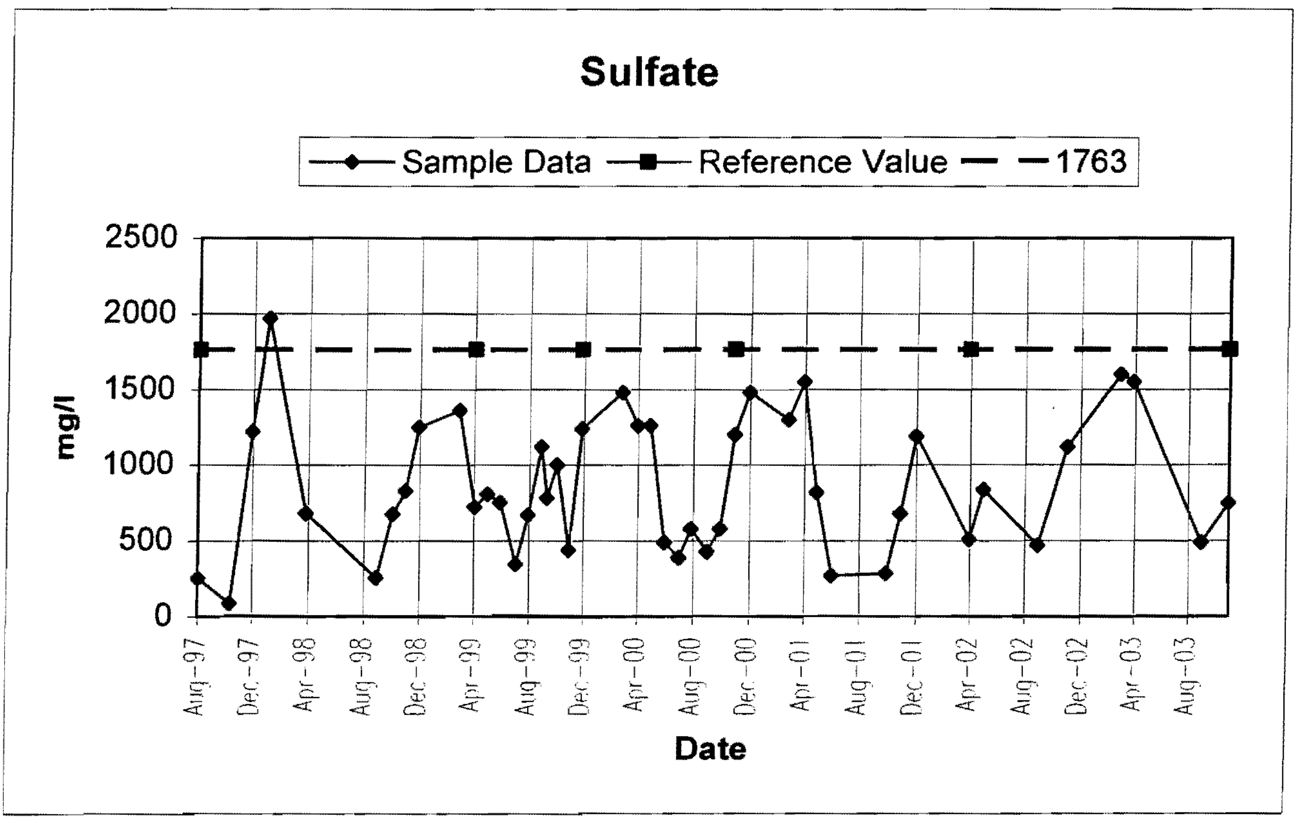
SURFACE WATER MONITORING DATA





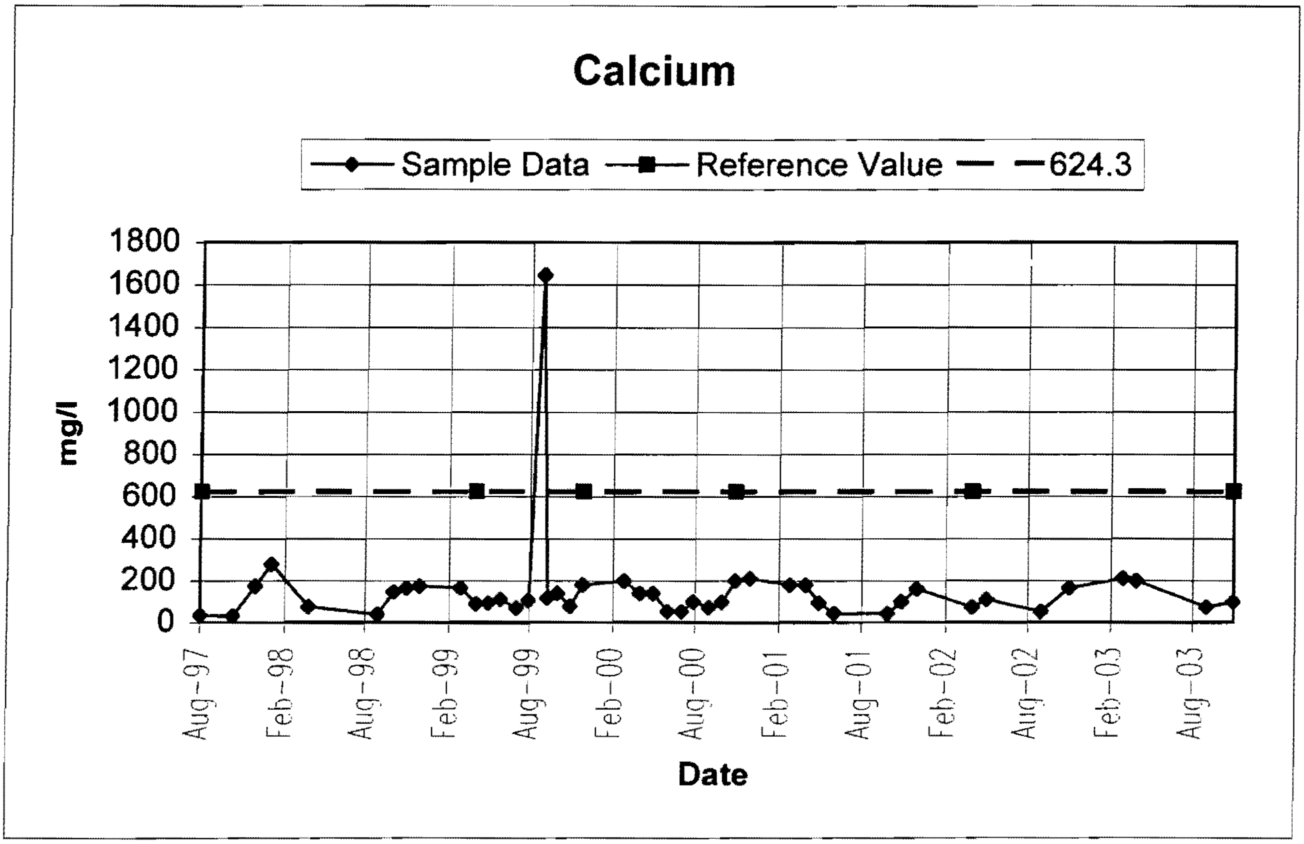
SURFACE WATER MONITORING DATA

