

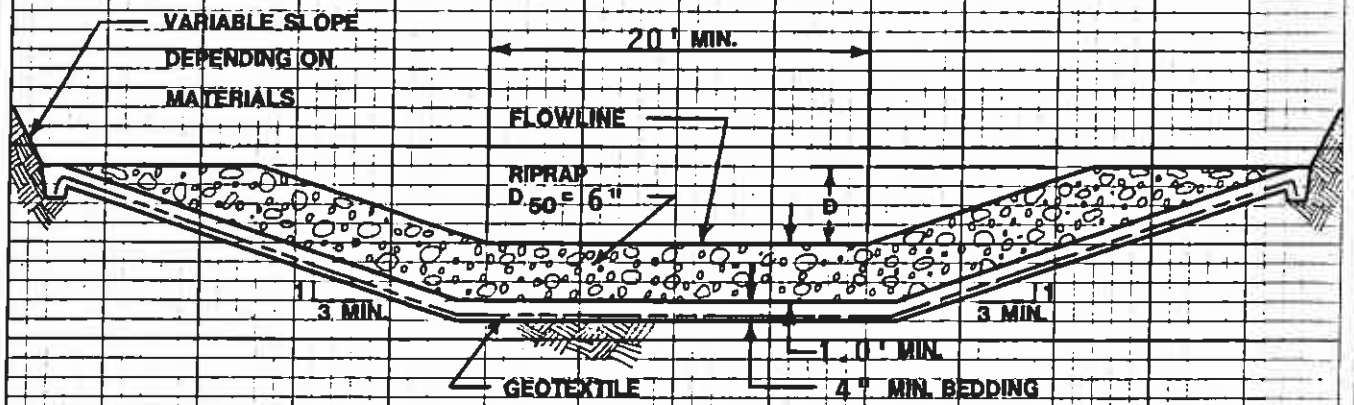
CHANNEL PROFILE A-A'

J21-B

Scale : 1" = 100'

SEE PLATE 1 FOR LOCATION

BY **PEABODY COAL CO.** Plate 3



SPILLWAY CHANNEL

D = 3.5'

LENGTH = 45'

FLOWLINE ELEV. = 6931.5'

OUTFLOW CHANNEL

D = 2.0'

**SPILLWAY AND
OUTFLOW CHANNEL
CROSS SECTION**

APPENDIX A

HYDROLOGY AND HYDRAULIC CALCULATIONS J21-B

J21-B

T_c calculation

Overland Method (SEDCAD Utility)

Segment #1, Land Use #5 (Overland, Near Bare)

$$H = 1,140 \text{ ft}$$

$$V = 74 \text{ ft}$$

Segment #2, Land Use #2 (Small Channel)

$$H = 1,660 \text{ ft}$$

$$V = 80 \text{ ft}$$

Segment #3, Land Use #3 (Large Channel)

$$H = 3,020 \text{ ft}$$

$$V = 95 \text{ ft}$$

$$\underline{T_c = 0.386 \text{ hr}}$$

J21-B

USLE Calculation

$$A = R * K * LS * C * P$$

$$R = 40$$

$$K = 0.37$$

$$LS = \left(\frac{L}{72.6}\right)^m * (17.2 \sin \theta - 0.55)$$

$$L = 500$$

$$m = 0.5$$

$$\theta = 6.28^\circ$$

$$LS = 3.49$$

$$C = 0.23$$

$$P = 0.36$$

$$A = \underline{4.32 \frac{\text{ton}}{\text{ac}}}$$

Sediment Inflow Rate

$$SI = A * DA * SDR * 94 / 192,400$$

$$A = 4.32$$

$$DA = 197$$

$$SDR = 0.90$$

$$SI = \underline{0.374 \frac{\text{ac-ft}}{\text{yr.}}}$$

TRAPEZOIDAL CHANNEL ANALYSIS
CRITICAL DEPTH COMPUTATION
December 7, 1988

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	34.7
Manning's Roughness Coefficient (n-value).....	0.0350
Channel Side Slope - Left Side (horizontal/vertical)....	3.00
Channel Side Slope - Right Side (horizontal/vertical)...	3.00
Channel Bottom Width (feet).....	20.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Critical Depth (feet).....	0.44
Critical Slope (feet per foot).....	0.0241
Flow Velocity (feet per second).....	3.67
Froude Number.....	1.000
Velocity Head (feet).....	0.21
Energy Head (feet).....	0.65
Cross-Sectional Area of Flow (square feet).....	9.46
Top Width of Flow (feet).....	22.66

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

TRAPEZOIDAL CHANNEL ANALYSIS
NORMAL DEPTH COMPUTATION
December 7, 1988

PROGRAM INPUT DATA:

DESCRIPTION	VALUE
Flow Rate (cubic feet per second).....	34.7
Channel Bottom Slope (feet per foot).....	0.0650
Manning's Roughness Coefficient (n-value).....	0.0350
Channel Side Slope - Left Side (horizontal/vertical)....	3.00
Channel Side Slope - Right Side (horizontal/vertical)...	3.00
Channel Bottom Width (feet).....	20.0

PROGRAM RESULTS:

DESCRIPTION	VALUE
Normal Depth (feet).....	0.33
Flow Velocity (feet per second).....	5.00
Froude Number (Flow is Super-Critical).....	1.570
Velocity Head (feet).....	0.39
Energy Head (feet).....	0.72
Cross-Sectional Area of Flow (square feet).....	6.93
Top Width of Flow (feet).....	21.98

TRAPEZOIDAL CHANNEL ANALYSIS COMPUTER PROGRAM, Version 1.1 (c) 1986
Dodson & Associates, Inc., 7015 W. Tidwell, #107, Houston, TX 77092
(713) 895-8322. A manual with equations & flow chart is available.

