CHAPTER VI

HYDROLOGY

VOLUME 2

Chapter VI HYDROLOGY

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6.1 Introduction

This section presents the general hydrologic setting of the permit area. It is based upon information contained in permit applications for the adjacent Sunnyside and South Lease areas, U.S. Steel Corporation mining records, publications for the permit and adjacent areas, and on-site investigations. The objective of this section is to provide sufficient hydrologic information to support the maintenance and reclamation plans for the present Horse Canyon facilities. The hydrologic information will also be used to support the runoff control plans for maintenance and reclamation and water monitoring plan development.

Detailed hydrologic information, which is normally presented for a proposed mining operation such as baseline quality and quantity information, ground water resource determinations of aquifer extent and characteristics will not be presented. Due to the limited scope of the proposed maintenance and reclamation plans, the above described areas will be addressed only as they are related to the maintenance and reclamation of the existing surface facilities.

6.2 Groundwater Information

This section addresses the concerns of UMC 783.15 and presents a brief overview of the regional and permit area ground water resources.

6.2.1 Regional Groundwater Resources

In the deeply incised mountainous areas of the Book Cliffs groundwater is present in consolidated bedrock, in both a regional aquifer and isolated perched aquifers. Associated with the bedrock aquifers is groundwater within fractures. Minor amounts of groundwater is found in shallow alluvial deposits at the bottom of the larger drainages.

Recharge rates were calculated by Waddell and others (1986, p. 43) for an area in the Book Cliffs near Soldier Creek Coal Mine (T.12 S., R.13 E.). Waddell estimated recharge at about 9 percent of annual precipitation. Lines and others (1984) indicates the mean annual precipitation along the Book Cliffs, in the area of the Horse Canyon Mine, is about 12 inches, indicating a recharge rate of just over one inch per year.

As described in Chapter V, the regional structure of the Book Cliffs results in the strata dipping generally to the east. Waddell and others (1986, p. 41) found that the regional flow in the Book Cliffs, near the Soldier Canyon Mine, was in the same direction as the structural dip. Although unconfirmed locally, it is believed that the groundwater flow direction in the regional aquifer follows the structural dip in the Horse Canyon section of the Book Cliffs. Another dominant control of groundwater flow direction and magnitude is fractures, which are caused by faulting and other structural forces.

In the Book Cliffs, the stratigraphy consists of, from oldest to youngest, the Mancos Shale, Blackhawk Formation, Castlegate Sandstone, Price River Formation, North Horn/Flagstaff Formation, and Colton Formation (or Wasatch Formation). Evaluations by JBR (1986) in the Sunnyside and Horse Canyon areas, indicate that the most probable water bearing formations are the upper Price River and the Flagstaff and North Horn undifferentiated. Waddell and others (1986) found that the water levels in the North Horn Formation in the Book Cliffs were generally several hundred feet above the regional aquifer potentiometric surface found in the Blackhawk Formation. These North Horn Formation aquifers are considered to be perched.

6.2.2 Permit Area Groundwater Resources

Ground water resources in the permit area are limited. This is due to the small surface area and low recharge rates. There is not enough base flow from ground water discharge to maintain a perennial flow in Horse Canyon Creek.

The local recharge and discharge areas for perched aquifers (North Horn Formation and stratigraphically above) generally lie within the drainage divide of Horse and Lila canyons. These local systems are complex and highly dependent on topography. The regional aquifer (Castlegate and Blackhawk formations) probably has a groundwater divide which lies somewhat west of the drainage divide between Horse Canyon drainage and Range Creek drainage, and between Lila Canyon drainage and Little Park drainage.

The perched aquifers are generally fluvial sandstone bodies or thin fractured limestone beds of limited lateral extent encased in shale and marlstone. The aquifers have a strong tendency toward anisotropism and heterogeneity. From drilling experience, the North Horn Formation also contains swelling shale (bentonite) which tend to heal fractures.

The regional aquifer consists of interbedded sandstone and shale. The aquifer is laterally continuous as a unit but some of the individual sandstone bodies are discontinuous. The aquifer is anisotropic and moderately heterogeneous. The hydraulic conductivity of the aquifer is believed to be about 0.01 to 0.02 feet per day, similar to values reported by Lines (1985) from the Wasatch Plateau for similar lithologies. Waddell and others (1983) reported a gradient in the regional aquifer of 42 ft/mile in the area of Soldier Creek (to the northwest). Structural dip in the Soldier Creek area is about 6 to 7 degrees. Gradient of the regional aquifer in the Horse Canyon area is probably less than

2 degrees. The Sunnyside coal bed lies within the regional aquifer. The base of the regional aquifer is at the contact with the Mancos Shale, a relatively impermeable massive shale.

Aerially small, alluvium aquifers contain a small amount of groundwater in the area. Two wells are located within the alluvium of lower Horse Canyon Creek. The location of these wells is shown on Plate VI-1.

Lines and Plantz (1981, p. 33) conducted three seepage surveys of Horse Canyon Creek in 1978 and 1979. The results of the surveys show no consistent trends through time. Mine discharges create difficulties in interpretation of the data because there is no indication of whether the mine was or was not discharging water at the time of the surveys.

JBR (1986) conducted a spring and seep inventory during the fall of 1985 of the Horse Canyon area. During the study no springs or seeps were located within the disturbed area, near the surface facilities. Within and adjacent to the permit area, 19 springs and seeps were found. Flows occurred from either sandstone beds located over shales or from alluvium located within or adjacent to stream channels where bedrock limits the extent of the alluvium. The flow rates from the springs varied from less than 1 gpm to about 10 gpm. Appendix VI-1 presents the water quality data collected from the springs sampled. Table 6.2.2-1 presents the flow rates and the field data collected for each site. The locations of the seeps and springs area shown on Plate VI-1.

Table 6.2.2-1. 1985 Spring and Seep Survey Results

Spring ID	Temp. (°C)	pH	Conduct. (umhos)	Flow (gpm)	Occurrence	Use	Sampled
H-1	7	8.1	950	2	SS over shale	wildlife	yes
H-2	10	8.0	1111	2	Colluvium	wildlife	no
H-3	-	-	-	<<1	Alluvium	wildlife	no
H-4	9	7.7	1229	1	Colluvium	wildlife	no
H-5	10.5	7.7	1359	1	Alluvium	wildlife	no
H-6	9	7.9	1366	10	SS over shale	cattle	yes
H-7	9.5	7.6	1985	<1	SS formation	cattle	no
H-8	12	7.3	1997	<1	SS formation	wildlife	no
H-9	11	7.7	1919	2	Alluvial gravels	cattle	no
H-10	11	7.9	2150	1	Alluvial gravels	cattle	no
H-11	9.5	7.8	1227	2.5	Alluvium	cattle	no
H-13	11	7.1	1596	4.5	Colluvium	cattle	no
H-14	7	7.5	2040	2	SS over shale	cattle	no
H-18	7	7.9	1381	9	Alluvium	wildlife	yes
H-19	6	8.2	645	3.5	SS over shale	developed	no
H-20	14	8.3	777	2.5	SS over shale	none	no
H-21	14	8.3	968	6	SS over shale	wildlife	yes
H-22	5	8.3	322	1	SS over shale	none	no
H-92	-	-	-	<<<1	SS over shale	none	no

Based on the data, nine of the springs occurred from alluvial deposits in the stream channels or in colluvium. Nine of the remaining springs discharge from sandstone located above less permeable shale. Spring (H-92) was developed by excavating into bedrock. The discharge is through a pipe.

No springs on Plate VI-1 occur below the Price River Formation nor above the North Horn Formation. The fact that no springs occur in the Castlegate Sandstone or stratigraphically below indicates these lower formations may be recharged by streams which flow over them. This also indicates the groundwater flow direction is similar to the structural dip direction in the regional aquifer.

Field conductivity of the springs (Table 6.2.2-1.) indicates that generally the springs which are stratigraphically highest in the section have the lowest conductivity, indicating they discharge from local flow systems.

Mining in the Horse Canyon area began in the late 1930's. Detailed hydrologic information was first gathered in the late 1970's. It is impossible to precisely describe the areas pre-mining hydrology. The conditions represented by these data help to define the hydrology about the time SMCRA was passed.

Monitoring of the groundwater resources will be limited to springs in the area. Present monitoring of spring RS-2 is done on a monthly basis. Several years of data has been gathered at the site. Kaiser conducted a spring and seep survey in 1985 when the proposed permit area was somewhat smaller than presently proposed. Kaiser will conduct a spring and seep survey on any additional areas in or around the new proposed permit area should the Division deem it necessary after reviewing the new proposed permit area. After the Division's review and, if necessary, after any additional areas are surveyed for springs and seeps, Kaiser will propose a revised post-mining monitoring plan.

During this review process, all of the present monitoring stations will continue to be sampled and monitored in accordance with the Division's guidelines.

6.2.2.1 Groundwater Encountered in the Mine

According to mining records of U.S. Steel (previous owner), groundwater was monitored within the mine in several locations (Plate II-2). Appendix VI presents the data from the sampling of these underground locations. Generally, the underground flows which issue from rock slopes and gob areas were small. Only when the mine intercepted the Sunnyside Fault was significant water encountered. The mine pumped water from the workings prior to suspending operations. The water was pumped for use in the water supply system for the mine and to keep some of the workings near the Sunnyside Fault from flooding.

The rate of in-flow into the mine is not precisely known. In U.S. Steel's PAP (1983) they estimated the average discharge from the mine to be 0.2 cfs. Lines and Plantz (1981, p. 32) also estimated the discharge from the mine at 0.2 cfs and mentioned that the discharge was intermittent. It is not known however if this represents a constant average flow or the average flow rate during discharge periods. The mine was using an unknown volume of water from the mine for dust suppression and other operational needs.

Figure 6.6.1-2 is a graph of the flow from four mine in-flow monitoring points. The flow is very consistent, with a few unexplainable fluctuations. The graph is only representative of the variations in rate of in-flow into the mine, not in total volume of in-flow. The lack of annual variations indicates the

PAP (p. 2) they state that the rate of mine discharge through pumping showed little variation through the year. It appears that any initial high flow rates due to de-watering the fault zone had passed by 1978. Flows in the late 1970's and early 1980's most likely represents the "steady state" discharge of the regional aquifer into the fault zone and hence into the mine.

In 1986 Kaiser re-entered the mine. They found that at the intersection of the Main Slope and 3rd level, at the rotary car dump, there was water in the bottom of the dump. The water level in the dump was described as "about 30 feet below the floor" (personnel communication, 1990). Monitoring site 2 Dip is very near this location and is at an elevation of 5827 feet (see Plate II-2), putting the water level in the rotary dump at about 5800 feet. No other water levels were obtained during 1986. This water level is probably representative of the potentiometric surface in the rest of the mine. Sample site 2 Dip was a sump and never had a record of flow. Since the water level in the mine in September 1982 (last sampling of 2 Dip) must have been near the elevation (5827 feet) of 2 Dip sample site and the 1986 level is also very near this elevation (perhaps below it), it appears as though the water level in the mine has change little since operations ceased.

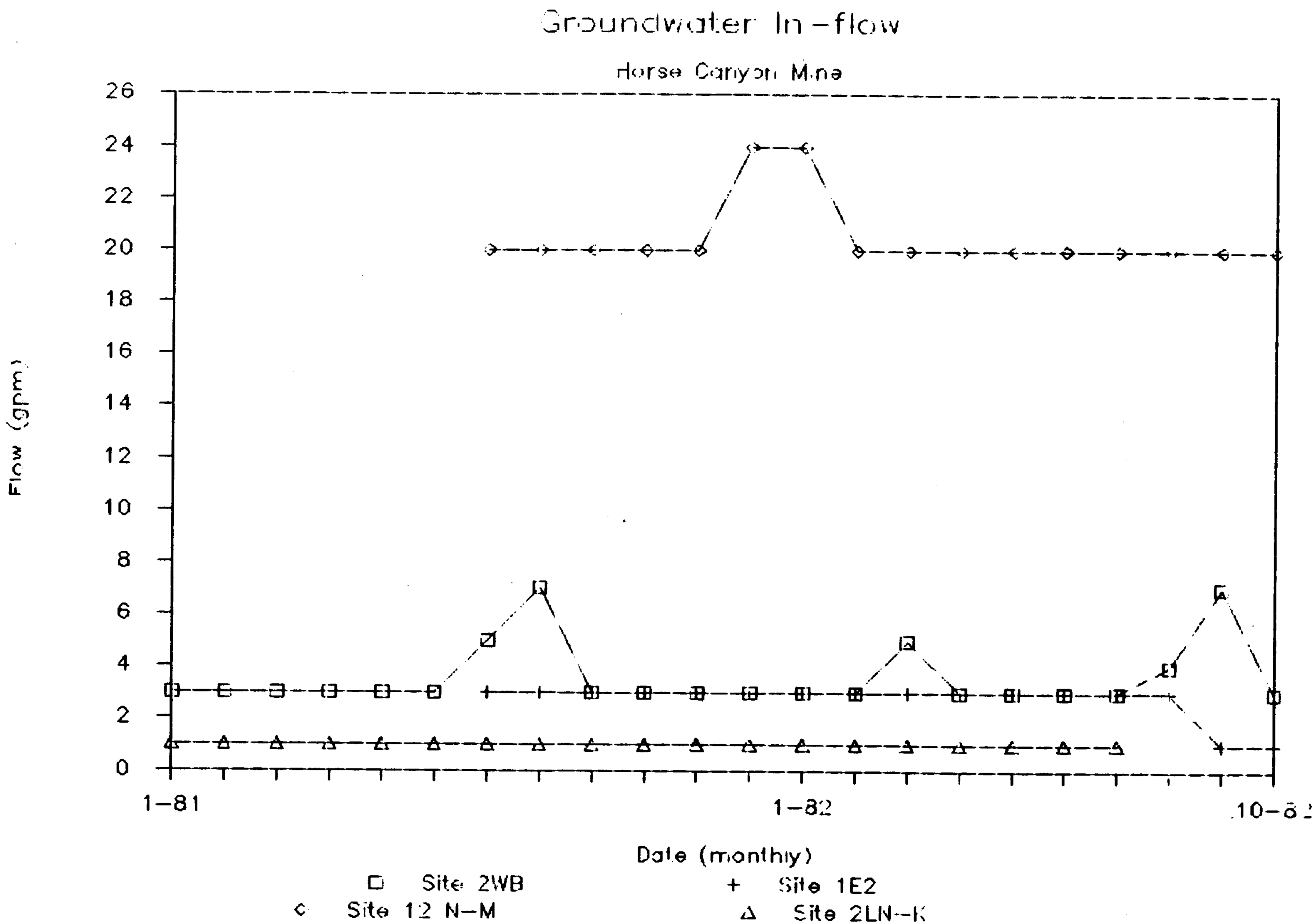

Figure 6.6.1-2 Groundwater In-flow.

6.3 Surface Water Information

This section addresses the general concerns of UMC 783.16 and provides a general description of the regional and permit area surface water resources.

6.3.1 Regional Surface Water Resources

Surface waters in this part of the Book Cliffs drain to the Price River. The Price River flows to the Green River which, in turn, flows to the Colorado River.

Generally, within the Book Cliffs, the regional drainage patterns are north-south with steep canyons which are incised in the Book Cliffs escarpment. Stream flows within the region, generally, are the result of snowmelt runoff or summer thunder storms. Perennial and intermittent streams along the Book Cliffs flow as a result of baseflow contribution from springs and seeps from the consolidated bedrock and/or from alluvial deposits in areas where the alluvium thins, due to areas confined by bedrock.

6.3.2 Permit Area Surface Water Resources

Within the permit area, the surface water resources consist of two main drainages: Horse Canyon Creek, an intermittent stream, and Lila Canyon Creek, an ephemeral drainage. These two drainage flow to Icelander Wash which, in turn, flows to Grassy Trail Creek and the Price River. Plate VI-1 shows the Horse Canyon Creek drainage boundary.

Generally, Horse Canyon and Lila Canyon Creeks flow during the spring snowmelt runoff period and also as a result of isolated summer thunder storms. Due to the limited drainage area and elevation of Lila Canyon, the duration of the snowmelt flows is quite short and is limited to the very early spring. Flows in Horse Canyon, generally, are limited to the early spring period (Lines and Plantz, 1981). By late spring to early summer, usually, no flow is evident in Horse Canyon Creek.

During most years, the snowmelt peak is the highest peak flow for the drainages. Under certain circumstances, when a significant summer thunder storm occurs over the drainages, the runoff event can be quite large.

U.S. Steel conducted water quality monitoring of the Horse Canyon drainage. These monitoring efforts were conducted prior to the development of the DOGM's present Water Monitoring Guidelines and as a result the data is quite limited. The results of these water monitoring efforts are presented in Appendix VI-1.

6.4 Alternative Water Supplies

The State of Utah's Water Rights files were searched for rights occurring in the permit area and adjacent to it for a distance of one mile. Plate VI-1 shows the locations of these water rights and Table 6.4-1 details the water rights information. Kaiser Coal owns the right to underground and surface flow in the permit area totaling 1.3 cfs.

Table 6.4-1 Water Rights

Map Reference Number	Water Right Number	Owner	Use
1	91-557	Floyd Hawkins	Stockwatering
2	91-2616	BLM	Stockwatering
3	91-185	Minerals Dev. Corp.	Domestic/Ind.
4	91-2615	BLM	Stockwatering
5	91-617	Mont Blackburn	Stockwatering
6	91-148	Kaiser Coal Corp.	Industrial
6	91-149	Kaiser Coal Corp.	Industrial
6	91-150	Kaiser Coal Corp.	Industrial
7	91-183	Kaiser Coal Corp.	Industrial

Water Right No. 91-185 is an abandoned well within the permit area. Sediment pond failure, reclamation slope failure, or any unforeseen results of the Plan will not have an impact on this right. The other four rights not in Kaiser's name are located upstream of the permit area. As discussed in Chapter V, any subsidence effects (and related change in water regime) would most likely have already occurred. Therefore, there is little potential for adverse effect to any water resources or water rights in the area. Kaiser has identified the alternative water supplies as the rights listed in the name of Kaiser Coal.

6.5 Diversion Designs

This section addresses regulations UMC 817.43 &.44 of the Utah State Program. Diversions will be used for both disturbed and undisturbed areas. The clear water diversions, consisting of a combination of berms, ditches and culverts, will be used to divert and convey clear water or undisturbed drainage runoff around and through the disturbed area. The disturbed area diversions, consisting mainly of berms, will be used to contain and convey the disturbed area runoff and any undisturbed area runoff which cannot be diverted to the sedimentation control structures. During reclamation, some of the diversions will remain as permanent structures. New berms will be constructed to convey reclaimed area runoff to silt fences during the reclamation phase and several culverts will be removed.

6.5.1 Maintenance Plan

Diversions were designed based on the 10 year - 24 hour rainfall runoff peak flow. These peaks were determined by use of the Storm Hydrograph Program developed by Hawkins and Marshall (1980). The diversion channels were sized using one of the following methods: symmetric trapezoidal and triangular channels were sized using a hand calculator program developed by Croley (1977); asymmetric triangular and trapezoidal channels were sized using a Uintex basic computer code. Both methods are based on

Manning's equation and use Newton's iteration scheme to solve for flow depth. Channel depths were determined based upon the depth at the reach with the gentlest slope; velocities were determined based upon the reach with the steepest slope.

Plates VI-1 through 3 show the drainage boundaries associated with the present mine site. The locations of the diversions and typical cross sections for the Maintenance Plan are presented on Plates VI-3 A-F.

Peak flows for the maintenance drainages are presented in Table 6.5.1-1. The drainage number identification in these tables are shown on Plates VI-2 A,B and on Plates VI-3 A-F. Calculations for these peak flow values are presented in Appendix VI-2. Data for the inputs to the Storm Hydrograph program were taken from the largest scale map which covered the entire drainage area in question. Curve number values were based on the soils and cover information presented in Chapters VII and VIII for the permit area and on SCS data for the larger drainages extending outside the permit area.

Table 6.5.1-1. Maintenance Plan Design Peak Flows

Drainage ID	Drainage Area (ac)	Peak Flow (cfs)	Design Storm
No. 1	7800.00	1154.70	50-year
No. 2	102.80	31.82	10-year
No. 3	53.30	20.23	10-year
No. 4	5.70	2.48	10-year
No. 5	4.95	2.10	10-year
No. 6	5.94	2.55	10-year
No. 7	4.48	1.85	10-year
No. 8	4.70	1.99	10-year
No. 9	17.03	7.11	10-year
No. 10	4.19	1.83	10-year
No. 11	5.20	2.29	10-year
No. 12	1.52	0.67	10-year
No. 13	69.20	27.41	10-year
No. 14	0.57	0.22	10-year
No. 15	2.50	2.01	10-year
No. 16	3.20	1.72	10-year
No. 17	2.40	1.36	10-year
No. 18	4.74	3.54	10-year
No. 18	4.74	4.81	25-year
No. 19	3.70	3.54	10-year
No. 19	3.70	4.60	25-year
No. 20	4.31	1.80	10-year
No. 21*	24.82	15.56	10-year
No. 21*	24.82	21.81	25-year
No. 22	0.35	0.36	10-year
No. 23	1.13	0.68	10-year
No. 24**	8.47	6.86	25-year
No. 25	1.20	1.17	10-year
No. 26	1.33	1.52	25-year
No. 27	2.50	1.87	10-year
No. 27	2.50	2.55	25-year
No. 28	0.88	1.12	25-year
No. 30	14.70	8.89	10-year
No. 31	8.60	7.95	10-year

*This area includes area 20 also.
**This area includes area 23 also.

Peak flows were not calculted for Drainage 29. This area will be treated with a hay bale structure, as total runoff is only 0.04 acre-feet.

Several diversions are already in-place and would only need minor upgrading and/or maintenance to meet the DOGM requirements. These include clear water diversions 2, 5, 6, 10, 21, 23, and 27. The diversions to be upgraded or constructed during the maintenance plan will follow the designs and sizing as presented in Table 6.5.1-2 and as shown in the typical cross-sections on Plates VI-3 A-F. Detailed calculations for the diversion ditch and berm sizing are presented in Appendix VI-3.

Table 6.5.1-2 Maintenance Diversions and Channel Configurations

Diversion ID	Q (cfs)	Max Slope (%)	Bottom width (ft)	Side Slope	Manning's n	Channel Depth (ft)	Design Velocity* (fps)
No. 2	31.82	50.0	12	2	0.04	0.45	10.20
No. 3	1.50	16.7	2	10&2	0.035	1.25	4.71
No. 3'	6.50	2.2	0	10&2	0.035	2.43	4.09
No. 4	2.48	40.0	8	3&2	0.035	1.16	4.45
No. 5	2.10	25.0	5	10&2	0.035	1.11	4.37
No. 6	2.55	6.7	3	20&2	0.035	1.36	3.77
No. 7	3.84	2.7	8	2	0.035	1.27	2.30
No. 8	1.99	2.5	5	2	0.035	1.20	2.05
No. 10	1.83	5.0	0	20&2	0.035	1.37	2.99
No. 11	2.29	2.2	0	2	0.035	0.76	2.76
No. 11a	1.00	50.0	0	2	0.0354	0.43	7.20
No. 12	0.67	11.1	2	2	0.035	1.18	2.91
No. 12a	0.67	67.0	2	2	0.0354	0.30	5.30
No. 18	3.54	2.9	3	2	0.035	1.37	2.99
No. 18	3.54	1.4	6	4	0.0354	0.30	1.90
No. 19	3.54	2.9	0	20&2	0.035	2.01	3.96
No. 20	1.80	5.7	3	10&2	0.035	1.77	4.24
No. 21	15.56	5.0	8	10&2	0.035	1.47	4.88
No. 23	0.68	3.3	6	4	0.0354	0.10	1.40
No. 23	0.68	4.0	0	2	0.035	1.40	2.54
No. 27	1.03	5.0	0	20&2	0.035	1.64	3.57

* Maximum Allowable Velocity for the site is 5.0 fps.

Six-inch riprap will be needed for the steep sections of diversions 11 and 12. Below is the proposed riprap gradation:

$d100 = 2 \times d50 = 1ft$

$d85 = 1.5 \times d50 = 0.75ft$

$d15 = 0.1 \times d50 = 0.05ft$

As indicated on Plates VI-3 A-F, the maintenance drainage control plan incorporates use of seven CMP culverts to assist in conveying the undisturbed runoff through the disturbed site. Table 6.5.1-3 demonstrates the adequacy of the culverts.

Table 6.5.1-3 Evaluation of Culvert Adequacy

Culvert No.	Culvert Diameter	Discharge Capacity*	Estimated Peak flow
1	48	100**	9.66
2	48	95**	9.66
3	72	300	20.59
4***	24	18	0.68
5	48	100	1.83
6	42	75	2.29
7	48	100	31.92
8	48	100	20.23

* Assuming a maximum headwater to diameter ratio of 1.5 for a projecting culvert

** These culverts have been partially blocked by large boulders on the inlet end. Due to the positioning and location of the inlets, it is prohibitive to remove and clean these inlets. Note that the blocked inlet still has more than twice the capacity required.

*** This existing culvert is to be removed, due to damage to the culvert inlet, and replaced by a swale (see drainage 18).

Within the Horse Canyon Creek channel, there are three areas where natural oversteepening of the channel has occurred that affect the stability of the channel bank. Generally, this would not be a concern, however, in these locations the channel is immediately adjacent to the public access road and sediment ponds 1 and 2. To minimize the concern of bank failure during the maintenance plan period, riprap will be end-dumped in the channel in these three areas and graded to a 2h:1v slope. The riprap will consist of 2.5 foot D_{50} durable, angular rock, which is to be placed in a 6 foot high wedge against the toe of the oversteepened channel bank. This will provide support to the bank and also prevent water from under-cutting the toe of the bank. Details on the design of the riprap are based on the peak flow for Drainage No. 1 in Table 6.5.1-1 and are presented in Appendix VI-4. The gradation of the riprap is shown in Table 6.5.1-4.

Table 6.5.1-4 Maintenance Riprap Gradation

D_{100}	2.0 * D_{50}	5.00 ft
D_{85}	1.5 * D_{50}	3.75 ft
D_{50}	1.0 * D_{50}	2.50 ft
D_{15}	0.1 * D_{50}	0.25 ft

6.5.2 Reclamation Plan

Drainage diversions to be used during reclamation are designed to pass a peak flow from a 10-year, 24-hour rainfall event. These diversions include clear water diversions which will be installed as specified in the Maintenance Plan portion of this report, berms and road ditches which will serve to direct runoff to silt fences, and reestablished channels which will replace existing culverts and will convey runoff from undisturbed areas. All of the above-mentioned diversions will collect overland flow or runoff from small ephemeral drainages. Therefore they have been designed as required under UMC 817.43 of the Utah State Program. The main Horse Canyon Drainage is classified as intermittent and stream channel treatments for it were designed for the peak runoff from a 100-year, 24-hour rainfall event as required under UMC 817.44.

Plates VI-4 A-F show diversions and cross sections for the Reclamation Plan. Location numbers on these plates match those in Table 6.5.2-1 which gives peak flow information for each location. Appendix VI-2 presents information used in the calculation of peak flows. Methodology used in determining the hydrology design information for the Reclamation Plan is the same as was used in the Maintenance Plan (Section 6.5.1).

Table 6.5.2-1. Peak Flows for Reclamation Drainages.

Drainage ID	Drainage Area (ac)	Peak Flow (cfs)
No. 1	0.78	0.33
No. 2	0.57	0.22
No. 3	4.95	2.10
No. 4	8.85	3.80
No. 5	3.60	1.43
No. 6	1.60	0.74
No. 7	102.80	31.82
No. 8	0.73	0.34
No. 9	3.44	1.56
No. 10	17.03	7.11
No. 11	30.50	11.38
No. 12	53.30	20.23
No. 13	0.92	0.42
No. 14	10.64	4.32
No. 15	1.63	0.75
No. 16	4.19	1.83
No. 17	9.30	3.47
No. 18	69.20	27.41
No. 19	8.50	3.70
No. 20	7.80	2.91
No. 21	7800.00	1762.00
No. 22	5.70	2.48
No. 23	0.88	0.39
No. 24	3.95	1.50
No. 25	17.12	6.50
No. 26	14.70	6.62
No. 27	0.85	0.40

Note: Due to differences in structures used in maintenance and reclamation, drainage ID's do not correspond. See Appendix VI-2 for cross reference.

During reclamation, clear water diversions which will have been installed under the maintenance plan and that are not affected by regrading will remain in operation. Locations 10, 12, 16 and 18 on Plates VI-4 A-F, are trapezoidal channels which will replace sections of culverts that will be removed during reclamation. Location 7 is a trapezoidal channel which will convey undisturbed runoff over the backfilled Woodard Portal. Locations 4, 17 and 19 are roadside ditches which will convey runoff to silt fences. Location 21 is the main Horse Canyon drainage which will have riprap protection added (see Section 6.6.2). The remaining locations (1, 2, 5, 6, 8, 9, 11, 13, 14, 15, 20, 23, 24, 25, and 26) are at berms and/or silt fences. Location 27 is at the roadside refuse pile and will consist of hay bales to trap the minor amount of sediment and runoff from the pile surface.

Table 6.5.2-2 presents design information for the diversions and reestablished channels. Typical cross sections for the channels are shown in the Plates mentioned above. All diversions constructed in the natural soils material have a Manning's coefficient of 0.035; those constructed with a 1.0-foot D50 riprap have a coefficient of 0.0395; riprap in the Horse Canyon channel gives a coefficient of 0.044 for the 2.0-foot D50 riprapped slope. Riprap gradations are shown in Table 6.5.2-3.

Table 6.5.2-2 Reclamation Diversions and Channel Configurations

Diversion ID	Q (cfs)	Slope (%)	Bottom width (ft)	Side Slope	Manning's n	Max flow Depth (ft)	Max Flow Velocity (fps)	Allowable Velocity (fps)
No. 3	2.10	25	5	10&2	.035	0.09	4.37	4.0-5.0
No. 4	3.80	6	0	2	.035	0.74	4.50	4.0-5.0
No. 7	31.82	50	8	2	.0395	0.74	11.87	12.5
No. 10	10.91	18	8	2	.0395	0.37	5.80	12.5
No. 12	20.23	25	8	2	.0395	0.56	8.10	12.5
No. 16	0.66	33	5	2	.035	0.08	3.00	4.0-5.0
No. 17	3.47	8	0	2	.035	0.71	5.00	12.5
No. 18	27.41	12	8	2	.0395	0.67	7.20	4.0-5.0
No. 19	3.70	5	0	2	.035	0.72	4.20	4.0-5.0
No. 21	1762.00	3.3	17	2&1	.035/.044	5.80	17.50	17.5

Drainages 7, 10, 12 and 18 will require riprap with a d50 of 1.0 foot. Drainage 21 will require riprap with d50 of 2.0 feet. This riprap gradation is given below.

Table 6.5.2-3 Reclamation Riprap Gradation

		For d50 equal to: 1.0'	2.0'
D100	2.5*D50	2.50 ft	5.00 ft
D85	1.8*D50	1.80 ft	3.60 ft
D15	0.1*D50	0.10 ft	0.20 ft

6.6 Sediment Control Designs

This section addresses the concerns of UMC 817.45, .46, .47, & .49. The proposed sediment control facilities to be used will consist of a combination of sediment ponds and silt fences.

6.6.1 Maintenance Plan

Sediment control for the maintenance plan will consist of silt fences for the small, isolated portions of the permit area, while the sediment ponds will provide control for the remainder of the site. Plates VI-3 A-F show the proposed locations of the silt fences and sediment ponds for the maintenance plan.

The silt fences will be used to treat the sections of the permit area where the drainage area is isolated due to topographic constraints, like the powder magazine area or the area below Culvert No. 5. A silt fence will consist of a geotextile fabric, such as Dupont's Typar 3301 (flow rate 100gpm/sq. ft), or equivalent, mounted on heavy gauge field fence and secured to T-posts spaced at 3 foot intervals. The fabric will be buried at least 6 inches along the base and extend to a height of at least 2.0 feet above the ground surface. The fence will also be extended laterally into the adjacent berms to ensure that runoff water cannot bypass the structure. Table 6.6.1-1 presents silt fence information.

Table 6.6.1-1 Locations of Silt Fences - Maintenance Plan

Location No.	Peak Flow (cfs)	Length of silt fence (ft)
15	2.01	10
16	1.72	10
17	1.36	8
22	0.36	3
25	1.17	7
30	8.89	50
31	7.95	40

Sediment ponds will be used during the maintenance plan to control runoff and sedimentation from the large portion of the disturbed areas. Table 6.6.1-2 presents the design volumes of sediment and runoff required for the various disturbed drainage areas and the storage capacity of the existing sediment ponds (see designs in Appendix VI-5). As can be seen, all but three of the existing ponds (7, 8, and 10) will need to be enlarged.

Due to its very limited storage volume, it is proposed that sediment pond 3 be eliminated, the embankment be breached in the area of the existing spillway structure, and the runoff be contained in pond 4 & 5. Also, due to the limited contributing drainage area and the location of sediment pond 10, resulting in difficulty in conveying runoff into the pond, it is proposed that this pond be eliminated and replaced with a silt fence. The remaining eight, existing sediment ponds proposed for use, in their present condition, would not be adequate. Therefore, these ponds must be upgraded to meet the performance standards.

It is the attempt of this plan to minimize the disturbance to the hydrologic system as much as possible. The sediment pond upgrades will consist of installation of any combination of the following: new spillways; pond embankment reconstruction; pond enlargement; and revision of contributing drainage areas. These upgrades will attempt to meet performance standards, as much as possible, within the constraints of the site. Where the areas are limiting or the existing natural slopes are steeper than allowed, attempts were made to work with the facilities available.

Table 6.6.1-2. Sediment Pond Design Volumes.

Sediment Pond ID	Weighted Curve Number	Runoff Depth (in)	Drainage Area (ac)	Runoff Volume (ac-ft)	Sediment Volume (ac-ft)	Total Volume (ac-ft)	Existing Volume (ac-ft)
1	86	0.71	4.74	0.28	0.39	0.67	0.27
2	90	0.96	3.70	0.30	0.02	0.32	0.11
3	82	0.56	13.17	0.62	1.82	2.44	0.05
4&5	86	0.71	11.65	0.69	0.58	1.27	0.62
6	82	0.56	8.47	0.40	0.47	0.87	0.25
7	90	0.96	0.88	0.07	0.01	0.08	0.16
8	86	0.71	2.5	0.15	0.03	0.18	0.41
9	89	0.89	1.38	0.10	0.01	0.11	0.08
10	90	0.96	1.15	0.09	0.01	0.10	0.34

Plates VI-5 A,B show the topography of the redesigned sediment ponds. Plate VI-5C shows cross sections of the redesigned ponds. Table 6.6.1-3 presents the pond configurations and design details. This is to be used with Figure 6.6.1-1, which provides the typical embankment design detail. Each pond will have the capacity to contain the 10 year - 24 hour runoff volume and the 2 year accumulated sediment volume as determined by the Universal Soil Loss Equation. Design assumptions, data inputs, and stage-capacity curves can be found in Appendix VI-5.

Table 6.6.1-3 Sediment pond Configurations and Design Details

Sediment Pond	Embankment Crest	Storage Volume	Spillway Elev.	Outlet Elev.	Spillway Length	Spillway Slope
1	6286.6	0.67	6284.45	6272.0	22	57%
2	6278.6	0.32	6276.55	6269.5	30	24%
3*	6268.0	0.00	6266.80	6266.8	13	0%
4&5	6241.6	3.76	6238.50	6208.0	68	45%
6	6229.0	0.87	6226.90	6199.0	65	42%
7	6144.0	0.08	6142.60	6139.0	60	6%
8	6179.7	0.18	6178.15	6176.9	28	5%
9	6195.6	0.11	6194.50	6184.0	24	44%

* Pond No. 3 is to be breached and the drainage collected in Pond No. 4&5.

The 25 year - 24 hour emergency spillway sizing was accomplished using the Storm Hydrograph program developed by Hawkins and Marshall (1980) and the use of a Uintex computer code to determine the critical and normal flow depths in a circular pipe. As is indicated in Table 6.6.1-4, the spillways will consist of a CMP half round culvert which is to be set in the outslope of the pond and stream channel sideslope. The outlet of certain spillways is to be protected by adequate riprap to prevent scouring during a period of discharge. Plate VI-5D gives details of the riprap and stage-discharge curves for the spillways.

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Figure 6.6.1-1 Typical Spillway Configuration

Table 6.6.1-4 Spillway Sizing and Design Details

Sediment Pond ID	25yr-24hr Discharge (cfs)	Spillway Type	Spillway Diameter (ft)	Flow Depth (ft)	Discharge Vel. (fps)	Riprap d50	Riprap length (ft)
1	4.81	H.R.*	2	0.77	15.5	none	0
2	4.60	H.R.	2	0.75	11.3	0.75	10
3	10.61	Breached					
4&5	21.81	H.R.	4	1.38	20.5	2.50	30
6	6.86	H.R.	3	0.82	14.2	1.50	14
7	1.12	H.R.	2	0.36	4.6	none	0
8	2.55	H.R.	2	0.56	5.3	none	0
9	1.52	H.R.	2	0.43	10.0	0.75	7

*Half-round cmp

During the reconstruction of these ponds, all work will be done under the supervision of and certified by a professional engineer. Also, during the maintenance period, each pond will be inspected under the supervision of a professional engineer for structural weakness, erosion, and other hazardous conditions and certified quarterly by a professional engineer.

During the maintenance period, each pond, which collects water, shall be dewatered by the use of a siphon or pump which shall be placed in the pond using a floating intake. During the dewatering, a sample shall be taken during periods of discharge to ensure the effluent limitations are being met.

6.6.2 Reclamation Plan

All eight sediment ponds will be regraded or breached at the start of reclamation and all runoff that was formerly conveyed to them will be treated with silt fences. This will allow vegetation in those areas to be reestablished at the start of reclamation, instead of causing additional disturbance later in the reclamation phase when the ponds would have to be removed. Silt fence treatment has been shown to be effective as long as the fences are properly designed, installed and maintained; Kaiser will assure that this is the case at the Horse Canyon site. At locations where a sediment pond will be breached (at ponds 4&5, 6 and 7: locations 14, 15 and 23, respectively), the emergency spillway will be removed, the embankment will be excavated to a depth of 0.5 feet from the pond interior bottom surface with 2:1 side slopes, and a silt fence will be installed in the breach. In doing this, a small amount of detention will be provided. A diagram depicting this is shown on Plates VI-4 B,C.

In other locations, as shown on Plates VI-4 A-F, a berm or road ditch will convey runoff to a silt fence. The silt fence fabric proposed for use will consist of a geotextile fabric, such as Mirafi, Dupont, or equivalent. (Dupont's Typar 3301 with a flow rate of 100 gpm was used in calculations to determine silt fence design length.) The fabric will be secured to metal teeposts driven in the ground at 3-foot intervals and will be backed by a heavy-gage field fence. The fabric will extend 2 feet above the ground surface and will be keyed in the ground at least 6 inches. The fabric will also be keyed into the pond embankments (or berms where applicable). All silt fences will be inspected and maintained to assure that all runoff is passed through them. After vegetation has been established and the disturbed area is stabilized the silt fences will be removed.

Table 6.6.2-1 shows the locations where silt fences will be installed, the flow the fence is required to pass, and the length of fence to be installed.

Table 6.6.2-1 Locations of Silt Fences

Location No.	Peak Flow (cfs)	Length of silt fence (ft)
1	0.33	3
2	0.22	3
4	3.80	20
5	1.43	10
6	0.74	6
8	0.34	3
9	1.56	10
11	11.38	55
13	0.42	100
14	4.32	25
15	0.75	5
17	3.47	20
19	3.70	20
20	2.91	16
23	0.39	3
26	6.22	100

In order to minimize the amount of sediment which must be trapped by the silt fences, diversions were designed for non-erosive velocities. Reestablishment of vegetation on disturbed areas as discussed in Chapter VIII will aid in prevention of erosion as well. Single-stage sediment samplers will be installed in the channel downstream from two silt fences to provide a measure of effectiveness of the treatment.