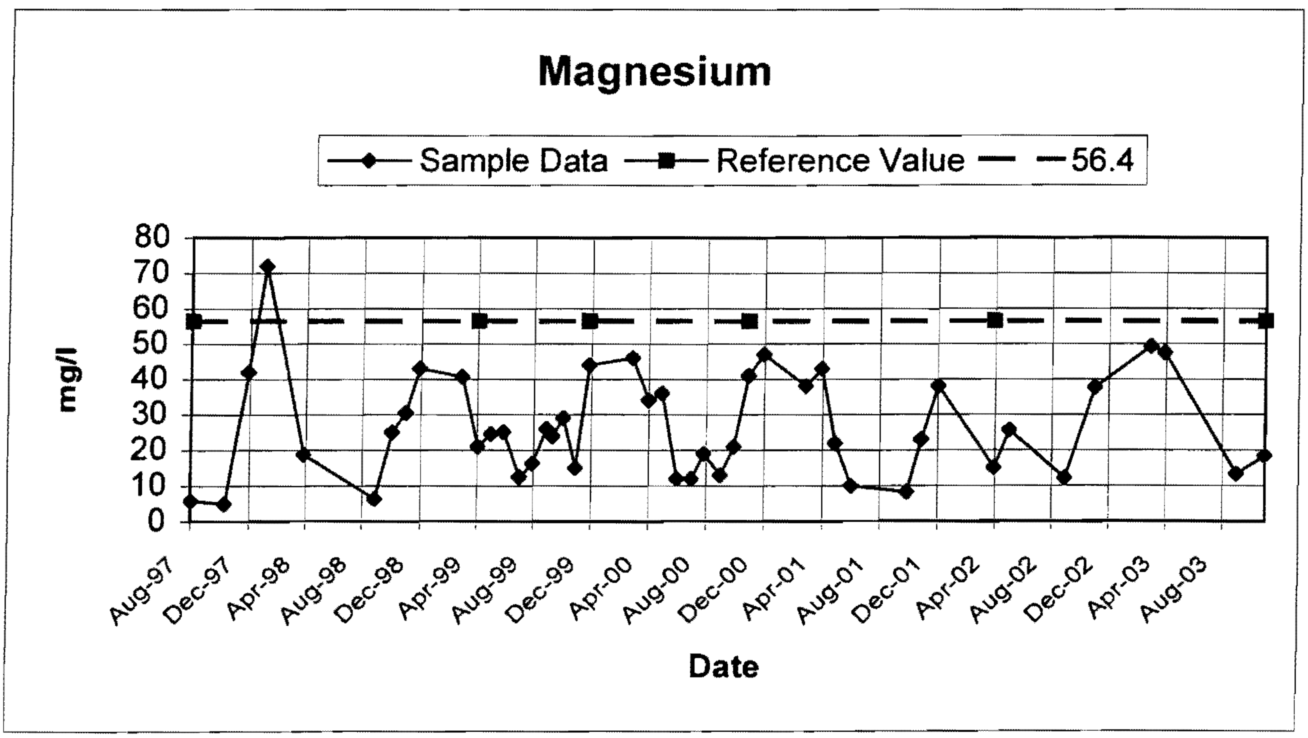




(5/04)

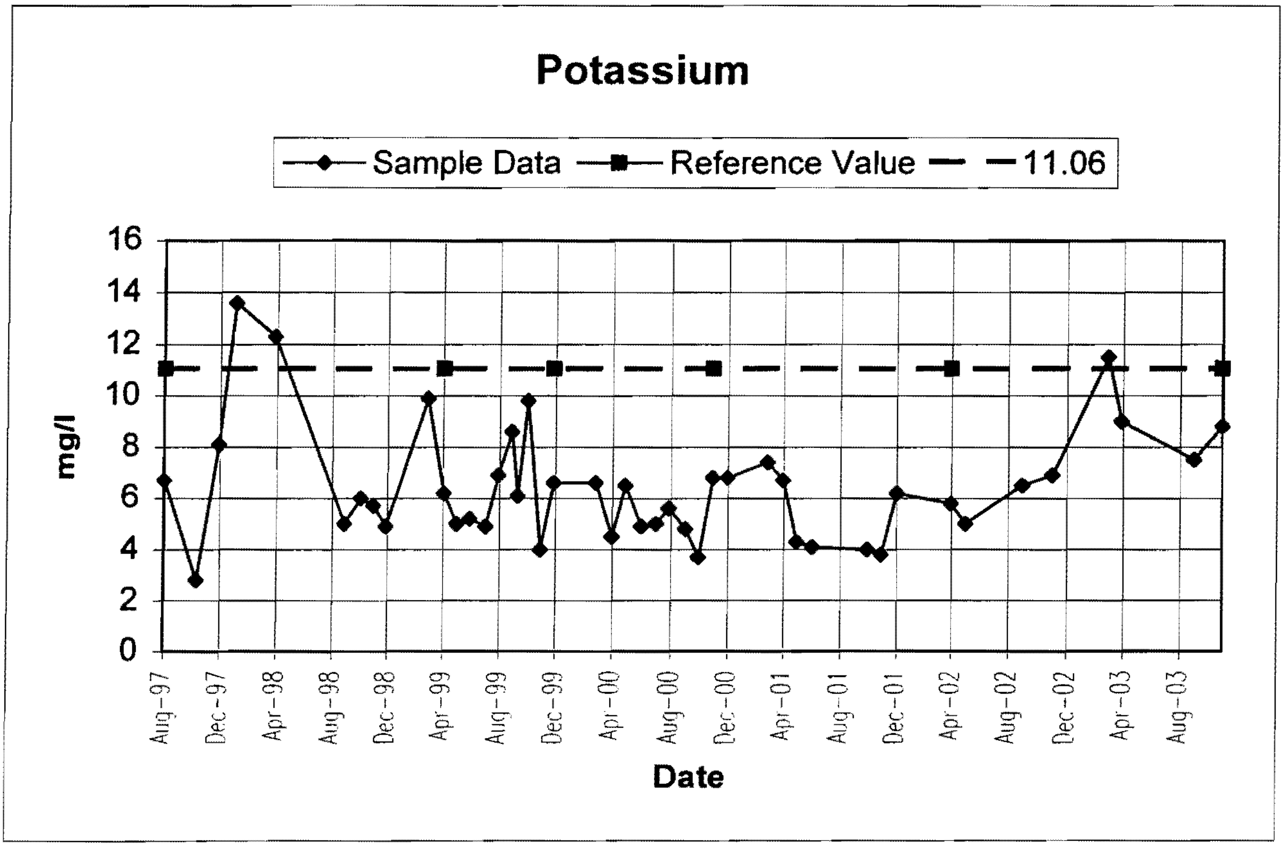
SURFACE WATER MONITORING DATA

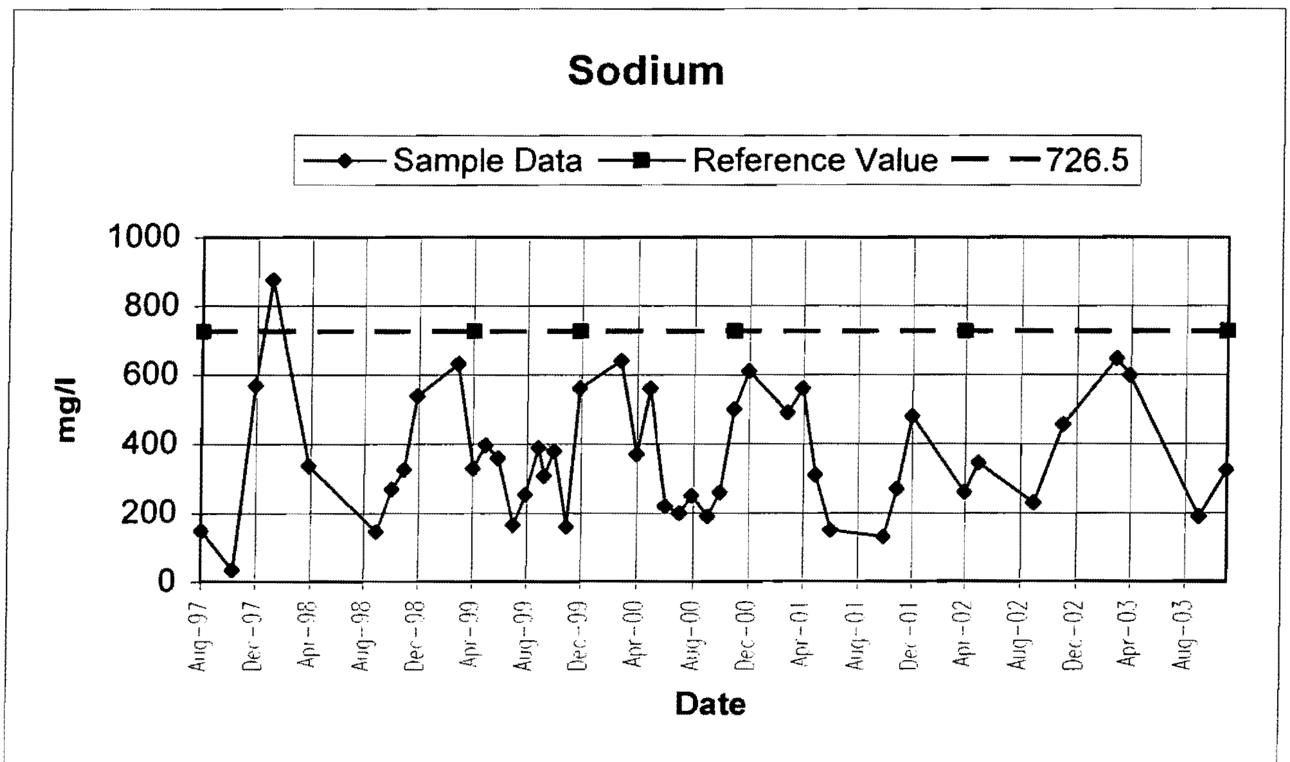




(5/04)