APPENDIX B

**SEDCAD+ (Input and Output)
10-Year, 24-Hour Storm**

*
 * SEDCAD+(TM) *
 * Sediment, Erosion, Discharge by Computer Aided Design *
 *
 * by *
 *
 * Pamela J. Schwab *
 * Civil Software Design *
 * P.O. Box 11092 *
 * Lexington, Kentucky 40572 *
 *
 * Version No. 2.15 (6/20/88) *
 *
 * COPYRIGHT (c) 1987-1988 PAMELA J. SCHWAB. ALL RIGHTS RESERVED. *
 *

* SEDCAD+(TM) Serial No. 194 has been Authorized and Released to: *
 *
 * Peabody Coal Company *
 * 1300 S. Yale *
 * Flagstaff, AZ 86001 *
 * (602) 677-5289 *
 *

* THE SEDCAD+ PROGRAM SYSTEM IS PROVIDED 'AS IS' WITHOUT WARRANTY OF ANY *
 * KIND, EITHER EXPRESS OR IMPLIED. IN NO EVENT SHALL THE AUTHORS OR *
 * CIVIL SOFTWARE DESIGN BE LIABLE FOR INCIDENTAL DAMAGES, CONSEQUENTIAL *
 * DAMAGE, LOST PROFITS, LOST SAVINGS, OR ANY OTHER DAMAGES ARISING OUT *
 * OF THE USE OR INABILITY TO USE THIS PROGRAM SYSTEM. *
 *

*
 * Current Date and Time: 01-29-1989 13:16:46 *
 * Computed Date and Time: 12-06-1988 10:42:11 *
 * File Created By: LGO *
 * File Currently Being Printed: J21B-25 *
 *

***** WATERSHED IDENTIFICATION *****

*
 * J21-B *
 *

***** STORM INPUT *****

*
 * Storm Type SCS TYPE 2 *
 * Rainfall Depth 2.1 inches *
 * Storm Duration 24.0 hours *
 *

***** WATERSHED NETWORK *****

JUNCTIONS	BRANCHES	STRUCTURES
1	1	1

***** SEDIMENTOLOGY INPUTS *****

Specific Gravity =	2.5
Submerged Bulk Specific Gravity =	1.25

PERCENT FINER DISTRIBUTIONS:

NO.	PARTICLE SIZE, (mm)	NO. 1
1	0.0740	100.00
2	0.0370	95.00
3	0.0190	73.00
4	0.0090	60.00
5	0.0050	49.00
6	0.0020	36.00
7	0.0010	30.00
8	0.0001	0.00

***** BETWEEN STRUCTURE ROUTING PARAMETERS *****

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

<<< SEDCAD+ >>>
 --- Peabody Coal Company ---

```

*****
*****
**                                     **
** JUNCTION 1 , BRANCH 1 , STRUCTURE 1 **
**           POND STRUCTURE           **
**           J21-B                     **
**                                     **
*****
*****
  
```

```

*****
*                                     *
*           SUBWATERSHED INFORMATION           *
*                                     *
*****
  
```

```

*                                     *
*           HYDRAULIC INPUT VALUES           *
*                                     *
*****
  
```

WATER SHED	AREA (acre)	CURVE NUMBER	TC (hr)	TT (hr)	ROUTING K-(hr)	COEF'S X	UNIT HYDRO RESPONSE
1	197.00	80.00	0.386	0.000	0.000	0.000	MED

```

*                                     *
*           SEDIMENT INPUT VALUES           *
*                                     *
*****
  
```

WATER SHED	SEG NUM	SOIL K	LENGTH (feet)	SLOPE (%)	CP VALUE	PART OPT
1	1	0.37	500.0	11.0	0.230	1 (RUSLE)

```

*                                     *
*           COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS           *
*                                     *
*****
  
```

WATERSHED	PEAK FLOW (cfs)	RUNOFF (inches)	SEDIMENT (tons)	D50 (mm)
1	72.532	0.624	1388.19	0.002

*
* JUNCTION 1 , BRANCH 1 , STRUCTURE 1 *
* J21-B *
* POND STRUCTURE INFORMATION *
* *****

*
* Time Increment of the Routed Hydrograph = 0.20 hours *
* Dead Space of Permanent Pool = 30.00 % *
* Number of Continuous Stirred Reactors = 2 *
* *****

* RIPRAP EMERGENCY SPILLWAY INPUTS *
* *****

* Crest stage of the Emergency Spillway = 11.500 feet *
* Crest Length = 45.000 feet *
* Width = 20.000 feet *
* Outslope factors: *
* Slope = 6.50 % *
* Side Slope Ratio = 3.00:1 *
* Safety Factor = 1.50 *
* *****

RESULTS TO J21-B

Total Drainage Area to This Point = 197.000 acres
Basin Trap Efficiency = 76.096 %

EMERGENCY SPILLWAY OUTSLOPE DESIGN:

Design Discharge = 29.971 cfs
Velocity = 4.765 fps
Depth of Flow = 0.301 feet
Manning's n = 0.035
D50 Channel Bed = 0.419 feet
D50 Channel Bank = 0.459 feet

DETAILED STAGE-DISCHARGE INFORMATION

Table with 5 columns: ELEVATION, STAGE (ft), PSW #1 (cfs), ESW (cfs), TOTAL DISCHARGE (cfs). Rows show data for elevations from 6920.00 to 6934.00.

*	6934.50	14.50	0.00	333.92	333.92	*
*	6935.00	15.00	0.00	451.80	451.80	*

RESULTS TO J21-B
 (continued)

INPUT AND CALCULATED BASIN GEOMETRY

ELEV- ATION	STAGE (ft)	AREA (ac)	DIS- CHARGE (cfs)	AVG. DEPTH (ft)	CAPACITY (ac-ft)	
6920.0	0.0	0.00	0.00	0.00	0.00	
6920.5	0.5	0.15	0.00	0.25	0.04	
6921.0	1.0	0.30	0.00	0.63	0.15	
6921.5	1.5	0.45	0.00	0.97	0.34	
6922.0	2.0	0.60	0.00	1.31	0.60	
6922.5	2.5	0.75	0.00	1.65	0.94	
6923.0	3.0	0.90	0.00	1.99	1.35	
6923.5	3.5	1.05	0.00	2.32	1.84	
6924.0	4.0	1.20	0.00	2.66	2.40	
6924.5	4.5	1.35	0.00	2.99	3.04	
6925.0	5.0	1.50	0.00	3.33	3.75	
6925.5	5.5	1.65	0.00	3.66	4.54	
6926.0	6.0	1.80	0.00	3.99	5.40	
6926.5	6.5	1.95	0.00	4.33	6.34	
6927.0	7.0	2.10	0.00	4.66	7.35	
6927.5	7.5	2.25	0.00	4.99	8.44	
6928.0	8.0	2.40	0.00	5.33	9.60	
6928.5	8.5	2.55	0.00	5.66	10.84	
6929.0	9.0	2.70	0.00	6.00	12.15	
6929.5	9.5	2.85	0.00	6.33	13.54	
6930.0	10.0	3.00	0.00	6.66	15.00	
6930.5	10.5	3.07	0.00	7.00	16.52	
6931.0	11.0	3.14	0.00	7.36	18.07	
6931.5	11.5	3.21	0.00	7.72	19.66	EMERGENCY SPILLWAY
6932.2	12.2	3.31	20.17	8.25	21.94	
6932.3	12.3	3.33	26.60	8.32	22.28	
	12.4				22.44	PEAK STAGE
6932.4	12.4	3.34	33.26	8.40	22.61	
6932.5	12.5	3.36	40.49	8.47	22.94	
6933.0	13.0	3.43	93.58	8.86	24.64	
6933.5	13.5	3.50	156.86	9.24	26.37	
6934.0	14.0	3.57	235.00	9.63	28.14	
6934.5	14.5	3.64	333.92	10.02	29.94	
6935.0	15.0	3.71	451.80	10.41	31.77	
RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (m1/l)	SEDIMENT YIELD (tons)		
IN	10.250	72.532	168208.09	14.643	1388.19	
OUT	10.251	29.971	32079.40	0.000	331.83	

