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FILE NO. 3

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DIVISION OF OIL
GAS & MINING

Mr. Thomas Munson
Hydrologist
Utah Division of Oil, Gas, & Mining
355 West North Temple
3 Triad Center, Suite 350
Salt Lake City, Utah 84180-1203

Dear Mr. Munson:

I appreciate the effort extended by yourself and others at D.O.G.M in participating in the May 16, 1985 site visit of our Gordon Creek No. 2 and 7 Mine facility area. The discussion of water handling options was most helpful and has allowed us to make significant progress in considering a revision to the site water handling procedure. We fully understand that any revision in water handling will require a modification to the permit, so careful consideration by both Beaver Creek Coal Company and D.O.G.M. must be given each step in the planning process.

The next step in the planning process is an understanding of the hydrology input variables of the mine area. To this end, I have enclosed a brief report prepared by Art O'Hayre. This report discussed the volumes of water and sediment expected from accepting into sedimentation ponds the entire drainage of upper Bryner Canyon and mine site areas. This particular option was one of the possible approaches decided upon during your site visit. This option appears very feasible and should greatly reduce any impact our operations have on the local hydrologic environment.

The hydrologic input variables are critical to the design of water handling facilities. After reviewing this report, it is essential that any questions you have concerning the hydrology be fully considered. Until there is agreement on the hydrology, engineering design of the facilities cannot proceed. Therefore, I propose a meeting between us, at the earliest convenient time, to review the contents of this report.

At the meeting, we can also discuss several additional details. We are currently undecided about some items and would like to discuss them with you. These items include matters such as outlet structure options, approval document contents and the pros and cons of having multiple discharge points. I am sure you will have your own list of discussion topics to add.

I am looking forward to hearing from you as to a meeting time.

Respectfully,

Dan W. Guy

Dan W. Guy
Manager of Permitting and Compliance

DWG/sb

Enclosures

cc: J.A. Herickhoff
M.P. Watson
S.E. Dole
A.P. O'Hayre
File
IBM D2

MINE SITE HYDROLOGY
Beaver Creek Coal Company
Gordon Creek No. 2 and No. 7 Mines

A revised water and sediment control plan is being considered for the Gordon Creek No. 2 and No. 7 Mine facility area because of the difficulties experienced by the operation in preventing impact to the left fork of Bryner Canyon. One option to the current water handling scheme is to route the entire drainage into sedimentation ponds. This option was jointly considered by Beaver Creek Coal Company and D.O.G.M.during the May 16, on site meeting. It was decided that before this option could be further considered, initial pond sizing would be required to determine if the site contained enough space for the requisite pond. This report is intended for this optional water handling capacity required for this optional water handling scheme and allow review of th hydrologic interpretation of the site.

This optional water handling plan directs into sedimentation ponds, runoff from both disturbed and undisturbed areas. For the computation of the 10-yr., 24-hr. event, it was determined that approximately 24% of the drainage is from disturbed areas. This option also continues the current practice of piping runoff from the undisturbed right fork of Bryner Canyon around the No. 2 mine disturbance. Therefore, the right fork of Bryner Canyon is not considered in the following computations.

The surface facility areas are divided into three sub-areas No. 7 site which includes the pad, the conveyor and access road, cut and fill slopes and topsoil stockpile, and Sub-1 and Sub-2 of the No. 2 Mine area as shown on Plate 7-2. The ponds are sized to accommodate three years sediment yield and 10-yr., 24-hr. storm runoff volume from these areas as well as the 10-yr., 24-hr. storm runoff volume from undisturbed areas - Area B and Sub-3. Area B and Sub-3 are included in this analysis because their location does not allow diversion around the disturbed area.

Peak flows from the 10-yr., 24-hr. event shall be used to size all culverts and ditches on the facilities area. The emergency spillway for the pond system is designed to safely pass the peak flow from a 25-yr., 24-hr. precipitation event.

Runoff Volume and Peak Flow Determinations

The technique used to determine runoff volumes and peak flows for design of diversions, culverts, and sedimentation ponds is the SCS runoff curve number method and the associated computer model - TR-20.