As part of the regrading plan, areas along the Horse Canyon channel where refuse is currently impinging upon the channel will be regraded and the refuse will be pulled back from the channel. In order to prevent subsequent erosion of the refuse slope by flows in Horse Canyon (location No. 21), riprap will be placed at the toe of the pulled-back slope for a distance of about 2,000 feet. The riprap will have a D50 of 2.0 feet with a gradation as specified above in Table 6.5.2-3. The riprap layer will be 4 feet thick and the 1-foot topsoil cover will serve as a filter blanket between the riprap and the refuse. The riprap will extend 7 feet up the side of the slope.

Sediment control for the topsoiled surface of the roadside refuse pile will be accomplished by the use of hay bales placed along the contour to keep runoff from the surface of the refuse pile from entering Horse Canyon drainage. The bales will be keyed into the surface and will be held in place with roof bolts. After vegetation has been established, they will be removed.

6.7 Probable Hydrologic Consequences

6.7.1 Surface Water

The climate associated with the Book Cliffs near the mine permit area can be classified as semi-arid. Precipitation averages 12 inches a year while mean annual evaporation is approximately 40 inches. Historically, heavy thunderstorms in the summer have produced runoff events in nearby drainages that have been estimated to have return periods of 100 years or greater. Local streamflow deteriorates in quality along the edges of the mountains because of water diversions, waste disposal, consumptive use and irrigation of poorly drained, saline soils of the Mancos shale.

6.7.1.1 Baseline Data

The U.S. Geological Survey conducted a water quality study in Horse Canyon from August 1978 until September 1979 during the time that U.S. Steel operated the mine. Samples were taken monthly from the Horse Canyon Creek and analyzed for most major ions and cations and field parameters. Metals, eight Nitrogen species and other minor chemical constituents were taken on a quarterly basis or less.

Between 1/81 and 4/83, baseline water quality data was collected for four surface water/spring sites on the permit area:

B-1, HC-1, RF-1 and RS-2. Between 14 and 19 samples were taken and analyzed during the monitoring period depending on the site. The parameters that were analyzed were derived from Section 783.16 in the regulations. The Division monitoring guidelines were not in force at that time. Three other sites, CA-1, RS-1 and RS-2 were sampled once a year during 78, 79, 80 and analyzed for most major chemical constituents. In addition, springs H-6, H-18 and H-21 were sampled once and analyzed for the major constituents in 1985. Third quarter data for 1989 were collected for HC-1 and RF-1 and sampled for most of the parameters in the Division guidelines. All monitoring sites are shown on Plate VI-1.

All laboratory analyses are presented in Appendix VI-1. The minimum, maximum and mean flow rates and water quality data are summarized in tabular form in Appendix VI-1 for sites with more than one sampling. In-mine flow and mine drainage monitoring sites are also included in the tables.

6.7.1.2 Analysis of Data

The analysis of the Horse Creek data is complicated by the fact that the 81-83 and earlier data reflects the mine discharge that contributed to the base flow in the stream. The early data shows flow rates in the lower reaches of the stream were on the order of magnitude of 10 times greater than those flows in the upper reaches. Since there is presently no mine discharge, Station

B-1, located 2 miles below the mine, does not flow except in response to rainfall and snow melt. HC-1, located above the mine discharge point(s) and approximately 2.75 miles above B-1 flows due to snow melt and ground water, about seven to eight months out of the year. Because Horse Creek is a losing stream, flow contributions from the upper channel do not reach B-1.

Even though the early data indicates a large difference in flow rates between the upper and lower reaches of Horse Creek, chemical analysis of comparable constituents show no significant differences between water at HC-1 and samples taken at B-1, which included mine discharge water. There are two exceptions. TSS is noticeably less in the lower stream probably due to prior deposition of suspended load. Average TDS is higher downstream, as analysis of mine water discharge data also shows elevated levels of dissolved solids. This occurs because the mine water probably originates from the Blackhawk Formation which is interbedded with some saline shale.

An analysis of base flow data from the right fork of Horse Canyon Creek and the limited data for springs indicate no anomalies that could be considered significant. H-21 has considerably lower alkalinity, bicarbonate, calcium and sodium resulting in a lower TDS than the other two similar springs sampled. This indicates the spring is associated with a local flow system.

6.7.1.3 Predictions of Hydrologic Impacts

As pointed out in the introduction for the hydrology chapter, only a limited evaluation will be undertaken to address the specific impacts as a result of the maintenance and reclamation plan. The scope of the data is also restricted in nature making it difficult to develop all but limited conclusions.

Within the permit area, the general seasonal streamflow is intermittent. The stream generally dries up by late spring with only occasional runoff during the summer resulting from rainfall events.

Because of the presence of large disturbed areas and the potential for large runoff events, the control of erosion is a prime factor in maintaining the hydrologic balance within the mine permit area. As indicated in the Sediment Control Designs, Section 6.6, there will need to be some upgrading of the sediment control structures to allow performance standards to be met. The specific schedule for these upgrades is discussed in Section 2.8. Drainage ditches and sediment control structures will be constructed according to methodologies and specifications in Sections 6.5 and 6.6. All construction and upgrading activities will be undertaken during periods of dry weather, commencing in late spring and lasting through fall. For both the maintenance and reclamation periods, it is expected that construction, upgrading or regrading activities would cause an increase in sediment load to the stream. Temporary sediment controls will be used whenever possible to lessen the impact of construction activities.

The contamination, diminution or interruption of any water resources would not likely occur within the mine permit area. Since surface water flows only a limited part of year and will be provided protection by use of sediment controls, the major usable water resources that could potentially be effected in the area would be springs that are currently in use by wildlife and livestock. Most of these springs are located upstream of the permit area or are in areas where subsidence resulting from post-1977 mining is not documented. To date no known depletion of flow and quality of surveyed springs in the permit area exists. Therefore, it is unlikely an alternative water supply will be needed, although they have been identified in Section 6.4.

Based on the previous comparison of upstream and downstream data gathered on Horse Creek which incorporates the analysis from past mine discharges to the channel, water quality will not be drastically affected in the intermittent creek even in the unlikely event of natural discharge of mine-water into the channel. However, as stated before, because of the potential for runoff events with return periods larger than the 50-years to occur in the drainage, any sediment control designed for less will likely fail.

6.7.2 Groundwater

6.7.2.1 Mine Water

There are several factors which indicate that the water level in the mine is highly unlikely to flood to the levels of the lowest portal (6,326 feet).

·1) Mine water level information gathered in 1986 indicates that there has been little, if any, rise in the water level since mining activities ceased.

·2) The Columbia Mine also encountered the Sunnyside Fault zone and has been closed since the late 1960's. If water inflow rates were high, the mine workings would have flooded, developing a head differential between the Columbia Mine and the Horse Canyon Mine (pumped). Sieler and Baskins (1986) showed that the water quality generally drops significantly when exposed to mine workings (gob etc). The water quality of the mine water samples from the sump locations (2 Dip, Main Slope, 2E-B) as compared to the water quality of springs in the lower stratigraphic section of the permit area so little difference in TDS. This indicates that water in the mine is not the result of in-flow along the fault zone from the Columbia Mine. Either the fault zone is a poor conductor of water or the Columbia Mine workings have not flooded much beyond the water levels in the Horse Canyon Mine while it was pumped.

3) There is evidence (presented in previous section) indicating that the regional groundwater flow direction is away

from the portal openings (down structural dip).

4) The coal mined at Horse Canyon is underlain by a marine sheet sandstone (Sunnyside, see Geology, chapter V). Balsely (1981) did extensive petrographic work on Blackhawk Formation marine sandstone beds and found them to contain the highest porosity and permeability in the formation. If the water level in the mine were to ever approach the level of the portal, the Sunnyside marine sandstone would likely discharge water, preventing any head development behind the portal closures.

5) Add to this the fact that much of the Horse Canyon Mine floor has been fractured by the effects of pillar removal, especially near the outcrop. Fracturing develops secondary porosity and enhances the permeability of the underlying Sunnyside marine sandstone. This would function as a means to dissipate any head which might otherwise develop on the portals.

6) There is about 500 feet of elevation difference between the lowest portal and the approximate water level in the mine (1986). If the water level in the mine continues to rise, the head differential between the discharging aquifer and the mine will decrease. This decrease in head will have the direct effect of decreasing the in-flow rate into the mine. The volume of water required to "fill the mine" would have to also fill the aquifer porosity above the mine, which has been de-watered throughout the history of the mine.

Based on these factors it is very unlikely that the groundwater level in the regional aquifer will ever rise to the level of the portal, at any portal location for the Horse Canyon Mine. Hence, there should be no natural discharge of groundwater through any of the sealed portals.

6.7.2.2 Springs and Seeps

The conditions represented by existing spring and seep data reflects the impacts (if any) of 50 years of mining. It is unlikely that there will be any additional measurable impacts from the maintenance and reclamation activities at the mine. Existing springs in the area above the mine should continue to flow, showing fluctuations which are related to variations in recharge.

Subsidence presents a potential to alter the groundwater flow regime in the area. There are two factors which tend to limit the effects of subsidence on the groundwater regime. One, the springs which supply most of the local flow discharge from the North Horn Formation. This formation or aquifer is perched from the underlying regional aquifer and the formation contains swelling clays which tend to heal small fractures. Second, since the perched aquifer materials are lenticular, there is a greater probability that fractures in one area will not drain all the different perched aquifers because they are not interconnected.

Water flow which previously was pumped from the mine into Horse Canyon Creek has ceased. This water will now remain in the natural flow regime of the regional aquifer.

6.8 References

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List of Appendices

Appendix VI-1

Water Quality Data

Water Quality and Flow Summaries - Mine in-flow
Horse Canyon Mine
(# = number of samples)

	Parameter	Units	Sample Site 2E-B Mean	Max.	Min.	#	Sample Site 2LN-K Mean	Max.	Min.	#	Sample Site Main Slope Mean	Max.	Min.	#	Sample Site 2 Dip Mean	Max.	Min.	#	Sample Site 12 N-M Mean	Max.	Min.	#	Parameter
1	Flow	(gpm)				0	2.75	3.00	1.00	16				0				0	20.50	24.00	20.00	16	1
2	pH	standard	7.53	7.90	7.10	22	7.23	7.60	7.00	22	7.65	8.20	7.20	22	7.92	8.20	7.70	5	7.94	8.40	7.50	22	2
3	Acidity as CaCO3	mg/l	14.47	30.00	0.00	22	40.50	76.00	4.00	22	11.21	20.00	0.00	22	3.20	8.00	0.00	5	4.27	16.00	0.00	22	3
4	Alkalinity as CaCO3	mg/l	402.51	589.20	44.00	22	602.80	1210.00	140.00	22	484.73	3567.00	185.10	22	339.00	410.10	288.00	5	290.84	384.00	204.40	22	4
5	Iron Dissolved	mg/l	1.389	3.380	0.020	20	0.152	1.290	0.020	20	1.288	2.150	0.020	20	0.118	0.200	0.050	5	0.138	0.550	0.010	20	5
6	Iron Total	mg/l	1.762	3.380	0.300	22	0.199	1.320	0.050	22	1.756	2.380	0.340	22	0.144	0.260	0.050	5	0.227	0.790	0.020	22	6
7	Manganese as Mn (Tot)	mg/l	0.056	0.080	0.040	22	0.020	0.040	0.009	22	0.065	0.110	0.019	22	0.011	0.015	0.008	5	0.043	0.160	0.010	22	7
8	Suspended Solids	mg/l	11.0	57.0	2.0	22	11.3	30.0	1.0	22	14.9	44.0	4.0	22	5.8	19.0	0.0	5	14.1	43.0	1.0	22	8
9	TDS	mg/l	1816	2162	1690	22	2503	3640	2100	22	2152	2770	1700	22	1602	1826	1450	5	2082	3096	1575	22	9

Water Quality and Flow Summaries - Mine Discharges
Horse Canyon Mine
(# = number of samples)

Prepared 2-2-90

NOTE: 0 = below detection limit
See individual analysis for detection limits

	Parameter	Units	Sample Site 001 Mean	Max.	Min.	#	Sample Site 002 Mean	Max.	Min.	#
1	Flow	(Mgpd)	0.26	1.60	0.00	32	0.19	0.99	0.00	35
2	pH	standard	7.89	8.20	7.45	22	7.67	7.95	7.30	24
3	Acidity as CaCO3	mg/l	2.24	10.00	0.00	24	8.78	35.00	0.00	22
4	Alkalinity as CaCO3	mg/l	362.90	472.00	238.00	25	391.17	485.10	311.80	22
5	Aluminum	mg/l	0.016	0.016	0.016	1	0.025	0.025	0.025	1
6	Antimony, Sb	mg/l					0.000	0.000	0.000	1
7	Arsenic	mg/l	0.002	0.002	0.002	1	0.005	0.005	0.005	1
8	Barium	mg/l	0.035	0.035	0.035	1	0.045	0.045	0.045	1
9	Beryllium, Be	mg/l					0.000	0.000	0.000	1
10	Boron	mg/l	0.020	0.020	0.020	1	0.033	0.033	0.033	1
11	Bromide, Br	mg/l					0.000	0.000	0.000	1
12	Cadmium	mg/l	0.000	0.000	0.000	1	0.000	0.000	0.000	1
13	Chromium	mg/l	0.000	0.000	0.000	1	0.000	0.000	0.000	1
14	Cobalt, Co	mg/l					0.000	0.000	0.000	1
15	Copper	mg/l	0.003	0.003	0.003	1	0.006	0.006	0.006	1
16	Flouride	mg/l	0.35	0.35	0.35	1	0.41	0.41	0.41	1
17	Iron Dissolved	mg/l	0.188	0.420	0.020	24	0.262	0.570	0.020	21
18	Iron Total	mg/l	0.218	0.425	0.089	25	0.390	1.100	0.150	24
19	Lead	mg/l	0.003	0.003	0.003	1	0.000	0.000	0.000	1
20	Magnesium	mg/l	112.80	112.80	112.80	1	96.00	96.00	96.00	1
21	Manganese	mg/l	0.01	0.01	0.01	1	0.02	0.02	0.02	1
22	Manganese as Mn (Tot)	mg/l	0.02	0.06	0.00	25	0.03	0.13	0.01	22
23	Mercury	mg/l	0.0000	0.0000	0.0000	1	0.0000	0.0000	0.0000	1
24	Molybdenum	mg/l	0.003	0.003	0.003	1	0.009	0.009	0.009	1
25	Nickel	mg/l	0.094	0.094	0.094	1	0.095	0.095	0.095	1
26	Ammonia	mg/l	0.10	0.10	0.10	1	0.45	0.45	0.45	1
27	Nitrate	mg/l	0.66	0.66	0.66	1	0.62	0.62	0.62	1
28	Nitrite	mg/l	0.00	0.00	0.00	1	0.08	0.08	0.08	1
29	Oil and Grease	mg/l	0.67	2.50	0.00	22	0.77	5.60	0.00	21
30	Phosphate	mg/l	0.070	0.070	0.070	1	0.060	0.060	0.060	1
31	Selenium	mg/l	0.000	0.000	0.000	1	0.000	0.000	0.000	1
32	Sulfate	mg/l	990.0	990.0	990.0	1	960.0	960.0	960.0	1
33	Sulfide	mg/l	0.67	0.67	0.67	1	0.92	0.92	0.92	1
34	Suspended Solids	mg/l	20.00	20.00	20.00	1	9.86	28.00	1.00	24
35	TDS	mg/l	2000	2643	1760	21	2010	2588	1700	24
36	Zinc	mg/l	0.01	0.01	0.01	1	0.02	0.02	0.02	1

A6-1

Water Quality and Flow Summaries - Surface and Groundwater
Horse Canyon Mine
(# = number of samples)

Parameter	Units	Sample Site RS-2 Mean	Max.	Min.	#	Sample Site B-1 Mean	Max.	Min.	#	Sample Site RF-1 Mean	Max.	Min.	#	Sample Site HC-1 Mean	Max.	Min.	#	Sample Site 2WB Mean	Max.	Min.	#	Sample Site 1E2 Mean	Max.	Min.	#	
1 Flow	(gpm)	23.92	34.00	9.00	25	256	650	0	18	11.36	25.00	0.00	22	20.95	65.00	0.00	19	3.59	7.00	3.00	22	1.00	1.00	1.00	19	1
2 pH	standard	7.95	8.36	7.37	27	8.13	8.40	7.80	15	8.20	8.60	7.60	22	8.05	8.48	7.70	22	7.90	8.20	7.40	22	7.95	8.50	7.50	22	2
3 Temp	o C	9.00	10.00	8.00	7					11.00	11.00	11.00	2	13.83	20.00	10.00	6									3
4 Conductivity	umhos/cm	2414.29	2700.00	2200.00	7					2500.00	2700.00	2300.00	2	3766.67	3900.00	3600.00	6									4
5 Dissolved Oxygen	ppm	6.47	8.10	4.20	7					4.40	4.90	3.90	2	5.77	7.40	4.30	6									5
6 Acidity as CaCO3	mg/l	2.69	18.00	0.00	18	0.75	6.00	0.00	14	2.21	14.00	0.00	19	1.47	10.00	0.00	15	2.85	12.00	0.00	22	2.65	14.00	0.00	22	6
7 Alkalinity as CaCO3	mg/l	432.25	552.00	79.00	18	394.58	1095.00	291.60	14	408.58	537.00	46.00	19	429.47	985.00	211.00	15	203.96	350.00	124.00	22	316.60	439.00	218.00	22	7
8 Aluminum	mg/l	0.063	0.310	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.000	6									8
9 Antimony as Sb	mg/l	0.020	0.060	0.000	3																					9
10 Arsenic	mg/l	0.000	0.000	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.000	6									10
11 Barium	mg/l	0.029	0.210	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.00	6									11
12 Beryllium as Be	mg/l	0.007	0.020	0.000	3																					12
13 Bicarbonate	mg/l	518.30	581.00	338.00	8					424.50	513.00	336.00	2	486.83	537.00	424.00	6									13
14 Boron	mg/l	0.198	0.315	0.090	10					0.180	0.180	0.180	2	0.240	0.400	0.16	6									14
15 Cadmium	mg/l	0.000	0.000	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.00	6									15
16 Calcium	mg/l	63.14	168.00	30.20	10					48.80	52.80	44.80	2	63.35	83.90	41.10	6									16
17 Carbonate	mg/l	8.27	78.00	0.00	10					44.00	72.00	16.00	2	6.80	19.00	0.00	6									17
18 Chloride	mg/l	22.8	30.0	19.7	10					24.2	26.3	22.0	2	32.3	43.0	13.0	6									18
19 Chromium	mg/l	0.000	0.000	0.000	10					0.000	0.000	0.000	2	0.00	0.00	0.00	6									19
20 Cobalt as Co	mg/l	0.003	0.005	0.000	3																					20
21 Copper	mg/l	0.003	0.020	0.000	10					0.000	0.000	0.000	2	0.00	0.00	0.00	6									21
22 Flouride	mg/l	0.37	0.52	0.18	10					0.63	0.78	0.48	2	0.61	1.01	0.14	6									22
23 Germanium as Ge	mg/l	0.000	0.000	0.000	3																					23
24 Hardness	mg/l	402	460	310	8					410	433	387	2	717	872	271	6									24
25 Iron Dissolved	mg/l	0.052	0.390	0.000	14	0.443	0.920	0.020	12	0.206	1.900	0.000	17	0.052	0.140	0.010	13	0.125	0.420	0.020	20	0.606	10.550	0.002	20	25
26 Iron Total	mg/l	0.293	4.210	0.000	29	1.886	14.800	0.060	15	141.804	3080.000	0.020	22	2.447	49.300	0.020	22	0.228	0.640	0.050	22	0.743	13.200	0.000	22	26
27 Lead	mg/l	0.000	0.003	0.000	8					0.000	0.000	0.000	2	0.000	0.000	0.000	6									27
28 Magnesium	mg/l	61.18	102.00	0.80	10					70.45	70.80	70.10	2	78.58	133.00	33.00	6									28
29 Manganese	mg/l	0.000	0.000	0.000	7					0.000	0.000	0.000	2	0.000	0.000	0.000	6									29
30 Manganese as Mn (Tot)	mg/l	0.014	0.050	0.000	23	0.076	0.515	0.010	15	0.047	0.360	0.000	20	0.136	1.450	0.010	16	0.021	0.030	0.003	22	0.020	0.115	0.000	22	30
31 Mercury	mg/l	0.000	0.000	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.000	6									31
32 Molybdenum	mg/l	0.016	0.160	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.000	6									32
33 Nickel	mg/l	0.000	0.000	0.000	10					0.000	0.000	0.000	2	0.000	0.000	0.000	6									33
34 Ammonia	mg/l	0.27	0.88	0.00	8					0.32	0.44	0.20	2	0.08	0.28	0.00	6									34
35 Nitrate	mg/l	0.70	3.46	0.00	10					0.06	0.12	0.00	2	0.27	1.24	0.00	6									35
36 Nitrite	mg/l	0.00	0.02	0.00	10					0.01	0.02	0.00	2	0.01	0.03	0.00	6									36
37 Phosphate	mg/l	0.013	0.060	0.000	10					0.000	0.000	0.000	2	0.002	0.010	0.000	6									37
38 Potassium	mg/l	4.25	12.40	0.80	8					2.30	2.80	1.80	2	6.35	8.10	2.60	6									38
39 Selenium	mg/l	0.000	0.004	0.000	10					0.009	0.000	0.000	2	0.000	0.000	0.000	6									39
40 Silver as As	mg/l	0.000	0.000	0.000	3																					40
41 Sodium	mg/l	185.59	408.00	140.00	10					179.50	180.00	179.00	2	204.50	224.00	184.00	6									41
42 Sulfate	mg/l	306	675	79	10					298	308	288	2	485	817	232	6									42
43 Sulfide	mg/l	0.00	0.00	0.00	8					0.00	0.00	0.00	2	0.00	0.00	0.00	6									43
44 Suspended Solids	mg/l	16.0	113.0	0.0	18	88.3	640.0	3.0	15	120.3	1648.0	0.0	20	151.2	2152.0	1.0	16	14.0	59.0	1.0	22	8.6	20.0	1.0	22	44
45 TDS	mg/l	930	1380	774	29	1910	2708	362	15	964	1800	847	22	1386	1760	800	22	2435	3928	2050	22	2106	2825	1430	22	45
46 Total Kjeldahl Nitrog	mg/l	0.11	0.22	0.00	3																					46
47 Vanadium as V	mg/l	0.08	0.25	0.00	3																					47
48 Zinc	mg/l	0.019	0.120	0.000	10					0.000	0.000	0.000	2	0.004	0.012	0.000	6									48

NOTE: 0 = below detection limit - see individual analysis for detection limit

Prepared 2-2-90

KAISER COAL CORPORATION
HORSE CANYON MINE
ACT/007/013

1989 WATER MONITORING DATA

SAMPLE LOCATION: B - 1 (Horse Canyon Wash Below Mine) * INACCESSIBLE

Parameter	Units	Jan 89	Feb 89	Mar 89	Apr 89	May 89	June 89	July 89	Aug 89	Sep 89	Oct 89	Nov 89	Dec 89
Flow	(gpm)	*	*	0	0	0	0	0	0	0			
pH	standard												
Temp	o C												
Conductivity	umhos/cm												
Dissolved Oxygen	ppm												
Aluminum	mg/l												
Arsenic	mg/l												
Barium	mg/l												
Bicarbonate	mg/l												
Boron	mg/l												
Cadmium	mg/l												
Calcium	mg/l												
Carbonate	mg/l												
Chloride	mg/l												
Chromium	mg/l												
Copper	mg/l												
Flouride	mg/l												
Hardness	mg/l												
Iron Total	mg/l												
Lead	mg/l												
Magnesium	mg/l												
Manganese	mg/l												
Mercury	mg/l												
Molybdenum	mg/l												
Nickel	mg/l												
Ammonia	mg/l												
Nitrate	mg/l												
Nitrite	mg/l												
Phosphate	mg/l												
Potassium	mg/l												
Selenium	mg/l												
Sodium	mg/l												
Sulfate	mg/l												
Sulfide	mg/l												
TDS	mg/l												
Zinc	mg/l												

KAISER COAL CORPORATION
HORSE CANYON MINE
ACT/007/013

1989 WATER MONITORING DATA

SAMPLE LOCATION: HC - 1 (Horse Canyon Wash)

* INACCESSIBLE

Parameter	Units	Jan 89	Feb 89	Mar 89	Apr 89	May 89	June 89	July 89	Aug 89	Sep 89	Oct 89	Nov 89	Dec 89
Flow	(gpm)	*	*	3	3	6	9	<1	<1	0			
pH	standard			8.33	8.48	7.88	7.78	8.02	8.1				
Temp	o C			10	13	12	10	18	20				
Conductivity	umhos/cm			3700	3900	3600	3800	3800	3800				
Dissolved Oxygen	ppm			4.3	4.8	5.2	6.3	6.6	7.4				
Aluminum	mg/l			<.1	<.1	<.1	<.1	<.1	<.1				
Arsenic	mg/l			<.01	<.01	<.01	<.01	<.01	<.1				
Barium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Bicarbonate	mg/l			424	491	537	499	514	456				
Boron	mg/l			0.22	0.4	0.22	0.157	0.18	0.26				
Cadmium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Calcium	mg/l			41.1	83.9	41.1	80.7	74.1	59.2				
Carbonate	mg/l			19	9.5	12.3	0	0	0				
Chloride	mg/l			29.3	33.1	13	43	34.1	41.3				
Chromium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Copper	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Flouride	mg/l			0.32	0.66	0.14	0.86	0.68	1.01				
Hardness	mg/l			766	697	271	872	834	863				
Iron Total	mg/l			0.182	0.17	0.02	0.055	0.07	0.102				
Lead	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Magnesium	mg/l			102	112	38.4	33	53.1	133				
Manganese	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Mercury	mg/l			<.0002	<.0002	<.0002	<.0002	<.0002	<.0002				
Molybdenum	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Nickel	mg/l			<.01	<.01	<.01	<.01	<.01	<.01				
Ammonia	mg/l			0.18	<.1	0.28	<.2	<.2	<.2				
Nitrate	mg/l			0.257	<.1	1.24	<.01	<.02	0.14				
Nitrite	mg/l			0.028	<.01	<.005	<.01	0.0065	<.005				
Phosphate	mg/l			<.01	<.01	<.01	<.01	<.01	0.01				
Potassium	mg/l			8.1	6.1	5.5	8	2.6	7.8				
Selenium	mg/l			<.002	<.002	<.002	<.002	<.002	<.002				
Sodium	mg/l			202	224	197	202	184	218				
Sulfate	mg/l			560	724	232	281	294	817				
Sulfide	mg/l			<.1	<.1	<.1	<.1	<.1	<.1				
TDS	mg/l			1400	1420	824	800	1635	1760				
Zinc	mg/l			<.01	<.01	0.012	0.012	<.01	<.01				

KAISER COAL CORPORATION
HORSE CANYON MINE
ACT/007/013

1989 WATER MONITORING DATA

SAMPLE LOCATION: RF - 1 (Right Fork, Horse Canyon Wash)

* INACCESSIBLE

Parameter	Units	Jan 89	Feb 89	Mar 89	Apr 89	May 89	June 89	July 89	Aug 89	Sep 89	Oct 89	Nov 89	Dec 89
Flow	(gpm)	*	*	<1	<1	0	0	0	0	0			
pH	standard			8.45	8.51								
Temp	o C			11	11								
Conductivity	umhos/cm			2300	2700								
Dissolved Oxygen	ppm			3.9	4.9								
Aluminum	mg/l			<.1	<.1								
Arsenic	mg/l			<.01	<.01								
Barium	mg/l			<.01	<.01								
Bicarbonate	mg/l			336	513								
Boron	mg/l			0.18	0.18								
Cadmium	mg/l			<.01	<.01								
Calcium	mg/l			52.8	44.8								
Carbonate	mg/l			72	16								
Chloride	mg/l			22	26.3								
Chromium	mg/l			<.01	<.01								
Copper	mg/l			<.01	<.01								
Flouride	mg/l			0.78	0.48								
Hardness	mg/l			433	387								
Iron Total	mg/l			0.144	0.065								
Lead	mg/l			<.01	<.01								
Magnesium	mg/l			70.8	70.1								
Manganese	mg/l			<.01	<.01								
Mercury	mg/l			<.0002	<.0002								
Molybdenum	mg/l			<.01	<.01								
Nickel	mg/l			<.01	<.01								
Ammonia	mg/l			0.2	0.44								
Nitrate	mg/l			<.01	0.12								
Nitrite	mg/l			0.021	<.01								
Phosphate	mg/l			<.01	<.01								
Potassium	mg/l			1.8	2.8								
Selenium	mg/l			<.002	<.002								
Sodium	mg/l			180	179								
Sulfate	mg/l			308	288								
Sulfide	mg/l			<.1	<.1								
TDS	mg/l			847	876								
Zinc	mg/l			<.01	<.1								

KAISER COAL CORPORATION
HORSE CANYON MINE
ACT/007/013

1989 WATER MONITORING DATA

SAMPLE LOCATION: RS - 2 (Redden Spring)

* INACCESSIBLE

Parameter	Units	Jan 89	Feb 89	Mar 89	Apr 89	May 89	June 89	July 89	Aug 89	Sep 89	Oct 89	Nov 89	Dec 89
Flow	(gpm)	*	*	12	20	20	20	20	20	20			
pH	standard			8.36	8.15	7.37	7.74	7.8	7.86	8.01			
Temp	o C			8	9	8	8	10	10	10			
Conductivity	umhos/cm			2200	2400	2700	2500	2400	2300	2400			
Dissolved Oxygen	ppm			4.2	5	6.4	6.4	7.1	8.1	8.1			
Aluminum	mg/l			<.1	<.1	<.1	<.1	<.1	<.1	<.1			
Arsenic	mg/l			<.01	<.01	<.01	<.01	<.01	<.1	<.01			
Barium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Bicarbonate	mg/l			338	564	503	581	553	533	540			
Boron	mg/l			0.31	0.22	0.18	0.113	0.21	0.12	0.23			
Cadmium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Calcium	mg/l			43.4	44.8	118	42.3	41	30.2	42.1			
Carbonate	mg/l			78	0.5	3	0	0	0	0			
Chloride	mg/l			19.7	23.7	26	20.1	23.5	20.9	19.9			
Chromium	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Copper	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Flouride	mg/l			0.44	0.42	0.44	0.4	0.36	0.498	0.52			
Hardness	mg/l			448	393	310	424	374	424	383			
Iron Total	mg/l			0.033	0.065	4.21	0.06	0.085	0.035	0.042			
Lead	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Magnesium	mg/l			102	0.8	58.6	83	79	50.2	70.2			
Manganese	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Mercury	mg/l			<.0002	<.0002	<.0002	<.0002	<.0002	<.0002	<.0002			
Molybdenum	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Nickel	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Ammonia	mg/l			0.16	<.2	0.22	0.88	<.2	<.2	0.88			
Nitrate	mg/l			0.38	3.46	0.89	0.691	<.02	0.36	0.761			
Nitrite	mg/l			0.02	<.01	<.005	<.01	<.005	<.005	0.02			
Phosphate	mg/l			<.01	<.01	<.01	<.01	<.01	<.01	<.01			
Potassium	mg/l			9.2	0.8	12.4	1.6	5.6	1.3	1.5			
Selenium	mg/l			<.002	<.002	<.002	<.002	<.002	<.002	<.002			
Sodium	mg/l			140	170	408	154	186	159	157			
Sulfate	mg/l			291	258	675	267	268	78.6	251			
Sulfide	mg/l			<.1	<.1	<.1	<.1	<.1	<.1	<.1			
TDS	mg/l			879	845	1380	1020	774	848	861			
Zinc	mg/l			<.01	0.12	<.01	0.011	<.01	<.01	<.01			

Table 7.--Summary of chemical constituents and bacteria in water at gaging station 09314374 in Horse Canyon, August 1978 through September 1979

Parameters and constituents	No. of analyses	Mean	Minimum-maximum
Discharge (cubic feet per second)	12	-	<0.01-1.20
Water temperature (degrees Celsius)	12	18.0	6.0-27.0
Specific conductance (micromhos per centimeter)	12	2,800	1,390-7,000
pH (units)	12	-	8.5-8.7
Milligrams per liter			
Dissolved solids, sum of constituents	12	1,960	953-4,220
Oxygen, dissolved (O_2)	12	7.8	6.1-10.6
Carbon dioxide, dissolved (CO_2)	12	2.1	1.2-4.7
Alkalinity ($CaCO_3$)	12	350	290-380
Bicarbonate (HCO_3)	12	398	338-444
Carbonate (CO_3)	12	16	8-26
Oil and grease	3	-	0
Nitrogen, dissolved (N)	2	-	0.83-0.89
Nitrogen, organic dissolved (N)	4	.31	0.20-0.46
Nitrogen, ammonia dissolved (N)	4	.19	0-0.42
Nitrogen, nitrite dissolved (N)	4	.03	0.02-0.06
Nitrogen, nitrate dissolved (N)	4	.54	0.19-1.20
Nitrogen, ammonia + organic suspended total (N)	4	.16	0.08-0.25
Nitrogen, nitrite + nitrate dissolved (N)	4	.57	0.21-1.20
Nitrogen, ammonia + organic total (N)	4	.66	0.50-0.85
Phosphorus, total (P)	4	.02	0-0.04
Phosphorus, ortho dissolved (P)	4	.005	0-0.02
Carbon, organic dissolved (C)	4	4.0	1.8-8.8
Hardness, (as $CaCO_3$)	12	790	420-1,600
Hardness, (as noncarbonate $CaCO_3$)	12	440	99-1,400
Calcium, dissolved (Ca)	12	98	61-210
Magnesium, dissolved (Mg)	12	130	65-260
Sodium, dissolved (Na)	12	360	130-1,000
Sodium-adsorption-ratio	12	5.7	1.4-12.0
Potassium, dissolved (K)	12	11	5.7-26
Chloride, dissolved (Cl)	12	160	18-1,500
Sulfate, dissolved (SO_4)	12	960	440-1,300
Fluoride, dissolved (F)	4	.3	0.2-0.4
Silica, dissolved (SiO_2)	12	11	10-15
Micrograms per liter			
Arsenic, dissolved (As)	4	-	1
Boron, dissolved (B)	4	260	0-360
Chromium, dissolved (Cr)	4	5	0-10
Iron, dissolved (Fe)	4	20	10-30
Lead, dissolved (Pb)	4	15	0-47
Manganese, dissolved (Mn)	4	15	10-20
Strontium, dissolved (Sr)	4	1,400	1,100-2,000
Zinc, dissolved (Zn)	4	20	10-30
Lithium, dissolved (Li)	4	200	50-630
Selenium, dissolved (Se)	4	1.2	0-3
Phenols	4	1.2	1-2
Bacteria (colonies per 100 milliliters)			
Coliform, fecal	2	-	3-5
Streptococci, fecal	1	-	84

U.S. Steel Data

SURFACE WATER QUALITY DATA
GENEVA COAL MINE

Sampling Date:	2/81	3/81	4/81	5/81
RF-1				
Flow (gpm)	NA	NA	NA	10
Acidity as CaCO3 mg/l	<0.1	14.0	<0.01	4.00
Alkalinity as CaCO3 mg/l	520.00	444.00	386.00	400.00
Dissolved Iron mg/l	0.218	0.210	0.820	0.070
Iron as Fe (Total) mg/l	1.100	0.250	3,080	0.180
Manganese as Mn (Tot) mg/l	0.060	0.010	0.290	0.020
Suspended Solids mg/l	59.0	9.0	303	104
Total Dissolved Solids mg/l	1,000	1,800	950	900
pH Units	8.00	8.00	8.10	8.20

Sampling Date:	6/81	7/81	8/81	9/81
RF-1				
Flow (gpm)	NA	5	7	15
Acidity as CaCO3 mg/l	<0.01	4.00	<0.01	<0.01
Alkalinity as CaCO3 mg/l	404.00	438.00	390.00	396.00
Dissolved Iron mg/l	0.030	0.010	<0.001	0.024
Iron as Fe (Total) mg/l	0.050	0.020	0.070	0.065
Manganese as Mn (Tot) mg/l	0.010	0.010	<0.001	0.013
Suspended Solids mg/l	15.0	8.0	2.0	7.0
Total Dissolved Solids mg/l	950	1,000	900	950
pH Units	8.20	7.70	8.60	8.30

Sampling Date:	10/81	11/81	12/81	3/82
RF-1				
Flow (gpm)	25	15	15	18
Acidity as CaCO3 mg/l	10.00	<0.01	<0.01	10.00
Alkalinity as CaCO3 mg/l	46.00	485.00	380.00	497.00
Dissolved Iron mg/l	0.030	0.033	0.026	1.900
Iron as Fe (Total) mg/l	0.140	0.065	0.095	9.400
Manganese as Mn (Tot) mg/l	0.020	0.020	0.013	0.018
Suspended Solids mg/l	6.2	5.0	2.0	130
Total Dissolved Solids mg/l	987	950	900	874
pH Units	8.00	8.20	8.10	7.60

Sampling Date:	4/82	5/82	6/82	7/82
RF-1				
Flow (gpm)	20	20	25	10
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	345.00	485.00	413.50	327.20
Dissolved Iron mg/l	NA	NA	0.030	0.030
Iron as Fe (Total) mg/l	0.200	1.100	0.100	0.040
Manganese as Mn (Tot) mg/l	0.020	0.035	0.008	0.005
Suspended Solids mg/l	15.0	59.0	13.0	<1.0
Total Dissolved Solids mg/l	988	862	925	915
pH Units	8.10	8.20	8.40	8.50

SURFACE WATER QUALITY DATA
GENEVA COAL MINE

Sampling Date:	8/82	9/82	10/82	4/83
F-1				
Flow (gpm)	25	20	20	NA
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	NA
Alkalinity as CaCO3 mg/l	505.00	364.40	537.00	NA
Dissolved Iron mg/l	0.020	0.036	0.021	NA
Iron as Fe (Total) mg/l	0.025	0.052	0.030	26.500
Manganese as Mn (Tot) mg/l	0.008	0.008	0.010	0.360
Suspended Solids mg/l	4.0	9.0	8.0	1,648
Total Dissolved Solids mg/l	874	890	920	940
pH Units	8.30	8.40	8.50	8.10

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

ampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

SURFACE WATER QUALITY DATA
GENEVA COAL MINE

Sampling Date:	2/81	3/81	4/81	5/81
B-1				
Flow (gpm)	NA	NA	NA	375
Acidity as CaCO3 mg/l	<0.1	<0.1	<0.01	6.00
Alkalinity as CaCO3 mg/l	424.00	372.00	346.00	330.00
Dissolved Iron mg/l	0.270	0.210	0.190	0.520
Iron as Fe (Total) mg/l	0.310	0.250	0.560	0.950
Manganese as Mn (Tot) mg/l	0.020	0.010	0.030	0.050
Suspended Solids mg/l	18.0	9.0	87.0	50.0
Total Dissolved Solids mg/l	1,900	1,800	2,050	1,700
pH Units	8.40	8.0	8.30	8.10

Sampling Date:	7/81	9/81	10/81	3/82
B-1				
Flow (gpm)	375	310	650	300
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	4.50
Alkalinity as CaCO3 mg/l	356.00	298.00	1,095.00	293.60
Dissolved Iron mg/l	0.020	0.075	0.080	0.640
Iron as Fe (Total) mg/l	0.440	0.280	0.255	1.110
Manganese as Mn (Tot) mg/l	0.030	0.014	0.017	0.022
Suspended Solids mg/l	136	10.0	8.1	18.0
Total Dissolved Solids mg/l	1,850	2,000	1,850	362
pH Units	8.20	8.30	8.30	8.20

Sampling Date:	4/82	5/82	6/82	8/82
B-1				
Flow (gpm)	425	400	500	520
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	291.60	350.30	366.90	297.50
Dissolved Iron mg/l	NA	NA	0.760	0.810
Iron as Fe (Total) mg/l	1.600	0.060	1.720	1.920
Manganese as Mn (Tot) mg/l	0.060	0.015	0.070	0.090
Suspended Solids mg/l	105	3.0	98.0	114
Total Dissolved Solids mg/l	2,708	2,178	2,175	2,372
pH Units	7.80	8.10	7.90	8.10