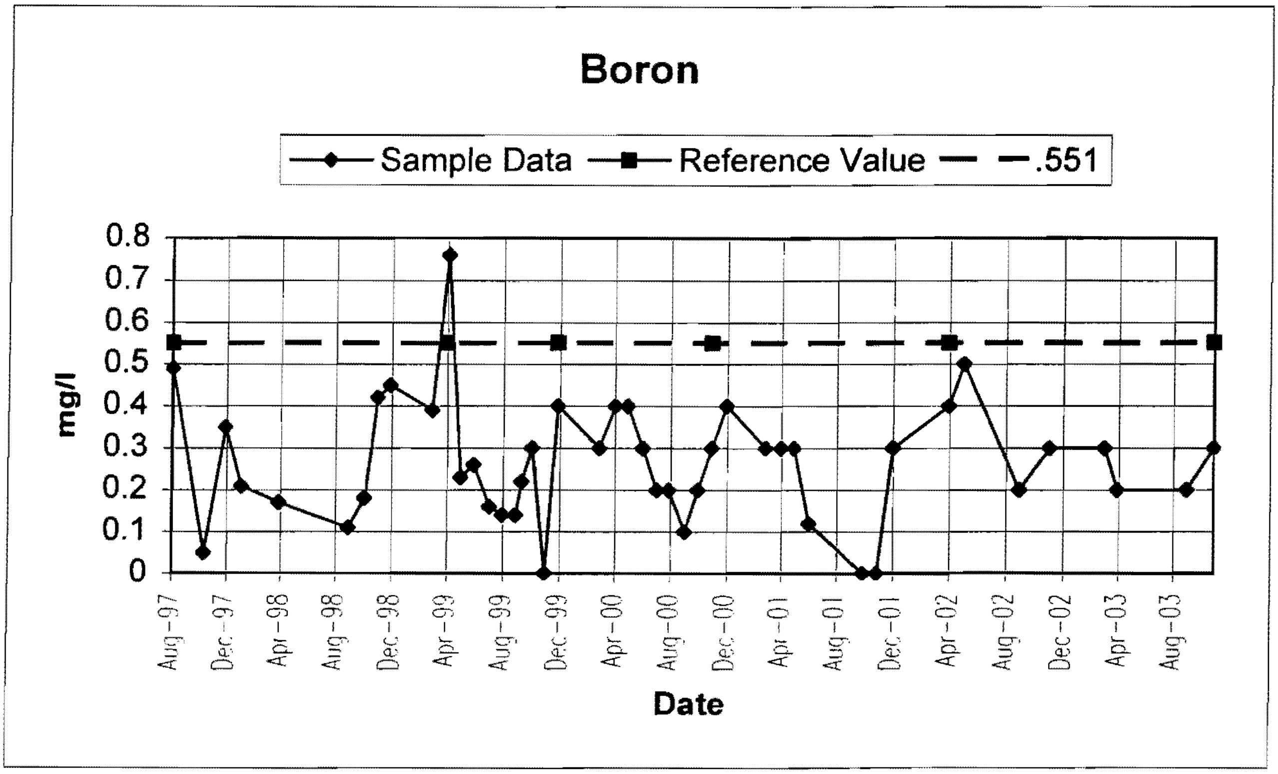
SURFACE WATER MONITORING DATA

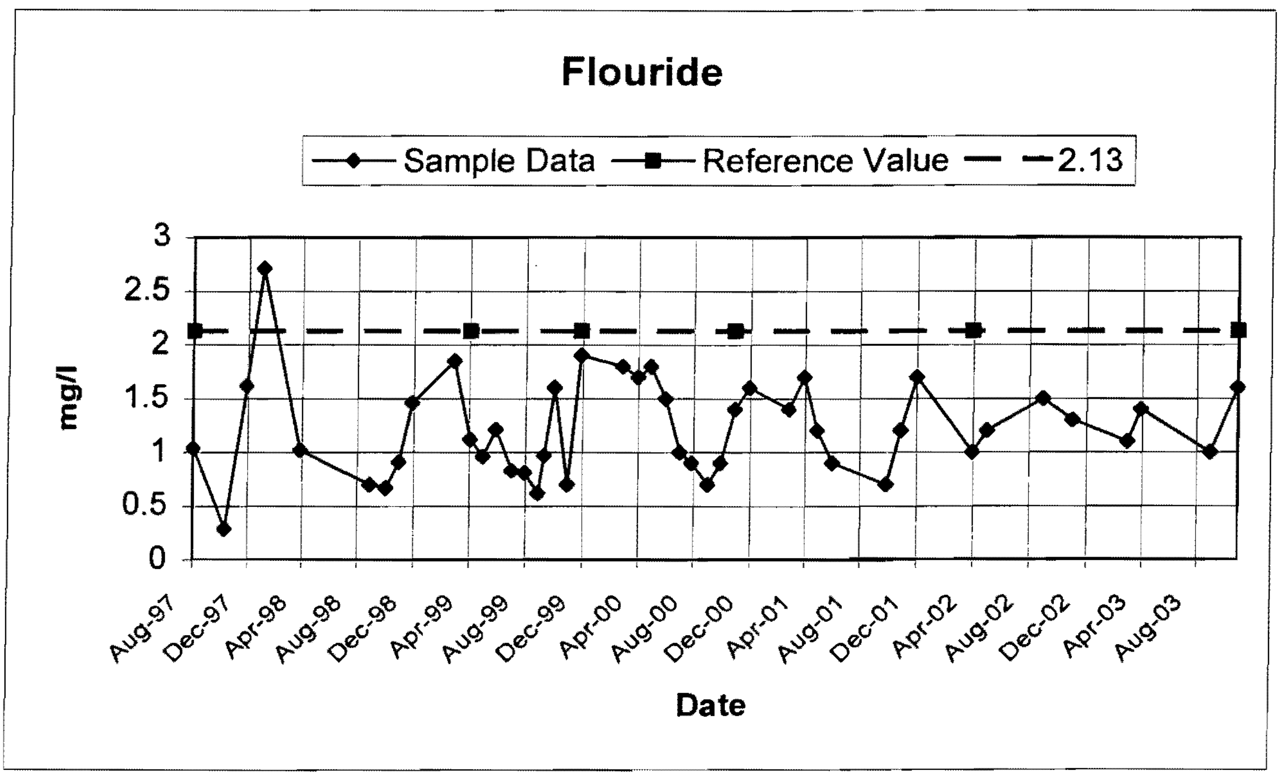




(5/04)

