Tuscaloosa Resources Inc. East Brookwood Mine P-3852 Re-evaluation of JWR Mine No. 5 Ponds 013A and 013 (shared facilities) with Slurry Impoundment No. 3 and 4 reclaimed.

25YEAR 6 HOUR STORM

Design storm for Pond 013A spillway

Robert Usher, P.E.

General Information

Storm Information:

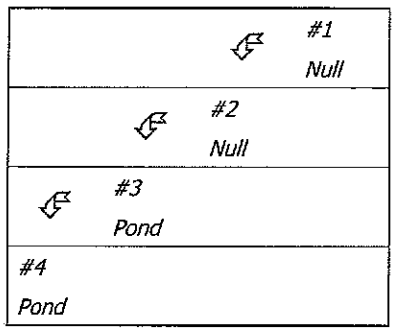
Storm Type:	SCS 6 Hour
Design Storm:	25 yr - 6 hr
Rainfall Depth:	5.000 inches

Particle Size Distribution:

Size (mm)	Topsoil	spoil
3.0000	96.000%	87.000%
2.0000	95.000%	85.000%
1.0000	92.000%	77.000%
0.5000	90.000%	68.000%
0.3000	88.000%	58.000%
0.2000	85.000%	46.000%
0.1000	74.000%	27.000%
0.0500	55.000%	16.000%
0.0300	44.000%	12.000%
0.0200	37.000%	8.000%
0.0100	28.000%	4.500%
0.0050	21.000%	3.500%
0.0030	15.000%	2.000%
0.0010	6.000%	0.500%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Null	#1	==>	#2	0.290	0.363	SLURRY 4 RECLAIMED
Null	#2	==>	#3	0.007	0.449	SLURRY 3 RECLAIMED
Pond	#3	==>	#4	0.038	0.363	POND 013A
Pond	#4	==>	End	0.000	0.000	POND 013



Structure Routing Details:

Stru #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	7. Paved area and small upland gullies	5.00	235.00	4,700.00	4.50	0.290
#1	**Muskingum K:**					**0.290**
#2	8. Large gullies, diversions, and low flowing streams	25.00	100.00	400.00	15.00	0.007
#2	**Muskingum K:**					**0.007**
#3	7. Paved area and small upland gullies	5.00	31.25	625.00	4.50	0.038
#3	**Muskingum K:**					**0.038**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#1		102.800	102.800	148.76	15.02	112.2	20,423	15.29	4.10
#2		267.400	370.200	441.92	55.39	14,731.3	353,071	265.23	133.77
#3	In	85.600	455.800	516.43	65.04	15,114.5	308,742	231.95	117.81
	Out			408.34	65.04	1,247.0	29,576	8.98	4.30
#4	In	203.000	658.800	514.87	82.97	1,284.2	22,628	7.16	3.60
	Out			110.83	82.97	668.1	8,376	0.04	0.03

Particle Size Distribution(s) at Each Structure

Structure #1 (SLURRY 4 RECLAIMED):

Size (mm)	In/Out
3.0000	96.175%
2.0000	95.586%
1.0000	91.440%
0.5000	80.768%
0.3000	68.906%
0.2000	54.649%
0.1000	32.077%
0.0500	19.008%
0.0300	14.256%
0.0200	9.504%
0.0100	5.346%
0.0050	4.158%
0.0030	2.376%
0.0010	0.594%

Structure #2 (SLURRY 3 RECLAIMED):

Size (mm)	In/Out
3.0000	97.407%
2.0000	95.185%
1.0000	86.280%
0.5000	76.200%
0.3000	64.999%
0.2000	51.558%
0.1000	30.277%
0.0500	17.956%
0.0300	13.475%
0.0200	8.992%
0.0100	5.064%
0.0050	3.938%
0.0030	2.253%
0.0010	0.565%

Structure #3 (POND 013A):

Size (mm)	In	Out
3.0000	97.245%	100.000%
2.0000	95.044%	100.000%
1.0000	86.197%	100.000%
0.5000	76.128%	100.000%
0.3000	64.940%	100.000%
0.2000	51.511%	100.000%
0.1000	30.249%	100.000%
0.0500	17.939%	100.000%
0.0300	13.462%	100.000%
0.0200	8.984%	100.000%
0.0100	5.059%	61.321%
0.0050	3.934%	47.686%
0.0030	2.251%	27.280%
0.0010	0.565%	6.843%

