KODIAK MINING
COKE MINE NO. 1
BASIN 012, 013, 018A and 018
R-5 RE-EVALUATION
with culvert at CO RD 260

10 YEAR,24 HOUR EVENT

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General Information

Storm Information:

Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.000 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	96.000%
2.0000	97.000%	92.000%
1.0000	93.000%	82.000%
0.5000	85.000%	70.000%
0.3000	78.000%	56.000%
0.2000	72.000%	48.000%
0.0500	46.000%	27.000%
0.0300	37.000%	20.000%
0.0200	29.000%	18.000%
0.0100	20.000%	14.000%
0.0050	18.000%	8.000%
0.0030	9.000%	5.000%
0.0010	4.000%	2.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#4	0.160	0.329	Basin 013
Pond	#2	==>	#3	0.000	0.000	Basin 012
Pond	#3	==>	End	0.000	0.000	Basin 018
Pond	#4	==>	#3	0.078	0.294	Basin 018A
Culvert	#5	==>	#4	0.080	0.377	Co Rd 260 culvert

		#5 Culvert
		#1 Pond
	#4 Pond	
	#2 Pond	
#3 Pond		

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	2.64	50.00	1,891.00	3.27	0.160
#1	**Muskingum K:**					**0.160**
#4	7. Paved area and small upland gullies	1.45	10.00	688.00	2.42	0.078
#4	**Muskingum K:**					**0.078**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5		161.000	161.000	120.70	31.42	4,935.1	195,651	132.32	73.80
#1	In	30.500	30.500	29.29	7.46	1,151.7	212,601	132.13	66.63
	Out			10.41	7.44	86.3	10,267	0.00	0.00
#4	In	211.700	403.200	293.92	80.70	5,474.8	108,160	71.88	32.81
	Out			263.33	80.19	834.7	15,225	0.44	0.23
#2	In	14.700	14.700	17.25	4.13	302.3	91,529	62.43	35.72
	Out			9.19	4.13	14.4	3,397	0.00	0.00
#3	In	143.400	561.300	390.99	117.24	6,073.9	94,865	50.67	20.78
	Out			327.31	110.76	1,923.1	25,541	0.40	0.20

Particle Size Distribution(s) at Each Structure

Structure #5 (Co Rd 260 culvert):

Size (mm)	In/Out
3.0000	100.000%
2.0000	96.324%
1.0000	85.902%
0.5000	73.395%
0.3000	58.805%
0.2000	50.452%
0.0500	28.412%
0.0300	21.063%
0.0200	18.931%
0.0100	14.709%
0.0050	8.444%
0.0030	5.264%
0.0010	2.108%

Structure #1 (Basin 013):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	97.003%	100.000%
1.0000	93.007%	100.000%
0.5000	85.014%	100.000%
0.3000	78.021%	100.000%
0.2000	72.024%	100.000%
0.0500	46.015%	100.000%
0.0300	37.012%	100.000%
0.0200	29.010%	100.000%
0.0100	20.007%	100.000%
0.0050	18.006%	100.000%
0.0030	9.003%	100.000%
0.0010	4.001%	53.395%

Structure #4 (Basin 018A):

Size (mm)	In	Out
3.0000	99.744%	100.000%
2.0000	96.160%	100.000%
1.0000	86.063%	100.000%
0.5000	73.898%	100.000%
0.3000	59.741%	100.000%
0.2000	51.594%	100.000%
0.0500	29.852%	100.000%
0.0300	22.596%	100.000%
0.0200	20.384%	100.000%
0.0100	16.139%	100.000%
0.0050	10.066%	66.022%
0.0030	6.824%	44.762%
0.0010	2.951%	19.359%

Structure #2 (Basin 012):

Size (mm)	In	Out
3.0000	96.000%	100.000%
2.0000	92.000%	100.000%
1.0000	82.000%	100.000%
0.5000	70.000%	100.000%
0.3000	56.000%	100.000%
0.2000	48.000%	100.000%
0.0500	27.000%	100.000%
0.0300	20.000%	100.000%
0.0200	18.000%	100.000%
0.0100	14.000%	100.000%
0.0050	8.000%	100.000%
0.0030	5.000%	100.000%
0.0010	2.000%	42.112%

Structure #3:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	99.382%	100.000%
1.0000	97.216%	100.000%
0.5000	90.076%	100.000%
0.3000	83.784%	100.000%
0.2000	78.404%	100.000%

Size (mm)	In	Out
0.0500	55.125%	100.000%
0.0300	47.067%	100.000%
0.0200	39.920%	100.000%
0.0100	31.874%	100.000%
0.0050	25.403%	80.231%
0.0030	14.438%	45.601%
0.0010	6.337%	20.015%