Curve numbers were determined by a weighted average based on the percentage of each basin occupied by a given land surface category. Land surface categories were assigned the following curve numbers:

Undisturbed forest land	63
Disturbed land	90
Reclaimed land	80

A curve number of 63 for undisturbed areas was selected as a conservative estimate for design use. This curve number corresponds with estimates from Table 2 in McCuen (1982) for forest and woods with soils from both soil group B and C as found at the site. Also, it provides higher design flows than would be obtained using other estimating procedures.

Curve numbers for reclaimed areas for hydrologic soil group DC are based on estimates in OSM (1981). Values are given in the range 74-88. A value of 80 was used. For disturbed areas including active mine areas and surface facilities, estimates in OSM (1981) range from 87 to 98. A value of 90 was used because of the lack of paved surfaces and minimal impervious area found at the mine site.

Time of concentration was determined from basin lag using the curve number method for estimating basin Tag (SCS Technical Release No. 55). Antecedent Moisture Condition II was used for all runoff estimates. Design rainfalls were determined form the "Precipitation-Frequency Atlas of the Western United States" (NOAA Atlas 2, Volume VI - UTAH, 1973) for the location of the Gordon Creek No. 2 facilities. The Fletcher-Farmer rainfall distribution was used to assign rainfall intensities throughout the 24-hour design storm.

Input specifications and results of TR-20 flow estimation for each sub-drainage area are provided in Table 1. A schematic of drainage configuration for TR-20 modeling is provided in Figure 1. Associated drainage area locations are designated on Plate 7-2.

Sediment Yield Estimation

The Universal Soil Loss Equation (USLE) was used to estimate sediment yield from disturbed areas. Sediment yield was calculated by estimating the soil loss from all disturbed areas. All soil loss from areas Sub-1, Sub-2 and No. 7 site was assumed to be delivered to and deposited in the ponds. Soil loss from undisturbed areas B and Sub-3 was determined to be zero because these areas are fully vegetated and not undergoing surface erosion.

Erosion rate (A) in tons/acre per year is determined using the USLE as:

$$A = (R)\ (K)\ (LS)\ (VM)$$

The variables R, K, LS and VM are defined as follows:

R is the rainfall factor which can be estimated from the empirical relation: $R = 27P^{2.2}$ where P is the 2-year, 6-hour precipitate value which for the Gordon Creek No. 2 facilities area is 1.1. inches.

Therefore, the estimated value for R is 33.3 which is somewhat larger than the value from an isoerodent map provided by Wischmeyer (1977) for the approximate location of the Gordon Creek No. 2 facility.

K is the soil erodibility factor. For disturbed areas, the K value was conservatively estimated to be 0.5. This value is representative of compacted disturbed areas such as roads, embankments and parking areas and is higher than would be expected for reclaimed acres or undisturbed soils. For reclaimed and undisturbed oils, a K factor of 0.35 was used based on K factors for soils listed in Table 8-4 of the Gordon Creek No. 2 Mining and Reclamation Plan.

LS is the length slope factor. The LS factors determined for sub-areas and segments are listed in Table 2. The LS factor was determined using the relation:

$$LS = \frac{(0.43 + 0.3^2 + 0.0435^2)}{6.613} \left(\frac{L}{72.6}\right)^m \quad COS^2 \left(TAN^{-1} \frac{S}{100}\right)$$

where S is the slope in percent, L is the slope length in feet, and m is an exponent which varies with slope.

VM is the factor accounting for vegetation cover and disturbance effects. VM factors were developed from the work of Clyde, Israelsen and Packer (1976). A VM factor of 1.2 was considered representative of compacted fill and scraped and compacted sites. A VM factor of 1.0 was assigned to the highwall. A VM factor of 0.38 for reseeded areas after 12 months of revegetation was assigned to road cut and fill slopes and to the topsoil salvage area.

Sediment yield calculations are developed in Table 2. A unit weight of 100 lb/ft^3 is used to convert sediment yield in weight per unit time to volume capacity requirements.