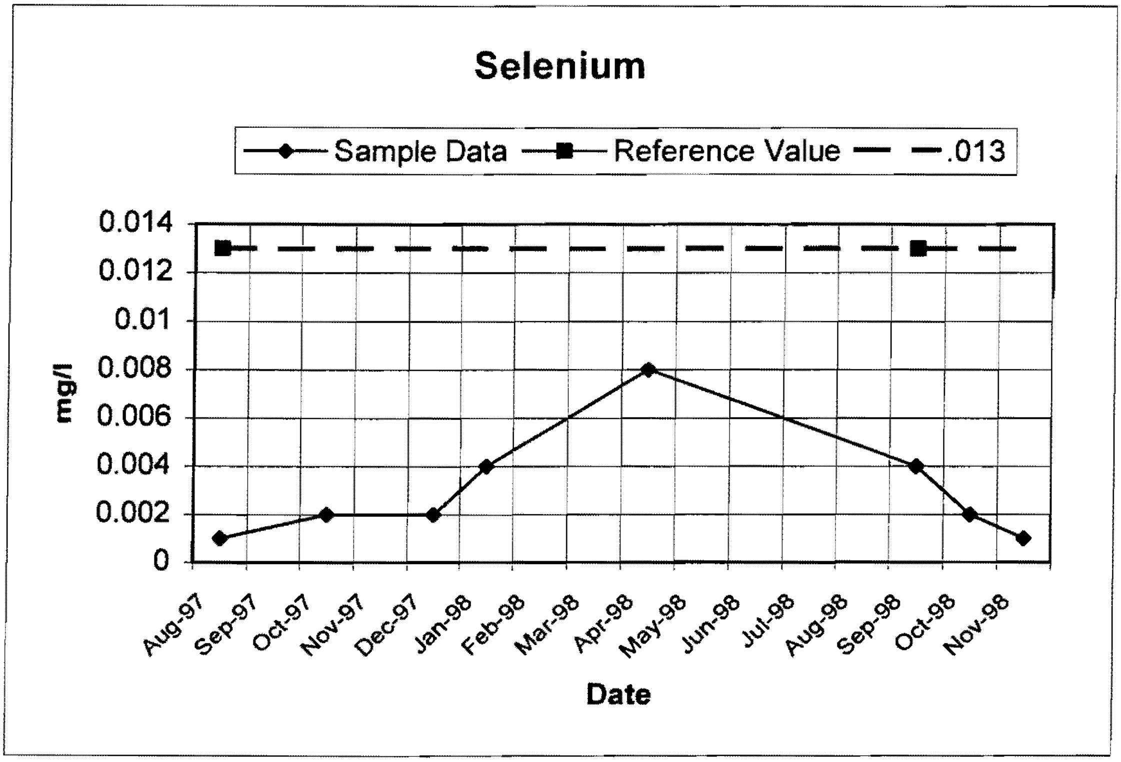
SURFACE WATER MONITORING DATA

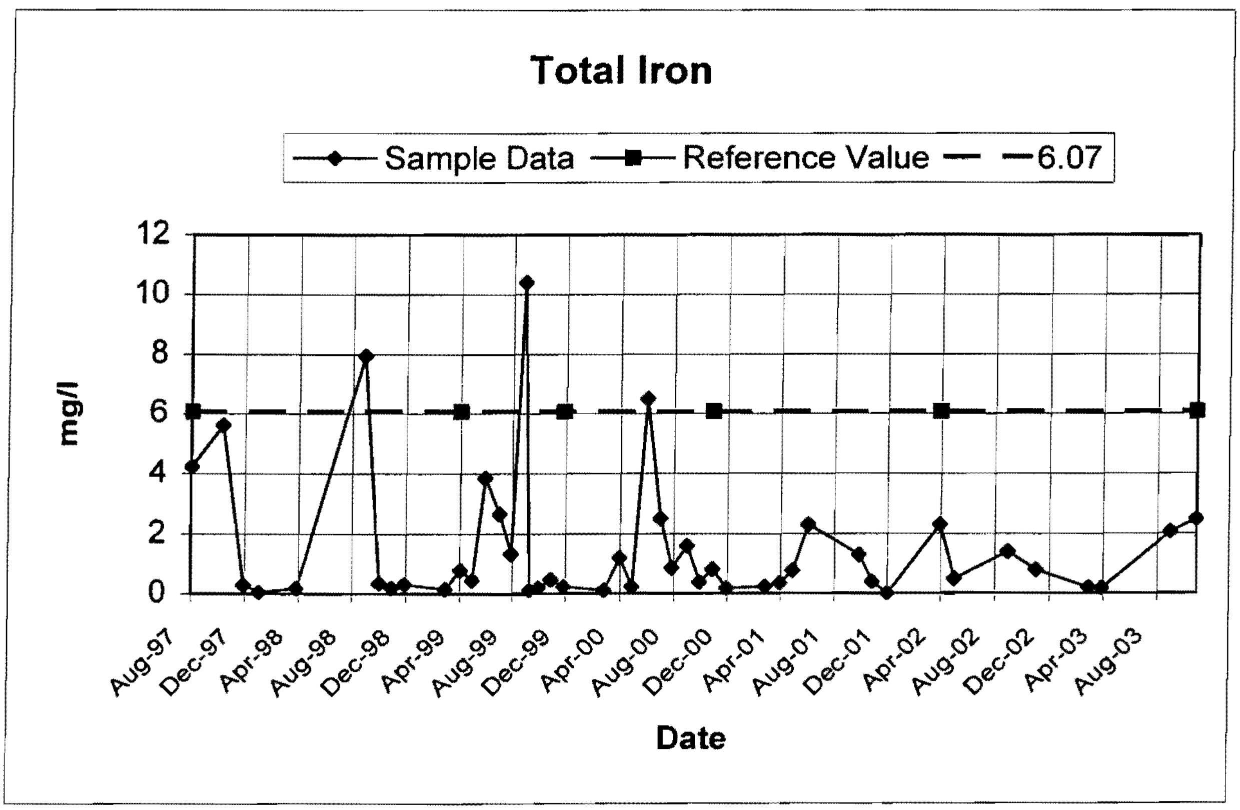




(5/04)

SURFACE WATER MONITORING DATA





(5/04)

APPENDIX 7-N

SOUTH BARBER CHANNEL PRE-MINE HYDROLOGY & SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

September-04

South Barber Channel Pre-mine Hydrology and Sedimentology

The hydrology model and drainage subdivisions are presented on Exhibit 7-3. The pre-mine channel alignment and profiles are presented on Exhibit 11-76F thru 11-76H.

LR

BHP Navajo Coal Company
Navajo Mine
PO Box 1717
Fruitland, NM 87415

Phone: 505-598-5861

General Information

Storm Information:

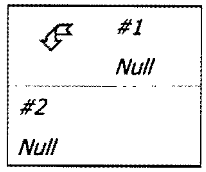
Storm Type:	NRCS Type II-60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.088	0.367	
Null	#2	==>	End	0.000	0.000	



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	8. Large gullies, diversions, and low flowing streams	2.47	37.00	1,497.00	4.71	0.088
#1	**Muskingum K:**					**0.088**

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	248.300	248.300	21.80	2.82	51.6	24,035	0.00	0.00
#2	277.900	526.200	51.15	6.54	169.6	34,473	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Structure #2:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	248.300	0.608	0.000	0.000	87.500	M	21.80	2.817
	Σ	**248.300**						**21.80**	**2.817**
#2	1	277.900	0.573	0.000	0.000	88.600	M	30.74	3.728
	Σ	**526.200**						**51.15**	**6.545**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.188	175.00	4.50	0.3890	1.0000	3	51.6	24,035	0.00	0.00
	Σ							**51.6**	**24,035**	**0.00**	**0.00**
#2	1	0.197	150.00	7.60	0.3930	1.0000	3	118.0	41,550	0.00	0.00
	Σ							**169.6**	**34,473**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	2.73	43.00	1,575.00	1.650	0.265
		8. Large gullies, diversions, and low flowing streams	2.28	128.00	5,604.20	4.530	0.343
#1	**1**	**Time of Concentration:**					**0.608**
#2	1	5. Nearly bare and untilled, and alluvial valley fans	1.30	15.00	1,152.00	1.140	0.280
		8. Large gullies, diversions, and low flowing streams	3.22	183.00	5,676.00	5.380	0.293
#2	**1**	**Time of Concentration:**					**0.573**

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	248.300	248.300	74.04	8.71	192.5	29,038	0.00	0.00
#2	277.900	526.200	166.13	19.52	598.5	40,564	0.00	0.00

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	248.300	248.300	112.78	13.03	305.2	30,686	0.00	0.00
#2	277.900	526.200	250.79	28.91	934.3	42,542	0.27	0.18

General Information

Storm Information:

Storm Type:	NRCS Type II-60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	248.300	248.300	169.53	19.35	478.5	32,242	0.29	0.20
#2	277.900	526.200	375.20	42.56	1,448.6	44,575	0.77	0.54

APPENDIX 7-O

CHACO AND PINABETE TRIBUTARIES
PRE-MINING HYDROLOGY AND SEDIMENTOLOGY

(2 YR-6 HR, 10 YR-6 HR, 25 YR-6 HR, & 100 YR-6 HR STORM EVENTS)

NOV 2004

Tributary A to the Chaco Wash

Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 7-4.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary A to Chaco

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	295.200	295.200	2.56	0.51	3.3	7,728	4.28	3.27

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	64.466%
0.0500	36.531%
0.0020	23.638%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	295.200	0.537	0.000	0.000	78.400	M	2.56	0.508
	Σ	**295.200**						**2.56**	**0.508**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.151	200.00	3.48	0.3870	1.0000	2	3.3	7,728	4.28	3.27
	Σ							**3.3**	**7,728**	**4.28**	**3.27**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.71	52.00	1,402.00	1.920	0.202
		8. Large gullies, diversions, and low flowing streams	1.21	48.00	3,979.00	3.290	0.335
#1	**1**	**Time of Concentration:**					**0.537**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	295.200	295.200	30.73	3.94	41.4	13,912	7.66	5.31

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	295.200	295.200	60.00	7.12	83.8	15,712	8.93	6.15

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	295.200	295.200	109.09	12.29	159.0	17,299	10.08	6.92

Tributary A to the Pinabete Arroyo

Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 7-4.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary A to Pinabete

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	344.500	344.500	3.78	0.85	4.4	6,274	3.02	2.31