		AVERAGE SETTLEABLE CONCENTRATION:			
		VOLUME WEIGHTED DURING		ARITHMETIC DURING	
		TIME OF	PEAK	TIME OF	PEAK
SIGNIFICANT CONCENTRATION		SIGN. CONC.	24 HOUR	SIGN. CONC.	24 HOUR
(hrs)		(m1/l)	(m1/l)	(m1/l)	(m1/l)
IN	14.30	8.24	8.24	4.50	2.68
OUT	24.40	0.00	0.00	0.00	0.00

```

*****
*
*           JUNCTION 1 , BRANCH 1 , STRUCTURE 1
*           J21-B
* HYDROGRAPH (AND SEDIMENTGRAPH) OUT OF THE STRUCTURE
*
*****
  
```

```

*
* HYDROGRAPH (AND SEDIMENTGRAPH)
* Time      Discharge   Sed Disch   Time      Discharge   Sed Disch
* (hr)      (cfs)        (mg/l)      (hr)      (cfs)        (mg/l)
*-----*-----*-----*-----*-----*-----*
  
```

Time (hr)	Discharge (cfs)	Sed Disch (mg/l)	Time (hr)	Discharge (cfs)	Sed Disch (mg/l)
* 0.00	0.000	0.000	0.20	0.000	0.000
* 0.40	0.000	0.000	0.60	0.000	0.000
* 0.80	0.000	0.000	1.00	0.000	0.000
* 1.20	0.000	0.000	1.40	0.000	0.000
* 1.60	0.000	0.000	1.80	0.000	0.000
* 2.00	0.000	0.000	2.20	0.000	0.000
* 2.40	0.000	0.000	2.60	0.000	0.000
* 2.80	0.000	0.000	3.00	0.000	0.000
* 3.20	0.000	0.000	3.40	0.000	0.000
* 3.60	0.000	0.000	3.80	0.000	0.000
* 4.00	0.000	0.000	4.20	0.000	0.000
* 4.40	0.000	0.000	4.60	0.000	0.000
* 4.80	0.000	0.000	5.00	0.000	0.000
* 5.20	0.000	0.000	5.40	0.000	0.000
* 5.60	0.000	0.000	5.80	0.000	0.000
* 6.00	0.000	0.000	6.20	0.000	0.000
* 6.40	0.000	0.000	6.60	0.000	0.000
* 6.80	0.000	0.000	7.00	0.000	0.000
* 7.20	0.000	0.000	7.40	0.000	0.000
* 7.60	0.000	0.000	7.80	0.000	0.000
* 8.00	0.000	0.000	8.20	0.000	0.000
* 8.40	0.000	0.000	8.60	0.000	0.000
* 8.80	0.000	0.000	9.00	0.000	0.000
* 9.20	0.000	0.000	9.40	0.000	0.000
* 9.60	0.000	0.000	9.80	0.000	0.000
* 10.00	0.000	0.000	10.20	0.000	0.000
* 10.40	0.000	0.000	10.60	0.000	0.000
* 10.80	0.000	0.000	11.00	0.000	0.000
* 11.20	0.000	0.000	11.40	0.016	0.000
* 11.60	0.098	0.014	11.80	0.965	4.727
* 12.00	4.667	187.837	12.20	11.982	1532.020
* 12.40	19.112	4454.564	12.60	26.038	7680.442
* 12.80	29.258	10811.110	13.00	29.971	13756.180
* 13.20	28.996	16372.220	13.40	27.036	18614.650
* 13.60	24.461	20456.689	13.80	21.678	21943.721
* 14.00	19.621	23161.900	14.20	18.429	24199.420
* 14.40	17.235	25092.029	14.60	16.047	25853.510
* 14.80	14.929	26515.881	15.00	13.920	27104.109
* 15.20	13.020	27632.131	15.40	12.226	28110.590
* 15.60	11.531	28547.381	15.80	10.929	28948.039
* 16.00	10.412	29318.221	16.20	9.955	29659.721
* 16.40	9.480	29958.520	16.60	8.950	30207.180
* 16.80	8.424	30418.730	17.00	7.939	30603.211
* 17.20	7.496	30764.070	17.40	7.097	30904.789