Sediment Pond Capacity Requirements

Ponds for the facilities areas for No. 2 Mine and No. 7 Mine including the left fork of Bryner Canyon should have sufficient capacity for 3 years sediment storage of 0.666 acre-feet and 10-yr., 24-hr. storm runoff capacity of 3.15 acre-feet or a total capacity of 3.82 acre-feet below the emergency spillway. A total site pond capacity of 4.0 acre feet would provide sufficient excess capacity to handle any unexpected mine water discharge and reduce difficulties with snow melt. More than one pond may be employed with the ponds linked in series. Included as Figure 2 is a drawing of the No. 2 Mine yard, showing the general size of a pond necessary to support this water handling option.

References

Clyde, C.F., C.F. Israelsen and P.E. Packer (1976), Erosion Control During Highway Construction. Volume II, Manual of Erosion Principles and Practices. Utah Water Research Lab. Utah State University, Logan.

Farmer, E.F. an S.E. Fletcher, 1972. Some Intra-Storm Characteristics of High-Intensity Rainfall Bursts. Proc. symposium on distribution of Precipitation in Mountainous Areas. WMO. Geilo, Norway.

McCuen, R.H., 1982. A guide to hydrologic Analysis Using SCS Methods.

OSM, 1981. Hydrology and Sediment Yield Work Manual. Prepared for Office of Surface Mining, Region V, Denver CO.

Wischmeyer, W.H., 1977. Procedure for Computing Sheet and Rill Erosion on Project Areas. USDA, Soil Conservation Service, Tech Release No. 41 (Rev. 2).

TABLE I - INPUT SPECIFICATIONS AND RESULTS OF TR-20 FLOW ESTIMATES

				Sub Drainages				
	Area B	No. 7 Site	Combined	Sub-1	Sub-2	Combined	Sub-3	Total Combined
Area - Acres	204	7.7	211.7	1.54	6.4	219.6	25.6	244.2
Curve Number	63	86		86	89	--	63	--
Slope Length (feet)	4500 ft.	1650 ft.	--	480 ft.	900 ft.	--	1500 ft.	--
Slope (%)	23%	16%	--	6%	4%	--	37%	--
Lag (hrs.)	0.36 hrs.	0.12 hrs.	--	0.06 hrs.	0.11 hrs.	--	0.14 hrs.	--
Time of Concentration (hrs.)	0.6 hrs.	0.20 hrs.	--	0.1 hrs.	0.18 hrs.	--	0.23 hrs.	--
10-yr., 24-hr. Precipitation Results								
Precipitation (in)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Peak Discharge (cfs)	2.5	0.94	3.13	0.19	0.93	3.8	0.35	4.15
Total Runoff (acre-feet)	1.73	0.54	2.27	0.11	0.55	2.93	0.22	3.15
25-yr., 24-hr. Precipitation Results								
Precipitation (in)	2.7	2.7	2.7	2.7	2.7	2.7	2.7	2.7
Peak Discharge (cfs)	8.1	1.52	9.0	0.32	1.58	10.1	1.06	11.13
Total Runoff (acre feet)	5.36	0.9	6.26	0.18	0.87	7.31	0.67	7.97

TABLE 2

USLE ESTIMATES OF SEDIMENT YIELD GORDON CREEK NO. 2 AND NO. 7 MINE FACILITY AREAS

Drainage or Segment	R Factor	K Factor	Area Acres	Avg. Slope Length, Ft.	Slopes %	LS Factor	VM Factor	A Tons/Acre Per Year	Yield Acre Ft. Per Year
No. 2 Mine Site									
Sub-1	33.3	0.5	1.54	200	6	0.95	1.2	15.73	0.0133
Sub-2	33.3	0.5	6.4	250	4	0.58	1.2	9.56	0.0052
No. 7 Mine Site									
Road Cut Slope	33.3	0.35	1.65	50	75	20.5	0.38	90.8	0.0688
Road and Ditch Below Slope	33.3	0.5	0.33	500	12	4.85	1.2	97	0.0147
Road and Ditch Between Upper and Lower Culverts	33.3	0.5	0.57	200	12	2.8	1.2	55.9	0.0025
Fill Slope Road	33.3	0.35	1.95	90	45	14.5	0.38	64.2	0.0575
Top Soil Stockpile	33.3	0.35	0.9	100	55	20.7	0.38	91.7	0.038
Pond and Pad Area	33.3	0.5	1.5	100	7	0.85	1.2	17.0	0.012
Highwall	33.3	0.35	0.8	40	120	44.2	1.0	28.4	0.0104
TOTAL ACRE FEET PER YEAR									0.222