Structure Detail:

Structure #5 (Culvert)

Co Rd 260 culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
120.00	2.00	0.0240	15.00	0.00	0.90

Culvert Results:

Design Discharge = 120.70 cfs

Minimum pipe diameter: 1 - 42 inch pipe(s) required

Structure #1 (Pond)

Basin 013

Pond Inputs:

Initial Pool Elev:	432.65 ft
Initial Pool:	4.97 ac-ft
*Sediment Storage:	4.80 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	100.00	3.00	0.0240	432.65	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
437.00	10.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	434.05 ft
H'graph Detention Time:	3.91 hrs
Pond Model:	CSTRS
Dewater Time:	0.82 days

Trap Efficiency:	92.51 %

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)	
428.94	1.019	0.000	0.000		Top of Sed. Storage
429.00	1.026	0.058	0.000		
429.50	1.087	0.586	0.000		
430.00	1.150	1.145	0.000		
430.50	1.255	1.746	0.000		
431.00	1.365	2.401	0.000		
431.50	1.480	3.112	0.000		
432.00	1.599	3.882	0.000		
432.50	1.723	4.712	0.000		
432.65	1.761	4.974	0.000		Spillway #1
433.00	1.851	5.606	1.308	5.85*	
433.50	1.984	6.564	4.930	8.75	
434.00	2.121	7.590	9.856	4.45	
434.05	2.137	7.692	10.408	0.65	Peak Stage
434.50	2.263	8.686	15.816		
435.00	2.410	9.855	22.629		
435.50	2.550	11.094	30.226		
436.00	2.694	12.406	38.516		
436.50	2.843	13.790	45.710		
437.00	2.995	15.249	52.039		Spillway #2
437.50	3.150	16.785	61.796		
438.00	3.311	18.400	116.828		
438.50	3.475	20.096	179.567		
439.00	3.642	21.875	253.430		
439.50	3.814	23.739	340.573		
440.00	3.990	25.690	441.348		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
428.94	0.000	0.000	0.000
429.00	0.000	0.000	0.000
429.50	0.000	0.000	0.000
430.00	0.000	0.000	0.000
430.50	0.000	0.000	0.000
431.00	0.000	0.000	0.000
431.50	0.000	0.000	0.000
432.00	0.000	0.000	0.000
432.50	0.000	0.000	0.000
432.65	0.000	0.000	0.000
433.00	(3)>1.308	0.000	1.308
433.50	(3)>4.930	0.000	4.930
434.00	(3)>9.856	0.000	9.856
434.50	(3)>15.816	0.000	15.816
435.00	(3)>22.629	0.000	22.629
435.50	(3)>30.226	0.000	30.226
436.00	(3)>38.516	0.000	38.516
436.50	(5)>45.710	0.000	45.710
437.00	(5)>52.039	0.000	52.039
437.50	(5)>57.674	4.122	61.796
438.00	(5)>62.812	54.016	116.828
438.50	(5)>67.551	112.015	179.567
439.00	(6)>70.777	182.653	253.430
439.50	(6)>73.329	267.245	340.573
440.00	(6)>75.775	365.573	441.348

Structure #4 (Pond)

Basin 018A

Pond Inputs:

Initial Pool Elev:	410.50 ft
Initial Pool:	1.92 ac-ft
*Sediment Storage:	13.00 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Fixed Siphon

Crest Elev	Inlet Elev	Outlet Elev	Diameter (in)	Length (ft)	Manning's n
412.00	410.50	400.00	6.00	100.00	0.0150

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
412.50	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	415.31 ft
H'graph Detention Time:	2.13 hrs
Pond Model:	CSTRS
Dewater Time:	1.60 days
Trap Efficiency:	84.75 %