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	83.366%
0.0500	47.241%
0.0020	30.568%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	344.500	0.928	0.000	0.000	79.700	M	3.78	0.854
	Σ	**344.500**						**3.78**	**0.854**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.155	300.00	2.52	0.3670	1.0000	2	4.4	6,274	3.02	2.31
	Σ							**4.4**	**6,274**	**3.02**	**2.31**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	1.69	45.00	2,664.00	1.290	0.573
		8. Large gullies, diversions, and low flowing streams	1.19	50.00	4,185.00	3.270	0.355
#1	**1**	**Time of Concentration:**					**0.928**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	344.500	344.500	30.83	5.38	40.4	9,517	4.82	3.50

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	344.500	344.500	57.26	9.39	78.0	10,644	5.60	4.02

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	344.500	344.500	100.20	15.80	142.8	11,614	6.28	4.50

Tributary B to the Pinabete Arroyo

Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 7-4.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary B to Pinabete

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	475.900	475.900	38.39	5.40	72.0	17,346	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	475.900	0.696	0.000	0.000	87.500	M	38.39	5.399
	Σ	**475.900**						**38.39**	**5.399**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.179	175.00	5.33	0.2460	1.0000	3	72.0	17,346	0.00	0.00
	Σ							**72.0**	**17,346**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	5.18	65.00	1,255.02	2.270	0.153
		8. Large gullies, diversions, and low flowing streams	1.13	70.00	6,219.45	3.180	0.543
#1	**1**	**Time of Concentration:**					**0.696**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	475.900	475.900	130.23	16.70	268.6	20,996	0.00	0.00

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	475.900	475.900	198.79	24.98	426.5	22,253	0.00	0.00

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	475.900	475.900	299.25	37.08	669.1	23,430	0.00	0.00

Tributary C to the Pinabete Arroyo

Pre-mine Hydrology and Sedimentology

The drainage subdivisions used to model the hydrology is presented on Exhibit 7-4.

LR

BHP Navajo Coal Company
PO Box 1717
Fruitland, NM 87416

Phone: 505-598-5861

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	2 yr - 6 hr
Rainfall Depth:	0.800 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	End	0.000	0.000	Tributary C to Pinabete

#1
Null

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	142.200	142.200	11.30	1.07	25.6	33,477	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In/Out
2.0000	100.000%
0.1000	100.000%
0.0500	100.000%
0.0020	100.000%
0.0010	0.000%

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	142.200	0.313	0.000	0.000	85.000	M	11.30	1.071
	Σ	**142.200**						**11.30**	**1.071**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.172	125.00	9.27	0.2850	1.0000	3	25.6	33,477	0.00	0.00
	Σ							**25.6**	**33,477**	**0.00**	**0.00**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.87	23.00	594.00	1.960	0.084
		8. Large gullies, diversions, and low flowing streams	2.65	107.00	4,030.13	4.880	0.229
#1	**1**	**Time of Concentration:**					**0.313**

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	10 yr - 6 hr
Rainfall Depth:	1.300 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	142.200	142.200	47.14	3.92	117.9	41,628	1.58	1.04

General Information

Storm Information:

Storm Type:	NRCS Type II - 60
Design Storm:	25 yr - 6 hr
Rainfall Depth:	1.600 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	142.200	142.200	74.18	6.12	195.0	43,508	2.14	1.42

General Information

Storm Information:

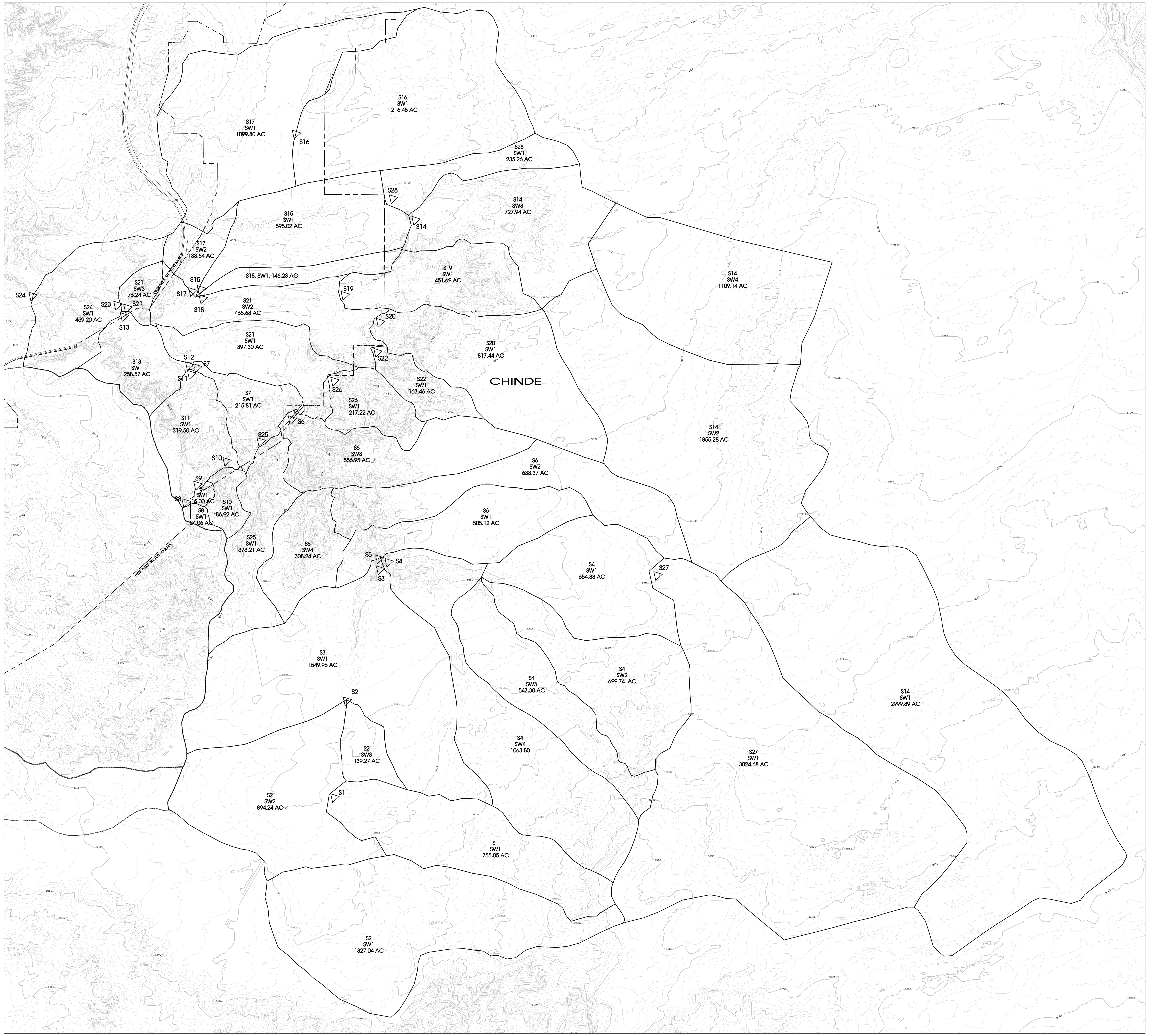
Storm Type:	NRCS Type II - 60
Design Storm:	100 yr - 6 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	PostMine-LoamySand	PreMine-LoamySand	PreMine-Badlands	LoamySand Postmining
2.0000	100.000%	100.000%	100.000%	0.000%
0.1000	26.500%	30.000%	83.500%	0.000%
0.0500	14.000%	17.000%	77.000%	0.000%
0.0020	11.000%	11.000%	56.000%	0.000%
0.0010	0.000%	0.000%	0.000%	0.000%

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1	142.200	142.200	114.87	9.42	317.2	45,429	2.71	1.82



SCALE: 1"=2000

LEGEND

- S1 STRUCTURE LOCATION AND DESIGNATION
- SW1 SUBWATERSHED DESIGNATION
- CHANNEL
- LEASE BOUNDARY

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND
NEW MEXICO
6600
REGISTERED PROFESSIONAL ENGINEER

REVISION	DATE
1 Submitted to OSM for Approval	Oct.21,99
2 Updated exhibit and submitted to OSM for Review	Oct.13,04
3	
4	
5	

PROJECT MANAGER: DEREK J. FAWSON
ENGR. of RECORD: LEONARD RAYMOND
REG. NO. 6600
SRVYR of RECORD:
REG. NO.