Sampling Date:	9/82	10/82	4/83
B-1			
Flow (gpm)	400	350	NA
Acidity as CaCO3 mg/l	<0.01	<0.01	NA
Alkalinity as CaCO3 mg/l	304.00	399.20	NA
Dissolved Iron mg/l	0.820	0.920	NA
Iron as Fe (Total) mg/l	1.890	2.140	14.800
Manganese as Mn (Tot) mg/l	0.095	0.095	0.515
Suspended Solids mg/l	21.0	8.0	640
Total Dissolved Solids mg/l	2,120	1,900	1,688
pH Units	8.20	8.30	7.80

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	3-81	4-81	5-81	6-81
HC1				
Flow (gpm)	NA	NA	25	NA
Acidity as CaCO3 mg/l	< 0.1	< 0.01	10.00	< 0.01
Alkalinity as CaCO3 mg/l	370.00	416.00	360.00	408.00
Dissolved Iron mg/l	0.030	0.010	0.140	0.010
Iron as Fe (Total) mg/l	0.060	0.230	0.270	0.120
Manganese as Mn (Tot) mg/l	0.030	0.020	0.040	0.050
Suspended Solids mg/l	1.0	23.0	12.0	44.0
Total Dissolved Solids mg/l	1,400	1,450	1,300	1,450
pH Units	7.70	8.10	8.00	8.10

Sampling Date:	7-81	8-81	10-81	11-81
HC1				
Flow (gpm)	40	3	35	25
Acidity as CaCO3 mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity as CaCO3 mg/l	420.00	416.00	985.00	452.00
Dissolved Iron mg/l	0.070	0.090	0.130	0.019
Iron as Fe (Total) mg/l	0.080	0.140	0.265	0.155
Manganese as Mn (Tot) mg/l	0.050	0.120	0.130	0.030
Suspended Solids mg/l	11.0	5.0	6.6	16.0
Total Dissolved Solids mg/l	1,400	1,400	1,500	1,500
pH Units	8.20	8.30	8.20	8.10

Sampling Date:	12-81	4-82	5-82	6-82
HC1				
Flow (gpm)	17	12	60	65
Acidity as CaCO3 mg/l	< 0.01	< 0.01	4.00	2.00
Alkalinity as CaCO3 mg/l	360.00	252.00	517.50	412.00
Dissolved Iron mg/l	0.013	NA	NA	0.040
Iron as Fe (Total) mg/l	0.150	0.030	2.250	0.070
Manganese as Mn (Tot) mg/l	0.025	0.010	0.100	0.010
Suspended Solids mg/l	11.0	4.0	106	9.0
Total Dissolved Solids mg/l	1,325	1,566	1,372	1,375
pH Units	8.10	7.80	7.90	8.00

Sampling Date:	7-82	8-82	10-82	4-83
HC1				
Flow (gpm)	45	40	10	NA
Acidity as CaCO3 mg/l	< 0.01	< 0.01	6.00	NA
Alkalinity as CaCO3 mg/l	339.50	523.00	211.00	NA
Dissolved Iron mg/l	0.040	0.040	0.038	NA
Iron as Fe (Total) mg/l	0.040	0.044	0.040	49.300
Manganese as Mn (Tot) mg/l	0.010	0.055	0.042	1.450
Suspended Solids mg/l	2.0	2.0	14.0	2,152
Total Dissolved Solids mg/l	1,425	1,502	1,500	1,188
pH Units	8.00	8.10	7.80	8.10

SURFACE WATER QUALITY

MINE DISCHARGES

	001 4-6-81	002 4-6-81
Aluminum, Al mg/l	0.016	0.025
Ammonia, NH3 mg/l	0.10	0.45
Antimony, Sb mg/l	<0.001	<.001
Arsenic, As mg/l	0.002	0.005
Barium, Ba mg/l	0.035	0.045
Bicarbonate, HNO3 mg/l		
Boron, B mg/l	0.020	0.033
Cadmium, Cd mg/l	<0.001	<0.001
Beryllium, Be mg/l	<0.01	<0.01
Bromide, Br mg/l	<0.001	<0.001
Cobalt, Co, mg/l	<0.001	<0.004
Chromium, Cr mg/l	<0.001	<0.001
Conductivity, umhos/cm		
Copper, Cu mg/l	0.003	0.006
Flouride, F mg/l	0.35	0.41
Hardness, CaCO3 mg/l		
Iron, Fe (total) mg/l	0.120	0.170
Lead, Pb mg/l	0.003	<0.001
Magnesium, Mg mg/l	112.80	96.00
Manganese, Mn mg/l	0.012	0.016
Mercury, Hg mg/l	<0.0002	<0.0002
Molybdenum, Mo mg/l	0.003	0.009
Nickel, Ni mg/l	0.094	0.095
Nitrate, NO3-N mg/l	0.66	0.62
Nitrite, NO2-N mg/l	<0.01	0.08
Phosphate, PO4 mg/l	0.070	0.060
Potassium, K mg/l		
Selenium, Se mg/l	<0.001	<0.001
Sodium, Na mg/l		
Sulfate, SO4 mg/l	990	960
Sulfide, S mg/l	0.67	0.92
Suspended Solids mg/l	20.0	28.0
Total Combustable Solids mg/l		
Total Dissolved Solids mg/l		
Zinc, Zn mg/l	0.006	0.019
pH Units		

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	3/11/81	3/27/81	4/6/81	4/22/81
001				
Average Flow (Mgpd)	NA	NA	1.60	1.60
Acidity as CaCO3 mg/l	<0.1	<0.1	NA	<0.1
Alkalinity as CaCO3 mg/l	376.00	378.00	NA	386.00
Dissolved Iron mg/l	0.220	0.040	NA	0.020
Iron as Fe (Total) mg/l	0.240	0.140	0.120	0.080
Manganese as Mn (Tot) mg/l	0.010	0.010	0.012	0.020
Oil and Grease mg/l	1.60	NA	0.80	NA
Suspended Solids mg/l	8.0	8.0	20.0	25.0
Total Dissolved Solids mg/l	1,770	1,750	NA	2,100
pH Units	7.70	7.80	7.30	8.10

Sampling Date:	5/13/81	6/11/81	6/24/81	7/8/81
001				
Average Flow (Mgpd)	1.60	1.60	0.197	0.197
Acidity as CaCO3 mg/l		<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l		370.00	366.00	366.00
Dissolved Iron mg/l		0.010	0.180	0.050
Iron as Fe (Total) mg/l		0.080	0.210	0.080
Manganese as Mn (Tot) mg/l		0.010	0.010	<0.001
Oil and Grease mg/l		1.00	NA	<0.01
Suspended Solids mg/l		1.0	29.0	9.0
Total Dissolved Solids mg/l		1,700	1,900	1,850
pH Units		8.10	8.10	8.20

Sampling Date:	7/22/81	8/12/81	8/26/81	9/9/81
001				
Average Flow (Mgpd)	0.197	0.197	0.197	0.197
Acidity as CaCO3 mg/l	<0.01	<0.01	3.46	3.60
Alkalinity as CaCO3 mg/l	372.00	370.00	388.00	340.00
Dissolved Iron mg/l	0.185	0.038	0.150	0.024
Iron as Fe (Total) mg/l	0.240	0.050	0.260	0.110
Manganese as Mn (Tot) mg/l	0.012	0.010	0.018	0.015
Oil and Grease mg/l	NA	1.60	NA	1.40
Suspended Solids mg/l	5.0	4.0	12.5	10.0
Total Dissolved Solids mg/l	1,822	1,800	1,850	1,975
pH Units	8.20	8.30	7.90	7.60

Sampling Date:	9/9/81	10/14/81	10/28/81	11/10/81
001				
Average Flow (Mgpd)	0.197	0.271	0.271	0.271
Acidity as CaCO3 mg/l	<0.01	2.40	6.00	<0.01
Alkalinity as CaCO3 mg/l	368.00	363.00	362.00	439.00
Dissolved Iron mg/l	0.040	0.040	0.085	NA
Iron as Fe (Total) mg/l	0.068	0,115	0.112	0.112
Manganese as Mn (Tot) mg/l	0.015	0.015	0.018	0.050
Oil and Grease mg/l	NA	2.50	NA	0.20
Suspended Solids mg/l	13.0	4.0	11.0	15.0
Total Dissolved Solids mg/l	1,985	2,000	1,900	1,800
pH Units	8.10	7.95	7.90	8.10

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	11/15/81	12/9/81	12/23/81	1/13/82
001				
Average Flow (Mgpd)	0.271	0.271	0.271	0.127
Acidity as CaCO3 mg/l				
Alkalinity as CaCO3 mg/l				
Dissolved Iron mg/l				
Iron as Fe (Total) mg/l				
Manganese as Mn (Tot) mg/l				
Oil and Grease mg/l				
Suspended Solids mg/l				
Total Dissolved Solids mg/l				
pH Units				

Sampling Date:	1/27/82	2/9/82	2/22/82	3/9/82
001				
Average Flow (Mgpd)	0.127	0.319	0.319	0.325
Acidity as CaCO3 mg/l		<0.01	NA	6.00
Alkalinity as CaCO3 mg/l		238.00	NA	472.00
Dissolved Iron mg/l		0.110	NA	0.380
Iron as Fe (Total) mg/l		0.125	0.240	0.420
Manganese as Mn (Tot) mg/l		0.044	NA	0.062
Oil and Grease mg/l		<1.0	NA	1.60
Suspended Solids mg/l		5.0	26.0	2.0
Total Dissolved Solids mg/l		2,000	2,150	2,456
pH Units		7.70	7.70	7.80

Sampling Date:	3/23/82	4/13/82	4/27/82	5/13/82
001				
Average Flow (Mgpd)	0.325	0.119	0.119	0.162
Acidity as CaCO3 mg/l	NA	<0.01	NA	10.0
Alkalinity as CaCO3 mg/l	NA	323.50	NA	381.20
Dissolved Iron mg/l	NA	0.180	NA	0.250
Iron as Fe (Total) mg/l	0.260	0.195	0.286	0.250
Manganese as Mn (Tot) mg/l	NA	0.020	NA	0.040
Oil and Grease mg/l	NA	1.4	NA	<0.1
Suspended Solids mg/l	1.0	13.0	4.0	5.0
Total Dissolved Solids mg/l	2,308	2,654	2,632	2,566
pH Units	7.80	7.90	7.90	7.80

Sampling Date:	5/24/82	6/8/82	6/23/82	7/13/82
001				
Average Flow (Mgpd)	0.162	0.184	0.184	0.183
Acidity as CaCO3 mg/l	NA	<0.01	NA	1.00
Alkalinity as CaCO3 mg/l	NA	401.10	NA	313.40
Dissolved Iron mg/l	NA	0.200	NA	0.250
Iron as Fe (Total) mg/l	0.150	0.210	0.230	0.250
Manganese as Mn (Tot) mg/l	NA	0.015	NA	0.035
Oil and Grease mg/l	NA	0.2	NA	1.2
Suspended Solids mg/l	2.0	9.0	6.0	5.0
Total Dissolved Solids mg/l	2,268	1,875	2,150	2,035
pH Units	8.00	7.90	7.80	7.80

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	7/28/82	8/11/82	8/26/82	9/15/8
001				
Average Flow (Mgpd)	0.263	0.208	0.208	0.23
Acidity as CaCO3 mg/l	NA	1.00	NA	9.0
Alkalinity as CaCO3 mg/l	NA	398.70	NA	348.5
Dissolved Iron mg/l	NA	0.050	NA	0.28
Iron as Fe (Total) mg/l	0.290	0.116	0.180	0.33
Manganese as Mn (Tot) mg/l	NA	0.055	NA	0.01
Oil and Grease mg/l	NA	<0.1	NA	0.
Suspended Solids mg/l	1.0	7.0	38.0	1.
Total Dissolved Solids mg/l	1,970	1,890	1,820	2,61
pH Units	8.00	8.00	7.90	7.6

Sampling Date:	9/28/82	10/12/82	10/26/82	11/10/8
001				
Average Flow (Mgpd)	0.263	0.208	0.208	0.2
Acidity as CaCO3 mg/l	NA	1.00	NA	9.
Alkalinity as CaCO3 mg/l	NA	398.70	NA	348.5
Dissolved Iron mg/l	NA	0.050	NA	0.2
Iron as Fe (Total) mg/l	0.290	0.116	0.180	0.3
Manganese as Mn (Tot) mg/l	NA	0.055	NA	0.0
Oil and Grease mg/l	NA	<0.1	NA	0.
Suspended Solids mg/l	1.0	7.0	38.0	1
Total Dissolved Solids mg/l	1,970	1,890	1,8250	2,6
pH Units	8.00	8.00	7.90	7.

Sampling Date:	11/24/82	12/8/82	12/22/82	1/12/8
001				
Average Flow (Mgpd)	0.234	0.263	0.263	0.2
Acidity as CaCO3 mg/l	NA	<0.01	NA	<0.
Alkalinity as CaCO3 mg/l	NA	319.80	NA	439.
Dissolved Iron mg/l	NA	0.420	NA	0.3
Iron as Fe (Total) mg/l	0.370	0.430	0.210	0.3
Manganese as Mn (Tot) mg/l	NA	0.025	NA	0.0
Oil and Grease mg/l	NA	0.6	NA	1
Suspended Solids mg/l	6.0	17.0	5.0	4
Total Dissolved Solids mg/l	1,920	1,815	1,840	1,8
pH Units	8.00	8.10	7.90	8.

Sampling Date:	1/26/83	2/9/83	2/22/83	3/9/8
001				
Average Flow (Mgpd)	0.272	NA	NA	NA
Acidity as CaCO3 mg/l	NA	6.00	NA	3
Alkalinity as CaCO3 mg/l	NA	328.20	NA	344.
Dissolved Iron mg/l	NA	0.380	NA	0.3
Iron as Fe (Total) mg/l	0.550	0.430	0.190	0.3
Manganese as Mn (Tot) mg/l	NA	0.020	NA	0.0
Oil and Grease mg/l	NA	0.6	NA	<0
Suspended Solids mg/l	17.0	26.0	<0.1	5
Total Dissolved Solids mg/l	1,850	1,800	1,775	1,8
pH Units	7.80	7.80	7.80	7.

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	3/23/83	4/14/83	4/28/83	5/17/83
001				
Average Flow (Mgpd)	NA	0.075	0.075	0.048
Acidity as CaCO3 mg/l	NA	<0.01	NA	<0.01
Alkalinity as CaCO3 mg/l	NA	324.00	NA	338.00
Dissolved Iron mg/l	NA	0.310	NA	0.190
Iron as Fe (Total) mg/l	0.200	0.370	0.290	0.190
Manganese as Mn (Tot) mg/l	NA	0.025	NA	0.018
Oil and Grease mg/l	NA	<0.2	NA	<0.1
Suspended Solids mg/l	13.0	3.0	15.0	11.0
Total Dissolved Solids mg/l	1,810	2,160	2,172	2,124
pH Units	7.30	7.10	7.80	8.20

Sampling Date:	5/26/83	6/8/83	6/29/83
001			
Average Flow (Mgpd)	0.048		
Acidity as CaCO3 mg/l	NA	<0.01	NA
Alkalinity as CaCO3 mg/l	NA	320.00	NA
Dissolved Iron mg/l	NA	0.030	NA
Iron as Fe (Total) mg/l	0.240	0.170	0.100
Manganese as Mn (Tot) mg/l	NA	0.027	NA
Oil and Grease mg/l	NA	<0.2	NA
Suspended Solids mg/l	30.0	29.0	11.0
Total Dissolved Solids mg/l	2,016	1,988	1,710
pH Units	8.00	7.90	7.80

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

SURFACE WATER QUALITY - GENEVA COAL MINE

Sampling Date:	2/12/81	2/27/81	3/11/81	3/27/81
002				
Average Flow (Mgpd)	NA	NA	NA	NA
Acidity as CaCO3 mg/l	<0.1	12.0	8.0	10.0
Alkalinity as CaCO3 mg/l	462.00	430.00	432.00	390.00
Dissolved Iron mg/l	NA	0.270	0.620	0.310
Iron as Fe (Total) mg/l	0.660	0.270	0.650	0.340
Manganese as Mn (Tot) mg/l	NA	0.025	0.030	0.020
Oil and Grease mg/l	5.60	NA	1.20	NA
Suspended Solids mg/l	3.0	6.0	7.0	6.0
Total Dissolved Solids mg/l	1,750	1,950	1,750	1,700
pH Units	8.40	7.50	7.60	7.30

Sampling Date:	4/6/81	4/22/81	5/13/81	6/11/81
002				
Average Flow (Mgpd)	0.319	0.319	0.319	0.319
Acidity as CaCO3 mg/l	NA	10.00	35.00	
Alkalinity as CaCO3 mg/l	NA	368.00	470.00	
Dissolved Iron mg/l	NA	0.020	0.050	
Iron as Fe (Total) mg/l	0.170	0.310	0.160	
Manganese as Mn (Tot) mg/l	0.016	0.250	0.020	
Oil and Grease mg/l	0.80	NA	2.10	
Suspended Solids mg/l	28.0	18.0	9.0	
Total Dissolved Solids mg/l	NA	1,900	1,800	
pH Units	7.40	7.60	7.80	

Sampling Date:	6/24/81	7/8/81	7/22/81	8/12/81
002				
Average Flow (Mgpd)	0.319	0.225	0.225	0.225
Acidity as CaCO3 mg/l	6.80	8.00	5.70	20.00
Alkalinity as CaCO3 mg/l	404.00	404.00	364.00	382.00
Dissolved Iron mg/l	0.330	0.110	0.350	0.090
Iron as Fe (Total) mg/l	0.350	0.140	0.398	0.150
Manganese as Mn (Tot) mg/l	0.080	<0.001	0.085	0.010
Oil and Grease mg/l	NA	<0.01	NA	0.80
Suspended Solids mg/l	19.0	9.0	4.0	5.0
Total Dissolved Solids mg/l	1,800	1,800	1,810	1,700
pH Units	7.80	7.80	7.70	7.90

Sampling Date:	8/26/81	9/9/81	9/23/81	10/14/81
002				
Average Flow (Mgpd)	0.225	0.225	0.225	0.213
Acidity as CaCO3 mg/l				10.00
Alkalinity as CaCO3 mg/l				451.00
Dissolved Iron mg/l				0.095
Iron as Fe (Total) mg/l				0.150
Manganese as Mn (Tot) mg/l				0.010
Oil and Grease mg/l				0.20
Suspended Solids mg/l				2.0
Total Dissolved Solids mg/l				1,800
pH Units				7.80

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	10/28/81	11/10/81	11/25/81	12/9/81
002				
Average Flow (Mgpd)	0.213	0.213	0.213	0.213
Acidity as CaCO3 mg/l				
Alkalinity as CaCO3 mg/l				
Dissolved Iron mg/l				
Iron as Fe (Total) mg/l				
Manganese as Mn (Tot) mg/l				
Oil and Grease mg/l				
Suspended Solids mg/l				
Total Dissolved Solids mg/l				
pH Units				

Sampling Date:	12/13/81	1/13/82	1/27/82	2/9/82
002				
Average Flow (Mgpd)	0.213	0.000	0.000	0.000
Acidity as CaCO3 mg/l				
Alkalinity as CaCO3 mg/l				
Dissolved Iron mg/l				
Iron as Fe (Total) mg/l				
Manganese as Mn (Tot) mg/l				
Oil and Grease mg/l				
Suspended Solids mg/l				
Total Dissolved Solids mg/l				
pH Units				

Sampling Date:	2/22/82	3/9/82	3/23/82	4/13/82
002				
Average Flow (Mgpd)	0.000	0.122	0.122	0.197
Acidity as CaCO3 mg/l			NA	<0.01
Alkalinity as CaCO3 mg/l			NA	335.80
Dissolved Iron mg/l			NA	0.570
Iron as Fe (Total) mg/l			0.630	0.588
Manganese as Mn (Tot) mg/l			NA	0.050
Oil and Grease mg/l			NA	1.6
Suspended Solids mg/l			1.0	12.0
Total Dissolved Solids mg/l			2,516	2,404
pH Units			7.40	7.60

Sampling Date:	4/27/82	5/17/82	5/24/82	6/8/82
002				
Average Flow (Mgpd)	0.197	0.185	0.185	0.819
Acidity as CaCO3 mg/l	NA	12.00	NA	24.00
Alkalinity as CaCO3 mg/l	NA	442.10	NA	410.20
Dissolved Iron mg/l	NA	0.300	NA	0.350
Iron as Fe (Total) mg/l	0.665	0.300	0.250	0.350
Manganese as Mn (Tot) mg/l	NA	0.035	NA	0.045
Oil and Grease mg/l	NA	<0.1	NA	0.6
Suspended Solids mg/l	6.0	6.0	3.0	9.0
Total Dissolved Solids mg/l	2,772	2,150	2,192	2,275
pH Units	7.60	7.70	7.70	7.50

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	6/23/82	7/13/82	7/29/82	8/11/82
002				
Average Flow (Mgpd)	0.819	0.360	0.360	0.253
Acidity as CaCO3 mg/l	NA		NA	10.00
Alkalinity as CaCO3 mg/l	NA		NA	311.80
Dissolved Iron mg/l	NA		NA	0.320
Iron as Fe (Total) mg/l	0.160		1.100	0.350
Manganese as Mn (Tot) mg/l	NA		NA	0.030
Oil and Grease mg/l	NA		NA	0.2
Suspended Solids mg/l	5.0		14.0	5.0
Total Dissolved Solids mg/l	2,200		2,344	2,450
pH Units	7.40		7.60	7.80

Sampling Date:	8/27/82	9/15/82	9/28/82	10/12/82
002				
Average Flow (Mgpd)	0.253	0.185	0.185	0.164
Acidity as CaCO3 mg/l	NA	5.00	NA	8.00
Alkalinity as CaCO3 mg/l	NA	346.10	NA	485.10
Dissolved Iron mg/l	NA	0.290	NA	0.065
Iron as Fe (Total) mg/l	1.320	0.330	0.230	0.380
Manganese as Mn (Tot) mg/l	NA	0.036	NA	0.041
Oil and Grease mg/l	NA	<0.1	NA	<0.1
Suspended Solids mg/l	18.0	25.0	1.0	6.0
Total Dissolved Solids mg/l	1,900	2,190	1,820	1,800
pH Units	7.80	7.80	7.80	7.60

Sampling Date:	10/26/82	11/10/82	11/24/82	12/8/82
002				
Average Flow (Mgpd)	0.164	0.180	1.180	0.153
Acidity as CaCO3 mg/l	NA	<0.01	NA	3.00
Alkalinity as CaCO3 mg/l	NA	339.60	NA	320.20
Dissolved Iron mg/l	NA	0.065	NA	0.520
Iron as Fe (Total) mg/l	0.240	0.120	0.570	0.535
Manganese as Mn (Tot) mg/l	NA	0.020	NA	0.025
Oil and Grease mg/l	NA	0.8	NA	1.0
Suspended Solids mg/l	5.0	2.0	3.0	11.0
Total Dissolved Solids mg/l	1,910	1,900	2,500	2,505
pH Units	7.70	8.10	7.40	7.50

Sampling Date:	12/22/82	1/13/83	1/27/83	2/9/83
002				
Average Flow (Mgpd)	0.153	0.993	0.993	0.150
Acidity as CaCO3 mg/l	NA	9.00	NA	11.00
Alkalinity as CaCO3 mg/l	NA	422.50	NA	329.00
Dissolved Iron mg/l	NA	0.500	NA	NA
Iron as Fe (Total) mg/l	0.380	0.530	0.300	0.310
Manganese as Mn (Tot) mg/l	NA	0.025	NA	0.015
Oil and Grease mg/l	NA	<0.1	NA	<0.1
Suspended Solids mg/l	8.0	9.0	27.0	27.0
Total Dissolved Solids mg/l	2,510	1,785	2,500	1,775
pH Units	7.70	7.50	7.60	7.60

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	2/22/83	3/9/83	3/23/83	4/13/83
002				
Average Flow (Mgpd)	0.150	0.132	0.132	0.304
Acidity as CaCO3 mg/l	NA	7.00	NA	<0.01
Alkalinity as CaCO3 mg/l	NA	351.30	NA	394.00
Dissolved Iron mg/l	NA	0.270	NA	0.380
Iron as Fe (Total) mg/l	0.250	0.270	0.285	0.380
Manganese as Mn (Tot) mg/l	NA	0.015	NA	0.015
Oil and Grease mg/l	NA	<0.2	NA	<0.2
Suspended Solids mg/l	1.0	3.0	13.0	<0.1
Total Dissolved Solids mg/l	1,845	1,725	1,750	1,710
pH Units	7.60	7.40	7.20	7.80

Sampling Date:	4/27/83	5/10/83	5/25/83	6/8/83
002				
Average Flow (Mgpd)	0.304	0.253	0.253	
Acidity as CaCO3 mg/l	NA	<0.01	NA	<0.01
Alkalinity as CaCO3 mg/l	NA	428.00	NA	374.00
Dissolved Iron mg/l	NA	0.300	NA	0.030
Iron as Fe (Total) mg/l	0.410	0.445	0.370	0.220
Manganese as Mn (Tot) mg/l	NA	0.017	NA	0.015
Oil and Grease mg/l	NA	<0.2	NA	1.2
Suspended Solids mg/l	14.0	11.0	27.0	12.0
Total Dissolved Solids mg/l	1,988	1,822	1,978	1,902
pH Units	7.60	7.80	7.80	7.70

Sampling Date:	6/29/83
002	
Average Flow (Mgpd)	
Acidity as CaCO3 mg/l	NA
Alkalinity as CaCO3 mg/l	NA
Dissolved Iron mg/l	NA
Iron as Fe (Total) mg/l	0.180
Manganese as Mn (Tot) mg/l	NA
Oil and Grease mg/l	NA
Suspended Solids mg/l	13.0
Total Dissolved Solids mg/l	1,724
pH Units	7.60

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Oil and Grease mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	2/1281	3/11/82	4/6/81	5/13/81
003				
BOD 5 day mg/l	4.8	0.19	0.04	NA
Free Chlorine (Avail) as Cl2	0.20	0.19	0.04	NA
MPN Fecal Coliform MPN/100 ml	<2.0	790	<2.0	<2.0
MPN Total Coliform MPN/100 ml	8.0	1,300	NA	460
Oil and Grease mg/l	2.01	3.80	<0.01	1.20
Suspended Solids mg/l	26.0	4.0	30.0	16.0
Total Chlorine mg/l	NA	NA	NA	<0.01
pH Units	7.80	7.50	7.50	7.50

Sampling Date:	6/11/81	7/8/81	8/12/81	9/9/81
003				
BOD 5 day mg/l	16.8	12.0	4.5	11.0
Free Chlorine (Avail) as Cl2	NA	NA	NA	NA
MPN Fecal Coliform MPN/100 ml	<2.0	23.0	23.0	<2.0
MPN Total Coliform MPN/100 ml	130	700	3,300	110
Oil and Grease mg/l	<0.01	1.20	5.40	<0.01
Suspended Solids mg/l	32.0	30.0	2.0	9.0
Total Chlorine mg/l	0.04	0.01	0.08	0.06
pH Units	7.20	7.30	7.50	7.70

Sampling Date:	10/15/81	11/10/81	11/12/81	12/9/81
003				
BOD 5 day mg/l	2.6	4.4	NA	2.0
MPN Fecal Coliform MPN/100 ml	<2.0	NA	<2.0	<2.0
MPN Total Coliform MPN/100 ml	8.0	NA	<2.0	<2.0
Oil and Grease mg/l	2.70	0.80	NA	4.00
Suspended Solids mg/l	4.0	2.0	NA	4.2
Total Chlorine mg/l	1.58	3.17	NA	2.14
pH Units	7.68	7.50	NA	7.70

Sampling Date:	1/13/82	2/9/82	3/9/82	4/14/82
003				
BOD 5 day mg/l	6.6	6.5	7.0	1.8
MPN Fecal Coliform MPN/100 ml	3,300	2.0	5.0p	<2.0
MPN Total Coliform MPN/100 ml	13,000	79.0	130	1,700
Oil and Grease mg/l	2.20	<1.0	1.20	1.6
Suspended Solids mg/l	12.0	15.0	3.2	4.0
Total Chlorine mg/l	3.11	2.46	3.78	0.06
pH Units	7.40	7.40	7.70	7.70

SURFACE WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/17/82	6/8/82	7/13/82	8/11/82
003				
BOD 5 Day mg/l	3.7	3.5	12.6	9.5
MPN Fecal Coliform MPN/100 ml	<2.0	<2.0	5.0	<2.0
MPN Total Coliform MPN/100 ml	79.0	1,300	13,000	4,900
Oil and Grease mg/l	4.0	1.8	13.0	0.6
Suspended Solids mg/l	16.0	22.0	18.0	8.5
Total Chlorine mg/l	<0.01	<0.01	<0.01	<0.01
pH Units	7.90	7.80	7.50	7.90

Sampling Date:	9/15/82	10/12/82	11/19/82	12/8/82
003				
BOD 5 Day mg/l	7.0	5.0	2.0	2.1
MPN Fecal Coliform MPN/100 ml	<2.0	<2.0	<2.0	<2.0
MPN Total Coliform MPN/100 ml	<2.0	21.0	<2.0	11.0
Oil and Grease mg/l	0.4	0.8	0.6	0.6
Suspended Solids mg/l	16.0	18.0	8.0	15.0
Total Chlorine mg/l	<0.01	5.48	0.63	0.83
pH Units	7.30	7.60	NA	7.60

Sampling Date:	1/12/83	2/9/83	3/9/83	4/13/83
003				
BOD 5 day mg/l	4.4	5.2	5.0	2.8
MPN Fecal Coliform MPN/100 ml	<2	<2	<2	<2
MPN Total Coliform MPN/100 ml	<2.0	79.0	<2.0	33.0
Oil and Grease mg/l	<0.2	0.2	<0.2	<0.2
Suspended Solids mg/l	24.0	13.0	12.0	4.0
Total Chlorine mg/l	0.84	0.07	4.22	0.34
pH Units	7.80	7.50	7.50	7.60

Sampling Date:	5/10/83	6/8/83
003		
BOD 5 day mg/l	3.2	3.90
MPN Fecal Coliform MPN/100 ml	<2	2
MPN Total Coliform MPN/100 ml	<2.0	22.0
Oil and Grease mg/l	<0.2	0.6
Suspended Solids mg/l	12.0	14.0
Total Chlorine mg/l	0.09	<0.02
pH Units	7.90	7.80

SURFACE WATER QUALITY DATA
GENEVA COAL MINE

Sampling Date:	2/81	3/81	4/81	5/81
B-1				
Flow (gpm)	NA	NA	NA	375
Acidity as CaCO3 mg/l	<0.1	<0.1	<0.01	6.00
Alkalinity as CaCO3 mg/l	424.00	372.00	346.00	330.00
Dissolved Iron mg/l	0.270	0.210	0.190	0.520
Iron as Fe (Total) mg/l	0.310	0.250	0.560	0.950
Manganese as Mn (Tot) mg/l	0.020	0.010	0.030	0.050
Suspended Solids mg/l	18.0	9.0	87.0	50.0
Total Dissolved Solids mg/l	1,900	1,800	2,050	1,700
pH Units	8.40	8.0	8.30	8.10

Sampling Date:	7/81	9/81	10/81	3/82
B-1				
Flow (gpm)	375	310	650	300
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	4.50
Alkalinity as CaCO3 mg/l	356.00	298.00	1,095.00	293.60
Dissolved Iron mg/l	0.020	0.075	0.080	0.640
Iron as Fe (Total) mg/l	0.440	0.280	0.255	1.110
Manganese as Mn (Tot) mg/l	0.030	0.014	0.017	0.022
Suspended Solids mg/l	136	10.0	8.1	18.0
Total Dissolved Solids mg/l	1,850	2,000	1,850	362
pH Units	8.20	8.30	8.30	8.20

Sampling Date:	4/82	5/82	6/82	8/82
B-1				
Flow (gpm)	425	400	500	520
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	291.60	350.30	366.90	297.50
Dissolved Iron mg/l	NA	NA	0.760	0.810
Iron as Fe (Total) mg/l	1.600	0.060	1.720	1.920
Manganese as Mn (Tot) mg/l	0.060	0.015	0.070	0.090
Suspended Solids mg/l	105	3.0	98.0	114
Total Dissolved Solids mg/l	2,708	2,178	2,175	2,372
pH Units	7.80	8.10	7.90	8.10

Sampling Date:	9/82	10/82	4/83
B-1			
Flow (gpm)	400	350	NA
Acidity as CaCO3 mg/l	<0.01	<0.01	NA
Alkalinity as CaCO3 mg/l	304.00	399.20	NA
Dissolved Iron mg/l	0.820	0.920	NA
Iron as Fe (Total) mg/l	1.890	2.140	14.800
Manganese as Mn (Tot) mg/l	0.095	0.095	0.515
Suspended Solids mg/l	21.0	8.0	640
Total Dissolved Solids mg/l	2,120	1,900	1,688
pH Units	8.20	8.30	7.80

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	2-81	3-81	4-81	5-81
RS2				
Flow (gpm)	NA	NA	NA	20
Acidity as CaCO3 mg/l	< 0.1	< 0.1	2.50	4.00
Alkalinity as CaCO3 mg/l	500.00	434.00	418.00	450.00
Dissolved Iron mg/l	0.032	0.060	NA	0.390
Iron as Fe (Total) mg/l	0.040	0.190	0.160	0.440
Manganese as Mn (Tot) mg/l	< 0.001	0.050	0.010	0.050
Suspended Solids mg/l	NA	NA	NA	9.0
Total Dissolved Solids mg/l	900	900	1,000	900
pH Units	8.10	7.80	8.00	8.20

Sampling Date:	6-81	7-81	8-81	9-81
RS2				
Flow (gpm)	NA	34	24	25
Acidity as CaCO3 mg/l	< 0.01	4.00	4.00	< 0.01
Alkalinity as CaCO3 mg/l	424.00	424.00	416.00	430.00
Dissolved Iron mg/l	0.010	<0.001	<0.001	0.018
Iron as Fe (Total) mg/l	0.400	0.010	0.070	0.420
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.009
Suspended Solids mg/l	113	14.0	5.0	8.0
Total Dissolved Solids mg/l	900	950	900	950
pH Units	8.10	7.80	8.10	8.10

Sampling Date:	10-81	11-81	12-81	4-82
RS2				
Flow (gpm)	30	30	24	20
Acidity as CaCO3 mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity as CaCO3 mg/l	79.00	486.00	388.00	494.00
Dissolved Iron mg/l	0.020	NA	0.015	NA
Iron as Fe (Total) mg/l	0.450	0.465	0.460	<0.001
Manganese as Mn (Tot) mg/l	0.015	0.025	0.017	0.010
Suspended Solids mg/l	6.1	NA	2.0	7.0
Total Dissolved Solids mg/l	950	900	900	1,050
pH Units	8.30	8.10	8.30	7.80

Sampling Date:	5-82	6-82	7-82	8-82
RS2				
Flow (gpm)	30	30	25	30
Acidity as CaCO3 mg/l	6.00	18.00	5.00	<0.01
Alkalinity as CaCO3 mg/l	520.20	411.00	500.00	536.00
Dissolved Iron mg/l	NA	0.010	0.030	0.060
Iron as Fe (Total) mg/l	0.060	0.010	0.030	0.150
Manganese as Mn (Tot) mg/l	0.005	0.002	0.005	0.015
Suspended Solids mg/l	7.0	11.0	<1.0	5.0
Total Dissolved Solids mg/l	886	900	950	862
pH Units	7.80	7.60	7.60	8.20

NA = NOT AVAILABLE

Sampling Date:	9-82	10-82	4-83
RS2			
Flow (gpm)	25	30	20
Acidity as CaCO3 mg/l	< 0.01	5.00	NA
lkalinity as CaCO3 mg/l	318.30	552	NA
Dissolved Iron mg/l	0.045	0.040	NA
Iron as Fe (Total) mg/l	0.056	0.049	0.180
Manganese as Mn (Tot) mg/l	0.010	0.012	0.003
Suspended Solids mg/l	11.0	8.0	61.0
Total Dissolved Solids mg/l	946	910	966
pH Units	8.10	7.80	7.90

Sampling Date:	1-81	2-81	3-81	4-81
2WB				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	<0.1	<0.1	2.0	3.60
Alkalinity as CaCO3 mg/l	184.00	168.00	162.00	150.00
Dissolved Iron mg/l	0.420	0.050	0.040	0.030
Iron as Fe (Total) mg/l	0.640	0.060	0.060	0.070
Manganese as Mn (Tot) mg/l	0.030	0.020	0.020	0.020
Suspended Solids mg/l	59.0	10.0	8.0	8.0
Total Dissolved Solids mg/l	2,200	2,200	2,100	2,200
pH Units	7.40	8.00	7.70	8.10

Sampling Date:	5-81	6-81	7-81	8-81
2WB				
Flow (gpm)	3	3	5	7
Acidity as CaCO3 mg/l	5.70	<0.01	10.80	<0.01
Alkalinity as CaCO3 mg/l	124.00	140.00	350.00	210.00
Dissolved Iron mg/l	0.140	0.033	0.150	0.146
Iron as Fe (Total) mg/l	0.360	0.075	0.380	0.410
Manganese as Mn (Tot) mg/l	0.030	0.025	0.027	0.020
Suspended Solids mg/l	19.0	13.0	15.0	1.0
Total Dissolved Solids mg/l	2,300	2,400	2,050	2,200
pH Units	8.00	8.10	7.60	7.90

Sampling Date:	9-81	10-81	11-81	12-81
2WB				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	2.00	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	265.00	198.10	203.30	228.20
Dissolved Iron mg/l	0.136	0.150	0.150	0.150
Iron as Fe (Total) mg/l	0.390	0.380	0.380	0.400
Manganese as Mn (Tot) mg/l	0.022	0.025	0.025	0.027
uspended Solids mg/l	24.0	17.0	13.0	7.0
otal Dissolved Solids mg/l	2,200	2,175	2,200	2,175
pH Units	8.10	7.90	8.10	8.20

NA = NOT AVAILABLE

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1-82	2-92	3-82	4-82
2WB				
Flow (gpm)	3	3	5	3
Acidity as CaCO3 mg/l	12.00	12.00	< 0.01	2.00
Alkalinity as CaCO3 mg/l	204.40	249.20	205.20	232.70
Dissolved Iron mg/l	0.350	0.020	NA	NA
Iron as Fe (Total) mg/l	0.365	0.050	0.100	0.100
Manganese as Mn (Tot) mg/l	0.030	0.020	0.020	0.020
Suspended Solids mg/l	23.0	40.0	10.0	7.0
Total Dissolved Solids mg/l	2,375	2,200	3,516	2,232
pH Units	7.50	8.00	7.70	7.80

Sampling Date:	5-82	6-82	7-82	8-82
2WB				
Flow (gpm)	3	3	3	4
Acidity as CaCO3 mg/l	<0.01	1.50	4.00	7.00
Alkalinity as CaCO3 mg/l	209.60	219.20	211.70	195.50
Dissolved Iron mg/l	0.030	0.113	0.090	0.090
Iron as Fe (Total) mg/l	0.200	0.180	0.090	0.095
Manganese as Mn (Tot) mg/l	0.003	0.015	0.015	0.012
Suspended Solids mg/l	1.0	17.0	3.0	1.0
Total Dissolved Solids mg/l	3,928	2,400	3,490	2,325
pH Units	8.10	7.70	7.80	8.00

Sampling Date:	9-82	10-82
2WB		
Flow (gpm)	7	3
Acidity as CaCO3 mg/l	<0.01	<0.01
Alkalinity as CaCO3 mg/l	193.70	183.40
Dissolved Iron mg/l	0.090	0.130
Iron as Fe (Total) mg/l	0.100	0.140
Manganese as Mn (Tot) mg/l	0.020	0.015
Suspended Solids mg/l	4.0	8.0
Total Dissolved Solids mg/l	2,410	2,300
pH Units	8.20	8.00

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

NA = NOT AVAILABLE

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
1E2				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.1	<0.1	4.0	10.80
Alkalinity as CaCO3 mg/l	330.00	294.00	296.00	290.00
Dissolved Iron mg/l	0.030	0.010	0.020	0.030
Iron as Fe (Total) mg/l	0.050	0.020	0.040	0.080
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.020
Suspended Solids mg/l	13.0	11.0	9.0	6.0
Total Dissolved Solids mg/l	1,900	1,810	1,800	1,875
pH Units	7.60	8.10	7.70	8.10