* 17.60	6.740	31029.221	17.80	6.426	31140.650	*
* 18.00	6.154	31241.859	18.20	5.920	31334.641	*
* 18.40	5.720	31419.801	18.60	5.549	31497.881	*
* 18.80	5.403	31570.051	19.00	5.278	31638.100	*
* 19.20	5.172	31703.080	19.40	5.081	31765.180	*
* 19.60	5.005	31824.439	19.80	4.941	31880.750	*
* 20.00	4.886	31934.010	20.20	4.834	31983.180	*
* 20.40	4.745	32022.410	20.60	4.604	32048.240	*
* 20.80	4.446	32064.600	21.00	4.293	32074.650	*
* 21.20	4.149	32079.340	21.40	4.014	32079.400	*
* 21.60	3.892	32075.711	21.80	3.783	32069.180	*
* 22.00	3.688	32060.590	22.20	3.607	32050.439	*
* 22.40	3.537	32038.990	22.60	3.478	32026.381	*
* 22.80	3.427	32012.750	23.00	3.384	31998.260	*
* 23.20	3.347	31983.160	23.40	3.316	31967.820	*
* 23.60	3.290	31952.631	23.80	3.268	31937.631	*
* 24.00	3.249	31922.650	24.20	3.219	31905.730	*
* 24.40	3.100	31877.641	24.60	2.865	31832.850	*
* 24.80	2.585	31776.949	25.00	2.306	31714.480	*
* 25.20	2.038	31646.859	25.40	1.786	31575.160	*
* 25.60	1.552	31500.141	25.80	1.341	31423.061	*
* 26.00	1.158	31345.211	26.20	1.001	31267.070	*
* 26.40	0.865	31189.119	26.60	0.747	31111.590	*
* 26.80	0.645	31034.561	27.00	0.558	30958.080	*
* 27.20	0.482	30882.211	27.40	0.416	30806.980	*
* 27.60	0.360	30732.449	27.80	0.311	30658.740	*
* 28.00	0.268	30586.131	28.20	0.232	30514.740	*
* 28.40	0.200	30444.471	28.60	0.173	30375.221	*
* 28.80	0.150	30306.949	29.00	0.129	30239.619	*
* 29.20	0.112	30173.211	29.40	0.096	30107.680	*
* 29.60	0.083	30043.039	29.80	0.072	29979.270	*
* 30.00	0.062	29916.340	30.20	0.054	29854.250	*
* 30.40	0.046	29792.971	30.60	0.040	29732.510	*
* 30.80	0.035	29672.830	31.00	0.030	29613.920	*
* 31.20	0.026	29555.789	31.40	0.022	29498.391	*
* 31.60	0.019	29441.730	31.80	0.017	29385.760	*
* 32.00	0.014	29330.500	32.20	0.012	29275.930	*
* 32.40	0.011	29222.199	32.60	0.009	29169.369	*
* 32.80	0.008	29117.410	33.00	0.007	29066.230	*
* 33.20	0.006	29015.779	33.40	0.005	28966.010	*
* 33.60	0.004	28916.900	33.80	0.004	28868.400	*
* 34.00	0.003	28820.490	34.20	0.003	28773.160	*
* 34.40	0.003	28726.391	34.60	0.002	28680.150	*
* 34.80	0.002	28634.449	35.00	0.002	28589.250	*
* 35.20	0.001	28544.551	35.40	0.001	28500.340	*
* 35.60	0.001	28456.609	35.80	0.001	28413.350	*
*						*

<<< SEDCAD+ >>>
Peabody Coal Company

*** RUN COMPLETED ***

APPENDIX C

**SEDCAD+ (Input and Output)
25-Year, 6-Hour Storm**

*
* SEDCAD+(TM) *
* Sediment, Erosion, Discharge by Computer Aided Design *
* by *
* Pamela J. Schwab *
* Civil Software Design *
* P.O. Box 11092 *
* Lexington, Kentucky 40572 *
* Version No. 2.15 (6/20/88) *

* COPYRIGHT (c) 1987-1988 PAMELA J. SCHWAB. ALL RIGHTS RESERVED. *

* SEDCAD+(TM) Serial No. 194 has been Authorized and Released to: *
* Peabody Coal Company *
* 1300 S. Yale *
* Flagstaff, AZ 86001 *
* (602) 677-5289 *

* THE SEDCAD+ PROGRAM SYSTEM IS PROVIDED 'AS IS' WITHOUT WARRANTY OF ANY *
* KIND, EITHER EXPRESS OR IMPLIED. IN NO EVENT SHALL THE AUTHORS OR *
* CIVIL SOFTWARE DESIGN BE LIABLE FOR INCIDENTAL DAMAGES, CONSEQUENTIAL *
* DAMAGE, LOST PROFITS, LOST SAVINGS, OR ANY OTHER DAMAGES ARISING OUT *
* OF THE USE OR INABILITY TO USE THIS PROGRAM SYSTEM. *

*
* Current Date and Time: 01-29-1989 13:22:42 *
* Computed Date and Time: 12-06-1988 10:42:35 *
* File Created By: LGO *
* File Currently Being Printed: J21B-25 *
*

***** WATERSHED IDENTIFICATION *****

*
* J21-B *
* (SECOND EMERGENCY SPILLWAY RUN) *
*

***** STORM INPUT *****

*
* Storm Type SCS TYPE 2 *
* Rainfall Depth 1.9 inches *
* Storm Duration 6.0 hours *
*

```
***** WATERSHED NETWORK *****
*
*           JUNCTIONS           BRANCHES           STRUCTURES           *
*-----*
*           1                   1                   1                   *
*-----*
*****
```

```
***** SEDIMENTOLOGY INPUTS *****
*
* Specific Gravity =                2.5           *
* Submerged Bulk Specific Gravity = 1.25         *
*-----*
```

```

*                                     PERCENT FINER DISTRIBUTIONS:
* NO.  PARTICLE SIZE, (mm)  NO.  1
*-----*
*  1      0.0740            100.00
*  2      0.0370            95.00
*  3      0.0190            73.00
*  4      0.0090            60.00
*  5      0.0050            49.00
*  6      0.0020            36.00
*  7      0.0010            30.00
*  8      0.0001            0.00
*-----*
```

```
***** BETWEEN STRUCTURE ROUTING PARAMETERS *****
*
*                                     TRAVEL TIME MUSK. K   MUSK. X
*           J   B                   (hours)   (hours)
*-----*
*   1   1   Prior J or S to Structure 1   0.000   0.000   0.000
*-----*
```

```

*****
*****
**
** JUNCTION 1 , BRANCH 1 , STRUCTURE 1 **
** POND STRUCTURE **
** J21-B **
**
*****
*****

```

```

*****
*
* SUBWATERSHED INFORMATION *
*
*****

```

```

*
* HYDRAULIC INPUT VALUES *
*
* WATER AREA CURVE TC TT ROUTING COEF'S UNIT HYDRO *
* SHED (acre) NUMBER (hr) (hr) K-(hr) X RESPONSE *
-----
* 1 197.00 80.00 0.386 0.000 0.000 0.000 MED *

```

```

*
* SEDIMENT INPUT VALUES *
*
* WATER SEG SOIL LENGTH SLOPE CP PART *
* SHED NUM K (feet) (%) VALUE OPT *
-----
* 1 1 0.37 500.0 11.0 0.230 1 (RUSLE) *

```

```

*
* COMPUTED VALUES FOR INDIVIDUAL WATERSHEDS *
*
* PEAK FLOW RUNOFF SEDIMENT D50 *
* WATERSHED (cfs) (inches) (tons) (mm) *
-----
* 1 82.251 0.503 1319.01 0.001 *

```

```
*****
```

```
*****  
*                                     *  
*           JUNCTION 1 , BRANCH 1 , STRUCTURE 1           *  
*                   J21-B                                     *  
*                   POND STRUCTURE INFORMATION             *  
*                                     *  
*****  
*                                     *  
* Time Increment of the Routed Hydrograph =      0.20 hours *  
* Dead Space of Permanent Pool =                 30.00 %   *  
* Number of Continuous Stirred Reactors =        2         *  
*                                     *  
*                                     *  
*                   RIPRAP EMERGENCY SPILLWAY INPUTS      *  
*                                     *  
* Crest stage of the Emergency Spillway =         11.500 feet *  
* Crest Length =                                 45.000 feet *  
* Width =                                         20.000 feet *  
* Outslope factors:                               *  
*   Slope =                                       6.50 % *  
*   Side Slope Ratio =                             3.00:1 *  
*   Safety Factor =                                1.50      *  
*                                     *  
*****
```