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

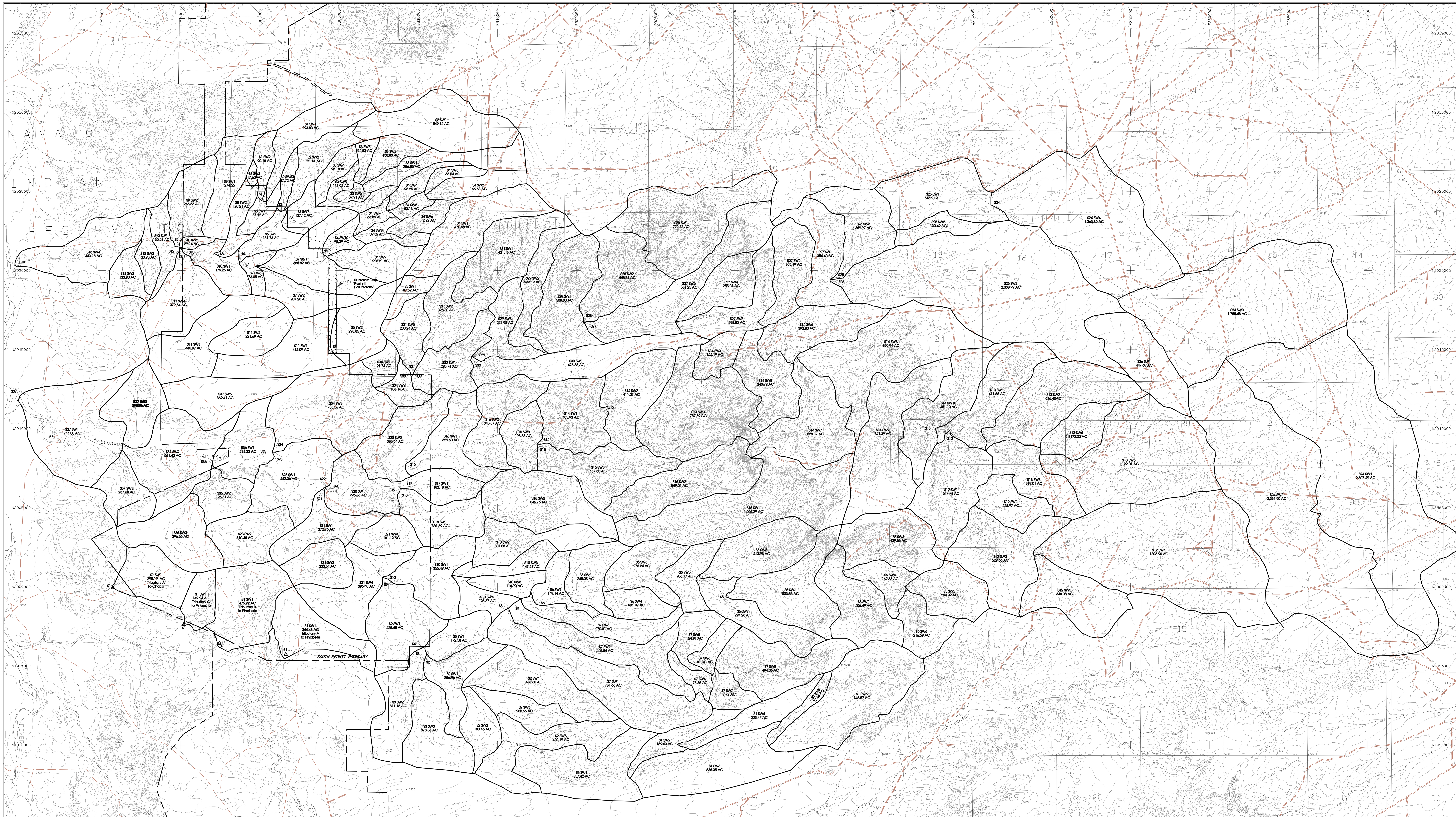
ACCOUNT: PERMITTING-N1854
DATE: SEPTEMBER 23, 1999
DESIGNED BY: KAYOUNG/LRAYMOND
DRAWN BY: GJFOSTER
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

LOCATION MAP

EXHIBIT 7-3
CHINDE ARROYO
PRE-MINING SEDCAD
DRAINAGE SUBDIVISION

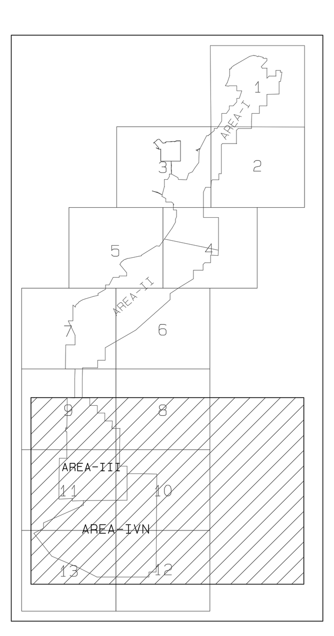
DRAWING

SHEET
OF 0



LEGEND

PAVED ROAD
DIRT ROAD
HAUL ROAD
TRAIL
BUILDING
FENCE
IRRIGATION LINE
CULVERT
DAM
DRAINAGE
RAILROAD
TREES
POWERLINE
× 5338.5 SPOT ELEVATION
INDEX CONTOUR
INTERMEDIATE CONTOUR
218 5422.45 HORIZ. & VERT. CONTROL
L-30 LEASE CORNER
PERMIT BOUNDARY



N

2000 0 2000 4000

CONTOUR INTERVAL: 10'

CERTIFICATION STATEMENT

I, KEVIN A. BAHE, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.

KEVIN A. BAHE
NEW MEXICO
17850
LICENSED PROFESSIONAL ENGINEER

Original Certified signed exhibits are maintained at the Mine Site and OSM

REV. No.	DATE	DRAFT. BY	REVISION DESCRIPTION	ENGR	E.Q.	P.E.	P.S.	CHIEF ENG.
09-A	7-12-09	PJF	ADDED IBR EASTSIDE OF LOWE PIT AND SUBMITTED TO OSM FOR REVIEW.	Shawn Smith	YB	KAB		
B	11-15-04	PJF	ADDED TRIBUTARIES TO CHACO, PINABETE AND SUBMITTED TO OSM FOR REVIEW	LR	MC	LR		
A	5-10-01	PJF	UPDATE PERMIT EXHIBIT AND SUBMITTED TO OSM FOR REVIEW AND APPROVAL	LR	MC	LR		