Sampling Date:	5/81	8/81	7/81	8/81
1E2				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	7.60	<0.01	1.80	<0.01
Alkalinity as CaCO3 mg/l	270.00	322.00	310.00	298.00
Dissolved Iron mg/l	0.010	0.035	0.009	0.010
Iron as Fe (Total) mg/l	0.150	0.095	0.136	0.150
Manganese as Mn (Tot) mg/l	0.010	0.021	0.011	0.019
Suspended Solids mg/l	5.0	10.0	1.0	4.0
Total Dissolved Solids mg/l	1,800	2,000	1,950	2,000
pH Units	8.00	8.00	8.20	7.90

Sampling Date:	9/81	10/81	11/81	12/81
1E2; 1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	2.00	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	439.00	312.00	287.10	317.80
Dissolved Iron mg/l	0.020	0.022	0.014	0.011
Iron as Fe (Total) mg/l	0.156	0.160	0.185	0.155
Manganese as Mn (Tot) mg/l	0.020	0.015	0.014	0.009
Suspended Solids mg/l	14.0	10.0	13.0	1.0
Total Dissolved Solids mg/l	1,900	1,900	1,950	1,875
pH Units	8.50	8.00	8.10	8.20

Sampling Date:	1/82	2/82	3/82	4/82
1E2; 1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.01	2.00	<0.01	<0.01
Alkalinity as CaCO3 mg/l	297.70	311.10	317.90	325.00
Dissolved Iron mg/l	0.030	0.020	NA	NA
Iron as Fe (Total) mg/l	0.060	0.190	0.020	0.040
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.010
Suspended Solids mg/l	20.0	11.0	11.0	6.0
Total Dissolved Solids mg/l	1,975	1,950	2,714	1,430
pH Units	7.80	8.00	7.90	8.00

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
1EB				
Flow (gpm)	1	1	1	Sump
Acidity as CaCO3 mg/l	<0.01	1.00	<0.01	14.00
Alkalinity as CaCO3 mg/l	315.00	335.50	317.30	356.70
Dissolved Iron mg/l	0.002	0.011	0.020	0.019
Iron as Fe (Total) mg/l	<0.001	0.020	0.020	0.022
Manganese as Mn (Tot) mg/l	<0.001	0.005	0.008	0.006
Suspended Solids mg/l	1.0	5.0	4.0	12.0
Total Dissolved Solids mg/l	2,622	2,000	2,626	2,825
pH Units	8.00	7.90	8.00	7.50

Sampling Date:	9/82	10/82
1EB		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	10.00	5.00
Alkalinity as CaCO3 mg/l	405.20	218.00
Dissolved Iron mg/l	1.240	10.550
Iron as Fe (Total) mg/l	1.400	13.200
Manganese as Mn (Tot) mg/l	0.105	0.115
Suspended Solids mg/l	5.0	17.0
Total Dissolved Solids mg/l	2,715	2,720
pH Units	7.60	7.80

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	14.0	30.0	16.0	18.00
Alkalinity as CaCO3 mg/l	482.00	416.00	422.00	408.00
Dissolved Iron mg/l	1.810	0.550	1.650	1.350
Iron as Fe (Total) mg/l	1.830	1.770	1.820	1.470
Manganese as Mn (Tot) mg/l	0.060	0.070	0.060	0.050
Suspended Solids mg/l	6.0	7.0	10.0	8.0
Total Dissolved Solids mg/l	1,850	1,830	1,750	1,750
pH Units	7.20	7.40	7.10	7.70

Sampling Date:	5/81	6/81	7/81	8/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	24.70	5.10	14.40	5.19
Alkalinity as CaCO3 mg/l	398.00	428.00	420.00	398.00
Dissolved Iron mg/l	1.250	0.996	1.310	1.440
Iron as Fe (Total) mg/l	1.470	1.510	1.542	1.825
Manganese as Mn (Tot) mg/l	0.050	0.048	0.066	0.060
Suspended Solids mg/l	5.0	20.0	8.0	4.0
Total Dissolved Solids mg/l	1,700	1,800	1,750	1,800
pH Units	7.40	7.50	7.60	7.40

Sampling Date:	9/81	10/81	11/81	12/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	12.0	12.0	12.0	16.00
Alkalinity as CaCO3 mg/l	252.00	448.00	499.00	343.00
Dissolved Iron mg/l	0.810	1.100	0.965	1.130
Iron as Fe (Total) mg/l	1.520	1.588	1.550	1.520
Manganese as Mn (Tot) mg/l	0.065	0.055	0.076	0.046
Suspended Solids mg/l	17.0	10.0	9.0	57.0
	1,750	1,750	1,750	1,700
Total Dissolved Solids mg/l	7.90	7.80	7.50	7.60
pH Units				

Sampling Date:	1/82	2/82	3/82	4/82
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	18.00	18.00	<0.01	24.00
Alkalinity as CaCO3 mg/l	317.80	550.00	479.00	332.70
Dissolved Iron mg/l	3.380	0.020	NA	NA
Iron as Fe (Total) mg/l	3.380	0.300	2.250	2.500
Manganese as Mn (Tot) mg/l	0.080	0.040	0.060	0.060
Suspended Solids mg/l	8.0	12.0	14.0	5.0
Total Dissolved Solids mg/l	1,825	1,850	2,162	1,690
pH Units	7.50	7.50	7.50	7.50

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	24.00	10.00	7.00	16.00
Alkalinity as CaCO3 mg/l	369.20	382.30	442.00	435.00
Dissolved Iron mg/l	2.100	1.450	1.900	1.800
Iron as Fe (Total) mg/l	2.100	2.100	1.930	1.870
Manganese as Mn (Tot) mg/l	0.050	0.050	0.045	0.050
Suspended Solids mg/l	6.0	3.0	2.0	15.0
Total Dissolved Solids mg/l	2,022	1,850	2,086	1,775
pH Units	7.60	7.40	7.60	7.50

Sampling Date:	9/82	10/82
2E-B		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	11.00	11.00
Alkalinity as CaCO3 mg/l	589.20	44.00
Dissolved Iron mg/l	1.220	1.540
Iron as Fe (Total) mg/l	1.230	1.680
Manganese as Mn (Tot) mg/l	0.045	0.045
Suspended Solids mg/l	5.0	10.0
Total Dissolved Solids mg/l	1,800	1,710
pH Units	7.80	7.70

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
2LN-K				
low (gpm)				
Acidity as CaCO3 mg/l	38.0	4.0	48.0	37.80
Alkalinity as CaCO3 mg/l	622.00	544.00	580.00	584.00
Dissolved Iron mg/l	0.060	0.030	0.040	0.040
Iron as Fe (Total) mg/l	0.120	0.090	0.080	0.090
Manganese as Mn (Tot) mg/l	0.010	0.010	0.020	0.010
Suspended Solids mg/l	5.0	10.0	15.0	10.0
Total Dissolved Solids mg/l	2,200	2,100	2,100	2,150
pH Units	7.00	7.60	7.00	7.40

Sampling Date:	5/81	6/81	7/81	8/81
2LN-K				
Flow (gpm)			3	3
Acidity as CaCO3 mg/l	57.00	40.80	43.20	50.17
Alkalinity as CaCO3 mg/l	582.00	620.00	650.00	618.00
Dissolved Iron mg/l	0.090	0.050	0.110	0.130
Iron as Fe (Total) mg/l	0.140	0.110	0.160	0.188
Manganese as Mn (Tot) mg/l	0.030	0.009	0.031	0.027
Suspended Solids mg/l	16.0	6.0	8.0	7.0
Total Dissolved Solids mg/l	2,100	2,300	2,400	2,450
pH Units	7.30	7.20	7.40	7.20

ampling Date:	9/81	10/81	11/81	12/81
2LN-K				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	32.00	48.00	28.00	38.00
Alkalinity as CaCO3 mg/l	526.00	620.00	752.00	140.00
Dissolved Iron mg/l	0.133	0.095	0.095	0.110
Iron as Fe (Total) mg/l	0.200	0.150	0.166	0.165
Manganese as Mn (Tot) mg/l	0.020	0.027	0.014	0.031
Suspended Solids mg/l	12.0	11.00	9.0	8.0
Total Dissolved Solids mg/l	2,350	2,275	2,300	2,250
pH Units	7.50	7.30	7.30	7.30

Sampling Date:	1/82	2/82	3/82	4/82
2LN-K				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	38.00	46.00	14.00	58.00
Alkalinity as CaCO3 mg/l	319.40	330.90	830.00	341.20
Dissolved Iron mg/l	1.290	0.300	NA	NA
Iron as Fe (Total) mg/l	1.320	0.355	0.300	0.140
Manganese as Mn (Tot) mg/l	0.040	0.020	0.030	0.025
Suspended Solids mg/l	11.0	8.0	22.0	3.0
Total Dissolved Solids mg/l	2,350	2,400	3,640	2,428
' Units	7.20	7.20	7.20	7.20

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
2LN-K				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	66.00	30.00	36.00	76.00
Alkalinity as CaCO3 mg/l	1,210.00	552.00	408.00	799.00
Dissolved Iron mg/l	0.020	0.040	0.090	0.110
Iron as Fe (Total) mg/l	0.050	0.100	0.090	0.120
Manganese as Mn (Tot) mg/l	0.010	0.015	0.015	0.016
Suspended Solids mg/l	1.0	11.0	30.0	16.0
Total Dissolved Solids mg/l	3,586	2,600	3,542	2,225
pH Units	7.00	7.10	7.20	7.10

Sampling Date:	9/82	10/82
2LN-K		
Flow (gpm)	1	1
Acidity as CaCO3 mg/l	27.00	35.00
Alkalinity as CaCO3 mg/l	789.20	844.00
Dissolved Iron mg/l	0.080	0.133
Iron as Fe (Total) mg/l	0.110	0.140
Manganese as Mn (Tot) mg/l	0.015	0.015
Suspended Solids mg/l	1.0	29.0
Total Dissolved Solids mg/l	2,710	2,620
pH Units	7.10	7.30

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	8.0	10.0	18.0	16.20
Alkalinity as CaCO3 mg/l	442.00	404.00	398.00	376.00
Dissolved Iron mg/l	1.930	2.150	2.120	1.850
Iron as Fe (Total) mg/l	1.930	2.150	2.130	1.960
Manganese as Mn (Tot) mg/l	0.110	0.100	0.100	0.090
Suspended Solids mg/l	14.0	9.0	16.0	10.0
Total Dissolved Solids mg/l	2,200	2,050	2,000	2,000
pH Units	7.20	7.60	7.20	7.60

Sampling Date:	5/81	6/81	7/81	8/81
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	3.80	8.50	7.20	6.92
Alkalinity as CaCO3 mg/l	270.00	406.00	390.00	360.00
Dissolved Iron mg/l	1.100	1.600	1.170	1.350
Iron as Fe (Total) mg/l	1.580	2.200	1.650	1.770
Manganese as Mn (Tot) mg/l	0.020	0.085	0.025	0.035
Suspended Solids mg/l	44.0	4.0	10.0	6.0
Total Dissolved Solids mg/l	1,700	2,150	2,100	2,200
pH Units	8.10	7.60	7.80	7.60

Sampling Date:	9/81	10/81	11/81	12/81
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	10.00	18.00	14.00	12.00
Alkalinity as CaCO3 mg/l	214.00	407.00	287.00	377.00
Dissolved Iron mg/l	0.470	1.060	1.160	1.130
Iron as Fe (Total) mg/l	1.410	1.850	1.650	1.665
Manganese as Mn (Tot) mg/l	0.039	0.031	0.025	0.019
Suspended Solids mg/l	35.0	12.0	14.0	15.0
Total Dissolved Solids mg/l	2,150	2,125	2,100	2,050
pH Units	8.00	7.50	8.05	7.70

Sampling Date:	1/82	2/82	3/82	4/82
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	20.00	20.00	2.00	18.00
Alkalinity as CaCO3 mg/l	332.30	320.70	500.00	318.10
Dissolved Iron mg/l	0.020	1.900	NA	NA
Iron as Fe (Total) mg/l	2.380	1.950	1.750	1.690
Manganese as Mn (Tot) mg/l	0.100	0.100	0.100	0.090
Suspended Solids mg/l	10.0	18.0	12.0	8.0
Total Dissolved Solids mg/l	2,175	2,200	2,770	2,640
pH Units	7.40	7.50	7.50	7.50

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	20.00	10.00	<0.01	15.00
Alkalinity as CaCO3 mg/l	351.30	3,567.00	230.10	241.20
Dissolved Iron mg/l	2.000	0.985	0.310	0.260
Iron as Fe (Total) mg/l	2.200	2.250	0.340	0.450
Manganese as Mn (Tot) mg/l	0.070	0.095	0.030	0.035
Suspended Solids mg/l	18.0	34.0	6.0	7.0
Total Dissolved Solids mg/l	2,584	2,225	2,016	2,020
pH Units	7.50	7.40	8.10	7.60

Sampling Date:	9/82	10/82
Main Slope		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	<0.01	9.00
Alkalinity as CaCO3 mg/l	185.10	287.30
Dissolved Iron mg/l	1.650	1.550
Iron as Fe (Total) mg/l	1.800	1.870
Manganese as Mn (Tot) mg/l	0.045	0.095
Suspended Solids mg/l	5.0	20.0
Total Dissolved Solids mg/l	1,795	2,090
pH Units	8.20	7.60

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
12 N-M				
Flow (gpm)				
Acidity as CaCO3 mg/l	<0.1	<0.1	4.0	7.20
Alkalinity as CaCO3 mg/l	384.00	348.00	336.00	328.00
Dissolved Iron mg/l	0.020	0.020	0.010	0.030
Iron as Fe (Total) mg/l	0.030	0.020	0.020	0.060
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.020
Suspended Solids mg/l	5.0	4.0	5.0	7.0
Total Dissolved Solids mg/l	1,650	1,600	1,575	1,875
pH Units	7.50	8.20	7.80	8.00

Sampling Date:	5/81	6/81	7/81	8/81
12 N-M				
Flow (gpm)			20	20
Acidity as CaCO3 mg/l	5.70	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	318.00	342.00	350.00	326.00
Dissolved Iron mg/l	0.030	0.035	0.027	0.038
Iron as Fe (Total) mg/l	0.080	0.077	0.095	0.099
Manganese as Mn (Tot) mg/l	0.010	0.019	0.011	0.015
Suspended Solids mg/l	8.0	9.0	4.0	3.0
Total Dissolved Solids mg/l	1,700	1,800	1,750	1,750
pH Units	8.10	8.10	8.40	7.90

Sampling Date:	9/81	10/81	11/81	12/81
12N-M				
Flow (gpm)	20	20	20	24
Acidity as CaCO3 mg/l	6.00	12.00	8.00	16.00
Alkalinity as CaCO3 mg/l	212.60	218.80	217.20	241.90
Dissolved Iron mg/l	0.040	0.045	0.040	0.035
Iron as Fe (Total) mg/l	0.080	0.089	0.075	0.088
Manganese as Mn (Tot) mg/l	0.012	0.011	0.014	0.012
Suspended Solids mg/l	41.0	25.0	22.0	16.0
Total Dissolved Solids mg/l	2,450	2,350	2,350	2,200
pH Units	7.90	7.60	7.80	8.00

Sampling Date:	1/82	2/82	3/82	4/82
12N-M				
Flow (gpm)	24	20	20	20
Acidity as CaCO3 mg/l	12.00	8.00	<0.01	12.00
Alkalinity as CaCO3 mg/l	269.80	290.70	295.20	250.40
Dissolved Iron mg/l	0.550	0.430	NA	NA
Iron as Fe (Total) mg/l	0.680	0.450	0.610	0.790
Manganese as Mn (Tot) mg/l	0.110	0.090	0.160	0.120
Suspended Solids mg/l	12.0	20.0	21.0	18.0
Total Dissolved Solids mg/l	2,125	2,000	3,096	2,186
pH Units	7.70	8.00	7.70	7.80

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
12N-M				
Flow (gpm)	20	20	20	20
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	3.00
Alkalinity as CaCO3 mg/l	204.40	294.90	292.20	288.10
Dissolved Iron mg/l	0.350	0.155	0.280	0.250
Iron as Fe (Total) mg/l	0.350	0.350	0.280	0.260
Manganese as Mn (Tot) mg/l	0.060	0.050	0.060	0.061
Suspended Solids mg/l	1.0	11.0	6.0	6.0
Total Dissolved Solids mg/l	2,398	2,050	2,756	2,050
pH Units	8.00	7.90	8.00	8.10

Sampling Date:	9/82	10/82
12N-M		
Flow (gpm)	20	20
Acidity as CaCO3 mg/l	<0.01	<0.01
Alkalinity as CaCO3 mg/l	300.30	290.00
Dissolved Iron mg/l	0.180	0.185
Iron as Fe (Total) mg/l	0.200	0.220
Manganese as Mn (Tot) mg/l	0.045	0.045
Suspended Solids mg/l	43.0	24.0
Total Dissolved Solids mg/l	2,090	2,005
pH Units	8.20	8.00

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	8/82	6/82	7/82	8/82
2 Dip				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	<0.01	4.00	4.00	8.00
Alkalinity as CaCO3 mg/l	313.70	331.90	351.30	288.00
Dissolved Iron mg/l	0.200	0.150	0.090	0.098
Iron as Fe (Total) mg/l	0.200	0.260	0.100	0.110
Manganese as Mn (Tot) mg/l	0.010	0.015	0.008	0.010
Suspended Solids mg/l	4.0	19.0	<1.0	5.0
Total Dissolved Solids mg/l	1,648	1,575	1,826	1,450
pH Units	8.00	7.70	7.80	7.90

Sampling Date:	9/82
2Dip	
Flow (gpm)	Sump
Acidity as CaCO3 mg/l	<0.01
Alkalinity as CaCO3 mg/l	410.10
Dissolved Iron mg/l	0.050
Iron as Fe (Total) mg/l	0.050
Manganese as Mn (Tot) mg/l	0.010
Suspended Solids mg/l	1.0
Total Dissolved Solids mg/l	1,510
pH Units	8.20

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY MONITORING
GENEVA COAL MINE

CA-1

Sample Date:	9/13/78	9/26/79	8/8/80	9/24/80
Aluminum, Al mg/l	0.47	<0.001	<0.010	NA
Ammonia, NH3 mg/l	NA	NA	0.15	NA
Arsenic, As mg/l	<0.001	<0.001	<0.001	NA
Antimony as Sb mg/l	<0.001	<0.001	0.100	NA
Barium, Ba mg/l	0.010	0.020	0.010	NA
Beryllium as Be mg/l	0.018	0.001	<0.001	NA
Bicarbonate, HNO3 mg/l	NA	NA	329.40	NA
Boron, B mg/l	0.230	0.140	0.060	NA
Cadmium, Cd mg/l	<0.001	<0.001	<0.001	NA
Calcium,Ca mg/l	92.8	280.00	116.80	NA
Carbonate, CO3 mg/l	<0.01	<0.01	<0.01	NA
Chloride, Cl mg/l	26.0	18.0	22.0	NA
Chromium, Cr mg/l	<0.001	<0.001	<0.001	NA
Cobalt as Co mg/l	0.025	0.045	0.026	NA
Copper, Cu mg/l	0.007	0.003	0.010	NA
Flouride, F mg/l	0.29	0.25	0.25	NA
Flow gpm	NA	3	4	4
Germanium as Ge mg/l	<0.001	<0.001	<0.001	NA
Hardness, CaCO3 mg/l	NA	NA	696	NA
Iron, Fe (total) mg/l	0.114	20.000	21.800	16.200
Lead, Pb mg/l	0.004	<0.001	<0.001	NA
Magnesium, Mg mg/l	54.72	2.40	96.96	NA
Manganese, Mn mg/l	0.077	0.088	0.050	0.100
Mercury, Hg mg/l	<0.0005	<0.0002	<0.0002	NA
Molybdenum, Mo mg/l	0.09	<0.001	<0.001	NA
Nickel, Ni mg/l	<0.001	0.046	0.023	NA
Nitrate, NO3-N mg/l	0.11	<0.01	0.04	NA
Nitrite, NO2-N mg/l	<0.01	<0.01	0.01	NA
Phosphate, PO4 mg/l	0.014	0.040	0.002	NA
Potassium, K mg/l	NA	NA	4.70	NA
Selenium, Se mg/l	<0.001	0.002	<0.001	NA
Silver as As mg/l	<0.001	<0.001	<0.001	NA
Sodium, Na mg/l	159.4	137.00	135.00	NA
Sulfate, SO4 mg/l	690.0	680	658	NA
Sulfide, S mg/l	NA	NA	<0.01	NA
Suspended Solids mg/l	6.0	1.0	58.0	36.0
Total Dissolved Solids mg/l	1,250	1,200	1,199	1,200
Total Kjeldahl Nitrogen mg/l	<0.01	0.20	0.30	NA
Vanadium as V mg/l	0.17	<0.001	<0.001	NA
Zinc, Zn mg/l	0.015	0.194	0.010	NA
pH Units	NA	NA	NA	7.10

NA - Not Available

GROUND WATER QUALITY MONITORING
GENEVA COAL MINE

RS-1

Sample Date:	9/18/78	9/26/68	8/8/80	9/24/8
Aluminum, Al mg/l	0.06			
Ammonia, NH3 mg/l	NA			
Arsenic, As mg/l	<0.001			
Antimony as Sb mg/l	<0.001			
Barium, Ba mg/l	0.030			
Beryllium as Be mg/l	0.014			
Bicarbonate, HNO3 mg/l	NA			
Boron, B mg/l	0.080			
Cadmium, Cd mg/l	<0.001			
Calcium,Ca mg/l	49.6			
Carbonate, CO3 mg/l	<0.01			
Chloride, Cl mg/l	18.0			
Chromium, Cr mg/l	<0.001			
Cobalt as Co mg/l	0.011			
Copper, Cu mg/l	0.002			
Flouride, F mg/l	0.21			
Flow gpm	NA	No Flow	No Flow	No Flow
Germanium as Ge mg/l	<0.001			
Hardness, CaCO3 mg/l	NA			
Iron, Fe (total) mg/l	0.105			
Lead, Pb mg/l	<0.001			
Magnesium, Mg mg/l	66.24			
Manganese, Mn mg/l	0.013			
Mercury, Hg mg/l	<0.0002			
Molybdenum, Mo mg/l	0.015			
Nickel, Ni mg/l	<0.001			
Nitrate, NO3-N mg/l	0.34			
Nitrite, NO2-N mg/l	<0.01			
Phosphate, PO4 mg/l	0.012			
Potassium, K mg/l	NA			
Selenium, Se mg/l	<0.001			
Silver as As mg/l	<0.001			
Sodium, Na mg/l	133.9			
Sulfate, SO4 mg/l	296.0			
Sulfide, S mg/l	NA			
Suspended Solids mg/l	8.0			
Total Dissolved Solids mg/l	976			
Total Kjeldahl Nitrogen mg/l	<0.01			
Vanadium as V mg/l	0.019			
Zinc, Zn mg/l	0.019			
pH Units	NA			

NA - Not Available

GROUND WATER QUALITY MONITORING
GENEVA COAL MINE

RS-2

Sample Date:	9/13/78	9/16/79	8/8/80	9/24/80
Aluminum, Al mg/l	0.31	0.010	0.310	NA
Ammonia, NH3 mg/l	NA	NA	<0.01	NA
Arsenic, As mg/l	<0.001	<0.001	<0.001	NA
Antimony as Sb mg/l	<0.001	<0.001	0.060	NA
Barium, Ba mg/l	0.210	0.050	0.030	NA
Beryllium as Be mg/l	0.020	<0.001	<0.001	NA
Bicarbonate, HNO3 mg/l	NA	NA	534.36	NA
Boron, B mg/l	0.315	0.190	0.090	NA
Cadmium, Cd mg/l	<0.001	<0.001	<0.001	NA
Calcium,Ca mg/l	49.6	168.00	52.00	NA
Carbonate, CO3 mg/l	<0.01	<0.01	1.20	NA
Chloride, Cl mg/l	22.0	22.0	30.0	NA
Chromium, Cr mg/l	<0.001	<0.001	<0.001	NA
Cobalt as Co mg/l	0.005	0.004	<0.001	NA
Copper, Cu mg/l	0.004	0.006	0.020	NA
Flouride, F mg/l	0.24	0.19	0.18	NA
Flow gpm	NA	9	30	30
Germanium as Ge mg/l	<0.001	<0.002	<0.001	NA
Hardness, CaCO3 mg/l	NA	NA	460	NA
Iron, Fe (total) mg/l	0.018	<0.001	0.310	0.080
Lead, Pb mg/l	0.003	<0.001	<0.001	NA
Magnesium, Mg mg/l	72.0	16.80	79.20	NA
Manganese, Mn mg/l	0.016	0.012	0.010	0.010
Mercury, Hg mg/l	<0.0002	<0.0002	<0.0002	NA
Molybdenum, Mo mg/l	0.16	<0.001	<0.001	NA
Nickel, Ni mg/l	<0.001	0.001	<0.001	NA
Nitrate, NO3-N mg/l	0.04	0.45	<0.01	NA
Nitrite, NO2-N mg/l	<0.01	<0.01	<0.01	NA
Phosphate, PO4 mg/l	0.055	0.060	0.010	NA
Potassium, K mg/l	NA	NA	1.57	NA
Selenium, Se mg/l	<0.001	0.004	<0.001	NA
Silver as As mg/l	<0.001	0.001	<0.001	NA
Sodium, Na mg/l	140.9	170.00	171.00	NA
Sulfate, SO4 mg/l	300.0	350	320	NA
Sulfide, S mg/l	NA	NA	<0.01	NA
Suspended Solids mg/l	9.0	1.0	10.0	14.0
Total Dissolved Solids mg/l	920	900	925	1,000
Total Kjeldahl Nitrogen mg/l	<0.01	0.10	0.22	NA
Vanadium as V mg/l	0.25	<0.001	<0.001	NA
Zinc, Zn mg/l	0.018	0.017	0.020	NA
pH Units	NA	NA	NA	7.70

NA - Not Available

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
1E2				
low (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.1	<0.1	4.0	10.80
Alkalinity as CaCO3 mg/l	330.00	294.00	296.00	290.00
Dissolved Iron mg/l	0.030	0.010	0.020	0.030
Iron as Fe (Total) mg/l	0.050	0.020	0.040	0.080
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.020
Suspended Solids mg/l	13.0	11.0	9.0	6.0
Total Dissolved Solids mg/l	1,900	1,810	1,800	1,875
pH Units	7.60	8.10	7.70	8.10

Sampling Date:	5/81	8/81	7/81	8/81
1E2				
Flow (gpm)				1
Acidity as Ca				<0.01
Alkalinity as				298.00
Dissolved Iro				0.010
Iron as Fe (T				0.150
Manganese as				0.019
Suspended Sol				4.0
Total Dissolv				2,000
pH Units				7.90

Duplicate H_2O Quality Sampler

duplicate

Sampling Date:				12/81
1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	2.00	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	439.00	312.00	287.10	317.80
Dissolved Iron mg/l	0.020	0.022	0.014	0.011
Iron as Fe (Total) mg/l	0.156	0.160	0.185	0.155
Manganese as Mn (Tot) mg/l	0.020	0.015	0.014	0.009
Suspended Solids mg/l	14.0	10.0	13.0	1.0
Total Dissolved Solids mg/l	1,900	1,900	1,950	1,875
pH Units	8.50	8.00	8.10	8.20

Sampling Date:	1/82	2/82	3/82	4/82
1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.01	2.00	<0.01	<0.01
Alkalinity as CaCO3 mg/l	297.70	311.10	317.90	325.00
Dissolved Iron mg/l	0.030	0.020	NA	NA
Iron as Fe (Total) mg/l	0.060	0.190	0.020	0.040
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.010
Suspended Solids mg/l	20.0	11.0	11.0	6.0
Total Dissolved Solids mg/l	1,975	1,950	2,714	1,430
oH Units	7.80	8.00	7.90	8.00

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
1E2				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.1	<0.1	4.0	10.80
Alkalinity as CaCO3 mg/l	330.00	294.00	296.00	290.00
Dissolved Iron mg/l	0.030	0.010	0.020	0.030
Iron as Fe (Total) mg/l	0.050	0.020	0.040	0.080
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.020
Suspended Solids mg/l	13.0	11.0	9.0	6.0
Total Dissolved Solids mg/l	1,900	1,810	1,800	1,875
pH Units	7.60	8.10	7.70	8.10

Sampling Date:	5/81	8/81	7/81	8/81
1E2				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	7.60	<0.01	1.80	<0.01
Alkalinity as CaCO3 mg/l	270.00	322.00	310.00	298.00
Dissolved Iron mg/l	0.010	0.035	0.009	0.010
Iron as Fe (Total) mg/l	0.150	0.095	0.136	0.150
Manganese as Mn (Tot) mg/l	0.010	0.021	0.011	0.019
Suspended Solids mg/l	5.0	10.0	1.0	4.0
Total Dissolved Solids mg/l	1,800	2,000	1,950	2,000
pH Units	8.00	8.00	8.20	7.90

Sampling Date:	9/81	10/81	11/81	12/81
1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	2.00	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	439.00	312.00	287.10	317.80
Dissolved Iron mg/l	0.020	0.022	0.014	0.011
Iron as Fe (Total) mg/l	0.156	0.160	0.185	0.155
Manganese as Mn (Tot) mg/l	0.020	0.015	0.014	0.009
Suspended Solids mg/l	14.0	10.0	13.0	1.0
Total Dissolved Solids mg/l	1,900	1,900	1,950	1,875
pH Units	8.50	8.00	8.10	8.20

Sampling Date:	1/82	2/82	3/82	4/82
1E-B				
Flow (gpm)	1	1	1	1
Acidity as CaCO3 mg/l	<0.01	2.00	<0.01	<0.01
Alkalinity as CaCO3 mg/l	297.70	311.10	317.90	325.00
Dissolved Iron mg/l	0.030	0.020	NA	NA
Iron as Fe (Total) mg/l	0.060	0.190	0.020	0.040
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.010
Suspended Solids mg/l	20.0	11.0	11.0	6.0
Total Dissolved Solids mg/l	1,975	1,950	2,714	1,430
oH Units	7.80	8.00	7.90	8.00

GROUND WATER QUALITY DATA - GENEVA COAL MINE

ampling Date:	5/82	6/82	7/82	8/82
1EB				
Flow (gpm)	1	1	1	Sump
Acidity as CaCO3 mg/l	<0.01	1.00	<0.01	14.00
Alkalinity as CaCO3 mg/l	315.00	335.50	317.30	356.70
Dissolved Iron mg/l	0.002	0.011	0.020	0.019
Iron as Fe (Total) mg/l	<0.001	0.020	0.020	0.022
Manganese as Mn (Tot) mg/l	<0.001	0.005	0.008	0.006
Suspended Solids mg/l	1.0	5.0	4.0	12.0
Total Dissolved Solids mg/l	2,622	2,000	2,626	2,825
pH Units	8.00	7.90	8.00	7.50

Sampling Date:	9/82	10/82
1EB		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	10.00	5.00
Alkalinity as CaCO3 mg/l	405.20	218.00
Dissolved Iron mg/l	1.240	10.550
Iron as Fe (Total) mg/l	1.400	13.200
Manganese as Mn (Tot) mg/l	0.105	0.115
Suspended Solids mg/l	5.0	17.0
Total Dissolved Solids mg/l	2,715	2,720
pH Units	7.60	7.80

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

GROUND WATER QUALITY DATA - GENEVA COAL MINE

duplicate

Sampling Date:	1/81	2/81	3/81	4/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	14.0	30.0	16.0	18.00
Alkalinity as CaCO3 mg/l	482.00	416.00	422.00	408.00
Dissolved Iron mg/l	1.810	0.550	1.650	1.350
Iron as Fe (Total) mg/l	1.830	1.770	1.820	1.470
Manganese as Mn (Tot) mg/l	0.060	0.070	0.060	0.050
Suspended Solids mg/l	6.0	7.0	10.0	8.0
Total Dissolved Solids mg/l	1,850	1,830	1,750	1,750
pH Units	7.20	7.40	7.10	7.70

Sampling Date:	5/81	6/81	7/81	8/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	24.70	5.10	14.40	5.19
Alkalinity as CaCO3 mg/l	398.00	428.00	420.00	398.00
Dissolved Iron mg/l	1.250	0.996	1.310	1.440
Iron as Fe (Total) mg/l	1.470	1.510	1.542	1.825
Manganese as Mn (Tot) mg/l	0.050	0.048	0.066	0.060
Suspended Solids mg/l	5.0	20.0	8.0	4.0
Total Dissolved Solids mg/l	1,700	1,800	1,750	1,800
pH Units	7.40	7.50	7.60	7.40

Sampling Date:	9/81	10/81	11/81	12/81
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	12.0	12.0	12.0	16.00
Alkalinity as CaCO3 mg/l	252.00	448.00	499.00	343.00
Dissolved Iron mg/l	0.810	1.100	0.965	1.130
Iron as Fe (Total) mg/l	1.520	1.588	1.550	1.520
Manganese as Mn (Tot) mg/l	0.065	0.055	0.076	0.046
Suspended Solids mg/l	17.0	10.0	9.0	57.0
	1,750	1,750	1,750	1,700
Total Dissolved Solids mg/l	7.90	7.80	7.50	7.60
pH Units				

Sampling Date:	1/82	2/82	3/82	4/82
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	18.00	18.00	<0.01	24.00
Alkalinity as CaCO3 mg/l	317.80	550.00	479.00	332.70
Dissolved Iron mg/l	3.380	0.020	NA	NA
Iron as Fe (Total) mg/l	3.380	0.300	2.250	2.500
Manganese as Mn (Tot) mg/l	0.080	0.040	0.060	0.060
Suspended Solids mg/l	8.0	12.0	14.0	5.0
Total Dissolved Solids mg/l	1,825	1,850	2,162	1,690
pH Units	7.50	7.50	7.50	7.50

Duplicate

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
2E-B				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	24.00	10.00	7.00	16.00
Alkalinity as CaCO3 mg/l	369.20	382.30	442.00	435.00
Dissolved Iron mg/l	2.100	1.450	1.900	1.800
Iron as Fe (Total) mg/l	2.100	2.100	1.930	1.870
Manganese as Mn (Tot) mg/l	0.050	0.050	0.045	0.050
Suspended Solids mg/l	6.0	3.0	2.0	15.0
Total Dissolved Solids mg/l	2,022	1,850	2,086	1,775
pH Units	7.60	7.40	7.60	7.50

Sampling Date:	9/82	10/82
2E-B		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	11.00	11.00
Alkalinity as CaCO3 mg/l	589.20	44.00
Dissolved Iron mg/l	1.220	1.540
Iron as Fe (Total) mg/l	1.230	1.680
Manganese as Mn (Tot) mg/l	0.045	0.045
Suspended Solids mg/l	5.0	10.0
Total Dissolved Solids mg/l	1,800	1,710
pH Units	7.80	7.70

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	2-81	3-81	4-81	5-81
RS2				
Flow (gpm)	NA	NA	NA	20
Acidity as CaCO3 mg/l	< 0.1	< 0.1	2.50	4.00
Alkalinity as CaCO3 mg/l	500.00	434.00	418.00	450.00
Dissolved Iron mg/l	0.032	0.060	NA	0.390
Iron as Fe (Total) mg/l	0.040	0.190	0.160	0.440
Manganese as Mn (Tot) mg/l	< 0.001	0.050	0.010	0.050
Suspended Solids mg/l	NA	NA	NA	9.0
Total Dissolved Solids mg/l	900	900	1,000	900
pH Units	8.10	7.80	8.00	8.20

Sampling Date:	6-81	7-81	8-81	9-81
RS2				
Flow (gpm)	NA	34	24	25
Acidity as CaCO3 mg/l	< 0.01	4.00	4.00	< 0.01
Alkalinity as CaCO3 mg/l	424.00	424.00	416.00	430.00
Dissolved Iron mg/l	0.010	<0.001	<0.001	0.018
Iron as Fe (Total) mg/l	0.400	0.010	0.070	0.420
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.009
Suspended Solids mg/l	113	14.0	5.0	8.0
Total Dissolved Solids mg/l	900	950	900	950
pH Units	8.10	7.80	8.10	8.10

Sampling Date:	10-81	11-81	12-81	4-82
RS2				
Flow (gpm)	30	30	24	20
Acidity as CaCO3 mg/l	< 0.01	< 0.01	< 0.01	< 0.01
Alkalinity as CaCO3 mg/l	79.00	486.00	388.00	494.00
Dissolved Iron mg/l	0.020	NA	0.015	NA
Iron as Fe (Total) mg/l	0.450	0.465	0.460	<0.001
Manganese as Mn (Tot) mg/l	0.015	0.025	0.017	0.010
Suspended Solids mg/l	6.1	NA	2.0	7.0
Total Dissolved Solids mg/l	950	900	900	1,050
pH Units	8.30	8.10	8.30	7.80

Sampling Date:	5-82	6-82	7-82	8-82
RS2				
Flow (gpm)	30	30	25	30
Acidity as CaCO3 mg/l	6.00	18.00	5.00	<0.01
Alkalinity as CaCO3 mg/l	520.20	411.00	500.00	536.00
Dissolved Iron mg/l	NA	0.010	0.030	0.060
Iron as Fe (Total) mg/l	0.060	0.010	0.030	0.150
Manganese as Mn (Tot) mg/l	0.005	0.002	0.005	0.015
Suspended Solids mg/l	7.0	11.0	<1.0	5.0
Total Dissolved Solids mg/l	886	900	950	862
pH Units	7.80	7.60	7.60	8.20

NA = NOT AVAILABLE

GROUNDWATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	9-82	10-82	4-83
RS2			
Flow (gpm)	25	30	20
Acidity as CaCO3 mg/l	< 0.01	5.00	NA
Alkalinity as CaCO3 mg/l	318.30	552	NA
Dissolved Iron mg/l	0.045	0.040	NA
Iron as Fe (Total) mg/l	0.056	0.049	0.180
Manganese as Mn (Tot) mg/l	0.010	0.012	0.003
Suspended Solids mg/l	11.0	8.0	61.0
Total Dissolved Solids mg/l	946	910	966
pH Units	8.10	7.80	7.90

Sampling Date:	1-81	2-81	3-81	4-81
2WB				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	<0.1	<0.1	2.0	3.60
Alkalinity as CaCO3 mg/l	184.00	168.00	162.00	150.00
Dissolved Iron mg/l	0.420	0.050	0.040	0.030
Iron as Fe (Total) mg/l	0.640	0.060	0.060	0.070
Manganese as Mn (Tot) mg/l	0.030	0.020	0.020	0.020
Suspended Solids mg/l	59.0	10.0	8.0	8.0
Total Dissolved Solids mg/l	2,200	2,200	2,100	2,200
pH Units	7.40	8.00	7.70	8.10

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Sampling Date:	5-81	6-81	7-81	8-81
2WB				
Flow (gpm)	3	3	5	7
Acidity as CaCO3 mg/l	5.70	<0.01	10.80	<0.01
Alkalinity as CaCO3 mg/l	124.00	140.00	350.00	210.00
Dissolved Iron mg/l	0.140	0.033	0.150	0.146
Iron as Fe (Total) mg/l	0.360	0.075	0.380	0.410
Manganese as Mn (Tot) mg/l	0.030	0.025	0.027	0.020
Suspended Solids mg/l	19.0	13.0	15.0	1.0
Total Dissolved Solids mg/l	2,300	2,400	2,050	2,200
pH Units	8.00	8.10	7.60	7.90

Sampling Date:	9-81	10-81	11-81	12-81
2WB				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	2.00	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	265.00	198.10	203.30	228.20
Dissolved Iron mg/l	0.136	0.150	0.150	0.150
Iron as Fe (Total) mg/l	0.390	0.380	0.380	0.400
Manganese as Mn (Tot) mg/l	0.022	0.025	0.025	0.027
Suspended Solids mg/l	24.0	17.0	13.0	7.0
Total Dissolved Solids mg/l	2,200	2,175	2,200	2,175
pH Units	8.10	7.90	8.10	8.20