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)	
409.58	2.004	0.000	0.000		Top of Sed. Storage
410.00	2.090	0.854	0.000		
410.50	2.159	1.916	0.000		
411.00	2.229	3.013	2.794	4.75*	
411.50	2.300	4.145	2.860	4.95	
412.00	2.373	5.314	2.925	5.25	Spillway #1
412.50	2.446	6.518	2.989	5.90	Spillway #2
413.00	2.521	7.760	6.154	4.85	
413.50	2.596	9.039	44.388	5.85	
414.00	2.673	10.356	89.643	5.15	
414.50	2.751	11.712	145.539	0.95	
415.00	2.830	13.108	213.321	0.40	
415.31	2.873	14.006	263.325	0.35	Peak Stage
415.50	2.901	14.540	293.019		
416.00	2.973	16.009	384.789		
416.50	3.046	17.514	488.856		
417.00	3.120	19.055	605.481		
417.50	3.194	20.634	734.946		
418.00	3.270	22.250	877.548		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Fixed Siphon (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
409.58	0.000	0.000	0.000
410.00	0.000	0.000	0.000
410.50	0.000	0.000	0.000
411.00	2.794*	0.000	2.794
411.50	2.860*	0.000	2.860
412.00	2.925	0.000	2.925
412.50	2.989	0.000	2.989
413.00	3.051	3.103	6.154
413.50	3.113	41.275	44.388
414.00	3.173	86.470	89.643
414.50	3.233	142.306	145.539
415.00	3.291	210.030	213.321
415.50	3.348	289.670	293.019
416.00	3.405	381.384	384.789
416.50	3.461	485.395	488.856
417.00	3.516	601.965	605.481
417.50	3.570	731.377	734.946
418.00	3.623	873.925	877.548

Structure #2 (Pond)

Basin 012

Pond Inputs:

Initial Pool Elev:	400.10 ft
Initial Pool:	2.38 ac-ft
*Sediment Storage:	3.60 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	100.00	2.00	0.0240	400.10	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
403.70	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	401.38 ft
H'graph Detention Time:	2.19 hrs
Pond Model:	CSTRS
Dewater Time:	1.15 days
Trap Efficiency:	95.25 %

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)	
397.14	0.709	0.000	0.000		Top of Sed. Storage
397.50	0.731	0.258	0.000		
398.00	0.764	0.632	0.000		
398.50	0.797	1.022	0.000		
399.00	0.830	1.428	0.000		
399.50	0.865	1.852	0.000		
400.00	0.900	2.293	0.000		
400.10	0.907	2.384	0.000		Spillway #1
400.50	0.937	2.752	1.590	17.45	
401.00	0.974	3.230	5.369	8.40	
401.38	1.003	3.607	9.189	1.70	Peak Stage
401.50	1.012	3.727	10.408		
402.00	1.051	4.243	16.454		
402.50	1.091	4.778	23.361		
403.00	1.131	5.334	31.024		
403.50	1.172	5.910	39.384		
403.70	1.189	6.146	42.254		Spillway #2
404.00	1.214	6.506	56.962		
404.50	1.257	7.124	80.831		
405.00	1.300	7.763	123.395		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
397.14	0.000	0.000	0.000
397.50	0.000	0.000	0.000
398.00	0.000	0.000	0.000
398.50	0.000	0.000	0.000
399.00	0.000	0.000	0.000
399.50	0.000	0.000	0.000
400.00	0.000	0.000	0.000
400.10	0.000	0.000	0.000
400.50	(3)>1.590	0.000	1.590
401.00	(3)>5.369	0.000	5.369
401.50	(3)>10.408	0.000	10.408
402.00	(3)>16.454	0.000	16.454
402.50	(3)>23.361	0.000	23.361
403.00	(3)>31.024	0.000	31.024
403.50	(3)>39.384	0.000	39.384
403.70	(5)>42.254	0.000	42.254
404.00	(5)>46.388	10.575	56.962
404.50	(5)>52.631	28.200	80.831
405.00	(6)>56.610	66.785	123.395

Structure #3 (Pond)

Basin 018

Pond Inputs:

Initial Pool Elev:	379.00 ft
Initial Pool:	4.67 ac-ft
*Sediment Storage:	7.20 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
381.00	10.00	2.00:1	2.00:1	20.00

Fixed Siphon

Crest Elev	Inlet Elev	Outlet Elev	Diameter (in)	Length (ft)	Manning's n
380.00	379.00	374.50	6.00	100.00	0.0150

Pond Results:

Peak Elevation:	383.80 ft
H'graph Detention Time:	1.06 hrs
Pond Model:	CSTRS
Dewater Time:	3.30 days
Trap Efficiency:	68.34 %