Structure #4:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	99.582%	100.000%
0.5000	98.261%	100.000%
0.3000	96.794%	100.000%
0.2000	94.833%	100.000%
0.1000	91.536%	100.000%
0.0500	89.628%	100.000%
0.0300	88.934%	100.000%
0.0200	88.240%	100.000%
0.0100	60.325%	100.000%
0.0050	46.912%	90.171%
0.0030	26.836%	51.583%
0.0010	6.731%	12.938%

Structure Detail:

Structure #1 (Null)

SLURRY 4 RECLAIMED

Structure #2 (Null)

SLURRY 3 RECLAIMED

Structure #3 (Pond)

POND 013A

Pond Inputs:

Initial Pool Elev:	501.50 ft
Initial Pool:	4.76 ac-ft
*Sediment Storage:	5.20 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Pond Results:

Peak Elevation:	505.12 ft
H'graph Detention Time:	0.51 hrs
Pond Model:	CSTRS
Dewater Time:	1.49 days
Trap Efficiency:	91.75 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
499.00	1.521	0.000	0.000		Top of Sed. Storage
499.50	1.686	0.795	0.000		
500.00	1.860	1.681	0.000		
500.50	1.988	2.643	0.000		
501.00	2.120	3.669	0.000		
501.50	2.260	4.764	0.000		
502.00	2.400	5.929	3.130	30.65	
502.50	2.543	7.165	44.800	1.70	
503.00	2.690	8.473	86.470	0.40	
503.50	2.843	9.856	148.235	1.35	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
504.00	3.000	11.316	210.000	0.80	
504.50	3.163	12.857	295.500	0.50	
505.00	3.330	14.480	381.000	0.30	
505.12	3.326	14.898	408.342	0.10	Peak Stage
505.50	3.424	16.168	491.500		
506.00	3.520	17.904	602.000		
506.50	3.619	19.689	658.500		
507.00	3.720	21.524	715.000		
507.50	3.819	23.409	992.500		
508.00	3.920	25.343	1,270.000		
508.50	4.014	27.327	1,835.000		
509.00	4.110	29.358	2,400.000		
509.50	4.204	31.437	2,600.000		
510.00	4.300	33.563	2,800.000		
510.50	4.399	35.738	3,000.000		
511.00	4.500	37.962	3,200.000		
511.50	4.599	40.237	3,400.000		
512.00	4.700	42.562	3,600.000		

Detailed Discharge Table

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
499.00	0.000	0.000
499.50	0.000	0.000
500.00	0.000	0.000
500.50	0.000	0.000
501.00	0.000	0.000
501.50	0.000	0.000
502.00	3.130	3.130
502.50	44.800	44.800
503.00	86.470	86.470
503.50	148.235	148.235
504.00	210.000	210.000
504.50	295.500	295.500
505.00	381.000	381.000
505.50	491.500	491.500
506.00	602.000	602.000
506.50	658.500	658.500

Elevation (ft)	User-input discharge (cfs)	Combined Total Discharge (cfs)
507.00	715.000	715.000
507.50	992.500	992.500
508.00	1,270.000	1,270.000
508.50	1,835.000	1,835.000
509.00	2,400.000	2,400.000
509.50	2,600.000	2,600.000
510.00	2,800.000	2,800.000
510.50	3,000.000	3,000.000
511.00	3,200.000	3,200.000
511.50	3,400.000	3,400.000
512.00	3,600.000	3,600.000

Structure #4 (Pond)

POND 013

Pond Inputs:

Initial Pool Elev:	454.50 ft
Initial Pool:	19.24 ac-ft
*Sediment Storage:	5.70 ac-ft
Dead Space:	0.20 %

**Sediment capacity was entered by user*

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)
24.00	7.00	24.00	100.00	2.00	0.0240	454.50

Drop Inlet

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)
30.00	7.00	30.00	100.00	2.00	0.0240	454.50

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
464.70	10.00	2.00:1	2.00:1	50.00

Pond Results:

Peak Elevation:	463.32 ft
H'graph Detention Time:	3.73 hrs
Pond Model:	CSTRS
Dewater Time:	1.43 days
Trap Efficiency:	47.97 %