*
 * RESULTS TO J21-B *
 *

*
 * Total Drainage Area to This Point = 197.000 acres *
 *
 * Basin Trap Efficiency = 79.879 % *
 *

EMERGENCY SPILLWAY OUTSLOPE DESIGN:

*
 * Design Discharge = 34.663 cfs *
 * Velocity = 4.985 fps *
 * Depth of Flow = 0.331 feet *
 * Manning's n = 0.035 *
 * D50 Channel Bed = 0.461 feet *
 * D50 Channel Bank = 0.504 feet *
 *

DETAILED STAGE-DISCHARGE INFORMATION.

ELEVATION	STAGE (ft)	PSW #1 (cfs)	ESW (cfs)	TOTAL DISCHARGE (cfs)
6920.00	0.00	0.00	0.00	0.00
6920.50	0.50	0.00	0.00	0.00
6921.00	1.00	0.00	0.00	0.00
6921.50	1.50	0.00	0.00	0.00
6922.00	2.00	0.00	0.00	0.00
6922.50	2.50	0.00	0.00	0.00
6923.00	3.00	0.00	0.00	0.00
6923.50	3.50	0.00	0.00	0.00
6924.00	4.00	0.00	0.00	0.00
6924.50	4.50	0.00	0.00	0.00
6925.00	5.00	0.00	0.00	0.00
6925.50	5.50	0.00	0.00	0.00
6926.00	6.00	0.00	0.00	0.00
6926.50	6.50	0.00	0.00	0.00
6927.00	7.00	0.00	0.00	0.00
6927.50	7.50	0.00	0.00	0.00
6928.00	8.00	0.00	0.00	0.00
6928.50	8.50	0.00	0.00	0.00
6929.00	9.00	0.00	0.00	0.00
6929.50	9.50	0.00	0.00	0.00
6930.00	10.00	0.00	0.00	0.00
6930.50	10.50	0.00	0.00	0.00
6931.00	11.00	0.00	0.00	0.00
6931.50	11.50	0.00	0.00	0.00
6932.20	12.20	0.00	20.17	20.17
6932.30	12.30	0.00	26.60	26.60
6932.40	12.40	0.00	33.26	33.26
6932.50	12.50	0.00	40.49	40.49
6933.00	13.00	0.00	93.58	93.58
6933.50	13.50	0.00	156.86	156.86
6934.00	14.00	0.00	235.00	235.00

*	6934.50	14.50	0.00	333.92	333.92	*
*	6935.00	15.00	0.00	451.80	451.80	*

 * RESULTS TO J21-B *
 * (continued) *
 * *****

* INPUT AND CALCULATED BASIN GEOMETRY *

ELEV- ATION	STAGE (ft)	AREA (ac)	DIS- CHARGE (cfs)	AVG. DEPTH (ft)	CAPACITY (ac-ft)	
6920.0	0.0	0.00	0.00	0.00	0.00	
6920.5	0.5	0.15	0.00	0.25	0.04	
6921.0	1.0	0.30	0.00	0.63	0.15	
6921.5	1.5	0.45	0.00	0.97	0.34	
6922.0	2.0	0.60	0.00	1.31	0.60	
6922.5	2.5	0.75	0.00	1.65	0.94	
6923.0	3.0	0.90	0.00	1.99	1.35	
6923.5	3.5	1.05	0.00	2.32	1.84	
6924.0	4.0	1.20	0.00	2.66	2.40	
6924.5	4.5	1.35	0.00	2.99	3.04	
6925.0	5.0	1.50	0.00	3.33	3.75	
6925.5	5.5	1.65	0.00	3.66	4.54	
6926.0	6.0	1.80	0.00	3.99	5.40	
6926.5	6.5	1.95	0.00	4.33	6.34	
6927.0	7.0	2.10	0.00	4.66	7.35	
6927.5	7.5	2.25	0.00	4.99	8.44	
6928.0	8.0	2.40	0.00	5.33	9.60	
6928.5	8.5	2.55	0.00	5.66	10.84	
6929.0	9.0	2.70	0.00	6.00	12.15	
6929.5	9.5	2.85	0.00	6.33	13.54	
6930.0	10.0	3.00	0.00	6.66	15.00	
6930.5	10.5	3.07	0.00	7.00	16.52	
6931.0	11.0	3.14	0.00	7.36	18.07	
6931.5	11.5	3.21	0.00	7.72	19.66	EMERGENCY SPILLWAY
6932.2	12.2	3.31	20.17	8.25	21.94	
6932.3	12.3	3.33	26.60	8.32	22.28	
6932.4	12.4	3.34	33.26	8.40	22.61	
	12.4				22.67	PEAK STAGE
6932.5	12.5	3.36	40.49	8.47	22.94	
6933.0	13.0	3.43	93.58	8.86	24.64	
6933.5	13.5	3.50	156.86	9.24	26.37	
6934.0	14.0	3.57	235.00	9.63	28.14	
6934.5	14.5	3.64	333.92	10.02	29.94	
6935.0	15.0	3.71	451.80	10.41	31.77	
	RUNOFF VOLUME (ac-ft)	PEAK DISCHARGE (cfs)	PEAK SEDIMENT CONCENTRATION (mg/l)	PEAK SETTLEABLE CONCENTRATION (m1/l)	SEDIMENT YIELD (tons)	
IN	8.250	82.251	162607.80	7.948	1319.01	
OUT	8.251	34.663	34412.55	0.000	265.40	

		AVERAGE SETTLEABLE CONCENTRATION:				
		VOLUME WEIGHTED DURING		ARITHMETIC DURING		
		TIME OF	PEAK	TIME OF	PEAK	
		SIGN. CONC.	24 HOUR	SIGN. CONC.	24 HOUR	
		(m1/1)	(m1/1)	(m1/1)	(m1/1)	
	TIME OF SIGNIFICANT CONCENTRATION (hrs)					
*	IN	5.00	5.46	5.46	3.46	0.72
*	OUT	17.00	0.00	0.00	0.00	0.00