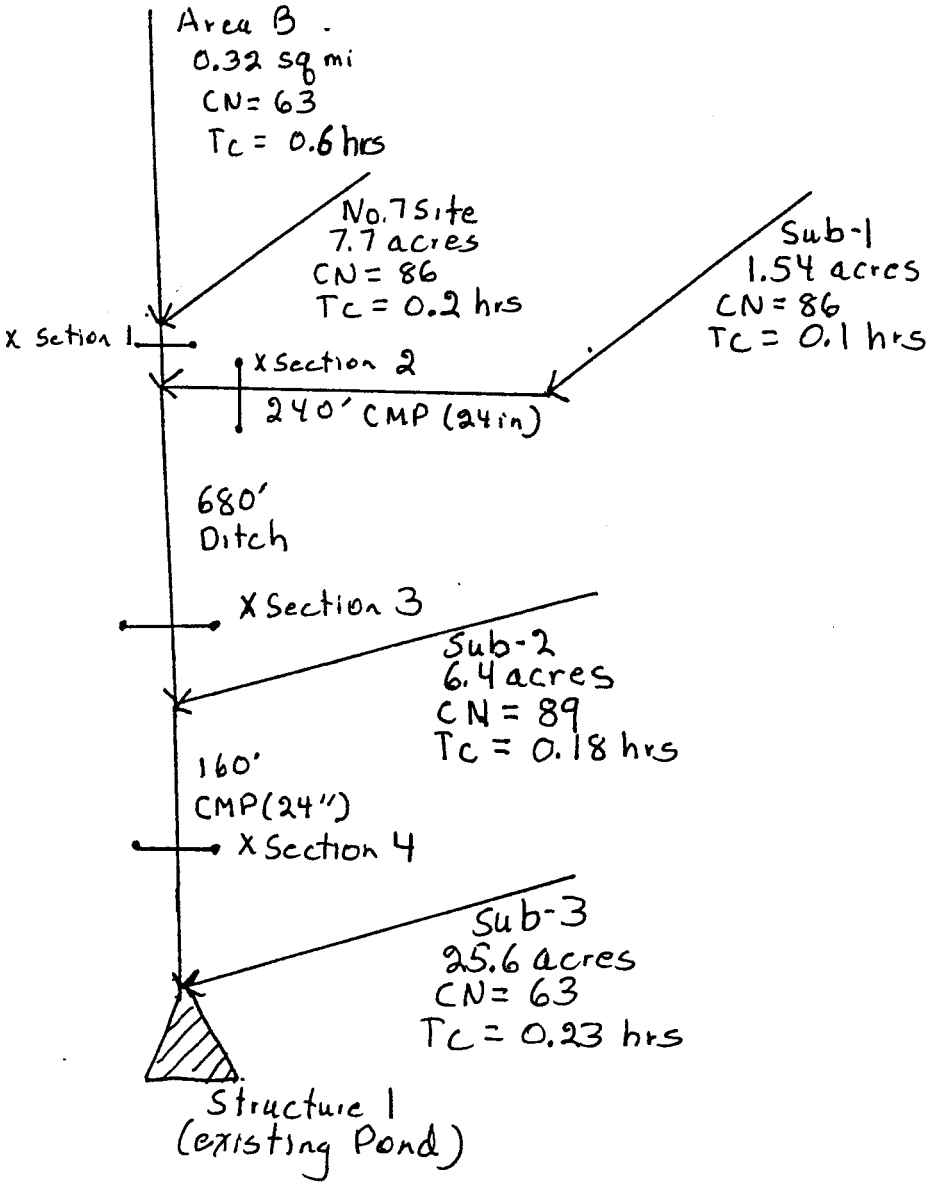

Figure 1.
TR-20 Analysis: schematic of drainage configuration for Gordon Creek Nos. 2 and 7 Mines.