NA = NOT AVAILABLE

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1-82	2-92	3-82	4-82
2WB				
Flow (gpm)	3	3	5	3
Acidity as CaCO3 mg/l	12.00	12.00	<0.01	2.00
Alkalinity as CaCO3 mg/l	204.40	249.20	205.20	232.70
Dissolved Iron mg/l	0.350	0.020	NA	NA
Iron as Fe (Total) mg/l	0.365	0.050	0.100	0.100
Manganese as Mn (Tot) mg/l	0.030	0.020	0.020	0.020
Suspended Solids mg/l	23.0	40.0	10.0	7.0
Total Dissolved Solids mg/l	2,375	2,200	3,516	2,232
pH Units	7.50	8.00	7.70	7.80

Sampling Date:	5-82	6-82	7-82	8-82
2WB				
Flow (gpm)	3	3	3	4
Acidity as CaCO3 mg/l	<0.01	1.50	4.00	7.00
Alkalinity as CaCO3 mg/l	209.60	219.20	211.70	195.50
Dissolved Iron mg/l	0.030	0.113	0.090	0.090
Iron as Fe (Total) mg/l	0.200	0.180	0.090	0.095
Manganese as Mn (Tot) mg/l	0.003	0.015	0.015	0.012
Suspended Solids mg/l	1.0	17.0	3.0	1.0
Total Dissolved Solids mg/l	3,928	2,400	3,490	2,325
pH Units	8.10	7.70	7.80	8.00

Sampling Date:	9-82	10-82
2WB		
Flow (gpm)	7	3
Acidity as CaCO3 mg/l	<0.01	<0.01
Alkalinity as CaCO3 mg/l	193.70	183.40
Dissolved Iron mg/l	0.090	0.130
Iron as Fe (Total) mg/l	0.100	0.140
Manganese as Mn (Tot) mg/l	0.020	0.015
Suspended Solids mg/l	4.0	8.0
Total Dissolved Solids mg/l	2,410	2,300
pH Units	8.20	8.00

Sampling Date:

Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
2LN-K				
Flow (gpm)				
Acidity as CaCO3 mg/l	38.0	4.0	48.0	37.80
Alkalinity as CaCO3 mg/l	622.00	544.00	580.00	584.00
Dissolved Iron mg/l	0.060	0.030	0.040	0.040
Iron as Fe (Total) mg/l	0.120	0.090	0.080	0.090
Manganese as Mn (Tot) mg/l	0.010	0.010	0.020	0.010
Suspended Solids mg/l	5.0	10.0	15.0	10.0
Total Dissolved Solids mg/l	2,200	2,100	2,100	2,150
pH Units	7.00	7.60	7.00	7.40

Sampling Date:	5/81	6/81	7/81	8/81
2LN-K				
Flow (gpm)			3	3
Acidity as CaCO3 mg/l	67.00	40.80	43.20	50.17
Alkalinity as CaCO3 mg/l	582.00	620.00	650.00	618.00
Dissolved Iron mg/l	0.090	0.050	0.110	0.130
Iron as Fe (Total) mg/l	0.140	0.110	0.160	0.188
Manganese as Mn (Tot) mg/l	0.030	0.009	0.031	0.027
Suspended Solids mg/l	16.0	6.0	8.0	7.0
Total Dissolved Solids mg/l	2,100	2,300	2,400	2,450
pH Units	7.30	7.20	7.40	7.20

2LN-K

Sampling Date:	9/81	10/81	11/81	12/81
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	32.00	48.00	28.00	38.00
Alkalinity as CaCO3 mg/l	526.00	620.00	752.00	140.00
Dissolved Iron mg/l	0.133	0.095	0.095	0.110
Iron as Fe (Total) mg/l	0.200	0.150	0.166	0.165
Manganese as Mn (Tot) mg/l	0.020	0.027	0.014	0.031
Suspended Solids mg/l	12.0	11.00	9.0	8.0
Total Dissolved Solids mg/l	2,350	2,275	2,300	2,250
pH Units	7.50	7.30	7.30	7.30

Sampling Date:	1/82	2/82	3/82	4/82
2LN-K				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	38.00	46.00	14.00	58.00
Alkalinity as CaCO3 mg/l	319.40	330.90	830.00	341.20
Dissolved Iron mg/l	1.290	0.300	NA	NA
Iron as Fe (Total) mg/l	1.320	0.355	0.300	0.140
Manganese as Mn (Tot) mg/l	0.040	0.020	0.030	0.025
Suspended Solids mg/l	11.0	8.0	22.0	3.0
Total Dissolved Solids mg/l	2,350	2,400	3,640	2,428
pH Units	7.20	7.20	7.20	7.20

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
2LN-K				
Flow (gpm)	3	3	3	3
Acidity as CaCO3 mg/l	66.00	30.00	36.00	76.00
Alkalinity as CaCO3 mg/l	1,210.00	552.00	408,00	799.00
Dissolved Iron mg/l	0.020	0.040	0.090	0.110
Iron as Fe (Total) mg/l	0.050	0.100	0.090	0.120
Manganese as Mn (Tot) mg/l	0.010	0.015	0.015	0.016
Suspended Solids mg/l	1.0	11.0	30.0	16.0
Total Dissolved Solids mg/l	3,586	2,600	3,542	2,225
pH Units	7.00	7.10	7.20	7.10

Sampling Date:	9/82	10/82
2LN-K		
Flow (gpm)	1	1
Acidity as CaCO3 mg/l	27.00	35.00
Alkalinity as CaCO3 mg/l	789.20	844.00
Dissolved Iron mg/l	0.080	0.133
Iron as Fe (Total) mg/l	0.110	0.140
Manganese as Mn (Tot) mg/l	0.015	0.015
Suspended Solids mg/l	1.0	29.0
Total Dissolved Solids mg/l	2,710	2,620
pH Units	7.10	7.30

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

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Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	8.0	10.0	18.0	16.20
Alkalinity as CaCO3 mg/l	442.00	404.00	398.00	376.00
Dissolved Iron mg/l	1.930	2.150	2.120	1.850
Iron as Fe (Total) mg/l	1.930	2.150	2.130	1.960
Manganese as Mn (Tot) mg/l	0.110	0.100	0.100	0.090
Suspended Solids mg/l	14.0	9.0	16.0	10.0
Total Dissolved Solids mg/l	2,200	2,050	2,000	2,000
pH Units	7.20	7.60	7.20	7.60

Sampling Date:	5/81	6/81	7/81	8/81
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	3.80	8.50	7.20	6.92
Alkalinity as CaCO3 mg/l	270.00	406.00	390.00	360.00
Dissolved Iron mg/l	1.100	1.600	1.170	1.350
Iron as Fe (Total) mg/l	1.580	2.200	1.650	1.770
Manganese as Mn (Tot) mg/l	0.020	0.085	0.025	0.035
Suspended Solids mg/l	44.0	4.0	10.0	6.0
Total Dissolved Solids mg/l	1,700	2,150	2,100	2,200
pH Units	8.10	7.60	7.80	7.60

Duplicate

Sampling Date:	9/81	10/81	11/81	12/81
Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	10.00	18.00	14.00	12.00
Alkalinity as CaCO3 mg/l	214.00	407.00	287.00	377.00
Dissolved Iron mg/l	0.470	1.060	1.160	1.130
Iron as Fe (Total) mg/l	1.410	1.850	1.650	1.665
Manganese as Mn (Tot) mg/l	0.039	0.031	0.025	0.019
Suspended Solids mg/l	35.0	12.0	14.0	15.0
Total Dissolved Solids mg/l	2,150	2,125	2,100	2,050
pH Units	8.00	7.50	8.05	7.70

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Sampling Date:	1/82	2/82	3/82	4/82
MAIN Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	20.00	20.00	2.00	18.00
Alkalinity as CaCO3 mg/l	332.30	320.70	500.00	318.10
Dissolved Iron mg/l	0.020	1.900	NA	NA
Iron as Fe (Total) mg/l	2.380	1.950	1.750	1.690
Manganese as Mn (Tot) mg/l	0.100	0.100	0.100	0.090
Suspended Solids mg/l	10.0	18.0	12.0	8.0
Total Dissolved Solids mg/l	2,175	2,200	2,770	2,640
pH Units	7.40	7.50	7.50	7.50

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
Main Slope				
Flow (gpm)	Sump	Sump	Sump	Sump
Acidity as CaCO3 mg/l	20.00	10.00	<0.01	15.00
Alkalinity as CaCO3 mg/l	351.30	3,567.00	230.10	241.20
Dissolved Iron mg/l	2.000	0.985	0.310	0.260
Iron as Fe (Total) mg/l	2.200	2.250	0.340	0.450
Manganese as Mn (Tot) mg/l	0.070	0.095	0.030	0.035
Suspended Solids mg/l	18.0	34.0	6.0	7.0
Total Dissolved Solids mg/l	2,584	2,225	2,016	2,020
pH Units	7.50	7.40	8.10	7.60

Sampling Date:	9/82	10/82
Main Slope		
Flow (gpm)	Sump	Sump
Acidity as CaCO3 mg/l	<0.01	9.00
Alkalinity as CaCO3 mg/l	185.10	287.30
Dissolved Iron mg/l	1.650	1.550
Iron as Fe (Total) mg/l	1.800	1.870
Manganese as Mn (Tot) mg/l	0.045	0.095
Suspended Solids mg/l	5.0	20.0
Total Dissolved Solids mg/l	1,795	2,090
pH Units	8.20	7.60

Duplicate

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

Sampling Date:	
Flow (gpm)	
Acidity as CaCO3 mg/l	
Alkalinity as CaCO3 mg/l	
Dissolved Iron mg/l	
Iron as Fe (Total) mg/l	
Manganese as Mn (Tot) mg/l	
Suspended Solids mg/l	
Total Dissolved Solids mg/l	
pH Units	

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	1/81	2/81	3/81	4/81
12 N-M				
Flow (gpm)				
Acidity as CaCO3 mg/l	<0.1	<0.1	4.0	7.20
Alkalinity as CaCO3 mg/l	384.00	348.00	336.00	328.00
Dissolved Iron mg/l	0.020	0.020	0.010	0.030
Iron as Fe (Total) mg/l	0.030	0.020	0.020	0.060
Manganese as Mn (Tot) mg/l	0.010	0.010	0.010	0.020
Suspended Solids mg/l	5.0	4.0	5.0	7.0
Total Dissolved Solids mg/l	1,650	1,600	1,575	1,875
pH Units	7.50	8.20	7.80	8.00

Sampling Date:	5/81	6/81	7/81	8/81
12 N-M				
Flow (gpm)			20	20
Acidity as CaCO3 mg/l	5.70	<0.01	<0.01	<0.01
Alkalinity as CaCO3 mg/l	318.00	342.00	350.00	326.00
Dissolved Iron mg/l	0.030	0.035	0.027	0.038
Iron as Fe (Total) mg/l	0.080	0.077	0.095	0.099
Manganese as Mn (Tot) mg/l	0.010	0.019	0.011	0.015
Suspended Solids mg/l	8.0	9.0	4.0	3.0
Total Dissolved Solids mg/l	1,700	1,800	1,750	1,750
pH Units	8.10	8.10	8.40	7.90

Sampling Date:	9/81	10/81	11/81	12/81
12N-M				
Flow (gpm)	20	20	20	24
Acidity as CaCO3 mg/l	6.00	12.00	8.00	16.00
Alkalinity as CaCO3 mg/l	212.60	218.80	217.20	241.90
Dissolved Iron mg/l	0.040	0.045	0.040	0.035
Iron as Fe (Total) mg/l	0.080	0.089	0.075	0.088
Manganese as Mn (Tot) mg/l	0.012	0.011	0.014	0.012
Suspended Solids mg/l	41.0	25.0	22.0	16.0
Total Dissolved Solids mg/l	2,450	2,350	2,350	2,200
pH Units	7.90	7.60	7.80	8.00

Sampling Date:	1/82	2/82	3/82	4/82
12N-M				
Flow (gpm)	24	20	20	20
Acidity as CaCO3 mg/l	12.00	8.00	<0.01	12.00
Alkalinity as CaCO3 mg/l	269.80	290.70	295.20	250.40
Dissolved Iron mg/l	0.550	0.430	NA	NA
Iron as Fe (Total) mg/l	0.680	0.450	0.610	0.790
Manganese as Mn (Tot) mg/l	0.110	0.090	0.160	0.120
Suspended Solids mg/l	12.0	20.0	21.0	18.0
Total Dissolved Solids mg/l	2,125	2,000	3,096	2,186
pH Units	7.70	8.00	7.70	7.80

duplicate

GROUND WATER QUALITY DATA - GENEVA COAL MINE

Sampling Date:	5/82	6/82	7/82	8/82
12N-M				
Flow (gpm)	20	20	20	20
Acidity as CaCO3 mg/l	<0.01	<0.01	<0.01	3.00
Alkalinity as CaCO3 mg/l	204.40	294.90	292.20	288.10
Dissolved Iron mg/l	0.350	0.155	0.280	0.250
Iron as Fe (Total) mg/l	0.350	0.350	0.280	0.260
Manganese as Mn (Tot) mg/l	0.060	0.050	0.060	0.061
Suspended Solids mg/l	1.0	11.0	6.0	6.0
Total Dissolved Solids mg/l	2,398	2,050	2,756	2,050
pH Units	8.00	7.90	8.00	8.10

Sampling Date:	9/82	10/82
12N-M		
Flow (gpm)	20	20
Acidity as CaCO3 mg/l	<0.01	<0.01
Alkalinity as CaCO3 mg/l	300.30	290.00
Dissolved Iron mg/l	0.180	0.185
Iron as Fe (Total) mg/l	0.200	0.220
Manganese as Mn (Tot) mg/l	0.045	0.045
Suspended Solids mg/l	43.0	24.0
Total Dissolved Solids mg/l	2,090	2,005
pH Units	8.20	8.00

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

duplicate

Sampling Date:
Flow (gpm)
Acidity as CaCO3 mg/l
Alkalinity as CaCO3 mg/l
Dissolved Iron mg/l
Iron as Fe (Total) mg/l
Manganese as Mn (Tot) mg/l
Suspended Solids mg/l
Total Dissolved Solids mg/l
pH Units

JBR Data

CHEMTECH
28 EAST 1500 NORTH
OREM, UTAH 84057
(801) 226-8822

CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: JBR Consultants
2556 East Oak Creek Circle
Sandy, UT 84092

LAB NO.: U009230

DATE SAMPLED: 11-6-85

TIME SAMPLED: 1500

SAMPLED BY: Martz

LOCATION: RB-21 H-1

COMMENTS: metals - dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	365
Ammonia as NH_3-N, mg/l	0.15
Arsenic as As, mg/l	0.012
Barium as Ba, mg/l	0.060
Bicarbonate as HCO_3, mg/l	445
Boron as B, mg/l	0.59
Cadmium as Cd, mg/l	<.005
Calcium as Ca, mg/l	27.5
Carbonate as CO_3, mg/l	0
Sulfide as S, mg/l	<.05
Molybdenum as Mo, mg/l	<.005

PARAMETER	LEVEL
Chloride as Cl, mg/l	12.6
Chromium as Cr (Hex.), mg/l	<.005
Chromium as Cr (Total), mg/l	<.005
Conductivity, umhos/cm	866
Copper as Cu, mg/l	0.020
Fluoride as F, mg/l	0.17
Hardness as $CaCO_3$, mg/l	399
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.248
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	0.022
Magnesium as Mg, mg/l	48.2
Manganese as Mn, mg/l	0.020
Mercury as Hg, mg/l	0.0003
Nickel as Ni, mg/l	0.006
Nitrate as NO_3-N, mg/l	0.27
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.042
Potassium as K, mg/l	1.92
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	10.44
Silver as Ag, mg/l	<.005
Sodium as Na, mg/l	89.8
Sulfate as SO_4, mg/l	115
Total Dissolved Solids, mg/l	581
Turbidity, NTU	--
Zinc as Zn, mg/l	0.10
pH Units	7.69

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OREM, UTAH 84057
(801) 226-8822

CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: JBR Consultants
2556 East Oak Creek Circle
Sandy, UT 84092

LAB NO.: U009231

DATE SAMPLED: 11-8-85

TIME SAMPLED: 1130

SAMPLED BY: Martz

LOCATION: RB-26 H-6

COMMENTS: metals - dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	375
Ammonia as NH_3-N, mg/l	0.15
Arsenic as As, mg/l	0.010
Barium as Ba, mg/l	0.050
Bicarbonate as HCO_3, mg/l	457
Boron as B, mg/l	1.07
Cadmium as Cd, mg/l	<.005
Calcium as Ca, mg/l	32.5
arbonate as CO_3, mg/l	0
Sulfide as S, mg/l	<.05
Molybdenum as Mo, mg/l	0.016
Chloride as Cl, mg/l	27.1
Chromium as Cr (Hex.), mg/l	<.005
Chromium as Cr (Total), mg/l	<.005
Conductivity, umhos/cm	1300
Copper as Cu, mg/l	0.010
Fluoride as F, mg/l	0.38
Hardness as $CaCO_3$, mg/l	401
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.023
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	0.024
Magnesium as Mg, mg/l	68.8
Manganese as Mn, mg/l	<.005
Mercury as Hg, mg/l	0.0005
Nickel as Ni, mg/l	<.005
Nitrate as NO_3-N, mg/l	0.48
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.016
Potassium as K, mg/l	1.84
Selenium as Se, mg/l	0.004
Silica as SiO_2 (Dissolved), mg/l	10.71
Silver as Ag, mg/l	<.005
Sodium as Na, mg/l	161
Sulfate as SO_4, mg/l	251
Total Dissolved Solids, mg/l	892
Turbidity, NTU	--
Zinc as Zn, mg/l	0.06
pH Units	7.87

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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: JBR Consultants
2556 East Oak Creek Circle
Sandy, UT 84092

LAB NO.: U009220

DATE SAMPLED: 11-8-85

TIME SAMPLED: 1015

SAMPLED BY: Martz

LOCATION: EWL-25 H-18

COMMENTS: metals - dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	377
Ammonia as NH_3-N, mg/l	0.12
Arsenic as As, mg/l	0.012
Barium as Ba, mg/l	0.120
Bicarbonate as HCO_3, mg/l	460
Boron as B, mg/l	0.37
Cadmium as Cd, mg/l	<.005
Calcium as Ca, mg/l	29.6
Carbonate as CO_3, mg/l	0
Sulfide as S, mg/l	<.05
Molybdenum as Mo, mg/l	<.005

PARAMETER	LEVEL
Chloride as Cl, mg/l	25.2
Chromium as Cr (Hex.), mg/l	<.005
Chromium as Cr (Total), mg/l	<.005
Conductivity, umhos/cm	1010
Copper as Cu, mg/l	0.030
Fluoride as F, mg/l	0.24
Hardness as $CaCO_3$, mg/l	343
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.040
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	0.024
Magnesium as Mg, mg/l	52.8
Manganese as Mn, mg/l	<.005
Mercury as Hg, mg/l	0.0010
Nickel as Ni, mg/l	<.005
Nitrate as NO_3-N, mg/l	0.11
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.025
Potassium as K, mg/l	1.64
Selenium as Se, mg/l	<.002
Silica as SiO_2 (Dissolved), mg/l	10.76
Silver as Ag, mg/l	<.005
Sodium as Na, mg/l	123
Sulfate as SO_4, mg/l	107
Total Dissolved Solids, mg/l	641
Turbidity, NTU	--
Zinc as Zn, mg/l	0.10
pH Units	7.58

[signature]
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OREM, UTAH 84057
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CERTIFICATE OF ANALYSIS

SAMPLE IDENTIFICATION

CLIENT: JBR Consultants
2556 East Oak Creek Circle
Sandy, UT 84092

LAB NO.: U009221

DATE SAMPLED: 11-8-85

TIME SAMPLED: 0945

SAMPLED BY: Martz

LOCATION: EWL-26 H-21

COMMENTS: metals - dissolved

PARAMETER	LEVEL
Alkalinity as $CaCO_3$, mg/l	152
Ammonia as NH_3-N, mg/l	0.15
Arsenic as As, mg/l	0.011
Barium as Ba, mg/l	0.220
Bicarbonate as HCO_3, mg/l	186
Boron as B, mg/l	0.22
Cadmium as Cd, mg/l	<.005
Calcium as Ca, mg/l	13.4
Carbonate as CO_3, mg/l	0
Sulfide as S, mg/l	<.05
Molybdenum as Mo, mg/l	<.005

PARAMETER	LEVEL
Chloride as Cl, mg/l	21.0
Chromium as Cr (Hex.), mg/l	<.005
Chromium as Cr (Total), mg/l	<.005
Conductivity, umhos/cm	525
Copper as Cu, mg/l	0.013
Fluoride as F, mg/l	0.10
Hardness as $CaCO_3$, mg/l	152
Hydroxide as OH, mg/l	0
Iron as Fe (Dissolved), mg/l	0.105
Iron as Fe (Total), mg/l	--
Lead as Pb, mg/l	0.011
Magnesium as Mg, mg/l	20.4
Manganese as Mn, mg/l	0.008
Mercury as Hg, mg/l	0.0008
Nickel as Ni, mg/l	<.005
Nitrate as NO_3-N, mg/l	0.29
Nitrite as NO_2-N, mg/l	<.005
Phosphate as PO_4-P, mg/l	0.025
Potassium as K, mg/l	0.67
Selenium as Se, mg/l	0.004
Silica as SiO_2 (Dissolved), mg/l	10.90
Silver as Ag, mg/l	<.005
Sodium as Na, mg/l	72.1
Sulfate as SO_4, mg/l	77.2
Total Dissolved Solids, mg/l	347
Turbidity, NTU	--
Zinc as Zn, mg/l	0.09
pH Units	7.86

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Appendix VI-2

Peak Flow Calculations

CROSS REFERENCE BETWEEN MAINTENANCE DRAINAGES AND RECLAMATION DRAINAGES

Maintenance Drainage ID	Reclamation Drainage ID
1	21
2	7
3	12
4	22
5	3
9	10
10	16
14	2
28	23
29	27
30	26

For the remaining drainages, there is not a correlation between the maintenance + reclamation areas due to different flow routing and regrading.

Drainage ID Cross Ref

MAINTENANCE PLAN – WATERSHED CHARACTERISTICS – INPUTS TO PEAK FLOW PROGRAM

DRAINAGE ID	CURVE NUMBER	AREA (ac)	HYDRAULIC LENGTH (ft)	WATERSHED SLOPE %	LAG (hr)	TOC (hr)
1	72	7800	32,500	53.2	.89	1.49
2	78	102.8	3,900	26.8	.19	.32
3	78	53.3	2,750	47.2	.11	.18
4	78	5.7	1,200	61.6	.05	.08
5	78	4.95	1,340	48.8	.06	.10
6	78	5.94	1,330	58.8	.06	.09
7	78	4.48	1,116	29.4	.07	.12
8	78	4.70	1,050	37.6	.06	.10
9	78	17.03	1,800	67.4	.07	.11
10	78	4.19	995	47.3	.05	.08
11	78	5.20	830	56.3	.04	.07
12	78	1.52	590	32.1	.04	.07
13	78	69.20	2,700	68.0	.09	.15
14	78	0.57	220	20.0	.02	.04
15	86	2.50	550	52.4	.02	.04
16	80	3.20	480	44.4	.03	.04
17	81	2.40	600	38.4	.03	.06
18	86	4.74	1925	27.2	.08	.14
19	90	3.70	720	4.2	.08	.14
20	78	4.31	1150	30.4	.07	.11
21	84	24.82	2800	35.6	.11	.18
22	90	1.20	1340	2.6	.06	.10
23	82	1.13	850	28.4	.05	.08
24	82	8.47	1600	29.3	.08	.13
25	90	0.35	150	38.8	.007	.013
26	89	1.33	930	2.9	.13	.21
27	86	2.50	900	9.3	.08	.13
28	90	0.88	465	7.4	.04	.07
29	90	0.50	Peaks not run – not needs Total runoff = 0.04 AF			
30	83	14.70	1240	17.6	.08	.14
31	90	8.60	1450	6.3	.12	.20

PRECIPITATION DEPTHS*

10-year	1.84 in
25-year	2.20 in
50-year	2.46 in

*for 24-hour duration

SCS Type II distribution was used in analysis

Formulas:

$$L = Lag = \frac{l^{0.8}(s+1)^{.7}}{1900\ Y^{.5}}$$

l = hydraulic length ft
$s = 1000/CN - 10$
Y = slope in %

$$TOC = L/0.6$$

Peek flows

Appendix VI-2 Table 1. Peak Flows for Undisturbed Drainages.

Drainage ID	Curve Number	Time of Conc. (hr)	Drainage Area (ac)	Storm Duration (hr)	Precip. Depth (in)	Rainfall Distribution	Peak Flow (cfs)
No. 1	72	1.49	7800.00	24	2.46	SCS Type II	1154.7
No. 2	78	0.32	102.80	24	1.84	SCS Type II	31.82
No. 3	78	0.18	53.30	24	1.84	SCS Type II	20.23
No. 4	78	0.08	5.70	24	1.84	SCS Type II	2.48
No. 5	78	0.10	4.95	24	1.84	SCS Type II	2.10
No. 6	78	0.09	5.94	24	1.84	SCS Type II	2.55
No. 7	78	0.12	4.48	24	1.84	SCS Type II	1.85
No. 8	78	0.10	4.70	24	1.84	SCS Type II	1.99
No. 9	78	0.11	17.03	24	1.84	SCS Type II	7.11
No. 10	78	0.08	4.19	24	1.84	SCS Type II	1.83
No. 11	78	0.07	5.20	24	1.84	SCS Type II	2.29
No. 12	78	0.07	1.52	24	1.84	SCS Type II	0.67
No. 13	78	0.15	69.20	24	1.84	SCS Type II	27.41

RECLAMATION PLAN - WATERSHED CHARACTERISTICS - INPUTS TO PEAK FLOW PROGRAM

Drainage ID	Curve Number	Area (ac)	Hydraulic length (ft)	Watershed Slope %	Lag (hr)	TOC (hr)
1	78	.78	450	8	.06	.10
2	78	.57	220	20	.02	.04
3	78	4.95	1340	49	.06	.10
4	78	8.85	1400	59	.05	.09
5	78	3.6	1200	20	.09	.15
6	78	1.6	510	78	.02	.04
7	78	102.8	3900	27	.19	.32
8	78	.73	290	40	.02	.03
9	78	3.44	700	65	.03	.05
10	78	17.03	1800	67	.07	.11
11	78	30.5	2400	35	.11	.19
12	78	53.3	2750	47	.11	.18
13	78	0.92	230	20	.02	.04
14	78	10.64	1600	29	.08	.13
15	78	1.63	370	32	.02	.04
16	78	2.9	1000	47	.05	.08
17	78	9.3	2300	33	.11	.19
18	78	69.2	2700	68	.09	.15
19	78	8.5	950	49	.05	.08
20	78	7.80	950	8	.11	.19
21	78	7800	32,500	53	.89	1.49
22	78	5.7	1200	62	.05	.08
23	78	.88	465	7.4	.04	.07
24	78	3.95	600	5	.10	.18
25	78	17.12	2500	47	.10	.17
26	78	14.70	1300	16	.06	.10
27	78	.5	no peaks calculated, total runoff = .02 AF			

PRECIPITATION	DEPTHS*
10-year	1.84
100-year	2.85

*for 24-hr duration

SCS Type II distribution was used in the analysis

Formulas:

$$Lag = \frac{l^{.8}(s+1)^{.7}}{1900\ Y^{.5}}$$

l = hydraulic length (ft)
s = 1000/CN − 10
Y = slope %

TOC = Lag/0.6

Appendix VI-2 Table 2. Peak Flows for Drainages (Reclamation Plan).

Drainage ID	Curve Number	Time of Concentration (hr)	Drainage Area (ac)	Storm Duration (hr)	Precip. Depth (in)	Rainfall Distribution	Peak Flow (cfs)
No. 1	78	0.10	0.78	24	1.84	SCS Type II	0.33
No. 2	78	0.04	0.57	24	1.84	SCS Type II	0.22
No. 3	78	0.10	4.95	24	1.84	SCS Type II	2.10
No. 4	78	0.09	8.85	24	1.84	SCS Type II	3.80
No. 5	78	0.15	3.60	24	1.84	SCS Type II	1.43
No. 6	78	0.04	1.60	24	1.84	SCS Type II	0.74
No. 7	78	0.32	102.80	24	1.84	SCS Type II	31.82
No. 8	78	0.03	0.73	24	1.84	SCS Type II	0.34
No. 9	78	0.05	3.44	24	1.84	SCS Type II	1.56
No. 10	78	0.11	17.03	24	1.84	SCS Type II	7.11
No. 11	78	0.19	30.50	24	1.84	SCS Type II	11.38
No. 12	78	0.18	53.30	24	1.84	SCS Type II	20.23
No. 13	78	0.04	0.92	24	1.84	SCS Type II	0.42
No. 14	78	0.13	10.64	24	1.84	SCS Type II	4.32
No. 15	78	0.04	1.63	24	1.84	SCS Type II	0.75
No. 16	78	0.08	4.19	24	1.84	SCS Type II	1.83
No. 17	78	0.19	9.30	24	1.84	SCS Type II	3.47
No. 18	78	0.15	69.20	24	1.84	SCS Type II	27.41
No. 19	78	0.08	8.50	24	1.84	SCS Type II	3.70
No. 20	78	0.19	6.06	24	1.84	SCS Type II	2.26
No. 21	72	1.49	7800.00	24	2.85	SCS Type II	1762
No. 22	78	0.08	5.70	24	1.84	SCS Type II	2.48
No. 23	78	0.07	0.88	24	1.84	SCS Type II	0.39

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Sed Pond 1

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.74 acres
depth = 2.20 inches	cn = 86.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

---

runoff depth	1.00318	inches	
initial abstr	0.32558	inches	
peak flow=	4.81	cfs	(1.00738 iph)
at time 12.021	hrs		

INPUT FOR: Sed Pond 2

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 3.70 acres
depth = 2.20 inches	cn = 90.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

---

runoff depth	1.26635	inches	
initial abstr	0.22222	inches	
peak flow=	4.60	cfs	(1.23199 iph)
at time 12.021	hrs		

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Sed Pond 3

```
------------------------------------------------------------
     STORM :                          WATERSHED :
   dist =SCS Type II - 24 Hr         area =     13.17   acres
   depth =  2.20   inches              cn = 82.00
   duration = 24.00  hrs             time conc =  0.140  hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth       0.78386    inches
    initial abstr      0.43902    inches
     peak flow=        10.61     cfs    (  0.79872  iph )
   at time    12.021    hrs
------------------------------------------------------------
```

INPUT FOR: Sed Ponds 4 & 5

```
------------------------------------------------------------
     STORM :                          WATERSHED :
   dist =SCS Type II - 24 Hr         area =     11.65   acres
   depth =  2.20   inches              cn = 86.00
   duration = 24.00  hrs             time conc =  0.220  hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth       1.00318    inches
    initial abstr      0.32558    inches
     peak flow=        11.17     cfs    (  0.95106  iph )
   at time    12.056    hrs
------------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Sed Ponds 4 & 5 - II

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 24.82 acres
depth = 2.20 inches	cn = 84.00
duration = 24.00 hrs	time conc = 0.180 hrs

OUTPUT SUMMARY

runoff depth	0.88859	inches	
initial abstr	0.38095	inches	
peak flow=	21.81	cfs	(0.87162 iph)
at time 12.024		hrs	

INPUT FOR: Sed Pond 6

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 8.47 acres
depth = 2.20 inches	cn = 82.00
duration = 24.00 hrs	time conc = 0.130 hrs

OUTPUT SUMMARY

runoff depth	0.78386	inches	
initial abstr	0.43902	inches	
peak flow=	6.86	cfs	(0.80295 iph)
at time 12.029		hrs	

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Sed. Pond 7
----------------------------------------------------------
    STORM :                         WATERSHED :
   dist =SCS Type II - 24 Hr       area =      0.88   acres
   depth =  2.20   inches            cn = 90.00
   duration = 24.00  hrs           time conc =  0.070  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth      1.26635    inches
    initial abstr     0.22222    inches
     peak flow=        1.12     cfs    (  1.26571  iph )
   at time    12.003    hrs
----------------------------------------------------------
```

```
INPUT FOR: Sed. Pond 8
----------------------------------------------------------
    STORM :                         WATERSHED :
   dist =SCS Type II - 24 Hr       area =      2.50   acres
   depth =  2.20   inches            cn = 86.00
   duration = 24.00  hrs           time conc =  0.130  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth      1.00318    inches
    initial abstr     0.32558    inches
     peak flow=        2.55     cfs    (  1.01099  iph )
   at time    12.012    hrs
----------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Sed. Pond 9

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.33 acres
depth = 2.20 inches	cn = 89.00
duration = 24.00 hrs	time conc = 0.210 hrs

OUTPUT SUMMARY

runoff depth	1.19591	inches	
initial abstr	0.24719	inches	
peak flow=	1.52	cfs	(1.12986 iph)
at time 12.040	hrs		

INPUT FOR: Sed. Pond 10

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.15 acres
depth = 2.20 inches	cn = 90.00
duration = 24.00 hrs	time conc = 0.020 hrs

OUTPUT SUMMARY

runoff depth	1.26635	inches	
initial abstr	0.22222	inches	
peak flow=	1.50	cfs	(1.29125 iph)
at time 12.002	hrs		

Peak Flow Calculations

Maintenance Plan

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance

INPUT FOR: Drainage 1 - Upper Horse Canyon - 50yr-24hr

```
   STORM :                              WATERSHED :
 dist =SCS Type II - 24 Hr             area =   7800.00   acres
 depth =  2.46   inches                  cn = 72.00
 duration = 24.00  hrs                 time conc =  1.490  hrs
```

OUTPUT SUMMARY

```
   runoff depth       0.50795    inches
   initial abstr      0.77778    inches
    peak flow=      1154.73     cfs   (  0.14682  iph )
 at time    13.112     hrs
```

Maintenance

INPUT FOR: Drainage 2 - Mine Portal - 10yr-24hr

```
   STORM :                              WATERSHED :
 dist =SCS Type II - 24 Hr             area =    102.80   acres
 depth =  1.84   inches                  cn = 78.00
 duration = 24.00  hrs                 time conc =  0.320  hrs
```

OUTPUT SUMMARY

```
   runoff depth       0.39740    inches
   initial abstr      0.56410    inches
    peak flow=       31.82      cfs   (  0.30702  iph )
 at time    12.160     hrs
```

REV. 2-26-88

Maintenance

INPUT FOR: Drainage 3 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 53.30 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.180 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	20.23	cfs	(0.37645 iph)
at time 12.048	hrs		

Maintenance

INPUT FOR: Drainage 4 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 5.70 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.080 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	2.48	cfs	(0.43227 iph)
at time 12.011	hrs		

REV. 2-26-88

Maintenance

INPUT FOR: Drainage 5 - 10yr-24hr

```
----------------------------------------------------------
     STORM :                              WATERSHED :
   dist =SCS Type II - 24 Hr             area =      4.95   acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00  hrs                 time conc =  0.100  hrs
----------------------------------------------------------
```

OUTPUT SUMMARY

```
----------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         2.10     cfs    (  0.41995  iph )
   at time    12.013    hrs
----------------------------------------------------------
```

Maintenance

INPUT FOR: Drainage 6 - 10yr-24hr

```
----------------------------------------------------------
     STORM :                              WATERSHED :
   dist =SCS Type II - 24 Hr             area =      5.94   acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00  hrs                 time conc =  0.090  hrs
----------------------------------------------------------
```

OUTPUT SUMMARY

```
----------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         2.55     cfs    (  0.42615  iph )
   at time    12.012    hrs
----------------------------------------------------------
```

Rev. 2-26-88

Maintenance

INPUT FOR: Drainage 7 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.48 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.120 hrs

OUTPUT SUMMARY

---

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	1.85	cfs	(0.40866 iph)
at time 12.032	hrs		

Maintenance

INPUT FOR: Drainage 8 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.70 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.100 hrs

OUTPUT SUMMARY

---

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	1.99	cfs	(0.41995 iph)
at time 12.013	hrs		

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance

INPUT FOR: Drainage 9 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 17.03 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.110 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	7.11	cfs	(0.41385 iph)
at time 12.027	hrs		

Maintenance

INPUT FOR: Drainage 10 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.19 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.080 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	1.83	cfs	(0.43227 iph)
at time 12.011	hrs		

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance

INPUT FOR: Drainage 11 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 5.20 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.070 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	2.29	cfs	(0.43712 iph)
at time	12.012	hrs	

Maintenance

INPUT FOR: Drainage 12 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.52 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.070 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	0.67	cfs	(0.43712 iph)
at time	12.012	hrs	

Rev. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance

INPUT FOR: Drainage 13 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 69.20 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.150 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches		
initial abstr	0.56410	inches		
peak flow=	27.41	cfs	(0.39280	iph)
at time 12.040	hrs			

REV. 2-26-88

```
INPUT SUMMARY FOR: Maintenance Area 16
------------------------------------------------------------
    STORM :                          WATERSHED :
  dist =SCS Type II - 24 Hr         area =      3.20   acres
  depth =  1.84   inches              cn = 80.00
  duration = 24.00  hrs             time conc =  0.040  hrs
------------------------------------------------------------
```

```
OUTPUT SUMMARY FOR: Maintenance Area 16
-----------------------------------------------------------
   runoff depth        0.46760    inches
   initial abstr       0.50000    inches
   peak flow          1.72      cfs    (  0.53384  iph )
  at time     12.005    hrs
------------------------------------------------------------
```

```
INPUT SUMMARY FOR: Maintenance Area 25
------------------------------------------------------------
    STORM :                          WATERSHED :
  dist =SCS Type II - 24 Hr         area =      1.20   acres
  depth =  1.84   inches              cn = 90.00
  duration = 24.00  hrs             time conc =  0.100  hrs
------------------------------------------------------------
```

```
OUTPUT SUMMARY FOR: Maintenance Area 25
-----------------------------------------------------------
   runoff depth        0.95907    inches
   initial abstr       0.22222    inches
   peak flow          1.17      cfs    (  0.96947  iph )
  at time     12.013    hrs
------------------------------------------------------------
```

```
NPUT SUMMARY FOR: Maintenance Area 15
------------------------------------------------------------
    STORM :                          WATERSHED :
  dist =SCS Type II - 24 Hr         area =      2.50   acres
  depth =  1.84   inches              cn = 86.00
  duration = 24.00  hrs             time conc =  0.040  hrs
------------------------------------------------------------
```

```
TPUT SUMMARY FOR: Maintenance Area 15
-----------------------------------------------------------
   runoff depth        0.72986    inches
   initial abstr       0.32558    inches
   peak flow          2.01      cfs    (  0.79725  iph )
  at time     12.005    hrs
------------------------------------------------------------
```

INPUT SUMMARY FOR: Maintenance Area 17

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 2.40 acres
depth = 1.84 inches	cn = 81.00
duration = 24.00 hrs	time conc = 0.060 hrs

OUTPUT SUMMARY FOR: Maintenance Area 17

runoff depth 0.50565 inches
initial abstr 0.46914 inches
peak flow 1.36 cfs (0.56311 iph)
at time 12.008 hrs

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 18

INPUT FOR: ~~Disturbed Area Diversion~~ 1

```
-----------------------------------------------------------
    STORM :                         WATERSHED :
  dist =SCS Type II - 24 Hr         area =      4.74   acres
  depth =  1.84   inches              cn = 86.00
  duration = 24.00  hrs             time conc =  0.140  hrs
-----------------------------------------------------------
```

OUTPUT SUMMARY

```
----------------------------------------------------------
   runoff depth       0.72986    inches
   initial abstr      0.32558    inches
    peak flow=         3.54     cfs    (  0.74054   iph )
  at time     12.021    hrs
----------------------------------------------------------
```

Maintenance Drainage 20

INPUT FOR: ~~Disturbed Area Diversion~~ 2

```
-----------------------------------------------------------
    STORM :                         WATERSHED :
  dist =SCS Type II - 24 Hr         area =      4.31   acres
  depth =  1.84   inches              cn = 78.00
  duration = 24.00  hrs             time conc =  0.110  hrs
-----------------------------------------------------------
```

OUTPUT SUMMARY