JUNCTION 1 , BRANCH 1 , STRUCTURE 1
 J21-B
 HYDROGRAPH (AND SEDIMENTGRAPH) OUT OF THE STRUCTURE

HYDROGRAPH (AND SEDIMENTGRAPH)						
Time (hr)	Discharge (cfs)	Sed Disch (mg/l)	Time (hr)	Discharge (cfs)	Sed Disch (mg/l)	
* 0.00	0.000	0.000	0.20	0.000	0.000	*
* 0.40	0.000	0.000	0.60	0.000	0.000	*
* 0.80	0.000	0.000	1.00	0.000	0.000	*
* 1.20	0.000	0.000	1.40	0.000	0.000	*
* 1.60	0.000	0.000	1.80	0.000	0.000	*
* 2.00	0.000	0.000	2.20	0.000	0.000	*
* 2.40	0.000	0.000	2.60	0.002	0.000	*
* 2.80	0.590	1.611	3.00	4.469	171.784	*
* 3.20	12.823	1689.658	3.40	21.344	4975.562	*
* 3.60	30.099	8583.679	3.80	33.717	12189.210	*
* 4.00	34.663	15614.090	4.20	33.725	18708.721	*
* 4.40	31.734	21408.650	4.60	28.969	23673.471	*
* 4.80	25.941	25548.609	5.00	23.124	27110.881	*
* 5.20	20.633	28426.520	5.40	19.291	29539.939	*
* 5.60	18.176	30499.551	5.80	17.112	31350.859	*
* 6.00	16.144	32119.141	6.20	15.185	32793.820	*
* 6.40	14.004	33320.711	6.60	12.590	33691.891	*
* 6.80	11.171	33957.578	7.00	9.849	34148.590	*
* 7.20	8.630	34279.141	7.40	7.519	34360.609	*
* 7.60	6.516	34401.750	7.80	5.630	34412.551	*
* 8.00	4.864	34400.199	8.20	4.203	34366.469	*
* 8.40	3.631	34314.730	8.60	3.137	34249.238	*
* 8.80	2.710	34173.020	9.00	2.342	34088.262	*
* 9.20	2.023	33996.520	9.40	1.748	33898.211	*
* 9.60	1.510	33793.461	9.80	1.305	33683.840	*
* 10.00	1.127	33572.031	10.20	0.974	33459.512	*
* 10.40	0.842	33346.660	10.60	0.727	33233.602	*
* 10.80	0.628	33120.000	11.00	0.543	33005.480	*
* 11.20	0.469	32890.461	11.40	0.405	32775.680	*
* 11.60	0.350	32661.561	11.80	0.302	32548.359	*
* 12.00	0.261	32436.170	12.20	0.226	32324.721	*
* 12.40	0.195	32213.770	12.60	0.169	32103.580	*
* 12.80	0.146	31994.500	13.00	0.126	31886.750	*
* 13.20	0.109	31780.400	13.40	0.094	31675.430	*
* 13.60	0.081	31571.680	13.80	0.070	31469.039	*
* 14.00	0.061	31367.609	14.20	0.052	31267.641	*
* 14.40	0.045	31169.539	14.60	0.039	31073.689	*
* 14.80	0.034	30980.010	15.00	0.029	30888.250	*
* 15.20	0.025	30798.289	15.40	0.022	30710.039	*
* 15.60	0.019	30623.420	15.80	0.016	30538.359	*
* 16.00	0.014	30454.770	16.20	0.012	30372.590	*
* 16.40	0.010	30291.770	16.60	0.009	30212.250	*
* 16.80	0.008	30134.000	17.00	0.007	30057.051	*
* 17.20	0.006	29981.561	17.40	0.005	29907.721	*

* 17.60	0.004	29835.449		17.80	0.004	29764.551	*
* 18.00	0.003	29694.900		18.20	0.003	29626.430	*
* 18.40	0.002	29559.051		18.60	0.002	29492.740	*
* 18.80	0.002	29427.539		19.00	0.002	29363.740	*
* 19.20	0.001	29301.359		19.40	0.001	29240.189	*
* 19.60	0.001	29180.100		19.80	0.001	29121.020	*
*							*

<<< SEDCAD+ >>>
Peabody Coal Company

*** RUN COMPLETED ***

DESIGN REPORT
Sedimentation Structure
J21-B
Kayenta Mine
Navajo County, Arizona
PEABODY COAL COMPANY



JAN 30 1989

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PLATE 1 - Site Plan

PLATE 2 - Stage-Capacity Chart

PLATE 3 - Channel Profile A-A'

PLATE 4 - Emergency Spillway Typical Cross Section

APPENDIX A - Hydrology and Hydraulic Calculations

APPENDIX B - SEDCAD+ (Input and Output) 10-Year, 24-Hour

APPENDIX C - SEDCAD+ (Input and Output) 25-Year, 6-Hour

Introduction

Sedimentation Structure J21-B will be an earthen embankment, designed and constructed by Peabody Coal Company as a temporary sedimentation structure to control runoff and sediment from disturbed areas of the Kayenta Mine. The location of Structure J21-B is shown on Plate 1, Site Plan, Drawing No. 85400 (Sheet N-10), and Drawing No. 85405.

This design report contains information specific to Structure J21-B. Regional site information is presented in the "General Report, Kayenta and Black Mesa Mines, Navajo County, Arizona for Peabody Coal Company", December, 1985 (PAP), Chapter 6, Attachment D, Volume 2 along with the methods and results of analyses used for slope stability, hydrology, and hydraulics.

Inspection

The proposed site of Structure J21-B was inspected by a Registered Professional Engineer from Peabody Coal Company in August, 1988 to ensure that the site is suitable and no adverse conditions exist to prevent the successful construction of the structure. A detailed geotechnical investigation was not performed, rather the information in Chapter 6, Attachment D will be utilized for embankment design during construction.

Site Description

Land Use

Structure J21-B has a 197-acre tributary drainage area and is located on a tributary of Dinnebito Wash at the Kayenta Mine. The watershed is classified as 48 percent pinyon-juniper, 19 percent sage-grass, and 33 percent disturbed.

Embankment

A homogeneous earthen embankment, a minimum of fifteen feet wide, was assumed for the hydraulic analysis and to develop the stage-capacity chart shown on Plate 2. An upstream slope of 3:1 (horizontal to vertical) and a downstream slope of 4:1 were used. The assumed slopes were not evaluated for geotechnical considerations such as slope stability since the foundation or embankment material types have not been determined. The incised portion of the structure will be excavated at 3:1 (horizontal to vertical) slopes.