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)	
377.21	2.190	0.000	0.000		Top of Sed. Storage
377.70	2.412	1.135	0.000		
378.20	2.647	2.399	0.000		
378.70	2.893	3.784	0.000		
379.00	3.046	4.674	0.000		
379.20	3.150	5.294	1.783	4.21*	
379.70	3.417	6.935	1.881	10.56*	
380.00	3.582	7.985	1.937	6.56*	Spillway #2
380.20	3.649	8.708	1.974	4.43*	
380.70	3.819	10.575	2.064	10.95*	
381.00	3.923	11.736	2.116	6.64*	Spillway #1
381.20	3.993	12.527	10.466	21.70	
381.70	4.170	14.568	31.338	2.25	
382.20	4.351	16.698	77.563	8.10	
382.70	4.536	18.920	140.962	2.25	
383.20	4.725	21.235	217.302	0.85	
383.70	4.918	23.646	307.474	0.50	
383.80	4.957	24.124	327.310	0.20	Peak Stage
384.20	5.114	26.153	411.356		
384.70	5.315	28.761	528.974		
385.00	5.437	30.373	606.183		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Fixed Siphon (cfs)	Combined Total Discharge (cfs)
377.21	0.000	0.000	0.000
377.70	0.000	0.000	0.000
378.20	0.000	0.000	0.000
378.70	0.000	0.000	0.000
379.00	0.000	0.000	0.000
379.20	0.000	1.783*	1.783
379.70	0.000	1.881*	1.881
380.00	0.000	1.937	1.937
380.20	0.000	1.974	1.974
380.70	0.000	2.064	2.064
381.00	0.000	2.116	2.116
381.20	8.316	2.150	10.466
381.70	29.104	2.233	31.338
382.20	75.248	2.314	77.563
382.70	138.570	2.392	140.962
383.20	214.834	2.468	217.302
383.70	304.932	2.542	307.474
384.20	408.742	2.614	411.356
384.70	526.289	2.685	528.974
385.00	603.457	2.726	606.183

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	120.000	0.126	0.000	0.000	70.000	S	71.84	18.921
	2	41.000	0.213	0.000	0.000	81.000	F	49.05	12.495
	Σ	**161.000**						**120.70**	**31.416**
#1	1	16.000	0.097	0.000	0.000	81.000	F	20.77	5.171
	2	14.500	0.125	0.000	0.000	70.000	S	8.68	2.286
	Σ	**30.500**						**29.29**	**7.457**
#4	1	37.200	0.125	0.049	0.388	70.000	S	22.27	5.865
	2	14.600	0.100	0.024	0.385	70.000	F	14.75	3.407
	3	23.000	0.125	0.102	0.345	70.000	S	13.77	3.626
	4	27.000	0.100	0.000	0.000	70.000	F	27.29	6.301
	5	16.400	0.125	0.210	0.336	70.000	S	9.82	2.586
	6	16.800	0.100	0.108	0.340	70.000	F	16.98	3.921
	7	53.400	0.115	0.000	0.000	70.000	F	53.96	12.462
	8	23.300	0.125	0.000	0.000	70.000	S	13.95	3.674
	Σ	**403.200**						**293.92**	**80.703**
#2	1	14.700	0.120	0.000	0.000	76.000	M	17.25	4.134
	Σ	**14.700**						**17.25**	**4.134**
#3	1	15.600	0.050	0.053	0.386	81.000	F	20.25	5.042
	2	53.400	0.292	0.000	0.000	81.000	F	63.21	16.209
	3	59.000	0.279	0.000	0.000	70.000	S	32.66	9.231
	4	15.400	0.125	0.000	0.000	70.000	S	9.22	2.428
	Σ	**561.300**						**390.99**	**117.237**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.320	200.00	14.00	0.0030	1.0000	1	21.8	1,475	0.83	0.48
	2	0.240	200.00	24.00	0.9000	1.0000	2	4,913.4	424,316	287.18	171.64
	Σ							**4,935.1**	**195,651**	**132.32**	**73.80**
#1	1	0.320	200.00	13.00	0.9000	1.0000	1	1,150.6	258,267	160.52	94.11
	2	0.240	200.00	11.00	0.0030	1.0000	1	1.1	623	0.35	0.20