APPROVALS

EXHIBIT 7-4

BHP NAVAJO COAL COMPANY

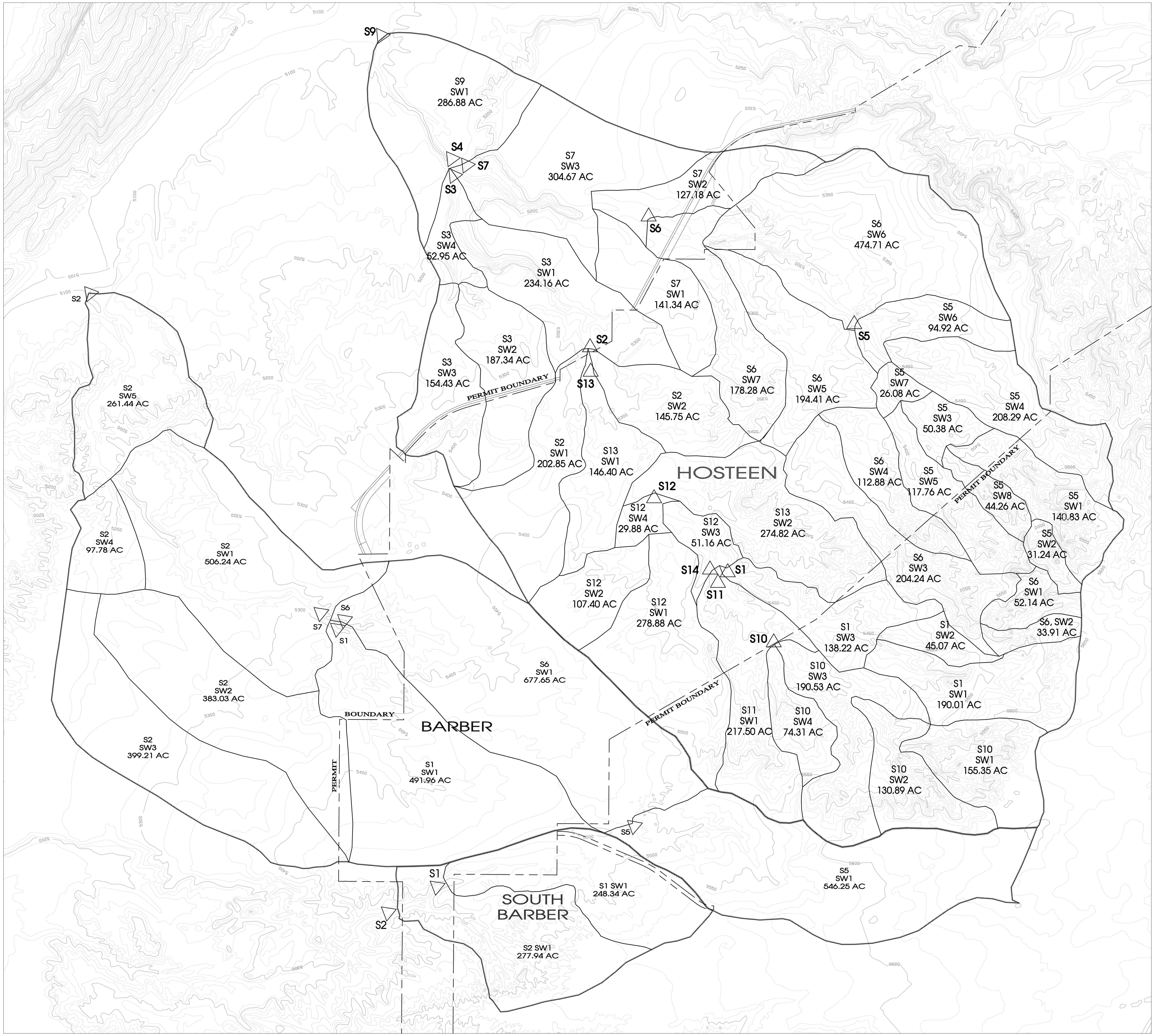
NAVAJO MINE
SAFETY PAYS

P.O. BOX 1717 FRUITLAND, NEW MEXICO 87416

LOWE, COTTONWOOD AND PINABETE ARROYO PRE-MINING SEDCAD DRAINAGE SUBDIVISIONS

PREPARED BY AAY/LR	DRAWN BY PJFOSTER	SCALE 1" = 2000'
APPROVED BY AAY/LR	DATE APRIL 27, 2001	

G: \Gs\OSM_SUBM\PER_PROG\Ch_07-SURFACE WATER MONITORING\EXH 7-4_PER-MINE_ DATA.pro



SCALE: 1"=2000

LEGEND

△ S1	STRUCTURE LOCATION AND DESIGNATION
SW1	SUBWATERSHED DESIGNATION
———	CHANNEL
— — —	LEASE BOUNDARY

NOTES :

1. THIS EXHIBIT SUPERCEDES EXHIBIT 7-4A FOR ONLY THE DATA RELATED TO THE HOSTEEN, BARBER AND SOUTH BARBER WATERSHEDS.

CERTIFICATION STATEMENT

I, Leonard Raymond, hereby certify that this drawing was reviewed by me and that the information shown is accurate and complete to the best of my knowledge.

LEONARD RAYMOND NEW MEXICO 6600 REGISTERED PROFESSIONAL ENGINEER

REVISION	DATE
1 Submitted to OSM for Approval	Oct.21.99
2 Updated exhibit and submitted to	Oct.13.04
3 OSM for Review.	
4	
5	

PROJECT MANAGER: DEREK J. RAWSON
ENGR. of RECORD: LEONARD RAYMOND
REG. NO: 6600
SRVYR of RECORD:
REG. NO:

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PERMITTING-N185A
DATE: SEPTEMBER 23, 1999
DESIGNED BY: AAYOUNG/LRAYMOND
DRAWN BY: PJFOSTER
CHECKED BY: LEONARD RAYMOND
APPROVED BY: LEONARD RAYMOND

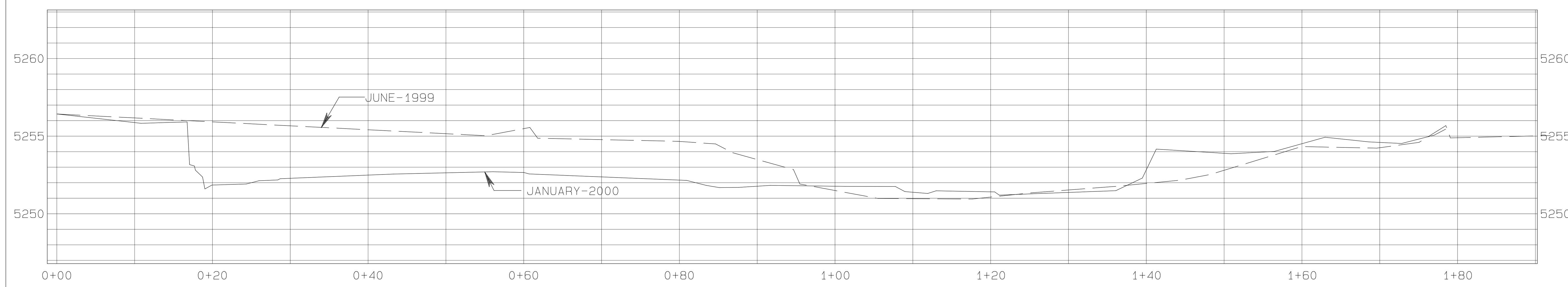
LOCATION MAP

EXHIBIT 7-4C HOSTEEN, BARBER AND SOUTH BARBER PRE-MINING SEDCAD DRAINAGE SUBDIVISION

DRAWING

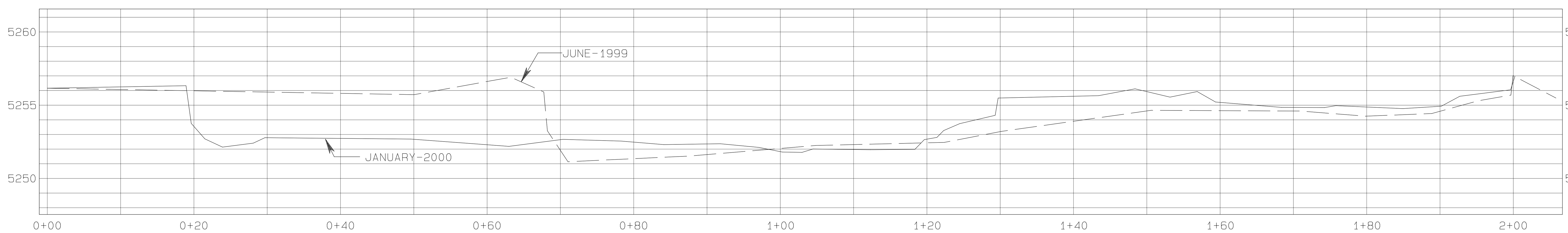
SHEET OF 0

Project Desc.: Path: \\ENCNMCFMN-SRV02\Data\Departments\Gs\OSM_SUBM\PER_PROG\Ch_07-SURFACE WATER MONITORING\A2 FSC 2004\EXH 7-3_4C.pro Plot time: Tue Feb 13 10:16:47 2007



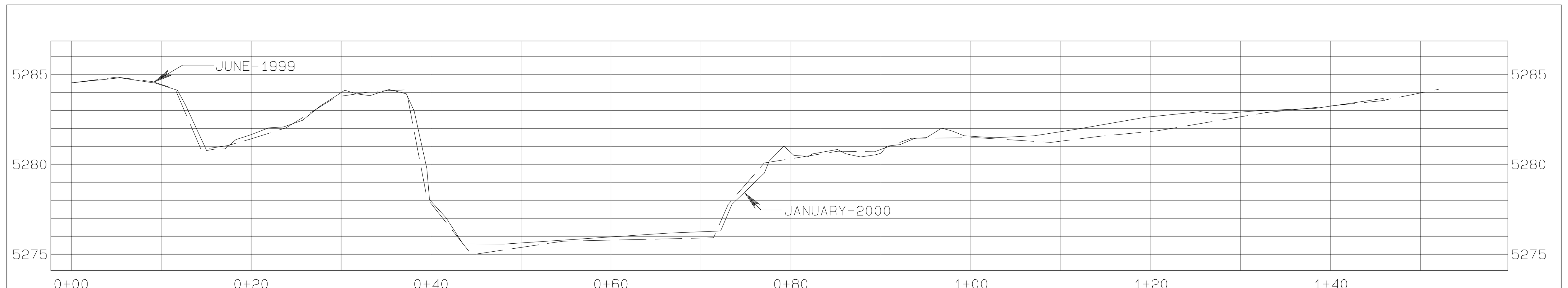
SURFACE WATER STATION CNS-1 SECTION 2 AND 2A