Design Analyses

General

Structure J21-B was designed by a Registered Professional Engineer from Peabody Coal Company. The design was performed in accordance with applicable 30 CFR 780 and 816 regulations of the United States Department of Interior, Office of Surface Mining (OSM) and included a review of available project files. The most current information contained in the Peabody Coal Company files includes topographic maps developed from aerial photography flown in 1984 for Peabody Coal Company and was used in the analyses of the structure.

Stability

The slopes of Structure J21-B will be chosen based on the stability analyses performed for existing structures in the General Report. The embankment fill materials and the type of foundation will be identified in the field during construction and stable slopes will be chosen based on the category classification of the structure.

Hydrology

The hydrologic analysis was completed using the generalized computer program SEDCAD+ (see Appendix A, B, and C). Structure J21-B is not in series with any other structure nor does the structure fall under the guidelines of the 30 CFR Section 77.216 for MSHA size structures. Therefore, the spillway was analyzed using the 25-year, 6-hour storm. The storage capacity of Structure J21-B was analyzed using the 10-year, 24-hour storm.

The following parameters were used in the hydrologic analysis:

1. Water Course length, L	1.102 mi
2. Elevation Difference, H	249 ft
3. Time of Concentration, Tc	0.386 hr
4. SCS Curve Number	80
5. Rainfall Depth, 10-year, 24-hour storm	2.1 in
25-year, 6-hour storm	1.9 in
6. Drainage Area	197.0 ac

Hydraulics

The SEDCAD+ program was used to evaluate inflow to the planned sedimentation structure, outflow from the structure, and the resulting water surface elevations. The initial conditions and results of the analysis are summarized in the following table.

J21-B HYDRAULICS

	Units	10-Year 24-Hour Storm	25-Year 6-Hour Storm
Initial Reservoir Volume Condition		Empty	Full to emergency spillway elevation
Inflow			
Peak Flow	cfs	72.5	82.2
Volume	acre-ft	10.2	8.2
Storage			
Peak Stage	ft	6928.3	6932.4
Emerg. Spillway Elev. . ft		6931.5	--
Peak Storage.	acre-ft	10.3	--
Storage Capacity	acre-ft	19.7	--
Outflow			
Peak Flow	cfs	0.0	34.7
Embankment Crest Elevation	ft	--	6935.0
Peak Stage	ft	--	6932.4
Freeboard	ft	--	2.6
Emergency Spillway Channel			
Flow Depth	ft	--	3.5
Critical Velocity. . . .	fps	--	3.67
Manning's "n".		--	0.035
Outflow Channel			
Slope.	%	--	6.5
Normal Velocity.	fps	--	5.0
Normal Depth	ft	--	0.3
Manning's "n".		--	0.035

Emergency Spillway and Outlet Channel

The emergency spillway and outlet channel for J21-B will be a trapezoidal channel with the following dimensions:

Channel Depth (Spillway)	3.5 ft.
(Outflow)	2.0 ft.
Channel Width	20 ft.
Channel Length (Spillway)	45 ft.
(Outflow)	255 ft.
Side Slopes (Horizontal to Vertical)	3:1 or flatter
Average Exit Slope (Spillway)	0 percent
(Outflow)	6.5 percent
Inlet Elevation	6931.5

Storage Capacity

The impoundment volume-elevation curve is based on site specific surveys conducted for Peabody Coal Company's August 1984 inspection, and 1985 resurveys, where available. Additionally, the most current topographic maps available were used in developing Plate 2, Volume-Elevation Curve, J21-B.

The calculations for the sediment load entering Structure J21-B were made utilizing the Revised Universal Soil Loss Equation with the following parameters:

1. Rainfall Factor, R 40
2. Soil Erodibility Factor, K 0.37
3. Slope Factor, LS 4.32
4. Cover Factor, C 0.23
5. Erosion Control Factor, P 0.36

The hydrologic analysis gives the storage volume required to contain the 10-year, 24-hour storm, and the remaining storage volume available for storing sediment. The proposed storage capacity of J21-B and the results of the sediment inflow analysis are summarized in the following table.

J21-B STORAGE

Total Storage Capacity	19.66 acre-ft
10-year, 24-hour Storm Inflow	10.25 acre-ft
Available Sediment Storage Capacity	9.41 acre-ft
Sediment Inflow Rate	0.374 acre-ft/yr
Sediment Storage Life	25.16 years

The following plates and appendix are attached and complete this inspection report.

* * *

Plate 1 - Site Plan J21-B

Plate 2 - Stage-Capacity Chart

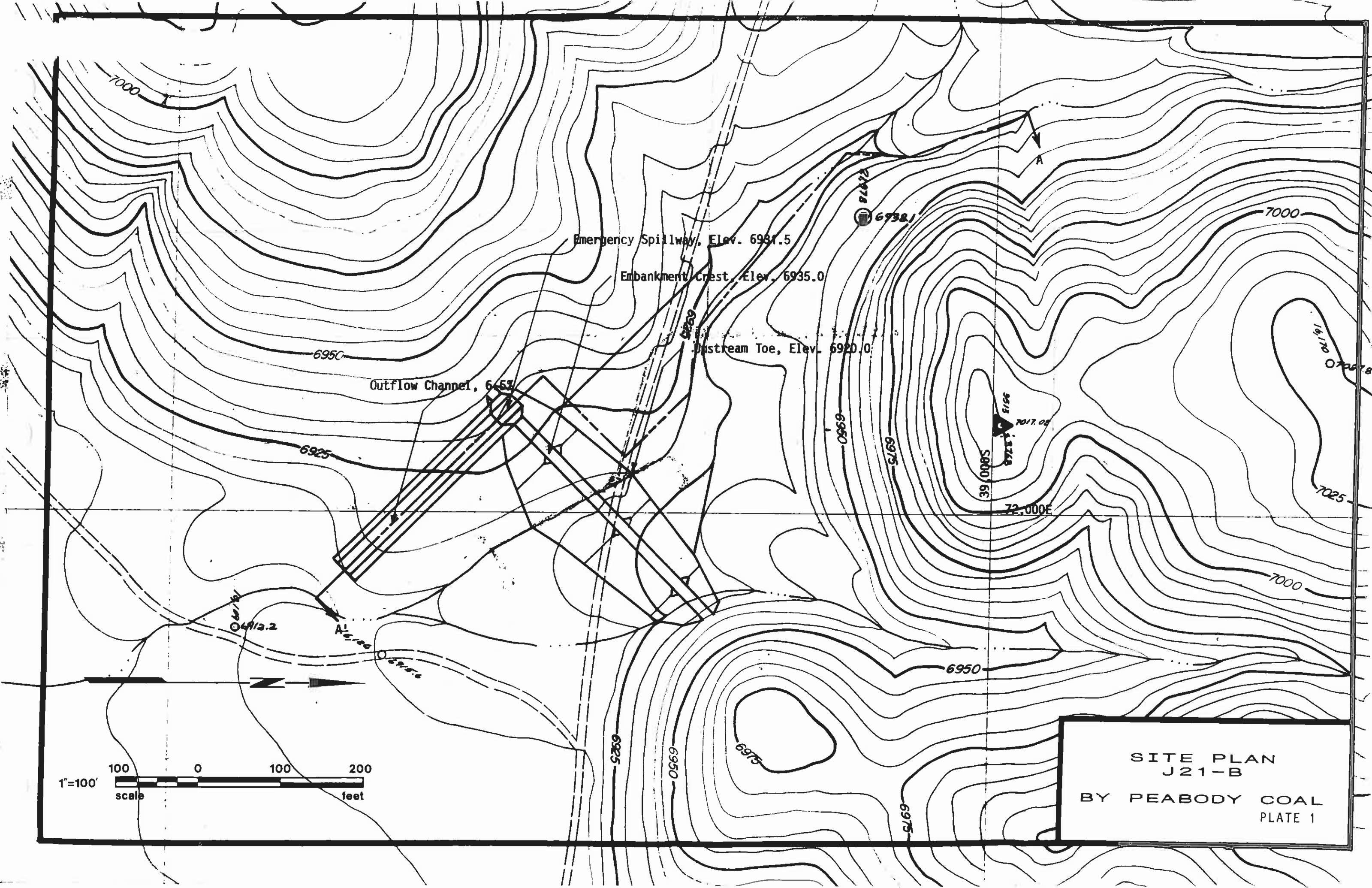
Plate 3 - Channel Profile J21-B, A-A'