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**1,151.7**	**212,601**	**132.13**	**66.63**
#4	1	0.320	200.00	18.00	0.0030	1.0000	1	8.0	1,744	0.98	0.56
	2	0.240	200.00	30.00	0.0500	1.0000	1	82.6	31,304	19.46	10.98
	3	0.320	200.00	21.00	0.0030	1.0000	1	5.6	1,962	1.10	0.63
	4	0.240	200.00	19.00	0.0500	1.0000	2	99.6	20,503	13.98	7.88
	5	0.320	200.00	15.00	0.0030	1.0000	1	2.6	1,260	0.71	0.41
	6	0.240	200.00	17.00	0.0500	1.0000	2	51.3	16,906	11.53	6.53
	7	0.240	200.00	18.00	0.0500	1.0000	2	200.6	20,880	14.24	8.02
	8	0.320	200.00	19.00	0.0030	1.0000	1	5.0	1,756	0.99	0.57
	Σ							**5,474.8**	**108,160**	**71.88**	**32.81**
#2	1	0.300	200.00	26.00	0.1400	1.0000	2	302.3	91,529	62.43	35.72
	Σ							**302.3**	**91,529**	**62.43**	**35.72**
#3	1	0.240	200.00	18.00	0.9000	1.0000	1	1,256.3	285,488	177.44	104.47
	2	0.300	200.00	13.00	0.9000	1.0000	1	3,950.5	281,522	172.32	100.89
	3	0.320	200.00	21.00	0.0030	1.0000	2	15.3	2,095	1.34	0.78
	4	0.320	200.00	19.00	0.0030	1.0000	1	3.2	1,671	0.94	0.54
	Σ							**6,073.9**	**94,865**	**50.67**	**20.78**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	7. Paved area and small upland gullies	5.24	110.00	2,100.00	4.600	0.126
#1	**1**	**Time of Concentration:**					**0.097**
#1	2	7. Paved area and small upland gullies	2.00	20.00	1,000.00	2.840	0.097
#1	**2**	**Time of Concentration:**					**0.125**
#3	2	7. Paved area and small upland gullies	2.42	80.00	3,300.00	3.130	0.292
#3	**2**	**Time of Concentration:**					**0.292**
#4	1	7. Paved area and small upland gullies	5.24	110.00	2,100.00	4.600	0.126
#4	**1**	**Time of Concentration:**					**0.125**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	7. Paved area and small upland gullies	8.18	90.00	1,100.00	5.750	0.053
#3	**1**	**Muskingum K:**					**0.053**

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KODIAK MINING
COKE MINE NO. 1
BASIN 012, 013, 018A and 018
R-5 RE-EVALUATION
with culvert at CO RD 260

25 YEAR,6 HOUR EVENT

Robert W. Usher, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 HOUR
Design Storm:	25 yr - 6 hr
Rainfall Depth:	5.100 inches

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	96.000%
2.0000	97.000%	92.000%
1.0000	93.000%	82.000%
0.5000	85.000%	70.000%
0.3000	78.000%	56.000%
0.2000	72.000%	48.000%
0.0500	46.000%	27.000%
0.0300	37.000%	20.000%
0.0200	29.000%	18.000%
0.0100	20.000%	14.000%
0.0050	18.000%	8.000%
0.0030	9.000%	5.000%
0.0010	4.000%	2.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	#4	0.160	0.329	Basin 013
Pond	#2	==>	#3	0.000	0.000	Basin 012
Pond	#3	==>	End	0.000	0.000	Basin 018
Pond	#4	==>	#3	0.078	0.294	Basin 018A
Culvert	#5	==>	#4	0.080	0.377	Co Rd 260 culvert

		#5 Culvert
		#1 Pond
	#4 Pond	
	#2 Pond	
#3 Pond		

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	2.64	50.00	1,891.00	3.27	0.160
#1	**Muskingum K:**					**0.160**
#4	7. Paved area and small upland gullies	1.45	10.00	688.00	2.42	0.078
#4	**Muskingum K:**					**0.078**

Structure Summary:

		Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc. (ml/l)	24VW (ml/l)
#5		161.000	161.000	231.27	24.13	6,673.3	313,206	210.00	123.93
#1	In	30.500	30.500	62.02	5.80	1,635.7	334,011	207.58	116.22
	Out			12.10	5.79	122.5	16,944	0.00	0.00
#4	In	211.700	403.200	495.84	61.30	7,396.3	194,293	127.99	57.21
	Out			329.69	61.28	1,251.5	26,441	0.91	0.53
#2	In	14.700	14.700	39.71	3.19	417.9	145,845	99.47	62.96
	Out			9.94	3.19	21.3	5,693	0.00	0.00
#3	In	143.400	561.300	476.97	90.04	8,230.1	277,889	143.72	33.85
	Out			341.81	85.22	2,984.1	59,664	3.34	1.50

Particle Size Distribution(s) at Each Structure

Structure #5 (Co Rd 260 culvert):

Size (mm)	In/Out
3.0000	100.000%
2.0000	100.000%
1.0000	90.155%
0.5000	77.017%
0.3000	61.690%
0.2000	52.931%
0.0500	29.828%
0.0300	22.112%
0.0200	19.876%
0.0100	15.444%
0.0050	8.864%
0.0030	5.527%
0.0010	2.213%

Structure #1 (Basin 013):

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	97.002%	100.000%
1.0000	93.006%	100.000%
0.5000	85.012%	100.000%
0.3000	78.017%	100.000%
0.2000	72.022%	100.000%
0.0500	46.019%	100.000%
0.0300	37.016%	100.000%
0.0200	29.012%	100.000%
0.0100	20.008%	100.000%
0.0050	18.008%	100.000%
0.0030	9.004%	100.000%
0.0010	4.002%	53.441%

Structure #4 (Basin 018A):