68 FT DOWNSTREAM FROM SECTION 3 AND 3A

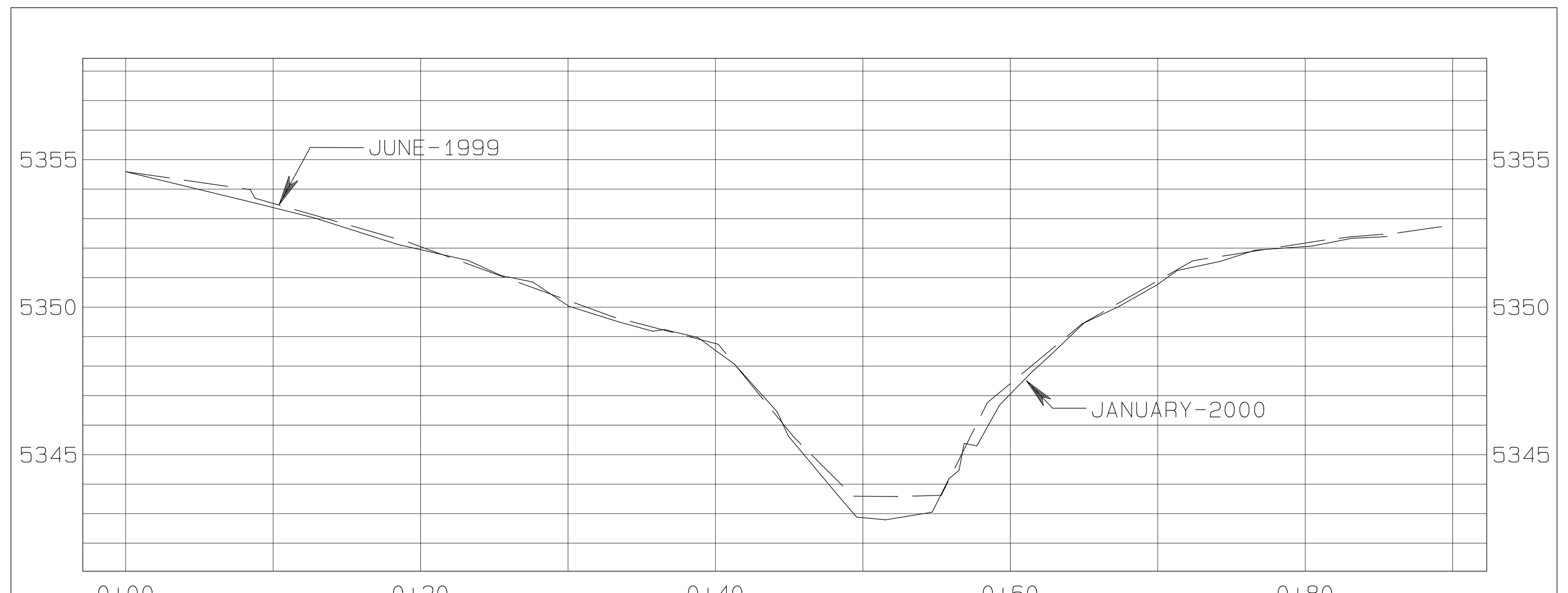


SURFACE WATER STATION CNS-1 SECTION 3 AND 3A

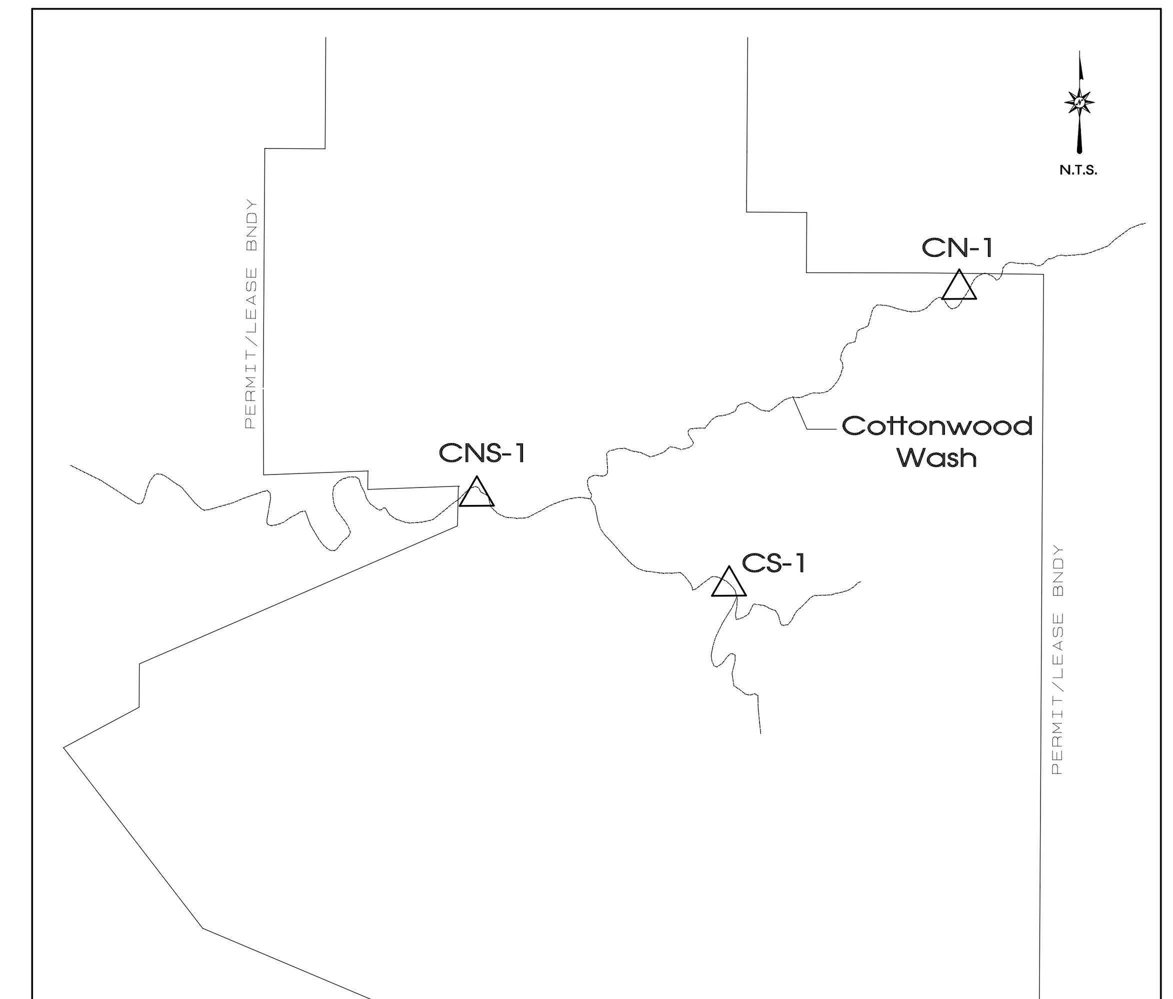
68 FT UPSTREAM FROM SECTION 2 AND 2A



SURFACE WATER STATION CS-1

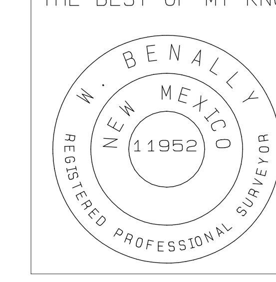


SURFACE WATER STATION CN-1



SURFACE WATER STATION
LOCATION MAP

I, W. BENALLY, HEREBY CERTIFY THAT THE INFORMATION DISPLAYED ON THIS DRAWING EXHIBIT 7-6, IS COMPLETE AND ACCURATE TO THE BEST OF MY KNOWLEDGE.



REV NO.	DESCRIPTION	BY	DATE
1	SUBMITTED TO OSM	PJF	2-29-00
2			
3			
4			
5			

PROJECT MANAGER: CORY NELSON
ENGR. of RECORD: ANDY YOUNG
REG. NO.
SRVYR of RECORD: W. BENALLY
REG. NO. 11952

BHP-NAVAJO COAL CO.
NAVAJO MINE
PO BOX 1717, FRUITLAND, NEW MEXICO, 87416

ACCOUNT: PERMITTING-N1B5A
DATE: JAN. 17, 2000
DESIGNED BY: AAYOUNG
DRAWN BY: DJESTER
CHECKED BY: AAYOUNG
APPROVED BY: AAYOUNG

SURFACE WATER MONITORING
STATIONS CN-1, CS-1, CNS-1
JUNE 1999 AND JANUARY 2000
SURFACES

EXHIBIT 7-6
CROSS-SECTIONS
COTTONWOOD WASH

DRAWING

SHEET
OF 0