```
----------------------------------------------------------
   runoff depth       0.39740    inches
   initial abstr      0.56410    inches
    peak flow=         1.80     cfs    (  0.41385   iph )
  at time     12.027    hrs
----------------------------------------------------------
```

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

~~INPUT FOR: DISTURBED DRAINAGE~~

STORM :		WATERSHED :	
dist =SCS Type II - 24 Hr		area =	1.88 acres
depth =	1.84 inches	cn =	86.00
duration =	24.00 hrs	time conc =	0.130 hrs

OUTPUT SUMMARY

runoff depth	0.72986	inches	
initial abstr	0.32558	inches	
peak flow=	1.03	cfs	(0.74321 iph)
at time 12.012	hrs		

Maintenance Drainage 19

~~INPUT FOR: DISTURBED DIVERSION C~~

STORM :		WATERSHED :	
dist =SCS Type II - 24 Hr		area =	3.70 acres
depth =	1.84 inches	cn =	90.00
duration =	24.00 hrs	time conc =	0.140 hrs

OUTPUT SUMMARY

runoff depth	0.95907	inches	
initial abstr	0.22222	inches	
peak flow=	3.54	cfs	(0.94812 iph)
at time 12.021	hrs		

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

PART OF MAINTENANCE DRAINAGE 21

INPUT FOR: [redacted]

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 13.17 acres
depth = 2.20 inches	cn = 82.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

runoff depth	0.78386	inches	
initial abstr	0.43902	inches	
peak flow=	10.61	cfs	(0.79872 iph)
at time	12.021	hrs	

[redacted]

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 11.65 acres
depth = 2.20 inches	cn = 86.00
duration = 24.00 hrs	time conc = 0.220 hrs

OUTPUT SUMMARY

runoff depth	1.00318	inches	
initial abstr	0.32558	inches	
peak flow=	11.17	cfs	(0.95106 iph)
at time	12.056	hrs	

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 21

~~INPUT FOR: Sed Ponds 4 & 5 - II.~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 24.82 acres
depth = 2.20 inches	cn = 84.00
duration = 24.00 hrs	time conc = 0.180 hrs

OUTPUT SUMMARY

runoff depth	0.88859	inches	
initial abstr	0.38095	inches	
peak flow=	21.81	cfs	(0.87162 iph)
at time 12.024		hrs	

Maintenance Drainage 24

~~INPUT FOR: Sed Pond 6.~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 8.47 acres
depth = 2.20 inches	cn = 82.00
duration = 24.00 hrs	time conc = 0.130 hrs

OUTPUT SUMMARY

runoff depth	0.78386	inches	
initial abstr	0.43902	inches	
peak flow=	6.86	cfs	(0.80295 iph)
at time 12.029		hrs	

REV. 2-26-88

```
INPUT SUMMARY FOR: Maintenance Area 22
-------------------------------------------------------------------
    STORM :                                   WATERSHED :
  dist =SCS Type II - 24 Hr                 area =      0.35   acres
  depth =  1.84   inches                      cn = 90.00
  duration = 24.00  hrs                     time conc =  0.010  hrs
-------------------------------------------------------------------
```

```
OUTPUT SUMMARY FOR: Maintenance Area 22
-------------------------------------------------------------------
   runoff depth       0.95907    inches
   initial abstr      0.22222    inches
   peak flow         0.36      cfs   (  1.00773  iph )
  at time    12.001    hrs
-------------------------------------------------------------------
```

```
INPUT SUMMARY FOR: Maintenance Area 30
-------------------------------------------------------------------
    STORM :                                   WATERSHED :
  dist =SCS Type II - 24 Hr                 area =     14.70   acres
  depth =  1.84   inches                      cn = 83.00
  duration = 24.00  hrs                     time conc =  0.140  hrs
-------------------------------------------------------------------
```

```
OUTPUT SUMMARY FOR: Maintenance Area 30
-------------------------------------------------------------------
   runoff depth       0.58816    inches
   initial abstr      0.40964    inches
   peak flow         8.89      cfs   (  0.59997  iph )
  at time    12.021    hrs
-------------------------------------------------------------------
```

```
INPUT SUMMARY FOR: Maintenance Area 31
-------------------------------------------------------------------
    STORM :                                   WATERSHED :
  dist =SCS Type II - 24 Hr                 area =      8.60   acres
  depth =  1.84   inches                      cn = 90.00
  duration = 24.00  hrs                     time conc =  0.200  hrs
-------------------------------------------------------------------
```

```
OUTPUT SUMMARY FOR: Maintenance Area 31
-------------------------------------------------------------------
   runoff depth       0.95907    inches
   initial abstr      0.22222    inches
   peak flow         7.95      cfs   (  0.91715  iph )
  at time    12.027    hrs
-------------------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 23

~~INPUT FOR: Disturbed Area Diversion 2~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.13 acres
depth = 1.84 inches	cn = 82.00
duration = 24.00 hrs	time conc = 0.080 hrs

OUTPUT SUMMARY

runoff depth	0.54580	inches	
initial abstr	0.43902	inches	
peak flow=	0.68	cfs	(0.59348 iph)
at time 12.011		hrs	

Maintenance Drainage 21

~~INPUT FOR: Disturbed Area Diversion 1~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 24.82 acres
depth = 1.84 inches	cn = 84.00
duration = 24.00 hrs	time conc = 0.180 hrs

OUTPUT SUMMARY

runoff depth	0.63286	inches	
initial abstr	0.38095	inches	
peak flow=	15.56	cfs	(0.62170 iph)
at time 12.048		hrs	

REV. 2-28-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 18

INPUT FOR: [redacted]

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.74 acres
depth = 2.20 inches	cn = 86.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

runoff depth	1.00318	inches	
initial abstr	0.32558	inches	
peak flow=	4.81	cfs	(1.00738 iph)
at time 12.021		hrs	

Maintenance Drainage 19

INPUT FOR: [redacted]

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 3.70 acres
depth = 2.20 inches	cn = 90.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

runoff depth	1.26635	inches	
initial abstr	0.22222	inches	
peak flow=	4.60	cfs	(1.23199 iph)
at time 12.021		hrs	

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 26

~~INPUT FOR: Sed. Pond 9~~

STORM :
dist =SCS Type II - 24 Hr
depth = 2.20 inches
duration = 24.00 hrs

WATERSHED :
area = 1.33 acres
cn = 89.00
time conc = 0.210 hrs

OUTPUT SUMMARY

---

runoff depth	1.19591	inches		
initial abstr	0.24719	inches		
peak flow=	1.52	cfs	(1.12986	iph)
at time 12.040		hrs		

~~INPUT FOR: Sed. Pond 10~~

STORM :
dist =SCS Type II - 24 Hr
depth = 2.20 inches
duration = 24.00 hrs

WATERSHED :
area = 1.15 acres
cn = 90.00
time conc = 0.020 hrs

OUTPUT SUMMARY

---

runoff depth	1.26635	inches		
initial abstr	0.22222	inches		
peak flow=	1.50	cfs	(1.29125	iph)
at time 12.002		hrs		

REV. 2-26-88

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Maintenance Area 27
--------------------------------------------------------------------------
    STORM :                                    WATERSHED :
   dist =SCS Type II - 24 Hr                  area =      2.50    acres
   depth =   1.84    inches                      cn = 86.00
   duration = 24.00   hrs                     time conc =   0.130   hrs
--------------------------------------------------------------------------
```

```
OUTPUT SUMMARY
--------------------------------------------------------------------------
     runoff depth        0.72986      inches
     initial abstr       0.32558      inches
      peak flow=          1.87       cfs    (   0.74321   iph )
    at time      12.012      hrs
--------------------------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

Maintenance Drainage 28

~~INPUT FOR: Sed. Pond 2~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 0.88 acres
depth = 2.20 inches	cn = 90.00
duration = 24.00 hrs	time conc = 0.070 hrs

OUTPUT SUMMARY

runoff depth	1.26635	inches	
initial abstr	0.22222	inches	
peak flow=	1.12	cfs	(1.26571 iph)
at time 12.003	hrs		

Maintenance Drainage 27

~~INPUT FOR: Sed. Pond [illegible]~~

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 2.50 acres
depth = 2.20 inches	cn = 86.00
duration = 24.00 hrs	time conc = 0.130 hrs

OUTPUT SUMMARY

runoff depth	1.00318	inches	
initial abstr	0.32558	inches	
peak flow=	2.55	cfs	(1.01099 iph)
at time 12.012	hrs		

REV. 2-26-88

UINTEX project worksheet	Project Horse Canyon	Sponsor JBR	p. 1 of 1
	Job Code	Task:Subject Drainage to haybales	
	Date:Time 2-20-88	Author KK	Chkd

Maintenance drainage 29

$A = 2.2\ in^2 = .5\ ac$

$CN = 90$

$P = 1.84\ in$

$Q = .95\ in$

$Vol = \frac{.95\ in}{12} \times .5\ ac = .04\ ac\text{-}ft = 1724.2\ ft^3$

If spread out along length of bales (500')

then: $3.4\ ft^2$ per linear foot; since relatively flat slope, not likely that over-topping could occur

Reclamation drainage 27 (same as above)

$A = 2.2\ in^2 = .5\ ac$

$CN = 78$

$P = 1.84$

$Q = .4\ in$

$Vol = \frac{.4}{12} \times .5\ ac = .02\ ac\text{-}ft$

Peak Flow Calculations
Reclamation Plan

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 1

```
   STORM :                              WATERSHED :
dist =SCS Type II - 24 Hr              area =      0.78   acres
depth =  1.84   inches                   cn = 78.00
duration = 24.00  hrs                  time conc =  0.100  hrs
```

OUTPUT SUMMARY

```
 runoff depth        0.39740    inches
 initial abstr       0.56410    inches
  peak flow=          0.33     cfs    (  0.41995  iph )
at time     12.013    hrs
```

INPUT FOR: Reclamation area 2

```
   STORM :                              WATERSHED :
dist =SCS Type II - 24 Hr              area =      0.57   acres
depth =  1.84   inches                   cn = 78.00
duration = 24.00  hrs                  time conc =  0.040  hrs
```

OUTPUT SUMMARY

```
 runoff depth        0.39740    inches
 initial abstr       0.56410    inches
  peak flow=          0.26     cfs    (  0.45594  iph )
at time     12.005    hrs
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 3

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 4.95 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.100 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches		
initial abstr	0.56410	inches		
peak flow=	2.10	cfs	(0.41995	iph)
at time 12.013	hrs			

INPUT FOR: Reclamation Area ~~5~~ 4

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 8.85 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.090 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches		
initial abstr	0.56410	inches		
peak flow=	3.80	cfs	(0.42615	iph)
at time 12.012	hrs			

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 5

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 3.60 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.150 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	1.43	cfs	(0.39280 iph)
at time	12.040	hrs	

INPUT FOR: Reclamation area 6

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.60 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.040 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	0.74	cfs	(0.45594 iph)
at time	12.005	hrs	

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Reclamation area 7
----------------------------------------------------------
     STORM :                            WATERSHED :
   dist =SCS Type II - 24 Hr           area =    102.80   acres
   depth =  1.84   inches                cn = 78.00
   duration = 24.00  hrs               time conc =  0.320  hrs
----------------------------------------------------------

OUTPUT SUMMARY
----------------------------------------------------------
    runoff depth      0.39740    inches
    initial abstr     0.56410    inches
     peak flow=       31.82     cfs    (  0.30702  iph )
   at time    12.160    hrs
----------------------------------------------------------

INPUT FOR: Reclamation area 8
----------------------------------------------------------
     STORM :                            WATERSHED :
   dist =SCS Type II - 24 Hr           area =      0.73   acres
   depth =  1.84   inches                cn = 78.00
   duration = 24.00  hrs               time conc =  0.030  hrs
----------------------------------------------------------

OUTPUT SUMMARY
----------------------------------------------------------
    runoff depth      0.39740    inches
    initial abstr     0.56410    inches
     peak flow=        0.34     cfs    (  0.46177  iph )
   at time    12.004    hrs
----------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 9

```
--------------------------------------------------------
    STORM :                          WATERSHED :
  dist =SCS Type II - 24 Hr         area =      3.44   acres
  depth =  1.84   inches              cn = 78.00
  duration = 24.00  hrs             time conc =  0.050  hrs
--------------------------------------------------------
```

OUTPUT SUMMARY

```
--------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         1.56     cfs    (  0.45003  iph )
  at time     12.007    hrs
--------------------------------------------------------
```

INPUT FOR: Reclamation area 10

```
--------------------------------------------------------
    STORM :                          WATERSHED :
  dist =SCS Type II - 24 Hr         area =     17.03   acres
  depth =  1.84   inches              cn = 78.00
  duration = 24.00  hrs             time conc =  0.110  hrs
--------------------------------------------------------
```

OUTPUT SUMMARY

```
--------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         7.11     cfs    (  0.41385  iph )
  at time     12.027    hrs
--------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 11

```
--------------------------------------------------------
    STORM :                              WATERSHED :
  dist =SCS Type II - 24 Hr             area =     30.50   acres
  depth =  1.84   inches                  cn = 78.00
  duration = 24.00  hrs                 time conc =  0.190  hrs
--------------------------------------------------------
```

OUTPUT SUMMARY

```
--------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=        11.38     cfs    (  0.37017  iph )
   at time     12.059     hrs
--------------------------------------------------------
```

INPUT FOR: Reclamation area 12

```
--------------------------------------------------------
    STORM :                              WATERSHED :
  dist =SCS Type II - 24 Hr             area =     53.30   acres
  depth =  1.84   inches                  cn = 78.00
  duration = 24.00  hrs                 time conc =  0.180  hrs
--------------------------------------------------------
```

OUTPUT SUMMARY

```
--------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=        20.23     cfs    (  0.37645  iph )
   at time     12.048     hrs
--------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 13

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 0.92 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.040 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	0.42	cfs	(0.45594 iph)
at time 12.005	hrs		

INPUT FOR: Reclamation area 14

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 10.64 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.130 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	4.32	cfs	(0.40272 iph)
at time 12.029	hrs		

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Reclamation area 15
---------------------------------------------------------
    STORM :                            WATERSHED :
  dist =SCS Type II - 24 Hr           area =      1.63   acres
  depth =  1.84   inches                cn = 78.00
  duration = 24.00  hrs               time conc =  0.040  hrs
---------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         0.75     cfs    (  0.45594  iph )
  at time    12.005     hrs
---------------------------------------------------------
```

```
INPUT FOR: Reclamation area 16
---------------------------------------------------------
    STORM :                            WATERSHED :
  dist =SCS Type II - 24 Hr           area =      4.19   acres
  depth =  1.84   inches                cn = 78.00
  duration = 24.00  hrs               time conc =  0.080  hrs
---------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         1.83     cfs    (  0.43227  iph )
  at time    12.011     hrs
---------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 17

```
------------------------------------------------------------
     STORM :                              WATERSHED :
   dist =SCS Type II - 24 Hr             area =     9.30   acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00  hrs                 time conc =  0.190  hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         3.47     cfs    (  0.37017  iph )
   at time    12.059    hrs
------------------------------------------------------------
```

INPUT FOR: Reclamation area 18

```
------------------------------------------------------------
     STORM :                              WATERSHED :
   dist =SCS Type II - 24 Hr             area =    69.20   acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00  hrs                 time conc =  0.150  hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=        27.41     cfs    (  0.39280  iph )
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 19

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 8.50 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.080 hrs

OUTPUT SUMMARY

---

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	3.70	cfs	(0.43227 iph)
at time 12.011	hrs		

[redacted]

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 6.06 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.190 hrs

OUTPUT SUMMARY

---

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	2.26	cfs	(0.37017 iph)
at time 12.059	hrs		

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation area 21

```
     STORM :                                   WATERSHED :
   dist =SCS Type II - 24 Hr              area =  7800.00   acres
   depth =  2.85   inches                   cn = 72.00
   duration = 24.00  hrs                  time conc =  1.490  hrs
```

OUTPUT SUMMARY

```
    runoff depth       0.72035    inches
    initial abstr      0.77778    inches
     peak flow=      1761.65     cfs    (  0.22399  iph )
   at time    13.112    hrs
```

INPUT FOR: Reclamation area 22

```
     STORM :                                   WATERSHED :
   dist =SCS Type II - 24 Hr              area =     5.70   acres
   depth =  1.84   inches                   cn = 78.00
   duration = 24.00  hrs                  time conc =  0.080  hrs
```

OUTPUT SUMMARY

```
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         2.48     cfs    (  0.43227  iph )
   at time    12.011    hrs
```

```
INPUT FOR: Reclamation area 23
--------------------------------------------------------------------------------
     STORM :                                    WATERSHED :
   dist =SCS Type II - 24 Hr                  area =       0.88    acres
   depth =   1.84    inches                     cn = 78.00
   duration = 24.00   hrs                     time conc =   0.070   hrs
  number of lines       2587
--------------------------------------------------------------------------------

OUTPUT FORMAT: 1=short, 2=long
? 1

OUTPUT SUMMARY
--------------------------------------------------------------------------------
    runoff depth        0.39740     inches
    initial abstr       0.56410     inches
     peak flow=          0.39      cfs   (   0.43712   iph )
   at time     12.012      hrs
--------------------------------------------------------------------------------
Additional runs
1=yes   2=no ? 2
Ok

1LIST   2RUN   3LOAD"   4SAVE"   5CONT 6,"LPT1 7TRON 8TROFF9KEY    0SCREEN
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation Area 24

STORM :
dist =SCS Type II - 24 Hr
depth = 1.84 inches
duration = 24.00 hrs

WATERSHED :
area = 3.95 acres
cn = 78.00
time conc = 0.180 hrs

OUTPUT SUMMARY

---

runoff depth	0.39740	inches		
initial abstr	0.56410	inches		
peak flow=	1.50	cfs	(0.37645	iph)
at time	12.048	hrs		

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Reclamation Area [redacted] 20

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 7.80 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.190 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	2.91	cfs	(0.37017 iph)
at time	12.059	hrs	

INPUT FOR: Reclamation Area 26

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 14.70 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.100 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	6.22	cfs	(0.41995 iph)
at time	12.013	hrs	

INPUT FOR: Reclamation Area 25

STORM :
dist =SCS Type II - 24 Hr
depth = 1.84 inches
duration = 24.00 hrs

WATERSHED :
area = 17.12 acres
cn = 78.00
time conc = 0.170 hrs

OUTPUT SUMMARY

---

runoff depth 0.39740 inches
initial abstr 0.56410 inches
peak flow= 6.54 cfs (0.37905 iph)
at time 12.059 hrs

Appendix VI-3

Hydraulic Designs

UINTEX Project Worksheet

Project JBK: HA-AC

Job Code 65033.00

Date:Time 24 APR 87 9:00

Sponsor JBK

Task:Subject PEAK FLOW IN [illegible]

Author [illegible]

Chkd

p. 1 of

CLEAR WATER DIVERSIONS & CHANNEL EVALUATION 3

DRAINAGE I.D.	CURVE NUMBER	HYDRAULIC LENGTH	AVERAGE WATERSHED SLOPE	LAG TIME	TIME OF CONC.	AREA	DURATION	PRECIP.	DIST.	PEAK DISCHARGE
HORSE CANYON DRAINAGE 1	72	32,800	53.2%	0.89	1.49	7800	24	2.46	TYPE "2"	1154.73
MINE PORTAL DRAINAGE #2	78	3,900	26.8%	0.19	0.32	102.8	24	1.84	TYPE "2"	31.82
PCB AREA DRAINAGE #3	78	2,750	47.2%	0.11	0.18	53.3	24	1.84	TYPE "2"	20.23
HILLSIDE PILE DRAINAGE #4	78	1,200	61.6%	0.05	0.08	5.70	24	1.84	TYPE "2"	2.48
OLD BUILDING DRAINAGE #5	78	1340	48.8%	0.06	0.10	4.95	24	1.84	TYPE "2"	2.10
HIGHWALL DRAINAGE #6	78	1330	58.8%	0.06	0.09	5.94	24	1.84	TYPE "2"	2.55
SIDING DRAINAGE #7	78	1160	29.4%	0.07	0.12	4.48	24	1.84	TYPE "2"	1.85
CONVEYOR DRAINAGE #8	78	1050	37.6%	0.06	0.10	4.70	24	1.84	TYPE "2"	1.99
CULVERT DRAINAGE #9	78	1800	67.4%	0.07	0.11	7.03	24	1.84	TYPE "2"	7.11
CONVEYOR CULVERT DRAINAGE #10	78	995	47.3%	0.05	0.08	4.19	24	1.84	TYPE "2"	1.83
DRAINAGE #11	78	830	56.3%	0.04	0.07	5.20	24	1.84	TYPE "2"	2.29
DRAINAGE #12	78	590	32.1%	0.04	0.07	1.52	24	1.84	TYPE "2"	0.67
DRAINAGE #13	78	2700	68.0%	0.09	0.15	69.2	24	1.84	TYPE "2"	27.41

$$L = \frac{(l)^{0.8}(S+1)^{0.7}}{1900\,(Y)^{0.5}}$$

L = LAG TIME (hrs)

l = HYDRAULIC LENGTH (FT)

Y = WATERSHED SLOPE

$S = \frac{1000}{CN} - 10$

CN = CURVE NUMBER

$T_c = L/0.6$ = TIME OF CONCENTRATION

PEAK DISCHARGE DETERMINED FROM STORM HYDROGRAPH COMPUTER PROGRAM

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Drainage 1 - Upper Horse Canyon - 50yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 7800.00 acres
depth = 2.46 inches	cn = 72.00
duration = 24.00 hrs	time conc = 1.490 hrs

OUTPUT SUMMARY

---

runoff depth 0.50795 inches
initial abstr 0.77778 inches
peak flow= 1154.73 cfs (0.14682 iph)
at time 13.112 hrs

INPUT FOR: Drainage 2 - Mine Portal - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 102.80 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.320 hrs

OUTPUT SUMMARY

---

runoff depth 0.39740 inches
initial abstr 0.56410 inches
peak flow= 31.82 cfs (0.30702 iph)
at time 12.160 hrs

```
INPUT FOR: Drainage 3 - 10yr-24hr
-----------------------------------------------------------
    STORM :                           WATERSHED :
  dist =SCS Type II - 24 Hr          area =     53.30   acres
  depth =  1.84   inches               cn = 78.00
  duration = 24.00  hrs              time conc =  0.180  hrs
-----------------------------------------------------------
```

```
OUTPUT SUMMARY
-----------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=        20.23     cfs    (  0.37645   iph )
  at time     12.048     hrs
-----------------------------------------------------------
```

```
INPUT FOR: Drainage 4 - 10yr-24hr
-----------------------------------------------------------
    STORM :                           WATERSHED :
  dist =SCS Type II - 24 Hr          area =      5.70   acres
  depth =  1.84   inches               cn = 78.00
  duration = 24.00  hrs              time conc =  0.080  hrs
-----------------------------------------------------------
```

```
OUTPUT SUMMARY
-----------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         2.48     cfs    (  0.43227   iph )
  at time     12.011     hrs
-----------------------------------------------------------
```

INPUT FOR: Drainage 5 - 10yr-24hr

```
------------------------------------------------------------
    STORM :                               WATERSHED :
   dist =SCS Type II - 24 Hr            area =       4.95    acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00   hrs               time conc =  0.100   hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth        0.39740    inches
    initial abstr       0.56410    inches
     peak flow=          2.10     cfs    (   0.41995   iph )
   at time      12.013     hrs
------------------------------------------------------------
```

INPUT FOR: Drainage 6 - 10yr-24hr

```
------------------------------------------------------------
    STORM :                               WATERSHED :
   dist =SCS Type II - 24 Hr            area =       5.94    acres
   depth =  1.84   inches                  cn = 78.00
   duration = 24.00   hrs               time conc =  0.090   hrs
------------------------------------------------------------
```

OUTPUT SUMMARY

```
------------------------------------------------------------
    runoff depth        0.39740    inches
    initial abstr       0.56410    inches
     peak flow=          2.55     cfs    (   0.42615   iph )
   at time      12.012     hrs
------------------------------------------------------------
```

INPUT FOR: Drainage 7 - 10yr-24hr

```
    STORM :                              WATERSHED :
 dist =SCS Type II - 24 Hr              area =      4.48   acres
 depth =  1.84   inches                   cn = 78.00
 duration = 24.00  hrs                  time conc =  0.120  hrs
```

OUTPUT SUMMARY

```
   runoff depth        0.39740    inches
   initial abstr       0.56410    inches
    peak flow=          1.85     cfs    (   0.40866  iph )
 at time    12.032     hrs
```

INPUT FOR: Drainage 8 - 10yr-24hr

```
    STORM :                              WATERSHED :
 dist =SCS Type II - 24 Hr              area =      4.70   acres
 depth =  1.84   inches                   cn = 78.00
 duration = 24.00  hrs                  time conc =  0.100  hrs
```

OUTPUT SUMMARY

```
   runoff depth        0.39740    inches
   initial abstr       0.56410    inches
    peak flow=          1.99     cfs    (   0.41995  iph )
 at time    12.013     hrs
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Drainage 9 - 10yr-24hr
----------------------------------------------------------
     STORM :                           WATERSHED :
   dist =SCS Type II - 24 Hr          area =     17.03   acres
   depth =  1.84   inches               cn = 78.00
   duration = 24.00  hrs              time conc =  0.110  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         7.11     cfs    (  0.41385  iph )
   at time    12.027    hrs
----------------------------------------------------------
```

```
INPUT FOR: Drainage 10 - 10yr-24hr
----------------------------------------------------------
     STORM :                           WATERSHED :
   dist =SCS Type II - 24 Hr          area =      4.19   acres
   depth =  1.84   inches               cn = 78.00
   duration = 24.00  hrs              time conc =  0.080  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         1.83     cfs    (  0.43227  iph )
   at time    12.011    hrs
----------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

```
INPUT FOR: Drainage 11 - 10yr-24hr
----------------------------------------------------------
     STORM :                          WATERSHED :
   dist =SCS Type II - 24 Hr         area =      5.20   acres
   depth =  1.84   inches              cn = 78.00
   duration = 24.00  hrs             time conc =  0.070  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         2.29     cfs    (  0.43712  iph )
   at time    12.012    hrs
----------------------------------------------------------
```

```
INPUT FOR: Drainage 12 - 10yr-24hr
----------------------------------------------------------
     STORM :                          WATERSHED :
   dist =SCS Type II - 24 Hr         area =      1.52   acres
   depth =  1.84   inches              cn = 78.00
   duration = 24.00  hrs             time conc =  0.070  hrs
----------------------------------------------------------
```

```
OUTPUT SUMMARY
---------------------------------------------------------
    runoff depth       0.39740    inches
    initial abstr      0.56410    inches
     peak flow=         0.67     cfs    (  0.43712  iph )
   at time    12.012    hrs
----------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Drainage 13 - 10yr-24hr

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 69.20 acres
depth = 1.84 inches	cn = 78.00
duration = 24.00 hrs	time conc = 0.150 hrs

OUTPUT SUMMARY

runoff depth	0.39740	inches	
initial abstr	0.56410	inches	
peak flow=	27.41	cfs	(0.39280 iph)
at time 12.040	hrs		

DISTURBED AREA DIVERSIONS:

Drainage I.D.	Curve Number	Hydraulic Length	Average Watershed Slope	Lag Time	Time of Conc.	Area	Duration	Precip.	Dist.	Peak Discharge
Disturbed Diversion - 1	86	1925	27.2	0.08	0.14	4.74	24	1.84	Type "2"	3.54
Disturbed Diversion - 2	78	1150	30.4	0.07	0.11	4.31	24	1.84	Type "2"	1.8
Disturbed Diversion - 3	82	850	28.4	0.05	0.08	1.13	24	1.84	Type "2"	0.68
Disturbed Diversion - 4	84	2800	35.6	0.11	0.18	24.82	24	1.84	Type "2"	15.56
Disturbed Diversion - 5	86	900	9.8	0.08	0.13	1.38	24	1.84	Type "2"	1.03
Disturbed Diversion - 6	90	720	4.2	0.08	0.14	3.70	24	1.84	Type "2"	3.54

$$L = \frac{(l)^{0.8}(S+1)^{0.7}}{1900\,(Y)^{0.5}}$$

L = Lag Time (hrs)

l = Hydralic Length (ft)

Y = Watershed Slope

$S = \frac{1000}{CN} - 10$

CN = Curve Number

$T_c = L/0.6$ = Time of Concentration

Peak Discharge Determined From Storm Hydrograph Computer Program

Project: MACK (?)
Job Code: 3033.00 (?)
Date:Time: 23 APRIL 91
Sponsor:
Task:Subject: PEAK FLOW RATES (?)
Author: DS
Chkd:
p. of

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Disturbed Area Diversion 1

```
--------------------------------------------------------------
     STORM :                           WATERSHED :
   dist =SCS Type II - 24 Hr         area =      4.74   acres
   depth =  1.84   inches              cn = 86.00
   duration = 24.00  hrs             time conc =  0.140  hrs
--------------------------------------------------------------
```

OUTPUT SUMMARY

```
-------------------------------------------------------------
    runoff depth      0.72986    inches
    initial abstr     0.32558    inches
     peak flow=        3.54     cfs    (  0.74054  iph )
   at time    12.021    hrs
--------------------------------------------------------------
```

INPUT FOR: Disturbed Area Diversion 2

```
--------------------------------------------------------------
     STORM :                           WATERSHED :
   dist =SCS Type II - 24 Hr         area =      4.31   acres
   depth =  1.84   inches              cn = 78.00
   duration = 24.00  hrs             time conc =  0.110  hrs
--------------------------------------------------------------
```

OUTPUT SUMMARY