Size (mm)	In	Out
3.0000	99.747%	100.000%
2.0000	99.450%	100.000%
1.0000	89.904%	100.000%
0.5000	77.172%	100.000%
0.3000	62.352%	100.000%
0.2000	53.854%	100.000%
0.0500	31.196%	100.000%
0.0300	23.611%	100.000%
0.0200	21.307%	100.000%
0.0100	16.876%	99.733%
0.0050	10.519%	62.163%
0.0030	7.138%	42.185%
0.0010	3.088%	18.251%

Structure #2 (Basin 012):

Size (mm)	In	Out
3.0000	96.000%	100.000%
2.0000	92.000%	100.000%
1.0000	82.000%	100.000%
0.5000	70.000%	100.000%
0.3000	56.000%	100.000%
0.2000	48.000%	100.000%
0.0500	27.000%	100.000%
0.0300	20.000%	100.000%
0.0200	18.000%	100.000%
0.0100	14.000%	100.000%
0.0050	8.000%	100.000%
0.0030	5.000%	98.187%
0.0010	2.000%	39.275%

Structure #3:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	99.352%	100.000%
1.0000	98.485%	100.000%
0.5000	95.173%	100.000%
0.3000	88.621%	100.000%
0.2000	82.984%	100.000%

Size (mm)	In	Out
0.0500	58.591%	100.000%
0.0300	50.147%	100.000%
0.0200	42.655%	100.000%
0.0100	34.185%	94.282%
0.0050	26.580%	73.307%
0.0030	15.106%	41.664%
0.0010	6.626%	18.275%

Structure Detail:

Structure #5 (Culvert)

Co Rd 260 culvert

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
120.00	2.00	0.0240	15.00	0.00	0.90

Culvert Results:

Design Discharge = 231.27 cfs

Minimum pipe diameter: 1 - 54 inch pipe(s) required

Structure #1 (Pond)

Basin 013

Pond Inputs:

Initial Pool Elev:	432.65 ft
Initial Pool:	4.97 ac-ft
*Sediment Storage:	4.80 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	100.00	3.00	0.0240	432.65	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
437.00	10.00	2.00:1	2.00:1	20.00

Pond Results:

Peak Elevation:	434.19 ft
H'graph Detention Time:	3.71 hrs
Pond Model:	CSTRS
Dewater Time:	1.68 days

Trap Efficiency:	92.51 %

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)	
428.94	1.019	0.000	0.000		Top of Sed. Storage
429.00	1.026	0.058	0.000		
429.50	1.087	0.586	0.000		
430.00	1.150	1.145	0.000		
430.50	1.255	1.746	0.000		
431.00	1.365	2.401	0.000		
431.50	1.480	3.112	0.000		
432.00	1.599	3.882	0.000		
432.50	1.723	4.712	0.000		
432.65	1.761	4.974	0.000		Spillway #1
433.00	1.851	5.606	1.308	32.55	
433.50	1.984	6.564	4.930	4.25	
434.00	2.121	7.590	9.856	1.80	
434.19	2.176	8.004	12.103	1.70	Peak Stage
434.50	2.263	8.686	15.816		
435.00	2.410	9.855	22.629		
435.50	2.550	11.094	30.226		
436.00	2.694	12.406	38.516		
436.50	2.843	13.790	45.710		
437.00	2.995	15.249	52.039		Spillway #2
437.50	3.150	16.785	61.796		
438.00	3.311	18.400	116.828		
438.50	3.475	20.096	179.567		
439.00	3.642	21.875	253.430		
439.50	3.814	23.739	340.573		
440.00	3.990	25.690	441.348		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
428.94	0.000	0.000	0.000
429.00	0.000	0.000	0.000
429.50	0.000	0.000	0.000
430.00	0.000	0.000	0.000
430.50	0.000	0.000	0.000
431.00	0.000	0.000	0.000
431.50	0.000	0.000	0.000
432.00	0.000	0.000	0.000
432.50	0.000	0.000	0.000
432.65	0.000	0.000	0.000
433.00	(3)>1.308	0.000	1.308
433.50	(3)>4.930	0.000	4.930
434.00	(3)>9.856	0.000	9.856
434.50	(3)>15.816	0.000	15.816
435.00	(3)>22.629	0.000	22.629
435.50	(3)>30.226	0.000	30.226
436.00	(3)>38.516	0.000	38.516
436.50	(5)>45.710	0.000	45.710
437.00	(5)>52.039	0.000	52.039
437.50	(5)>57.674	4.122	61.796
438.00	(5)>62.812	54.016	116.828
438.50	(5)>67.551	112.015	179.567
439.00	(6)>70.777	182.653	253.430
439.50	(6)>73.329	267.245	340.573
440.00	(6)>75.775	365.573	441.348