Dewatering time is calculated from peak stage to lowest spillway

Elevation-Capacity-Discharge Table

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
447.57	1.905	0.000	0.000		Top of Sed. Storage
448.00	2.028	0.848	0.000		
448.50	2.176	1.899	0.000		
449.00	2.329	3.025	0.000		
449.50	2.487	4.229	0.000		
450.00	2.650	5.513	0.000		
450.50	2.736	6.859	0.000		
451.00	2.823	8.249	0.000		
451.50	2.911	9.682	0.000		
452.00	3.001	11.160	0.000		
452.50	3.092	12.683	0.000		
453.00	3.184	14.252	0.000		
453.50	3.278	15.868	0.000		
454.00	3.373	17.531	0.000		
454.50	3.470	19.241	0.000		Spillway #1 Spillway #2
455.00	3.570	21.001	15.495	26.00	
455.50	3.804	22.844	38.762	0.90	
456.00	4.045	24.806	47.474	0.60	
456.50	4.293	26.891	54.818	0.50	
457.00	4.549	29.101	61.288	0.50	
457.50	4.812	31.441	67.138	0.45	
458.00	5.083	33.915	72.517	0.45	
458.50	5.361	36.526	77.524	0.40	
459.00	5.647	39.278	82.227	0.45	
459.50	5.940	42.174	86.675	0.40	
460.00	6.240	45.219	90.905	0.45	
460.50	6.427	48.386	94.948	0.45	
461.00	6.617	51.647	98.509	0.40	
461.50	6.810	55.004	101.396	0.40	

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
462.00	7.006	58.457	104.194	0.45	
462.50	7.204	62.010	106.910	0.45	
463.00	7.405	65.662	109.552	0.50	
463.32	7.535	68.032	110.825	0.65	Peak Stage
463.50	7.609	69.416	111.568		
464.00	7.816	73.272	113.107		
464.50	8.026	77.232	114.626		
464.70	8.110	78.846	115.227		Spillway #3
465.00	8.210	81.294	149.930		
465.50	8.374	85.440	207.755		
466.00	8.540	89.668	326.475		
466.50	8.704	93.979	478.457		
467.00	8.870	98.373	655.724		
467.50	9.034	102.849	858.398		
468.00	9.200	107.407	1,085.208		
468.50	9.374	112.051	1,335.309		
469.00	9.550	116.782	1,608.120		
469.50	9.724	121.600	1,903.238		
470.00	9.900	126.506	2,220.388		
470.50	10.121	131.511	2,559.384		
471.00	10.345	136.628	2,920.110		
471.50	10.571	141.857	3,302.503		
472.00	10.800	147.200	3,706.542		
472.50	11.075	152.668	4,132.239		
473.00	11.353	158.275	4,579.631		
473.50	11.635	164.022	5,048.779		
474.00	11.920	169.910	5,539.761		
474.50	12.210	175.943	6,052.668		
475.00	12.503	182.121	6,587.606		
475.50	12.800	188.446	7,144.691		
476.00	13.100	194.921	7,724.044		
476.50	13.371	201.539	8,325.799		
477.00	13.644	208.293	8,950.091		
477.50	13.921	215.184	9,597.063		
478.00	14.200	222.214	10,266.860		

Detailed Discharge Table

Elevation (ft)	Drop Inlet (cfs)	Drop Inlet (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
447.57	0.000	0.000	0.000	0.000
448.00	0.000	0.000	0.000	0.000
448.50	0.000	0.000	0.000	0.000
449.00	0.000	0.000	0.000	0.000
449.50	0.000	0.000	0.000	0.000
450.00	0.000	0.000	0.000	0.000
450.50	0.000	0.000	0.000	0.000
451.00	0.000	0.000	0.000	0.000
451.50	0.000	0.000	0.000	0.000
452.00	0.000	0.000	0.000	0.000
452.50	0.000	0.000	0.000	0.000
453.00	0.000	0.000	0.000	0.000
453.50	0.000	0.000	0.000	0.000
454.00	0.000	0.000	0.000	0.000
454.50	0.000	0.000	0.000	0.000
455.00	6.886	8.608	0.000	15.495
455.50	15.127	23.635	0.000	38.762
456.00	18.526	28.947	0.000	47.474
456.50	21.392	33.426	0.000	54.818
457.00	23.917	37.371	0.000	61.288
457.50	26.200	40.938	0.000	67.138
458.00	28.299	44.218	0.000	72.517
458.50	30.253	47.271	0.000	77.524
459.00	32.089	50.138	0.000	82.227
459.50	33.824	52.851	0.000	86.675
460.00	35.475	55.430	0.000	90.905
460.50	37.053	57.895	0.000	94.948
461.00	38.251	60.259	0.000	98.509
461.50	38.863	62.534	0.000	101.396
462.00	39.465	64.728	0.000	104.194
462.50	40.059	66.851	0.000	106.910
463.00	40.644	68.909	0.000	109.552
463.50	41.220	70.348	0.000	111.568
464.00	41.789	71.319	0.000	113.107
464.50	42.350	72.276	0.000	114.626
464.70	42.572	72.655	0.000	115.227
465.00	42.903	73.221	33.806	149.930
465.50	43.450	74.154	90.152	207.755
466.00	43.990	75.075	207.411	326.475
466.50	44.523	75.985	357.949	478.457