```
-------------------------------------------------------------
    runoff depth      0.39740    inches
    initial abstr     0.56410    inches
     peak flow=        1.80     cfs    (  0.41385  iph )
   at time    12.027    hrs
--------------------------------------------------------------
```

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Disturbed Area Diversion 3

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.13 acres
depth = 1.84 inches	cn = 82.00
duration = 24.00 hrs	time conc = 0.080 hrs

OUTPUT SUMMARY

runoff depth	0.54580	inches	
initial abstr	0.43902	inches	
peak flow=	0.68	cfs	(0.59348 iph)
at time 12.011	hrs		

INPUT FOR: Disturbed Area Diversion 4

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 24.82 acres
depth = 1.84 inches	cn = 84.00
duration = 24.00 hrs	time conc = 0.180 hrs

OUTPUT SUMMARY

runoff depth	0.63286	inches	
initial abstr	0.38095	inches	
peak flow=	15.56	cfs	(0.62170 iph)
at time 12.048	hrs		

OUTPUT FROM SCS STORM HYDROGRAPH PROGRAM

INPUT FOR: Disturbed Drainage 5

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 1.38 acres
depth = 1.84 inches	cn = 86.00
duration = 24.00 hrs	time conc = 0.130 hrs

OUTPUT SUMMARY

runoff depth 0.72986 inches
initial abstr 0.32558 inches
peak flow= 1.03 cfs (0.74321 iph)
at time 12.012 hrs

INPUT FOR: Disturbed Diversion 6

STORM :	WATERSHED :
dist =SCS Type II - 24 Hr	area = 3.70 acres
depth = 1.84 inches	cn = 90.00
duration = 24.00 hrs	time conc = 0.140 hrs

OUTPUT SUMMARY

runoff depth 0.95907 inches
initial abstr 0.22222 inches
peak flow= 3.54 cfs (0.94812 iph)
at time 12.021 hrs

Culvert Calculations

Tom determined allowable headwater depths in field. Minimum was 1.5 x culvert depth, so he used this ratio in all cases to be conservative.

Check on his values shows they are correct for inlet control, with exception of 1 + 2 which actually have capacity of 100. He must have been taking in consideration the partial plugging. For now - just assume no plugging.

Check to make sure inlet control was valid assumption

Culvert	S_o	Sf
1	.032	.017
2	.014	.017
3	.1399	.0009
4	irrelevant - is being removed	
5	.067	.017
6	.098	.009
7	.07	.017
8	.226	.017

In all cases ~~but~~ but culvert #2, So > Sf so inlet control is most likely

For culvert 2, assume outlet control, but since culvert outlet is about channel, no submersion is likely. Therefore either:

① TW ~ Ho = diameter of culvert +

$HW = ~~H~~ H + H_o - S_o l$

$6 = H + 4 - (.014)(160)$

$H = 4.24$

and from outlet control nomograph Q = 95

② TW ~ 3/4 (D)

$HW = H + H_o - S_o l$

$6 = H + 3 - (.014)(160)$

$H = 5.24$

and from outlet control nomograph Q = 100

Determine culvert velocities based upon peak flows to them rather than the over-sized discharge capacity

Culvert	Q	$\frac{Qn}{D^{8/3}S^{1/2}}$	d/D	d	R
1	9.7	.032	.18	.72'	.44
2	9.7	.049	.22	.88'	.52
3					
4	irrelevant				
5	1.8	.004	<.1	.4	.13
6	2.3	.006	<.1	.35	.12
7	31.9	.072	.26	1.04	.61
8	20.2	.053	.23	.92	.54

Use table for partial flow in circular pipe (attached)

Calculate $\frac{Qn}{D^{8/3} S^{1/2}}$, n= .024

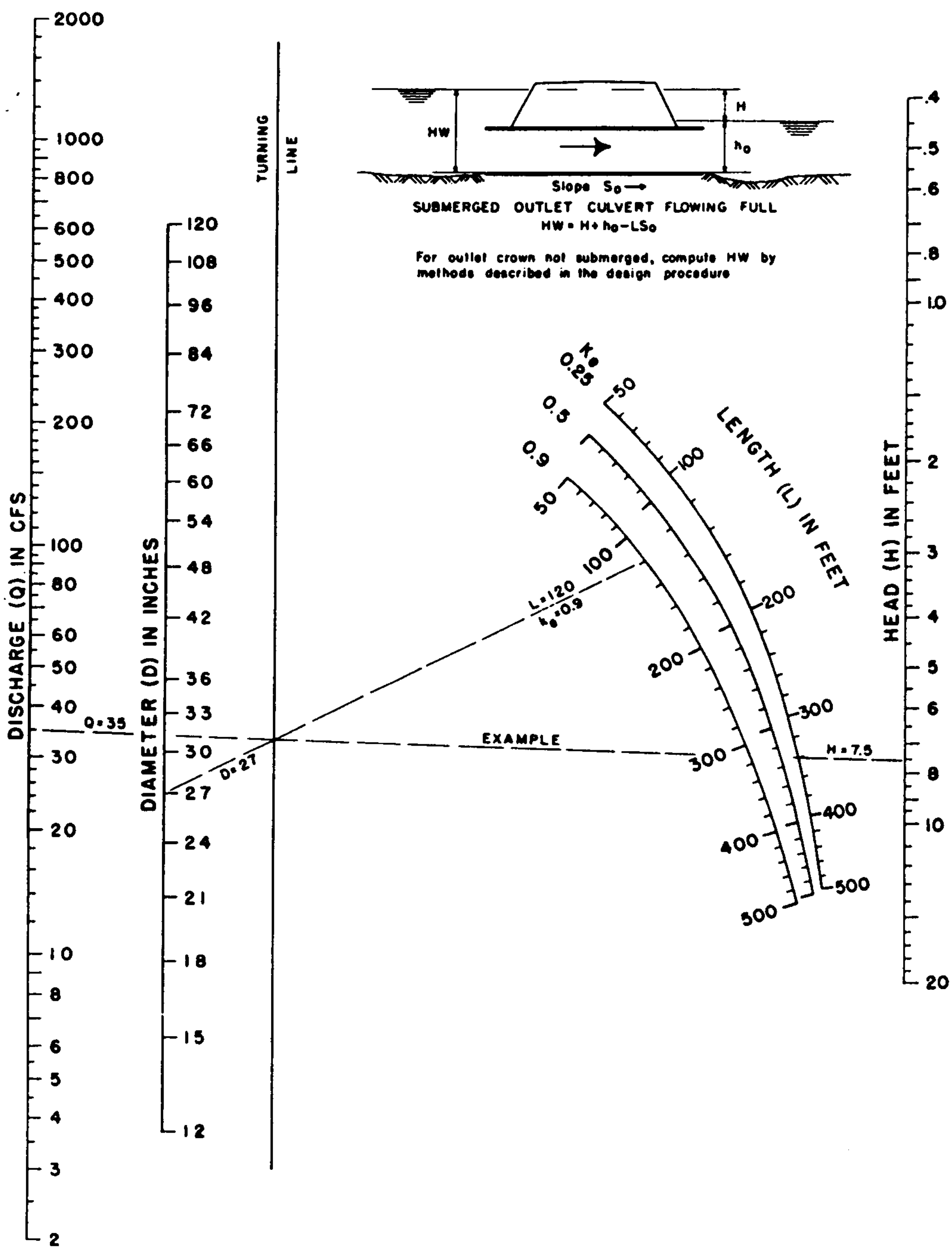
Use mannings to get v's

culvert	v
1	6
2	4.5
3	
4	—
5	~3
6	~4
7	10.2
8	12

} (7, 8) could be erosive depending upon material which exists at out fall.

look in field & decide.

Chart 2-56: HEAD FOR STANDARD C.M.P. CULVERTS FLOWING FULL (n = 0.024)



Project KAISER
Job Code 85033.00
Date:Time 30 APRIL 97

Sponsor
p. of
Task:Subject VOLUME-CAPACITY CALCULATIONS
Author TJS
Chkd

POND # 3 - SCALE 1" = 20'

CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6176.1	0	0					
			1930	0.9	1737	1737	0.04
6177	9.65	3860					
			5104	1.0	5104	6341	0.16
6178	15.87	6348					
			7468	1.0	7468	14,309	0.33
6179	21.47	8588					
			9024	0.4	3610	17,919	0.41
6179.4	23.65	9460					

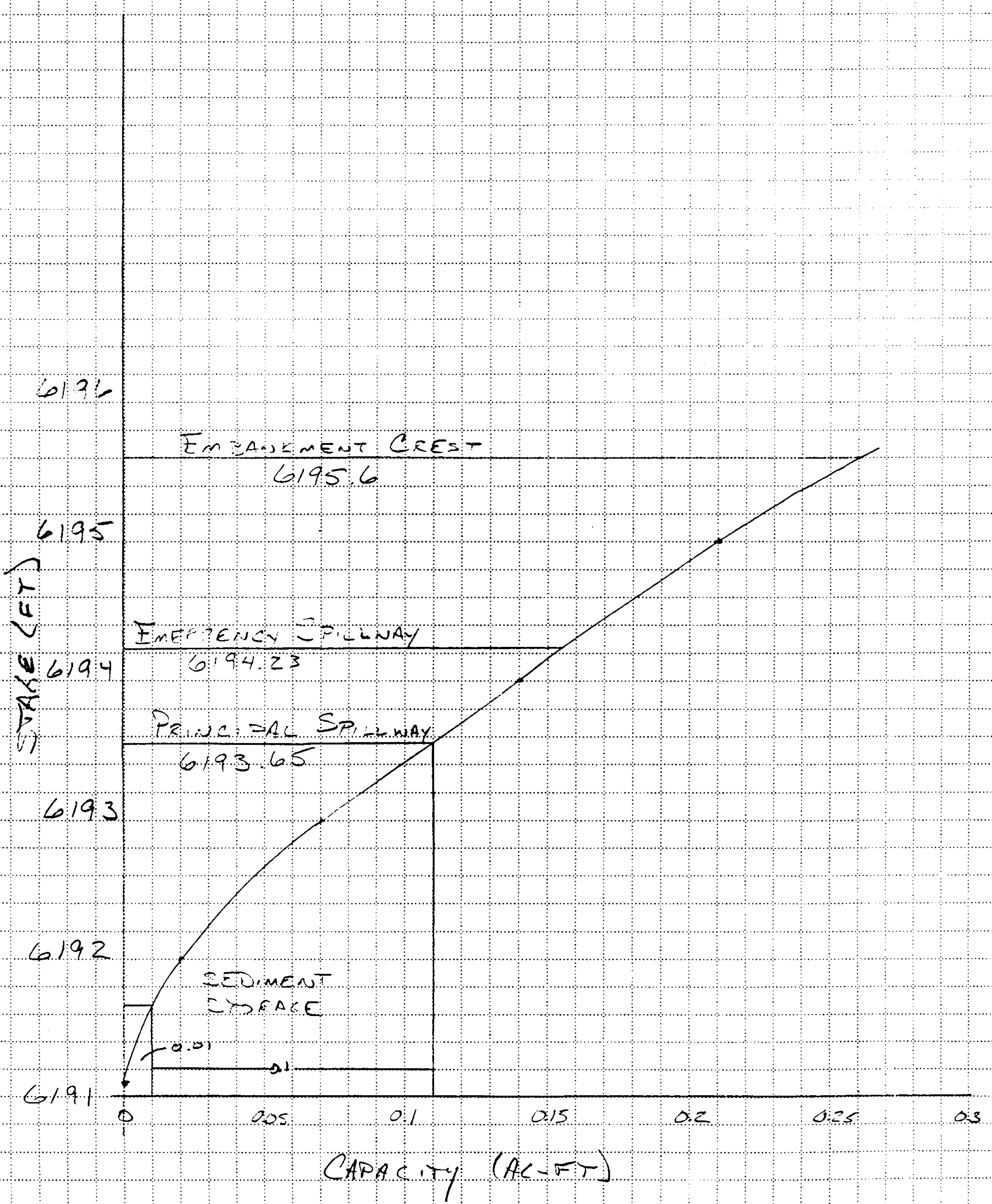
TOTAL VOLUME = 0.41 AC FT REQUIRED VOLUME 0.18

POND IS ADEQUATE

Project KAISER
Job Code 35033.00
Date:Time 2 MAY 87

Sponsor
p. of
Task:Subject STAGE-CAPACITY CURVE
Author
Chkd

POND No. 9 - PROPOSED



Project KAISER
Job Code 85033.00
Date:Time 30 APRIL 87
Sponsor
p. of
Task:Subject VOLUME - CAPACITY CALCULATIONS
Author TJS
Chkd

POND # 9 - SCALE 1" = 20'

CONTOUR	VERNIER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6192.4	0	0					
			724	0.6	434	434	
6193	3.62	1448					
			2166	1.0	2166	2600	EXISTING
6194	7.21	2884					
			3046	0.3	913	3513	
6194.3	8.02	3208					
6191.1	0	0					
			970	0.9	873	873	0.02
6192	4.85	1940					
			2310	1.0	2310	3133	0.07
6193	6.70	2680					
			2782	1.0	2782	5965	0.14
6194	7.21	2884					
			3246	1.0	3246	9211	0.21 PROPOSED
6195	9.02	3608					
			3754	0.6	2252	11,463	0.26
6195.6	9.75	3900					

TOTAL VOLUME = 0.031 AC-FT   REQUIRE 0.11

POND IS TOO SMALL.

Appendix VI-3

Diversion Ditch Designs

Diversion I.D.	Mannings n	S_{max} Maximum Channel Slope (ft/ft)	m Channel side Slope 1:m	B, Bottom Width (ft)	Q_{10} Flow depth at S_{max} (ft)	Q_{10} Area at S_{max} (ft^2)	Q_{10} Wetted Perimeter at S_{max} (ft)	Velocity at S_{max} (fps)	Q_{10} Discharge (CFS)	S_{min}, Minimum Channel Slope (ft/ft)	Velocity at S_{min} (FT)	Q_{10} Flow Depth at S_{min} (ft)	Freeboard (ft)	Total Channel Depth (ft)
TRI 1	0.035	0.022	2	0	0.64	0.83	2.88	2.76	2.29	0.009	1.97	0.76	1.0	1.76
TRAP 2	0.035	0.111	2	2	0.10	0.23	2.47	2.91	0.67	0.017	1.58	0.18	1.0	1.18
TRAP 3	0.035	0.027	2	8	0.20	1.67	8.90	2.30	3.84	0.01	1.70	0.27	1.0	1.27
TRAP 4	0.035	0.025	2	5	0.18	0.97	5.31	2.05	1.99	0.017	1.81	0.20	1.0	1.20
Asym 5	0.035	0.050	L-2 R-0.05	0	0.65	4.33	13.74	4.13	1.82	0.010	2.26	0.89	1.0	1.89
Asym TRAP 6	0.035	0.40	L 3.0 R-2.0	8	0.07	0.562	8.15	4.45	2.43	0.025	1.91	0.16	1.0	1.16
Asym TRAP 7	0.035	0.167	L-0.1 R-2.0	2	0.15	0.42	3.68	4.71	1.50	0.027	2.64	0.25	1.0	1.25
Asym 8	0.035	0.022	L-2.0 R-0.1	0	1.24	8.07	13.85	4.09	6.50	[illegible]	3.04	1.43	1.0	2.43
Asym TRAP 9	0.035	0.067	L-0.05 R-2.0	3	0.21	1.08	7.44	3.77	2.55	0.011	2.14	0.36	1.0	1.36
Asym TRAP 10	0.035	0.250	L-2.0 R-0.1	5	0.09	0.49	6.01	4.37	2.10	0.054	3.77	0.11	1.0	1.11

TRI - TRIANGULAR DITCH
TRAP - TRAPEZOIDAL DITCH
Asym - ASYMETRIC TRIANGULAR DITCH

CLEAR WATER DIVERSIONS

Project KAISER
Job Code 85033.0
Date:Time 4/14/87
Sponsor
Task:Subject DIVERSION DESIGN
Author JS
Chkd
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Diversion I.D.	Mannings n	S_{max} Maximum Channel Slope (ft/ft)	M Channel side Slope 1:m	B, Bottom Width (ft)	Q_{10} Flow depth at S_{max} (ft)	Q_{10} AREA at S_{max} (ft²)	Q_{10} Wetted Perimeter at S_{max} (ft)	Velocity at S_{max} (FPS)	Q_{10} Discharge (CFS)	S_{min} Minimum Channel Slope (ft/ft)	Velocity at S_{min} (FT)	Q_{10} Flow Depth at S_{min} (ft)	Freeboard (ft)	Total Channel Depth (ft)
TRAP 1	0.035	0.029	2	3	0.32	1.18	4.45	2.99	3.54	0.018	2.55	0.37	1.0	1.37
ASYM TRAP 2	0.035	0.057	L-2.0 R-0.1	3	0.64	2.15	7.15	4.24	1.80	0.020	2.86	0.77	1.0	1.77
TRI 3	0.035	0.040	2	0	0.37	0.27	1.64	2.54	0.68	0.025	2.13	0.40	1.0	1.40
ASYM TRAP 4	0.035	0.050	L-2 R-0.1	8	0.38	0.76	4.24	4.88	15.56	0.024	3.89	0.47	1.0	1.47
ASYM 5	0.035	0.050	L-0.05 R-2.0	0	0.53	2.88	11.21	3.57	1.03	0.018	2.44	0.64	1.0	1.64
ASYM 6	0.035	0.029	L-0.05 R-2.0	0	0.93	8.87	19.66	3.96	3.54	0.019	3.38	1.01	1.0	2.01

ASYM - ASYMETRICAL TRIANGULAR DITCH
ASYM TRAP - ASYMETRICAL TRAPEZOIDAL DITCH
TRI - TRIANGULAR DITCH
TRAP - TRAPEZOIDAL DITCH.

DISTURBED DIVERSIONS

Diversion I.D.	Mannings n	S_{max} Maximum Channel Slope (ft/ft)	m Channel side Slope 1:m	B, Bottom Width (ft)	Q_{50} Flow depth at S_{max} (ft)	Q_{50} Area at S_{max} (ft²)	Q_{50} Wetted Perimeter at S_{max} (ft)	Velocity at S_{max} (FPS)	Q_{50} Discharge (CFS)	S_{min}, Minimum Channel Slope (ft/ft)	Velocity at S_{min} (FT)	Q_{50} Flow Depth at S_{min} (ft)	Freeboard (ft)	Total Channel Depth (ft)
PORTAL CHANNEL	0.04	0.5	2	12	0.25	3.14	13.12	10.14 *	31.82	0.07	5.48	0.45	1.0	1.45

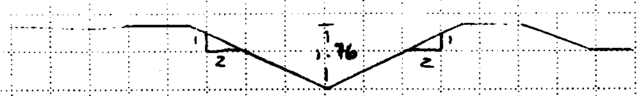
* WITHIN DESIGN CAPABILITIES FOR ENKAMATOR MIRAMAT < 20 FPS. FOR DESIGNS BETWEEN 10-20 FPS USE 18" STEEL PINS W/ 1.5 INCH DIAMETER WASHERS TO SECURE.

Project KAISER
Job Code 35035 00
Date:Time 5/14/87
Sponsor
Task:Subject REESTABLISHED CHANNEL
Author JS
Chkd
p. of

Project KAISER	Sponsor	p. of	
Job Code 85033.00	Task:Subject CROSS-SECTIONS - DITCHES		
Date:Time 5 MAY '87	Author [illegible]	Chkd	

A — A'

CLEAR WATER DIVERSION -1

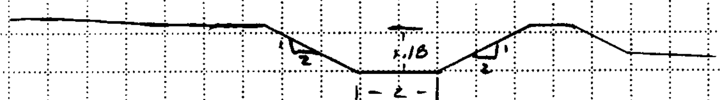


B — B'

DISTURBED AREA DIVERSION -2

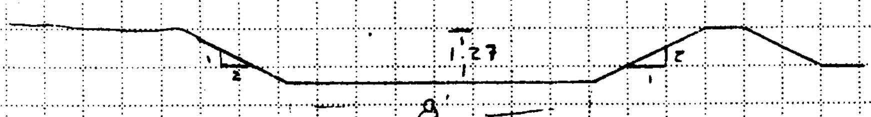
C — C'

CLEAR WATER DIVERSION - 2



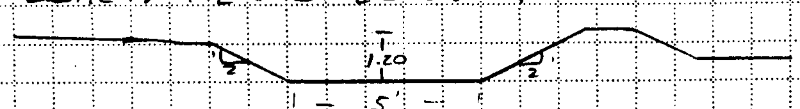
D — D'

CLEAR WATER DIVERSION - 3



E — E'

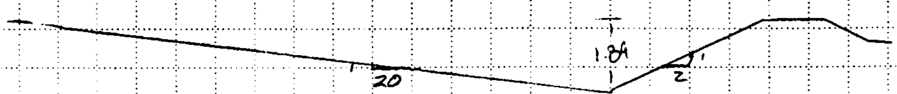
CLEAR WATER DIVERSION - 4



Project KAISER | Sponsor | p. of
Job Code 85053.00 | Task:Subject TYPICAL DITCH CROSS-SECTIONS
Date:Time 5 MAY 87 | Author JS | Chkd

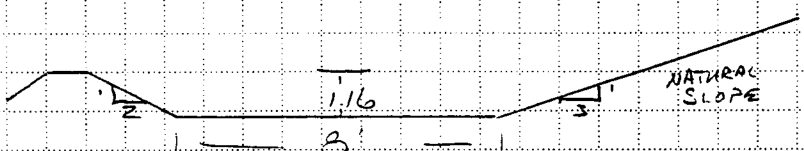
F F'

CLEAR WATER DIVERSION - 5



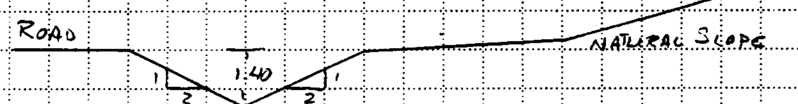
G G'

CLEAR WATER DIVERSION - 6



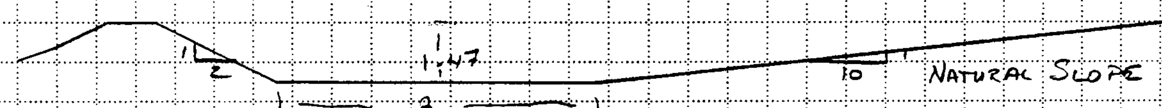
H H'

DISTURBED DIVERSION - 3



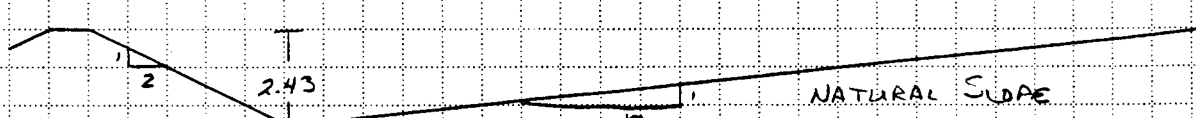
I I'

DISTURBED DIVERSION - 4



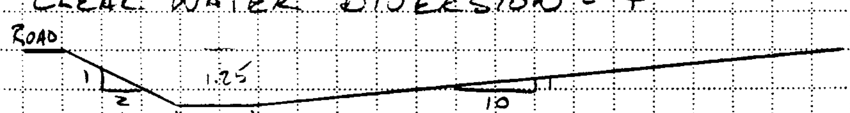
J J'

CLEAR WATER DIVERSION - 8



K K'

CLEAR WATER DIVERSION - 7



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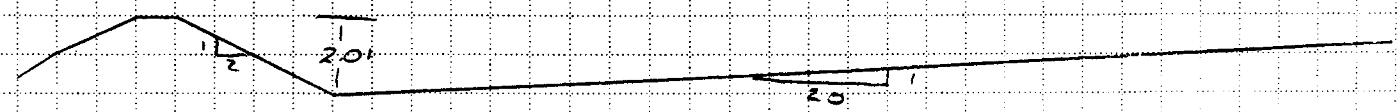
Job Code 85033.00 | Task:Subject TYPICAL DITCH CROSS-SECTIONS
Date:Time 5 MAY 87 | Author DS | Chkd

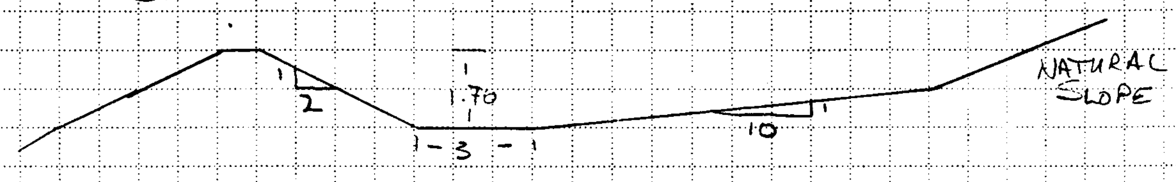
L — L'

DISTURBED DIVERSION - 6



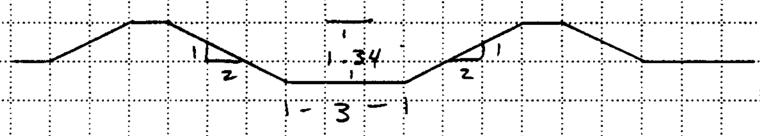
M — M'

DISTURBED DIVERSION - 2



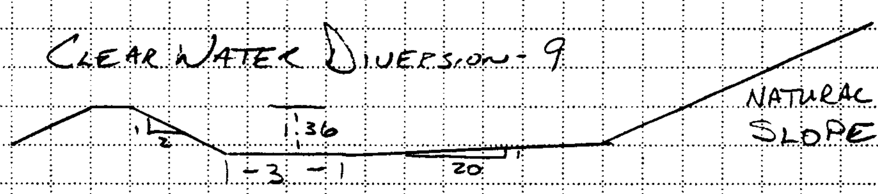
N — N'

DISTURBED DRAINAGE - 1



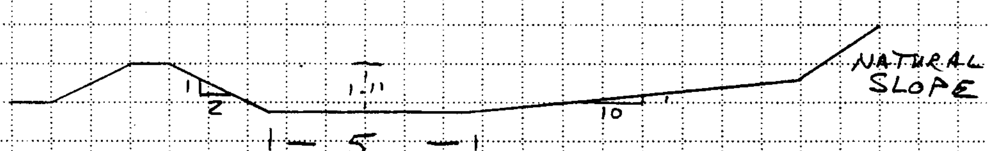
O — O'

CLEAR WATER DIVERSION - 9



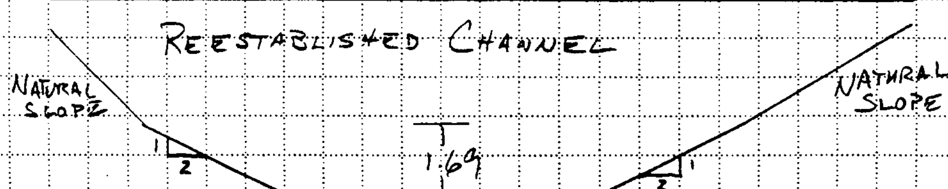
P

CLEAR WATER DIVERSION - 10



Q — Q'

REESTABLISHED CHANNEL



Project KAISER | Sponsor | p. of
Job Code 85033.00 | Task:Subject CULVERT ADEQUACY
Date:Time 6 MAY 87 | Author TJS | Chkd

EVALUATION OF CULVERT ADEQUACY

CULVERT #	CULVERT DIAMETER	DISCHARGE* CAPACITY	ESTIMATED PEAK FLOW	
1	48"	100**	9.66	
2	48"	100**	9.66	
3	72"	300	20.23	
~~4~~	~~24"~~	~~18~~	~~0.63~~	REMOVE REPLACE W/ SWALE
5	48"	100	[illegible].33	
6	48"	100	22.9	
7	48"	100	29.93	
8	36"	50	20.23	

* ASSUMING MAXIMUM OF 1.5 HEADWATER TO DIAMETER RATIO FOR PROJECTING CULVERT

**

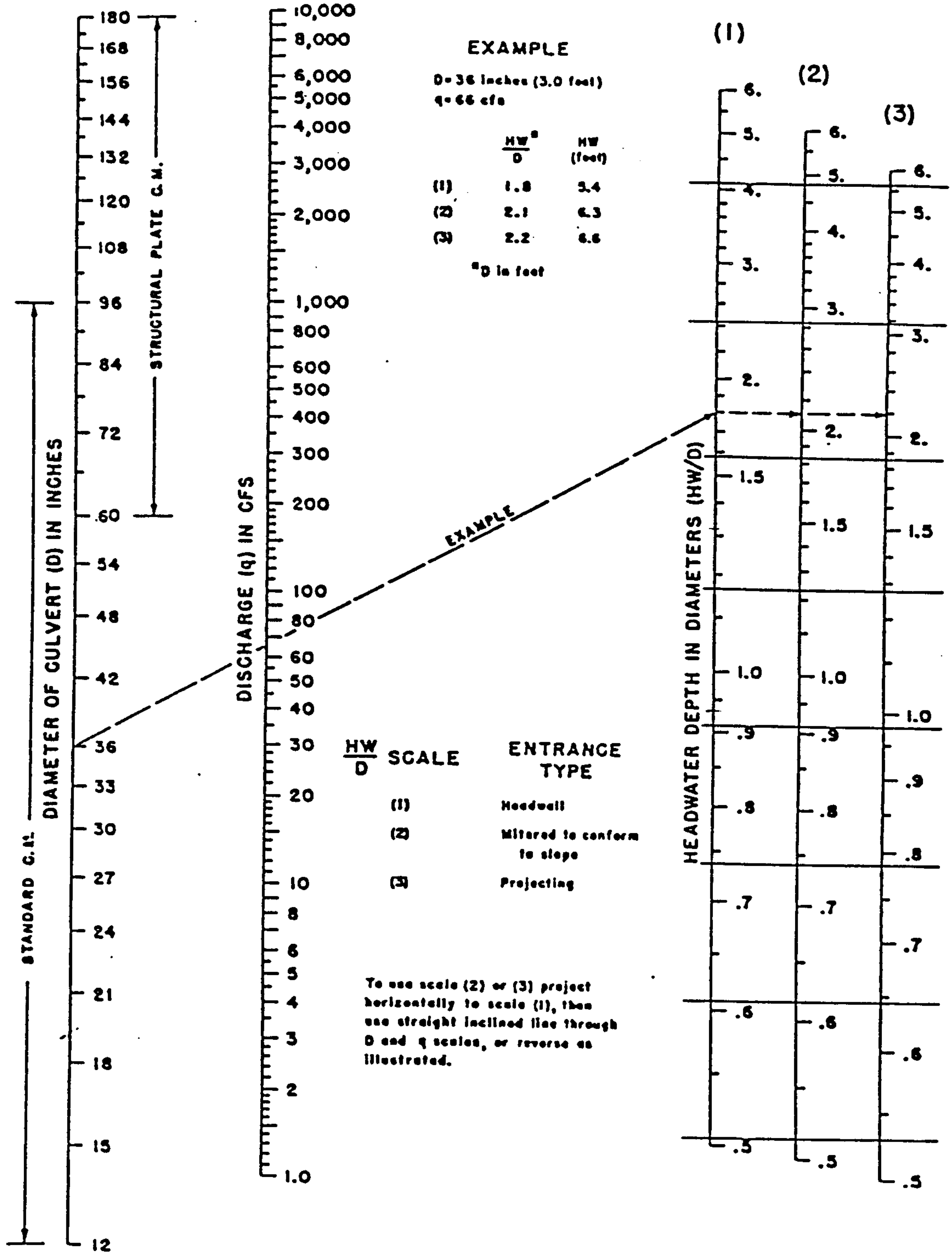


Figure 7-5. Headwater depth for corrugated metal pipe culverts with inlet control (U.S. Soil Conservation Service, 1972).

- PRESENT DRAINAGE CONFIGURATION IS SHOWN IN FIG. 1. UNDER THIS CONFIGURATION WATER FROM DRAINAGE #2 FLOWS THROUGH THE DISTURBED AREA AND ENTERS THE CREEK w/o TREATMENT.

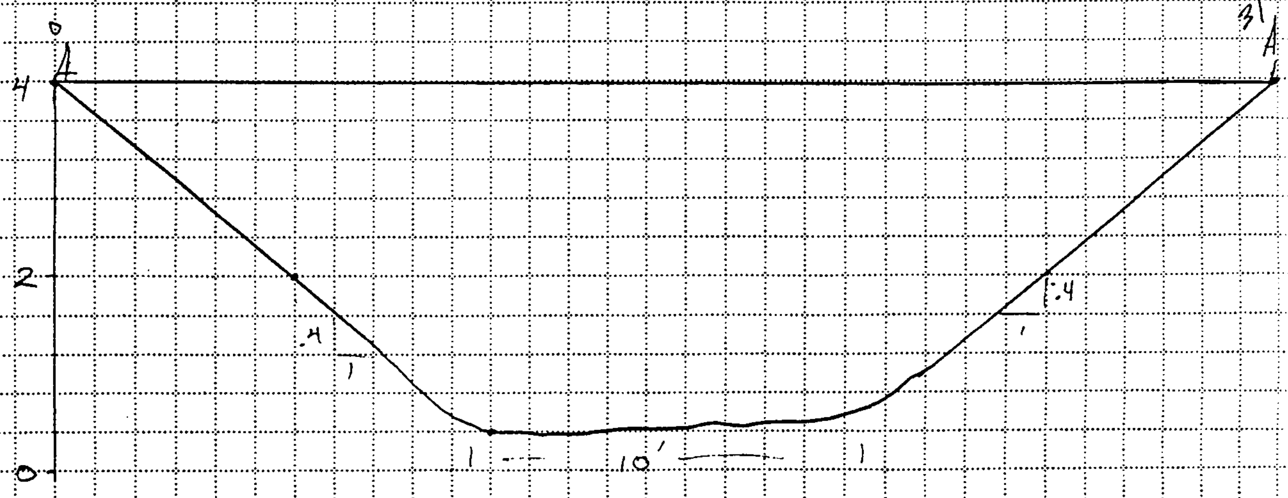
TO MEET THE REGULATIONS IT IS NECESSARY TO ISOLATE UNDISTURBED DRAINAGE FROM DISTURBED DRAINAGE THEREFORE IT IS PROPOSED THAT AN ISOLATED DRAINAGE CHANNEL BE CONSTRUCTED TO PREVENT THE MINGLING OF DISTURBED + UNDISTURBED WATER. FIGURE 2 PRESENTS THE MODIFIED CONFIGURATION.

THE COAL + CARBONACEOUS SHALE AT THE BASE OF THE HIGHWALL WILL BE REMOVED TO THE UNDERLYING SANDSTONE. THIS WILL RESULT IN A VERTICAL DROP, FROM THE EXISTING CHANNEL ABOVE THE HIGHWALL TO THE SANDSTONE LEDGE. THE LEDGE WILL CONTROL THE IMPACT AND THE WATER WILL BE CONTAINED BY CONCRETE HIGHWAY MEDIAN BARRIERS.

DESIGN OF THE DROP STRUCTURE/ IMPACT BASIN AND DOWNSTREAM CHANNEL WILL BE BASED ON THE 10yr-24hr PEAK FLOW AND THE METHODOLOGY PRESENTED BY HENDERSON (1966) AND BY ELEVATORSKI (1959).

BASED ON PROFILE OF THE TEMPORARY DRAINAGE CONFIGURATION, THE DROP WILL BE APPROXIMATELY 26 FT.

BASED ON CROSS-SECTION OF THE CHANNEL JUST ABOVE THE HIGHWALL:



FOR THE CHANNEL JUST ABOVE THE LIP CRITICAL FLOW IS

SIDE SLOPES = 2.5H : 1V

BOTTOM WIDTH = 10'

CHANNEL SLOPE = 0.12 FT/FT

MANNING'S n = 0.032

Q = 31.82 USE 32.0

y_c = 0.645 FT

V_c = 4.27 FPS

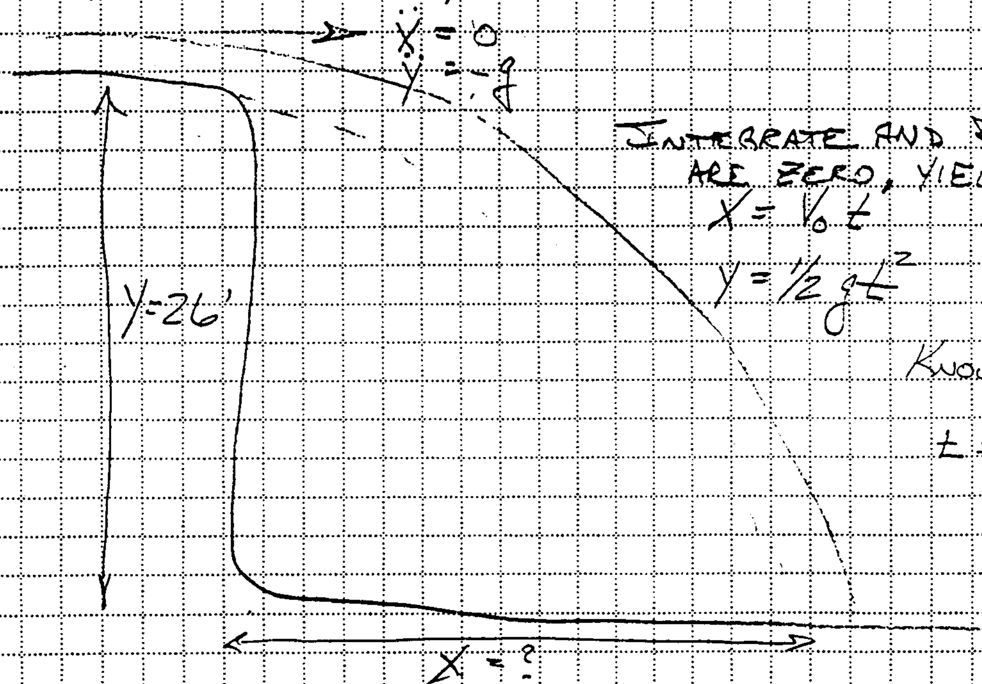
WHILE NORMAL DEPTH =

y_n = 0.367 FT

V_n = 8.0 FPS

THEREFORE, FLOW AT THE BRINK IS SUPER CRITICAL.

LENGTH OF NAPPE L_n = IS BASED ON PARABOLA.



INTEGRATE AND DROP ALL TERMS WHICH ARE ZERO, YIELDS:

$x = V_0 t$

$y = \frac{1}{2} g t^2$

KNOWING $y = 26$ FT

$t = \sqrt{\frac{y}{\frac{1}{2} g}}$

$= \sqrt{\frac{26}{(\frac{1}{2} 32.2)}}$

$= 1.27$ SEC

$x = 8.0 \times 1.27$

$= 10.17$ FT

DOWN STREAM FROM DROP THE CHANNEL WILL APPROXIMATE A TRAPEZOIDAL CHANNEL (SEE FIG. 3).

- 20 FT BOTTOM WIDTH - SIDESLOPE 3V : 1H = 0.33H:1
- 0.083 FT/FT CHANNEL SLOPE
- Q = 32.0 FPS
- MANNING'S n = 0.032
- DEPTH$_N$ = 0.28 FT   DEPTH$_C$ = 0.43 FT
- VELOCITY$_N$ = 5.46 FPS   VELOCITY$_C$ = 3.70 FPS

$$S_C = \left(\frac{3.70}{\frac{1.49}{0.032} \left(\frac{5.6}{20.59} \right)^{2/3}} \right)^2 =$$

$$= 0.036 \text{ FT/FT}$$

MINIMUM SLOPE OF LOWER CHANNEL = 0.05

THIS IS GREATER THAN S_C, THEREFORE, NO JUMP WILL OCCUR.

SUPER CRITICAL FLOW WILL EXIST THROUGH THE ENTIRE STRUCTURE. THE ENTIRE CHANNEL WILL BE SET ON SANDSTONE BEDROCK, THEREFORE NO BOTTOM RIPRAP WILL BE REQUIRED. THROUGH THE DISTURBED AREA THE CHANNEL IS DEFINED BY THE CONCRETE HIGHWAY MEDIAN BERMS. THESE WILL BE SPRAYED W/ GUNITE TO SEAL THE JOINTS AND TO ENSURE A GOOD SEAL ALONG THE BASE AND TO THE HIGHWALL

BASED ON THE ABOVE, NO SPECIAL PROTECTION OF THE TEMPORARY DIVERSION IS PLANNED.

KAISER- WOODARD PORTAL DIVERSION 1/10

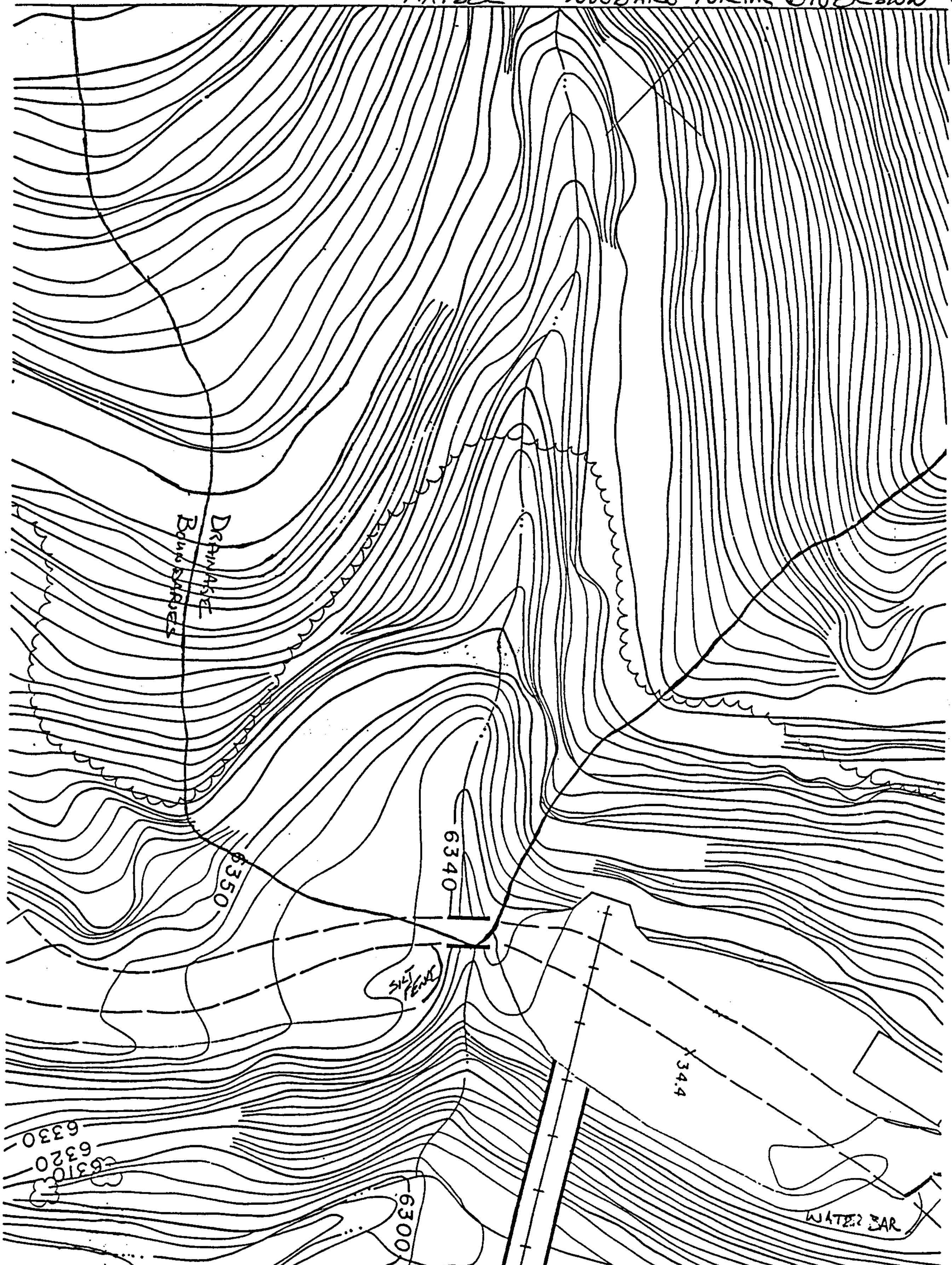
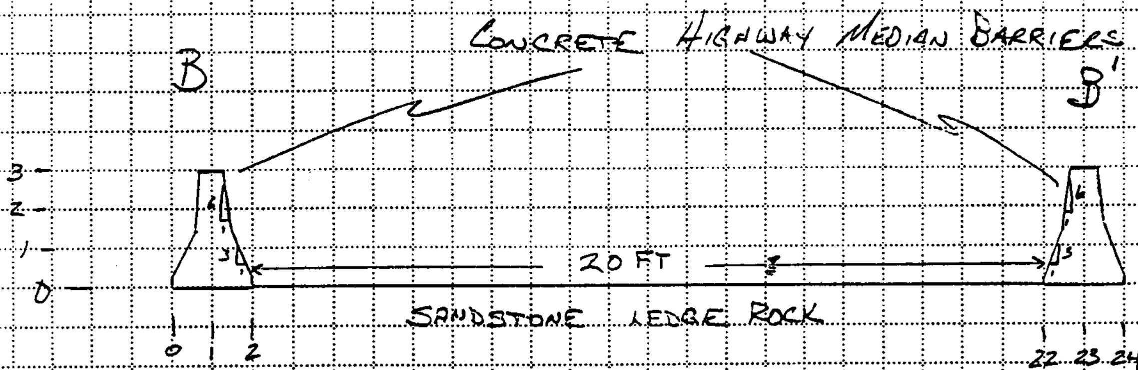
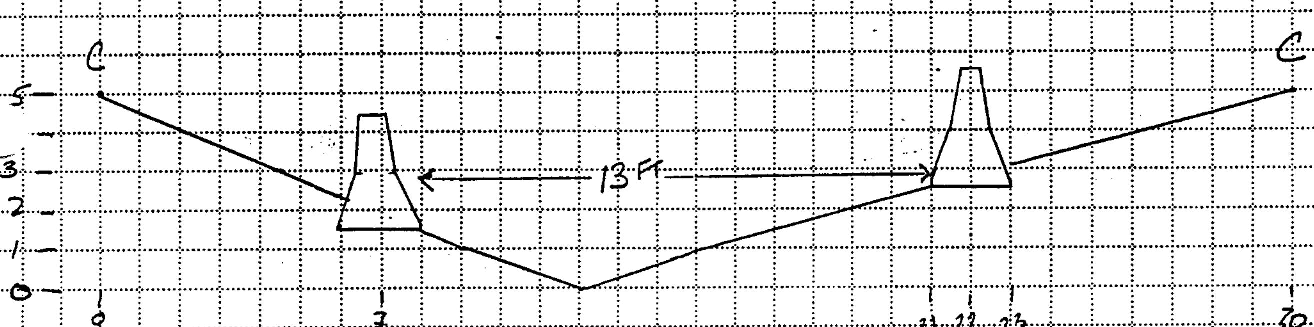


FIG. 1 - EXISTING DRAINAGE CONFIGURATION

FIG. 2 - TEMPORARY DRAINAGE CONFIGURATION


CONCRETE HIGHWAY MEDIAN BARRIERS
B
B'
3
2
1
0
20 FT
SANDSTONE LEDGE ROCK
0
1
2
22
23
24


C
C'
5
3
2
1
0
13 FT
0
7
21
22
23
30

Appendix VI-4

Riprap Design
for Main Horse Canyon Channel

Appendix VI-4

Riprap Design

EVALUATION OF HORSE CANYON DRAINAGE CHANNEL STABILIZATION

- PEAK FLOW - JUST ABOVE MINE YARD - 50YR-24HR PEAK
  - 154.7 CFS.

THREE AREAS OF CHANNEL HAVE OVERSTEEPENED CHANNEL SLOPES WHICH THREATEN THE STABILITY OF STRUCTURES.

AREAS ARE:

- JUST DOWNSTREAM FROM MINE BRIDGE.
- ADJACENT TO SED POND #1.