Structure #4 (Pond)

Basin 018A

Pond Inputs:

Initial Pool Elev:	410.50 ft
Initial Pool:	1.92 ac-ft
*Sediment Storage:	13.00 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Fixed Siphon

Crest Elev	Inlet Elev	Outlet Elev	Diameter (in)	Length (ft)	Manning's n
412.00	410.50	400.00	6.00	100.00	0.0150

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
412.50	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	415.70 ft
H'graph Detention Time:	2.19 hrs
Pond Model:	CSTRS
Dewater Time:	1.35 days
Trap Efficiency:	83.08 %

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)	
409.58	2.004	0.000	0.000		Top of Sed. Storage
410.00	2.090	0.854	0.000		
410.50	2.159	1.916	0.000		
411.00	2.229	3.013	2.794	4.75*	
411.50	2.300	4.145	2.860	5.00	
412.00	2.373	5.314	2.925	5.25	Spillway #1
412.50	2.446	6.518	2.989	6.15	Spillway #2
413.00	2.521	7.760	6.154	6.05	
413.50	2.596	9.039	44.388	1.80	
414.00	2.673	10.356	89.643	0.50	
414.50	2.751	11.712	145.539	1.25	
415.00	2.830	13.108	213.321	0.95	
415.50	2.901	14.540	293.019	0.45	
415.70	2.930	15.127	329.691	0.20	Peak Stage
416.00	2.973	16.009	384.789		
416.50	3.046	17.514	488.856		
417.00	3.120	19.055	605.481		
417.50	3.194	20.634	734.946		
418.00	3.270	22.250	877.548		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Fixed Siphon (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
409.58	0.000	0.000	0.000
410.00	0.000	0.000	0.000
410.50	0.000	0.000	0.000
411.00	2.794*	0.000	2.794
411.50	2.860*	0.000	2.860
412.00	2.925	0.000	2.925
412.50	2.989	0.000	2.989
413.00	3.051	3.103	6.154
413.50	3.113	41.275	44.388
414.00	3.173	86.470	89.643
414.50	3.233	142.306	145.539
415.00	3.291	210.030	213.321
415.50	3.348	289.670	293.019
416.00	3.405	381.384	384.789
416.50	3.461	485.395	488.856
417.00	3.516	601.965	605.481
417.50	3.570	731.377	734.946
418.00	3.623	873.925	877.548

Structure #2 (Pond)

Basin 012

Pond Inputs:

Initial Pool Elev:	400.10 ft
Initial Pool:	2.38 ac-ft
*Sediment Storage:	3.60 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
36.00	100.00	2.00	0.0240	400.10	0.90	0.00

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
403.70	10.00	2.00:1	2.00:1	15.00

Pond Results:

Peak Elevation:	401.45 ft
H'graph Detention Time:	1.88 hrs
Pond Model:	CSTRS
Dewater Time:	0.86 days
Trap Efficiency:	94.91 %

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)	
397.14	0.709	0.000	0.000		Top of Sed. Storage
397.50	0.731	0.258	0.000		
398.00	0.764	0.632	0.000		
398.50	0.797	1.022	0.000		
399.00	0.830	1.428	0.000		
399.50	0.865	1.852	0.000		
400.00	0.900	2.293	0.000		
400.10	0.907	2.384	0.000		Spillway #1
400.50	0.937	2.752	1.590	16.20	
401.00	0.974	3.230	5.369	1.85	
401.45	1.009	3.681	9.941	2.60	Peak Stage
401.50	1.012	3.727	10.408		
402.00	1.051	4.243	16.454		
402.50	1.091	4.778	23.361		
403.00	1.131	5.334	31.024		
403.50	1.172	5.910	39.384		
403.70	1.189	6.146	42.254		Spillway #2
404.00	1.214	6.506	56.962		
404.50	1.257	7.124	80.831		
405.00	1.300	7.763	123.395		

Detailed Discharge Table

Elevation (ft)	Straight Pipe (cfs)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
397.14	0.000	0.000	0.000
397.50	0.000	0.000	0.000
398.00	0.000	0.000	0.000
398.50	0.000	0.000	0.000
399.00	0.000	0.000	0.000
399.50	0.000	0.000	0.000
400.00	0.000	0.000	0.000
400.10	0.000	0.000	0.000
400.50	(3)>1.590	0.000	1.590
401.00	(3)>5.369	0.000	5.369
401.50	(3)>10.408	0.000	10.408
402.00	(3)>16.454	0.000	16.454
402.50	(3)>23.361	0.000	23.361
403.00	(3)>31.024	0.000	31.024
403.50	(3)>39.384	0.000	39.384
403.70	(5)>42.254	0.000	42.254
404.00	(5)>46.388	10.575	56.962
404.50	(5)>52.631	28.200	80.831
405.00	(6)>56.610	66.785	123.395