Plate 4 - Emergency Spillway Typical Cross Section

Appendix A - Hydrology and Hydraulic Calculations

Appendix B - SEDCAD+ (Input and Output) 10-Year, 24-Hour Storm

Appendix C - SEDCAD+ (Input and Output) 25-Year, 6-Hour Storm



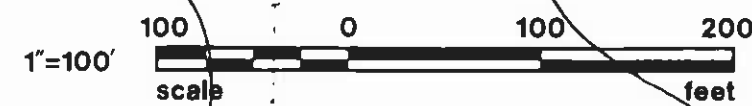
Emergency Spillway, Elev. 6987.5

Embankment Crest, Elev. 6935.0

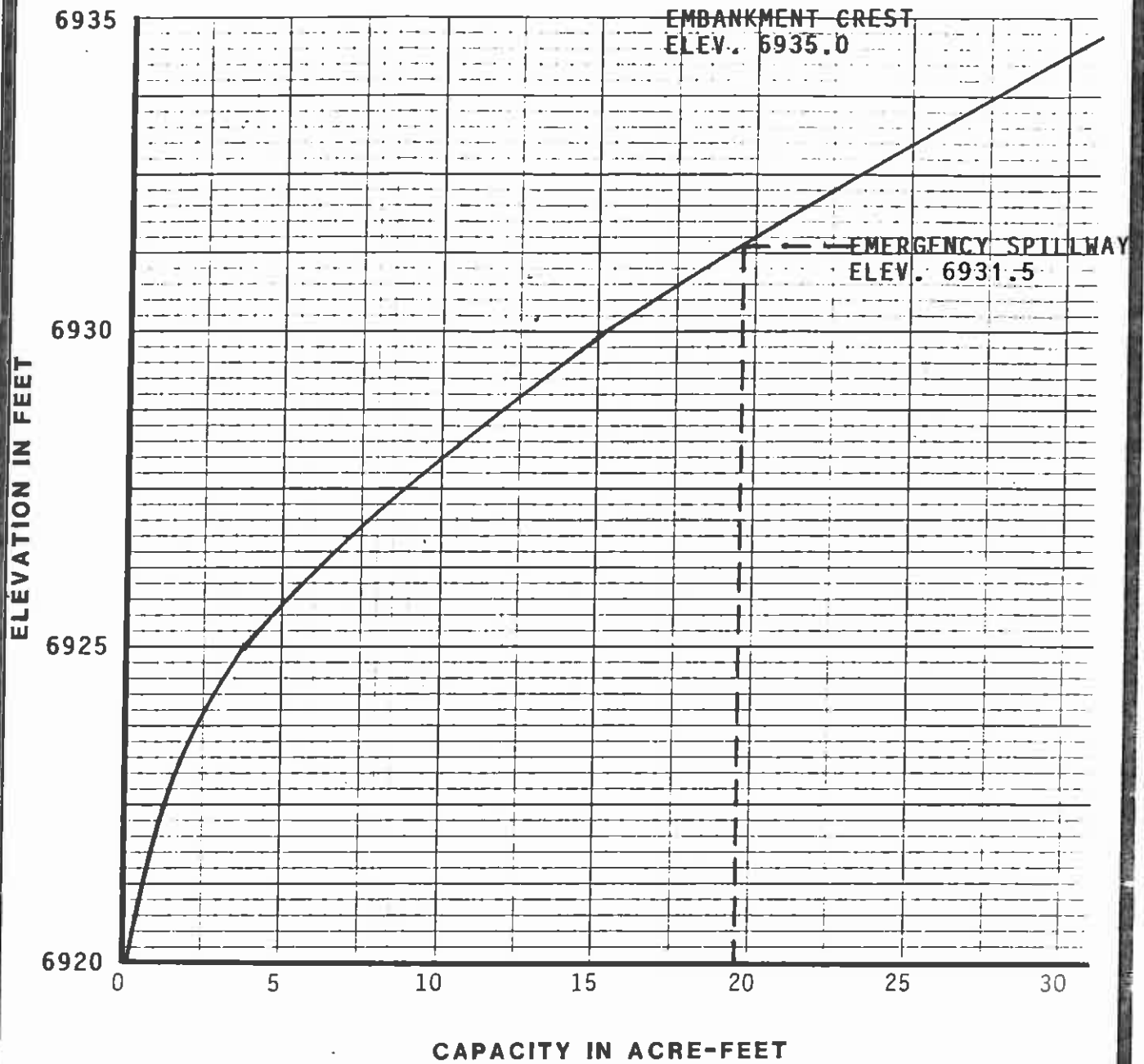
Upstream Toe, Elev. 6920.0

Outflow Channel, 645%

72,000E



SITE PLAN
J21-B
BY PEABODY COAL
PLATE 1



VOLUME-ELEVATION CURVE
J21-B