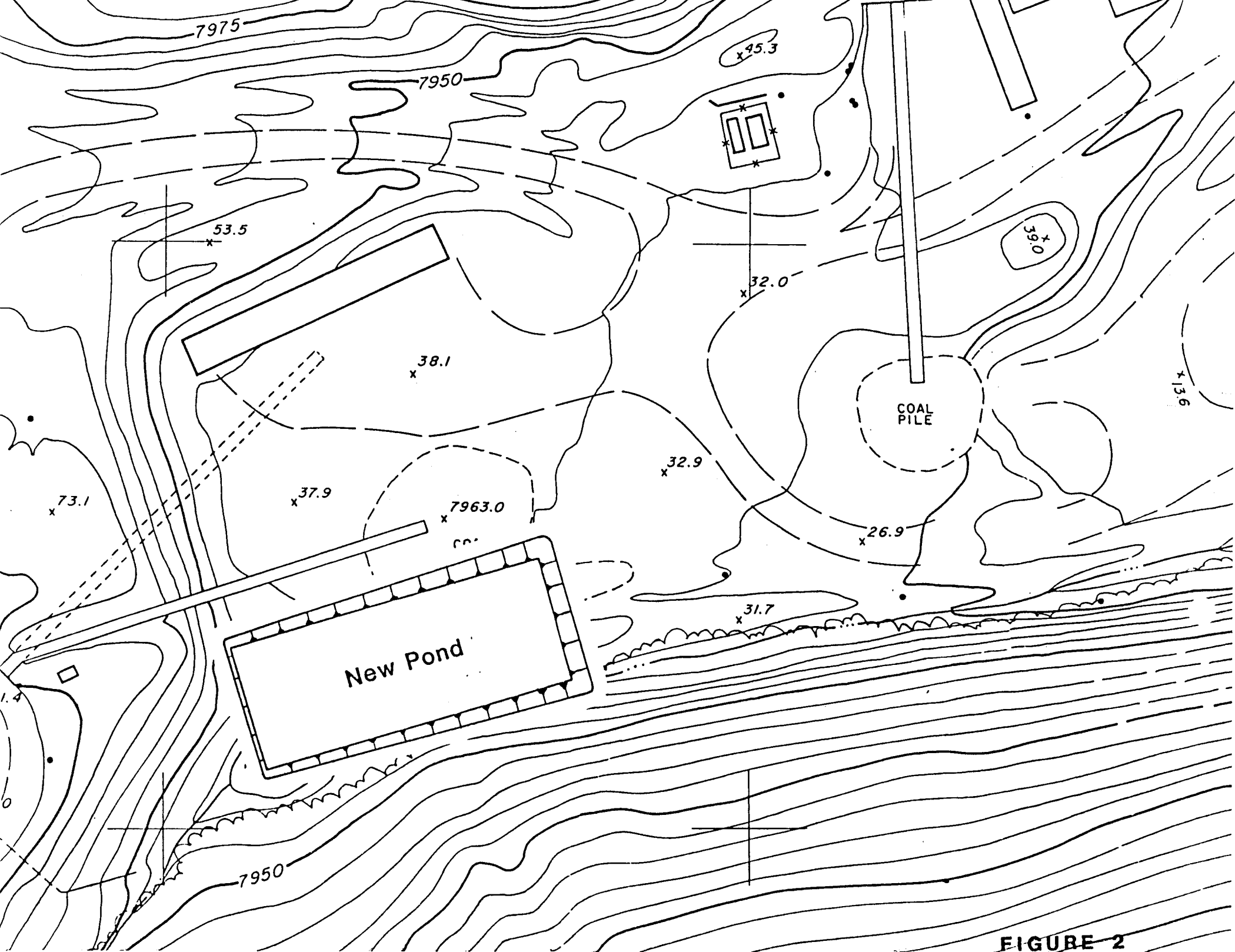
7975
7950
45.3
53.5
39.0
32.0
38.1
13.6
COAL PILE
32.9
37.9
7963.0
73.1
26.9
31.7
New Pond
7950

FIGURE 2