- ADJACENT TO SED POND #2.

- CROSS-SECTIONS: EXISTING

AREA 1

BOTTOM WIDTH = 20 FT
- MANNING'S n = 0.030

RIGHT CHANNEL BANK
- SLOPE = 15/29 = 0.52
- MANNING'S n = 0.032

LEFT CHANNEL BANK
- SLOPE = 15/20 = 0.75
- MANNING'S n = 0.031

AREA 2

BOTTOM
WIDTH = 16 FT.
MANNING'S n = 0.030

RIGHT CHANNEL BANK
SLOPE = 9/9.5 = 0.95
MANNING'S n = 0.032

LEFT CHANNEL BANK
SLOPE = 9/8 = 1.13
MANNING'S n = 0.032

AREA 3 -

BOTTOM -
WIDTH = 18 FT
MANNING'S n = 0.030

RIGHT CHANNEL BANK -
SLOPE = 6/5 = 1.20
MANNING'S n = 0.032

LEFT CHANNEL BANK -
SLOPE = 6/11 = 0.55
MANNING'S n = 0.032

CHANNEL SLOPE

BASED ON THE CHANNEL REACH FROM THE MINE BRIDGE ABOVE AREA 1 TO JUST BELOW POND 2

THE CHANNEL SLOPE = 6300 - 6250 / 1475 = 0.034

- PROPOSE RIPRAPPING LEFT BANK OF CHANNEL IN THESE AREAS TO REDUCE SLOPE AND PROTECT FROM EROSION & UNDER-CUTTING.
  - CONSIST OF END DUMPING RIPRAP AGAINST CHANNEL SLOPE AND WORKING WITH CAT OR HOE TO POSITION FOR MAXIMUM PROTECTION.
  - RIPRAP DEPOSIT WILL CONSIST OF A WEDGE OF MATERIAL AT 2:1 SLOPE APPROXIMATELY 5 FT HIGH. D_{50} OF MATERIAL = 1.6 FT.

- NEW CHANNEL CROSS-SECTIONS

AREA 1

BOTTOM
- WIDTH = 14 FT
- MANNING'S n = 0.030

LEFT CHANNEL BANK
- SLOPE = 0.5
- MANNING'S n = 0.043

RIGHT CHANNEL BANK
- SLOPE = 0.52
- MANNING'S n = 0.032

- VELOCITY EVALUATION

  - USING TRAPEZOC PROGRAM CRITICAL DEPTH FOR CHANNEL = 4.73 FT + CRITICAL VELOCITY = 10.41 FPS.

  - USING TRAPNORM PROGRAM
    - NORMAL DEPTH = 3.39 FT
    - NORMAL VELOCITY = 16.53 FT/SEC.

  - INDICATES SUPER CRITICAL FLOW

  - USING ISBASH CURVE VELOCITY OF 16.4 FT/SEC REQUIRED D_{100} OF 38 in = 3.167 FT

    $D_{50} = 2 \times D_{100}$

    $D_{50} = 1.6$ FT.

- AREA 2

  NEW CROSS-SECTION
  - BOTTOM
    WIDTH = 10 FT
    n = 0.030

  - RIGHT CHANNEL BANK
    SLOPE = 0.95 = 1.05 m
    n = 0.032

  - LEFT CHANNEL BANK
    SLOPE = 0.5 = 2 m
    n = 0.046 ASSUMING 2.35 d_{50}

  CRITICAL DEPTH = 5.61 FT
  CRITICAL VELOCITY = 11.10 FT/SEC

  NORMAL DEPTH = 3.99 FT
  NORMAL VELOCITY = 17.95 FT/SEC

  SUPER CRITICAL FLOW

  WILL REQUIRE 2.35 d_{50} STONE.

- AREA 3

CROSS-SECTION
BOTTOM
WIDTH = 12 FT
n = 0.03
LEFT BANK
SLOPE = 2H:1V
n = 0.046
RIGHT BANK
SLOPE = 1.8 H:1V
n = 0.032

CRITICAL VELOCITY = 10.59 FT/SEC
CRITICAL DEPTH = 5.05 FT.

NORMAL DEPTH = 3.57 FT
NORMAL VELOCITY = 17.20 FT/SEC

SUPER CRITICAL FLOW

REQUIRES 2.35 d_{50} STONE.

RECOMMEND USING SAME STONE
FOR ALL SECTIONS.

- REFUSE POND AREA - NEED TO STABILIZE NORTH CHANNEL BANK.

CROSS-SECTION BOTTOM W 3 FT - n = 0.03
RIGHT BANK - SLOPE - 2H:1V; n = 0.046
LEFT BANK - SLOPE 1.0H:1V; n = 0.03

PEAK FLOW - 1122.3 CFS

CHANNEL SLOPE - 0.030 FT/FT.

CRITICAL DEPTH = 5.9 FT
CRITICAL VELOCITY = 11.2 FT/SEC

NORMAL DEPTH = 4.47 FT
NORMAL VELOCITY = 17.1 FT/SEC

REQUIRES d_{50} > 2.35 FT.

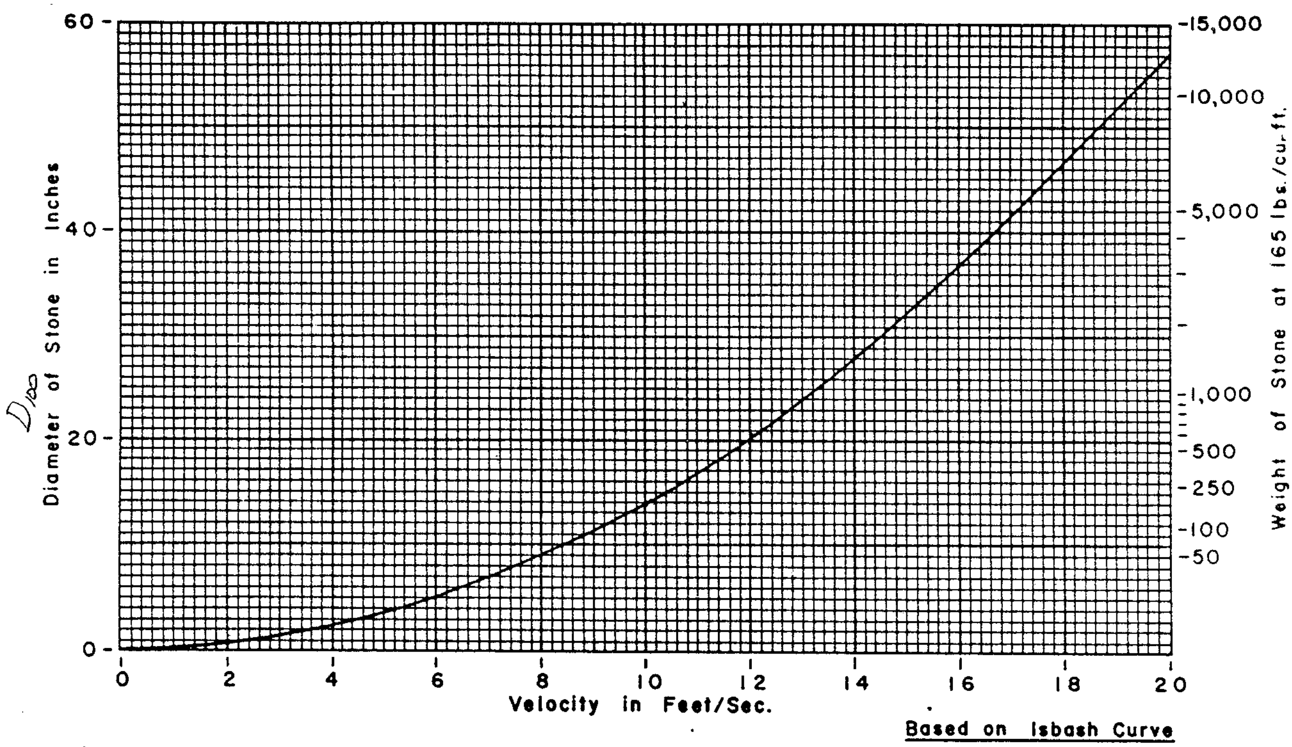


Exhibit 16-1 Maximum stone size for riprap

Appendix VI-5

Sediment Pond Designs

Partial Flow in a Circular Pipe

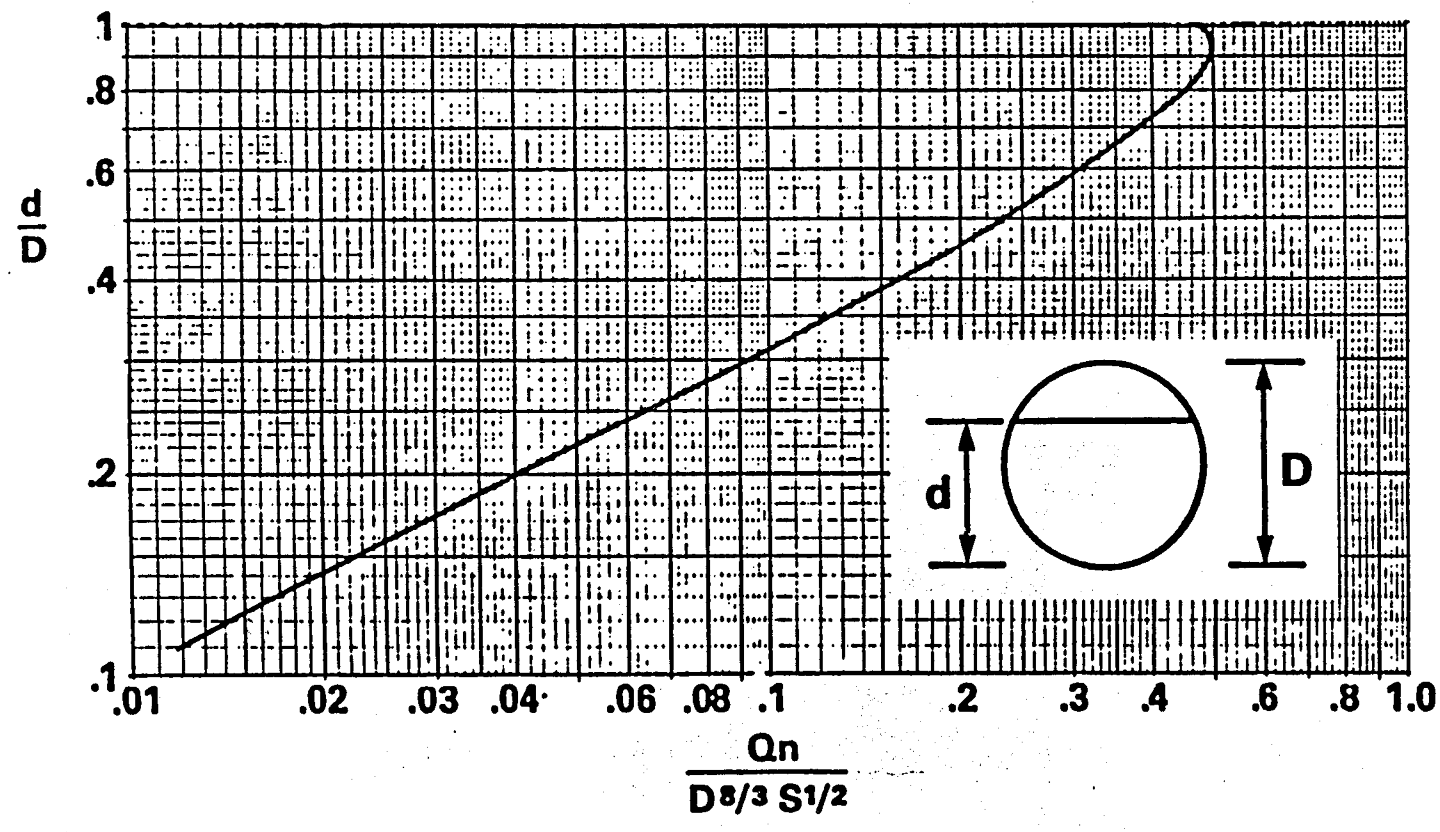


Chart 2-62: PARTIAL FLOW IN A CIRCULAR PIPE

UINTEX project worksheet	Project Horse Canyon	Sponsor JBR	p. of
	Job Code	Task:Subject Riprap below spillways	
	Date:Time 2-20-88	Author KK	Chkd

Size of d50 based upon normal velocity calcs (represents v max)

Pond	d50	length	width
1	1.5'	16 ft	4
2	9 in	10 ft	4
3	6 in	7 ft	6
4	2.5'	30 ft	8
5		—	8
6	1.5'	14	6
7	none	–	4
8	none	–	4
9	9 in	7 ft	4
10	6 in	6 ft	4

channel width = 2D

side slope 2:1

length = $2d + 4V^2/2g$

} from UDOT manual for culvert outlets

Can't tell what Tom did, plus he used n = .012 which is wrong for cmp! Redo.

Using Circloc.bas, calculate d_c, V_c, d_n + V_n for design Q. Calculate d_c for other Q's to get stage / Q curve.

Pond 1

Q	d_c	V_c	d_n	V_n	S	dia	n
					.57	2	.024
4.81	.77	4.3	.31	15.5			
2.00	.49						
3.00	.60						
1.00	.34						
.50	.24						
.25	.17						
5.0	.79						
6.0	.87						
7.0	.94						
8.0	1.01						

Pond 2

Q	d_c	V_c	d_n	V_n	S	dia	n
					.24	2	.024
4.60	.75	4.2	.37	11.3			

Pond 3

Q	d_c	V_c	d_n	V_n	S	dia	n
					.062	3	.024
10.6	1.03	4.9	.69	8.48			
11.0	1.05						
12.0	1.10						
13.0	1.15						
15.0	1.24						
17.0	1.32						
19.0	1.40						
21.0	1.47						
23.0	1.54						
9.	.95						
7.	.83						
5.	.70						
3	.54						
1	.31						
.25	.15						

Pond 4/5

Q	dc	Vc	dn	Vn	S	D	n
21.8	1.50				.45	3	.024

better make culvert 4' — D: 4

Q	dc	Vc	dn	Vn
21.8	1.38	5.7	.56	20.5
22	1.38			
24	1.45			
28	1.57			
32	1.68			
36	1.79			
40	1.89			
45	2.00			
18	1.25			
14	1.10			
10	.92			
5	.66			
1	.29			
.25	.14			

Pond	Q	dc	Vc	dn	Vn	S	D	n
Pond 6	6.86	.82	4.4	.36	14.2	.42	3	.024
Pond 7	1.12	.36	2.9	.26	4.6	.06	2	.024
Pond 8	2.55	.56	3.6	.42	5.3	.045	2	.024
Pond 9	1.52	.43	3.1	.19	10.0	.44	2	.024
Pond 10	1.50	.42	3.1	.20	8.8	.31	2	.024

SED POND I.D.	WEIGHTED CURVE NUMBER	10YR-24hr RAINFALL DEPTH	RUNOFF DEPTH (IN.)	DRAINAGE AREA (Ac)	RUNOFF VOLUME (AC-FT)	2 YEAR SED. VOLUME[1] (AC-FT)	TOTAL SED. POND VOLUME (AC-FT)
POND 1	86	1.84	0.71	4.74	0.28	0.39	0.67
POND 2	90	1.84	0.96	3.70	0.30	0.02	0.32
POND 3	82	1.84	0.56	13.17	0.62	1.82	2.44
POND 4 POND 5	86	1.84	0.71	11.65	0.69 1.31	0.58 2.40	1.27
POND 6	82	1.84	0.56	8.47	0.40	0.47	0.87
POND 7	90	1.84	0.96	0.88	0.07	0.01	0.08
POND 8	86	1.34	0.71	2.50	0.15	0.03	0.18
POND 9	89	1.34	0.89	1.38	0.10	0.01	0.11
POND 10	90	1.34	0.96	1.15	0.09	0.01	0.10

1 - BASED ON UNIVERSAL SOIL LOSS METHOD (SEE CALCULATION SHEETS).

Project KAISER
Job Code 85033.00
Date:Time 28 APR 87
Sponsor
Task:Subject SED. POND VOLUMES
Author DS
Chkd
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POND ID	A EMBANKMENT CREST	B SPILLWAY DIAMETER	C SPILLWAY ELEVATION	D OUTLET ELEVATION	E SPILLWAY LENGTH	SPILLWAY SLOPE	SPILLWAY CAPACITY
1	6286.6	2.0 FT	6284.45	6272.0	22	57%	4.81
2	6278.6	2.0 FT	6276.55	6269.5	30	24%	4.60
3	6268.0	3.0 FT	6267.60	6266.8	13	6.2%	10.61
4+5	6241.6	3.0 FT	6238.50	6208.0	68	45%	21.81
6	6229.0	3.0 FT	6226.90	6199.0	65	42%	6.86
7	6144.0	2.0 FT	6142.60	6139.0	60	6.0%	1.12
8	6179.7	2.0 FT	6178.15	6176.9	28	4.5%	2.55
9	6195.6	2.0 FT	6194.5	6184.0	24	44%	1.55
10	6214.1	2.0 FT	6212.75	6198.0	47	31%	1.50

Project KAISER
Job Code 65033.00
Date:Time 5 MAY 87
Sponsor
Task:Subject SCA POND TABLE
Author TJS
Chkd
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Project KAISER
Job Code 85033.00
Date:Time 27 APRIL 87

Sponsor
p. of
Task:Subject WEIGHTED CURVE NUMBER
Author TJS
Chkd

DRAINAGE ID	DISTURBED AREA	DISTURBED CURVE NUMBER	UNDISTURBED AREA	UNDISTURBED CURVE NUMBER	WEIGHTED CURVE NUMBER
POND # 10	1.15	90	0	78	90
POND # 9	1.26	90	0.12	78	89
POND # 8	1.58	90	0.92	78	86
POND # 6	3.11	90	5.36	78	82
POND # 5 / POND # 4	7.45	90	4.20	78	86
POND # 3	4.85	90	8.32	78	82
POND # 2	3.70	90	0	78	90
POND # 1	2.98	90	1.76	78	86
POND # 7	0.88	90	0	78	90

$$WCN = \frac{(\text{AREA DIST.}) * (\text{DIST. CN}) + (\text{AREA UNDIST.}) * (\text{UNDIST. CN})}{(\text{TOTAL AREA})}$$

Project KAISER	Sponsor	p. of
Job Code 85033.00	Task:Subject SED. STORAGE CALCS.	
Date:Time 28 APRIL 87	Author LS	Chkd

SED. POND I.D.	AREA (ac)	R FACTOR	K[1] FACTOR	LS[6] FACTOR	CP[2] FACTOR	A[3]	D[4]	T[5]
POND 1	4.74	20	0.28	29.5	0.72	113.9	0.75	0.39
POND 2	3.70	20	0.28	0.93	1.0	5.2	0.76	0.02
POND 3	13.17	20	0.28	84.6	0.53	251.1	0.60	1.32
POND 4 / POND 5	11.65	20	0.28	21.2	0.73	86.7	0.62	0.58
POND 6	8.47	20	0.28	30.4	0.53	90.33	0.67	0.47
POND 7	0.88	20	0.28	1.92	1.0	10.75	0.95	0.01
POND 8	2.50	20	0.28	3.80	0.72	15.32	0.31	0.03
POND 9	1.38	20	0.28	0.52	0.94	2.74	0.85	0.01
POND 10	1.15	20	0.28	0.53	1.0	2.97	0.72	0.01

1 K FACTOR VALUE BASED ON GRAVELLY LOAM TO GRAVELLY FINE SANDY LOAM.

2 CP FACTOR BASED ON WEIGHTED VALUES USING THE FOLLOWING PARAMETERS:

- 1.0 FOR DISTURBED AREAS.
- 0.25 FOR UNDISTURBED OR REVEGETATED AREAS.

3 A = R * K * LS * CP = TONS/YR-AC.

4 D - SEDIMENT DELIVERY RATIO - BASED ON AREA-DELIVERY METHOD BARFIELD, WARNER, & HAAN, 1981

5 T - SEDIMENT VOLUME IN AC-FT FOR 2YR PERIOD, BASED ON DENSITY OF 100 lbs/FT³.

6 LS FACTOR FROM HYDRAULIC LENGTH AND AVERAGE W.S. SLOPE INPUT INTO [illegible] (ATTACHED)

Project KAISER   Sponsor   p. of
Job Code 35033.00   Task:Subject SPILLWAY DESIGN
Date:Time 2 MAY 87   Author DS   Chkd

POND ID	DESIGN DISCHARGE [1]	SPILLWAY CROSS-SECTION TYPE	RADIUS	FLOW DEPTH	MAXIMUM CHANNEL SLOPE	MANNING'S n	DISCHARGE VELOCITY	
POND 1	4.81	HALF ROUND	1 FT	1.05	57%	0.012	25.3 F/s	
POND 2	4.60	HALF ROUND	1 FT	1.03	24%	0.012	18.4 F/s	
POND 3	10.61	HALF ROUND	1.5 FT	1.4	6.2%	0.012	14.5 F/s	
POND 4+5	21.81	HALF ROUND	1.5 FT	2.1	45%	0.012	33.5 F/s	*
POND 6	6.86	HALF ROUND	1.5 FT	1.1	42%	0.012	23.2 F/s	*
POND 7	1.12	HALF ROUND	1 FT	0.5	6.0%	0.012	7.4 F/s	
POND 8	2.55	HALF ROUND	1 FT	0.55	4.5%	0.012	3.[illegible] F/s	
POND 9	1.52	HALF ROUND	1 FT	0.58	44%	0.012	16.3 F/s	
POND 10	1.50	HALF ROUND	1 FT	0.57	31%	0.012	14.4 F/s	

1 - FROM PEAK FLOW CALC'S FOR SED. PONDS

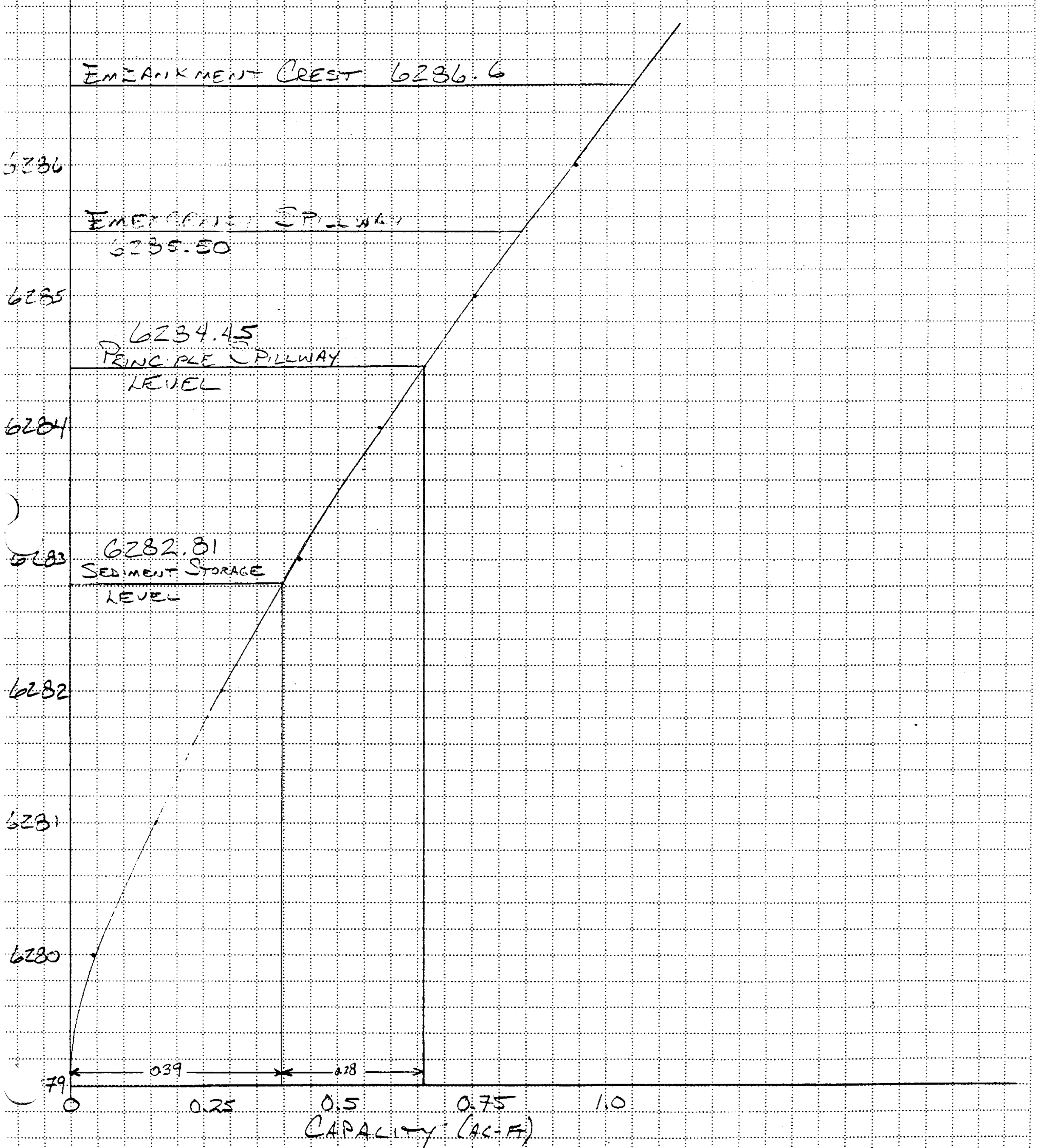
Project KAISER | Job Code 85033.00 | Date:Time 2 MAY 87
Sponsor | p. of
Task:Subject SPILLWAY SLOPE
Author DJ | Chkd

SPILLWAY SLOPES

	INLET ELEV.	OUTLET ELEV	LENGTH	SLOPE
Pond 1	6284.45	6272.0	22	0.57
Pond 2	6276.55	6269.5	30	0.24
Pond 3	6267.6	6266.3	13	[illegible]
Pond 4+5	6238.5	6208.0	68	0.45
Pond 6	6226.9	6199.0	65	0.42
Pond 7	6142.6	6139.0	60	0.06
Pond 8	6178.15	6176.9	28	0.045
Pond 9	6194.5	6184.0	24	0.44
Pond 10	6212.75	6193.0	47	0.314

Project KAISER
Job Code 85033.00
Date:Time 2 MAY 87
Sponsor
p. of
Task:Subject STAGE-CAPACITY CURVE.
Author KS
Chkd

POND NO. 1 - PROPOSED



Project KAISER | Sponsor | p. of
Job Code 85033.00 | Task:Subject VOLUME - CAPACITY CALCULATIONS
Date:Time 30 APRIL '87 | Author TJS | Chkd

EXISTING
POND #1 - SCALE 1" = 20'

CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6282.4	0	0					
			982	.6	589	589	
6283	4.91	1964					
			2522	1.0	2522	3111	
6284	7.70	3080					
			3442	1.0	3442	6553	
6285	9.51	3804					EXISTING
			4164	1.0	4164	10,717	
6286	11.31	4524					
			4570	0.2	914	11,631	
6286.2	11.54	4616					
6279.1	0	0	2244	0.9	2020	2020	0.046 AC-FT
6280	11.22	4488					
			4844	1.0	4844	6864	0.153
6281	13.00	5200					
			5546	1.0	5546	12,410	0.235
6282	14.73	5892					0.427 PROPOSED
			6174	1.0	6174	18,584	
6283	16.14	6456					
			6784	1.0	6784	25,363	0.582
6284	17.78	7112					
			7468	1.0	7468	32,336	0.754
6285	19.56	7824					
			8198	1.0	8198	41,034	0.942
6286	21.43	8572					

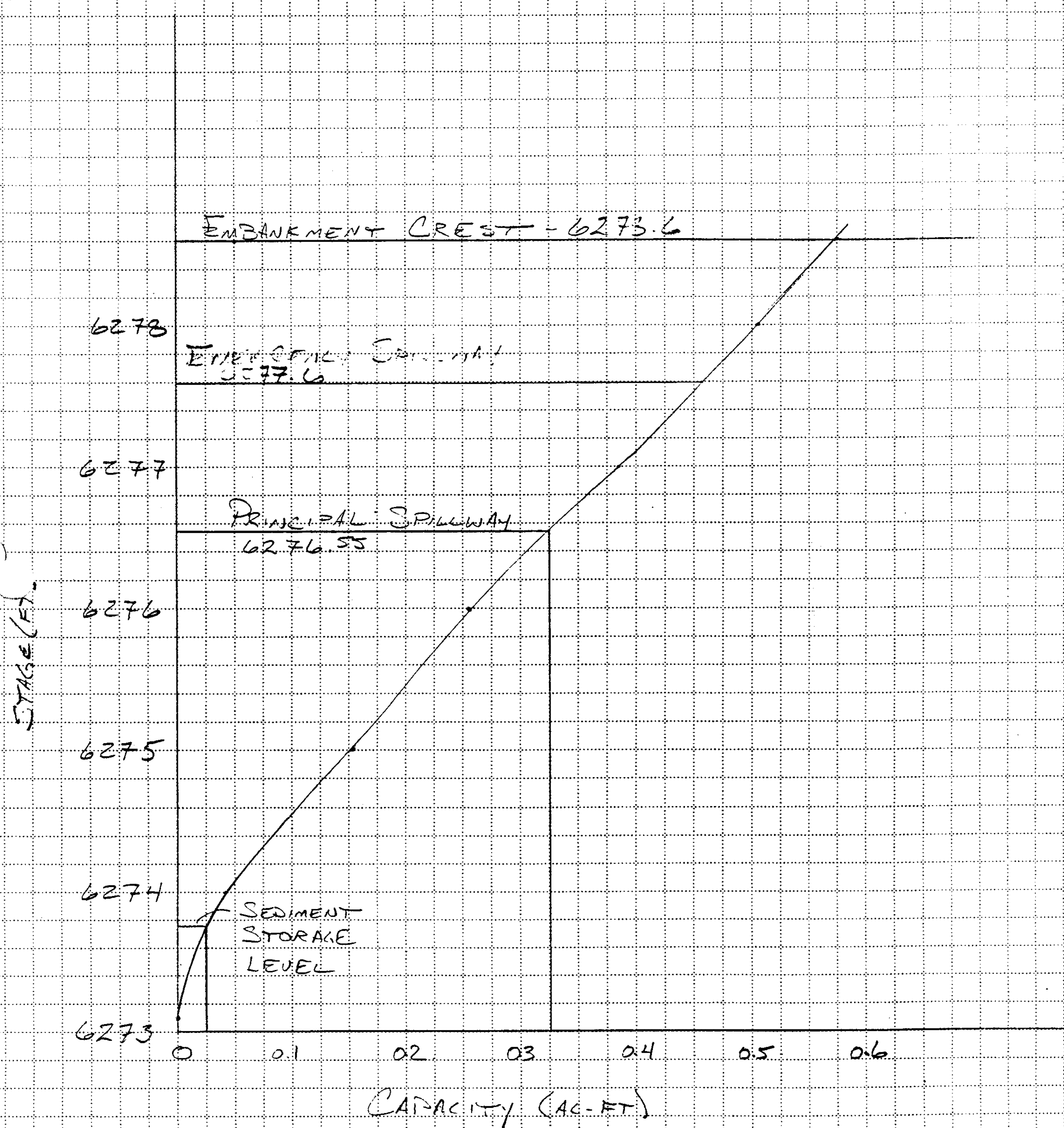
TOTAL VOLUME = 0.267 AC-FT REQUIRE 0.67 AC-FT

EXISTING POND TOO SMALL

Project KAISER
Job Code 85053.00
Date:Time 2 MAY '87

Sponsor
p. of
Task:Subject STAGE-CAPACITY CURVE
Author TJS
Chkd

POND No. 2 - PROPOSED



Project KAISER | Sponsor | p. of
Job Code 30033.00 | Task:Subject VOLUME-CAPACITY CALCULATIONS
Date:Time 30 APRIL 97 | Author TJS | Chkd

POND #2 - SCALE 1" = 20'

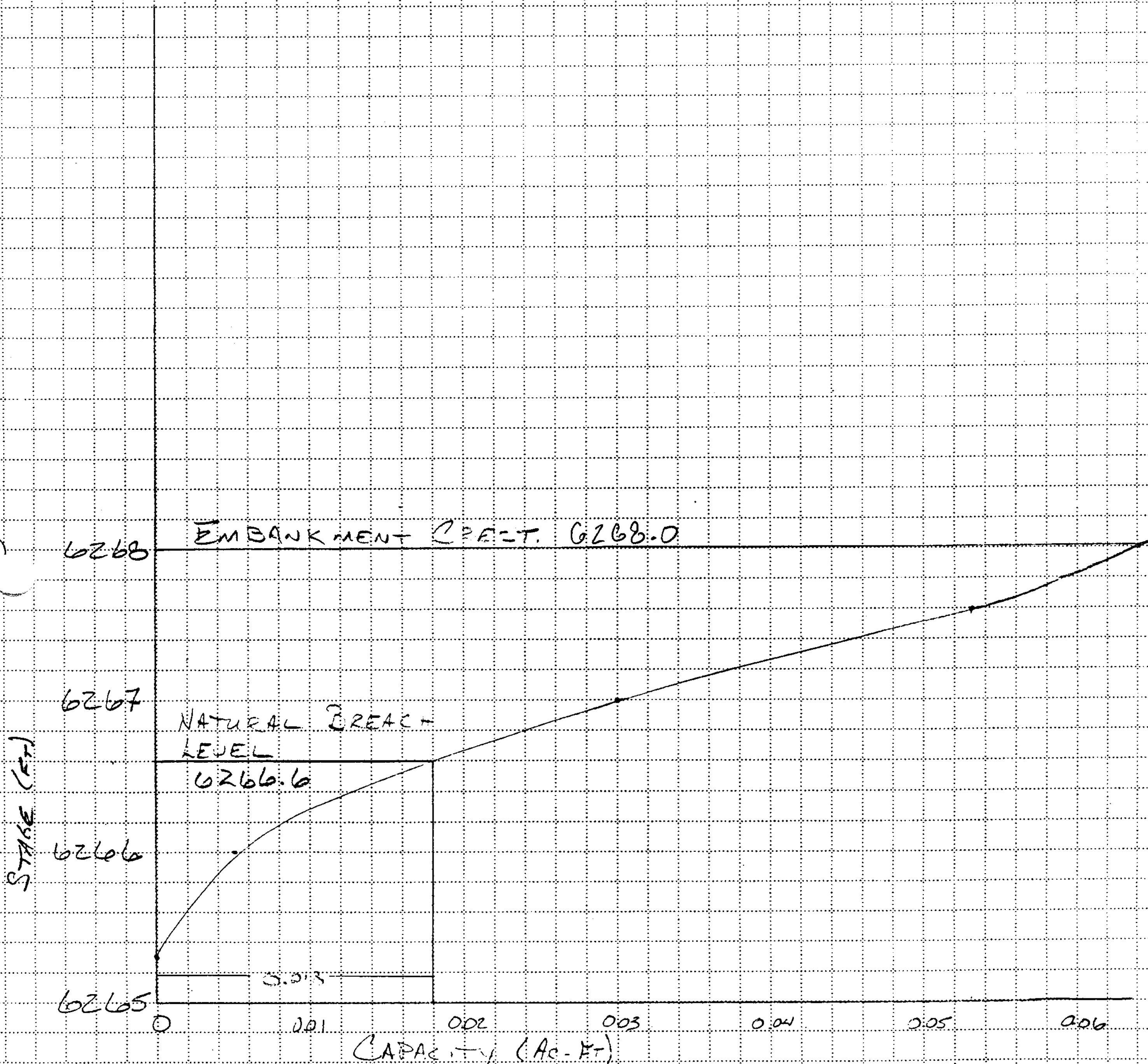
CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6274.5	0	0					
			222	0.5	111	111	EXISTING
6275	1.11	444					
			833	1.0	833	949	
6276	3.08	1232					
			1488	1.0	1488	2437	
6277	4.36	1744					
			2058	1.1	2264	4701	
6278.1	5.93	2372					
6273.1	0	0					PROPOSED
			2030	0.9	1827	1827	0.042
6274	10.15	4060					
			4338	1.0	4338	6165	0.142
6275	11.54	4616					
			4930	1.0	4930	11,095	0.255
6276	13.11	5244					
			5578	1.0	5578	16,673	0.383
6277	14.78	5912					
			6236	1.0	6236	22,909	0.526
6278	16.40	6560					

TOTAL VOLUME = 0.108 AC-FT   REQUIRE 0.32 AC-FT

EXISTING POND TOO SMALL

Project KAISER | Sponsor | p. of
Job Code 85033.00 | Task:Subject STAGE - CAPACITY CURVE
Date:Time 2 MAY 87 | Author [illegible] | Chkd

POND NO. 3:* EXISTING



* POND USED AS A SEDIMENT TRAP AND SMALL DETENTION POND. FLOW CONVEYED TO POND 4-5

Project KAISER
Job Code 85033.00
Date:Time 30 APRIL 87

Sponsor
p. of
Task:Subject VOLUME - CAPACITY CALCULATIONS
Author TJS
Chkd

POND #3 - SCALE = 1"=20'

CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6265.3	0	0					
			304	0.7	213	213	0.005
6266	1.52	608					
			1074	1.0	1074	1237	0.03
6267	3.35	1540					
			1734	0.6	1070	2327	0.053
6267.6	4.82	1928					

TOTAL VOLUME = 0.053 AC-FT REQUIRE 2.44

POND IS TOO SMALL

USE ONLY FOR DETENTION POND - CATCH RUNOFF IN PONDS 4&5

Project KAISER
Job Code 85033.00
Date:Time 2 MAY 87

Sponsor
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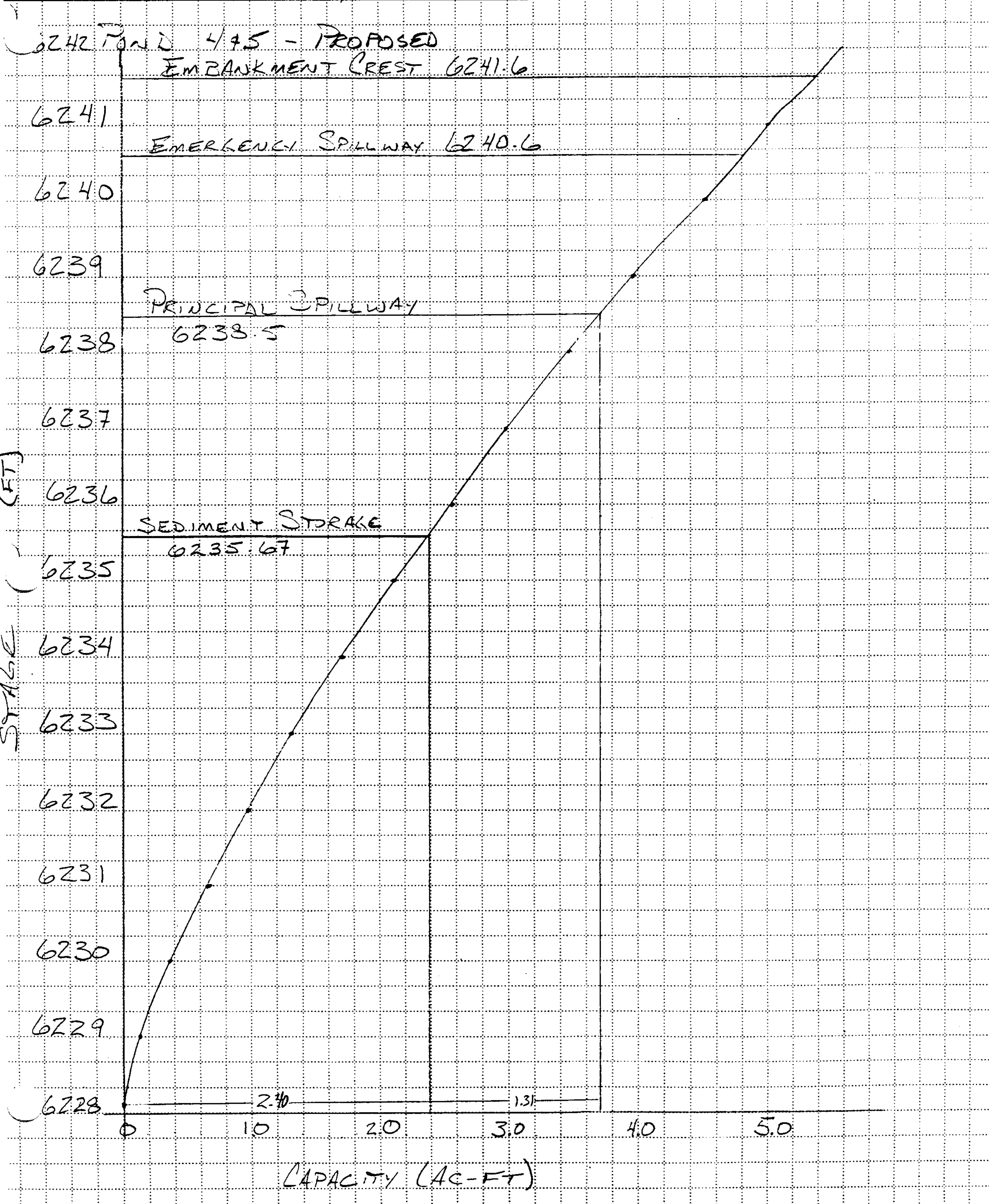
Task:Subject STAGE - CAPACITY CURVE
Author TJS
Chkd



Project KAISER
Job Code 35033.20
Date:Time 30 APRIL 97

Sponsor
Task:Subject VOLUME - CAPACITY CALCULATIONS
Author TJS
Chkd

p. of

POND #4 - SCALE 1" = 20'

CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6240.2	0	0					
			[illegible]52	0.8	1322	1322	
6241	3.26	3304					
			5240	1.0	5240	6562	
6242	17.94	7176					
			8074	1.0	8074	14,635	
6243	22.43	8972					
			9284	0.3	2786	17,421	
6243.3	23.99	9596					

TOTAL VOLUME = 0.40 AC-FT   REQUIRE 3.76 AC FT

POND IS TOO SMALL

COMBINED W/ PONDS 3 & 5

Project KAISEL | Sponsor | p. of
Job Code 35035.00 | Task:Subject VOLUME - CAPACITY CALCULATIONS
Date:Time 30 APRIL '87 | Author TJS | Chkd

POND #5 - SCALE 1" = 20'

CONTOUR	VERNEER UNITS	AREA	AVERAGE AREA	CONTOUR INTERVAL	INCREMENTAL VOLUME	TOTAL VOLUME	COMMENTS
6232.5	0	0					EXISTING
			326	0.5	413	413	
6233	4.13	1652					
			2322	1.0	2322	2735	
6234	7.48	2992					
			3794	1.0	3794	6529	
6235	11.49	4596					
			5113	0.6	3071	9600	
6235.6	14.10	5640					
6228.1	0	0					PROPOSED
6229	27.80	11,120	5560	0.9	5004	5004	0.115
6230	30.43	12172	11646	1.0	11646	16650	0.382
6231	33.00	13200	12686	1.0	12686	29336	0.673
6232	35.64	14256	13728	1.0	13728	43064	0.989
			14936	1.0	14936	58,000	1.331
6233	39.04	15,616					
			16218	1.0	16218	74,218	1.704
6234	42.05	16,820					
			17,410	1.0	17410	91628	2.103
6235	45.00	18,000					
			18,524	1.0	18,524	110,152	2.529
6236	47.62	19,048					
			19,694	1.0	19694	129,846	2.981
6237	50.85	20,340					
			20,912	1.0	20,912	150,758	3.461
6238	53.71	21,484					
			22,166	1.0	22,166	172,924	3.970
6239	57.12	22,848					
			23,504	1.0	23504	196428	4.509
6240	60.40	24,160					

TOTAL VOLUME = 0.22 REQUIRE 3.76

POND IS TOO SMALL