Elevation (ft)	Drop Inlet (cfs)	Drop Inlet (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
467.00	45.050	76.884	533.790	655.724
467.50	45.570	77.773	735.054	858.398
468.00	46.085	78.652	960.471	1,085.208
468.50	46.595	79.521	1,209.193	1,335.309
469.00	47.098	80.381	1,480.641	1,608.120
469.50	47.597	81.231	1,774.410	1,903.238
470.00	48.090	82.073	2,090.225	2,220.388
470.50	48.578	82.906	2,427.899	2,559.384
471.00	49.062	83.731	2,787.317	2,920.110
471.50	49.540	84.548	3,168.415	3,302.503
472.00	50.014	85.357	3,571.171	3,706.542
472.50	50.484	86.159	3,995.596	4,132.239
473.00	50.949	86.953	4,441.729	4,579.631
473.50	51.410	87.740	4,909.629	5,048.779
474.00	51.867	88.520	5,399.374	5,539.761
474.50	52.320	89.293	5,911.055	6,052.668
475.00	52.770	90.059	6,444.778	6,587.606
475.50	53.215	90.819	7,000.657	7,144.691
476.00	53.656	91.573	7,578.815	7,724.044
476.50	54.094	92.320	8,179.384	8,325.799
477.00	54.529	93.062	8,802.500	8,950.091
477.50	54.960	93.798	9,448.306	9,597.063
478.00	55.388	94.528	10,116.950	10,266.860

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	88.800	0.154	0.000	0.000	72.000	M	135.00	13.217
	2	4.700	0.125	0.000	0.000	75.000	M	8.01	0.780
	3	7.300	0.125	0.000	0.000	60.000	S	4.15	0.534
	4	2.000	0.100	0.000	0.000	81.000	F	5.98	0.495
	Σ	**102.800**						**148.76**	**15.025**
#2	1	126.000	0.700	0.000	0.000	55.000	S	25.81	6.876
	2	141.400	0.253	0.000	0.000	81.000	F	345.45	33.491
	Σ	**370.200**						**441.92**	**55.392**
#3	1	24.500	0.125	0.000	0.000	75.000	M	41.73	4.064
	2	6.400	0.100	0.000	0.000	81.000	F	19.12	1.583
	3	54.700	0.125	0.000	0.000	60.000	S	31.10	4.000
	Σ	**455.800**						**516.43**	**65.039**
#4	1	34.000	0.125	0.000	0.000	75.000	M	57.92	5.639
	2	169.000	0.267	0.000	0.000	60.000	S	77.83	12.290
	Σ	**658.800**						**514.87**	**82.968**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#1	1	0.240	200.00	5.00	0.0500	1.0000	2	74.1	6,406	4.77	3.06
	2	0.320	200.00	6.00	0.0500	1.0000	2	4.9	7,246	5.40	3.47
	3	0.320	200.00	5.00	0.0030	1.0000	2	0.2	314	0.23	0.16
	4	0.240	200.00	5.00	0.9000	1.0000	2	33.0	75,248	56.94	36.28
	Σ							**112.2**	**20,423**	**15.29**	**4.10**
#2	1	0.320	200.00	11.00	0.0030	1.0000	1	5.1	675	0.17	0.13
	2	0.240	200.00	15.00	0.9000	1.0000	2	14,621.2	415,427	312.18	210.91
	Σ							**14,731.3**	**353,071**	**265.23**	**133.77**
#3	1	0.300	200.00	16.00	0.0500	1.0000	2	112.9	31,427	23.43	15.10
	2	0.240	200.00	10.00	0.9000	1.0000	2	267.9	182,459	138.05	89.02
	3	0.320	200.00	9.00	0.0030	1.0000	2	2.8	753	0.55	0.37
	Σ							**15,114.5**	**308,742**	**231.95**	**117.81**

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#4	1	0.300	200.00	15.00	0.0500	1.0000	2	150.5	30,199	22.52	14.50
	2	0.300	200.00	15.00	0.0030	1.0000	2	18.4	1,519	1.09	0.79
	Σ							**1,284.2**	**22,628**	**7.16**	**3.60**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#2	2	7. Paved area and small upland gullies	5.00	205.00	4,100.00	4.500	0.253
#2	**2**	**Time of Concentration:**					**0.253**
#4	2	7. Paved area and small upland gullies	1.68	42.00	2,500.00	2.600	0.267
#4	**2**	**Time of Concentration:**					**0.267**