Structure #3 (Pond)

Basin 018

Pond Inputs:

Initial Pool Elev:	379.00 ft
Initial Pool:	4.67 ac-ft
*Sediment Storage:	7.20 ac-ft
Dead Space:	0.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
381.00	10.00	2.00:1	2.00:1	20.00

Fixed Siphon

Crest Elev	Inlet Elev	Outlet Elev	Diameter (in)	Length (ft)	Manning's n
380.00	379.00	374.50	6.00	100.00	0.0150

Pond Results:

Peak Elevation:	383.87 ft
H'graph Detention Time:	1.72 hrs
Pond Model:	CSTRS
Dewater Time:	3.19 days
Trap Efficiency:	63.74 %

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)	
377.21	2.190	0.000	0.000		Top of Sed. Storage
377.70	2.412	1.135	0.000		
378.20	2.647	2.399	0.000		
378.70	2.893	3.784	0.000		
379.00	3.046	4.674	0.000		
379.20	3.150	5.294	1.783	4.21*	
379.70	3.417	6.935	1.881	10.56*	
380.00	3.582	7.985	1.937	6.56*	Spillway #2
380.20	3.649	8.708	1.974	4.43*	
380.70	3.819	10.575	2.064	10.95*	
381.00	3.923	11.736	2.116	10.15	Spillway #1
381.20	3.993	12.527	10.466	23.25	
381.70	4.170	14.568	31.338	2.30	
382.20	4.351	16.698	77.563	0.90	
382.70	4.536	18.920	140.962	0.60	
383.20	4.725	21.235	217.302	1.20	
383.70	4.918	23.646	307.474	0.95	
383.87	4.984	24.474	341.807	0.40	Peak Stage
384.20	5.114	26.153	411.356		
384.70	5.315	28.761	528.974		
385.00	5.437	30.373	606.183		

**Designates time(s) to dewater have been extrapolated beyond the 50 hour hydrograph limit.*

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Fixed Siphon (cfs)	Combined Total Discharge (cfs)
377.21	0.000	0.000	0.000
377.70	0.000	0.000	0.000
378.20	0.000	0.000	0.000
378.70	0.000	0.000	0.000
379.00	0.000	0.000	0.000
379.20	0.000	1.783*	1.783
379.70	0.000	1.881*	1.881
380.00	0.000	1.937	1.937
380.20	0.000	1.974	1.974
380.70	0.000	2.064	2.064
381.00	0.000	2.116	2.116
381.20	8.316	2.150	10.466
381.70	29.104	2.233	31.338
382.20	75.248	2.314	77.563
382.70	138.570	2.392	140.962
383.20	214.834	2.468	217.302
383.70	304.932	2.542	307.474
384.20	408.742	2.614	411.356
384.70	526.289	2.685	528.974
385.00	603.457	2.726	606.183

Subwatershed Hydrology Detail:

Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#5	1	120.000	0.126	0.000	0.000	70.000	S	124.93	14.237
	2	41.000	0.213	0.000	0.000	81.000	F	106.34	9.889
	Σ	**161.000**						**231.27**	**24.127**
#1	1	16.000	0.097	0.000	0.000	81.000	F	49.12	4.075
	2	14.500	0.125	0.000	0.000	70.000	S	15.10	1.720
	Σ	**30.500**						**62.02**	**5.796**
#4	1	37.200	0.125	0.049	0.388	70.000	S	38.73	4.414
	2	14.600	0.100	0.024	0.385	70.000	F	32.72	2.550
	3	23.000	0.125	0.102	0.345	70.000	S	23.94	2.729
	4	27.000	0.100	0.000	0.000	70.000	F	60.52	4.716
	5	16.400	0.125	0.210	0.336	70.000	S	17.07	1.946
	6	16.800	0.100	0.108	0.340	70.000	F	37.65	2.935
	7	53.400	0.115	0.000	0.000	70.000	F	119.69	9.328
	8	23.300	0.125	0.000	0.000	70.000	S	24.26	2.764
	Σ	**403.200**						**495.84**	**61.302**
#2	1	14.700	0.120	0.000	0.000	76.000	M	39.71	3.187
	Σ	**14.700**						**39.71**	**3.187**
#3	1	15.600	0.050	0.053	0.386	81.000	F	47.89	3.973
	2	53.400	0.292	0.000	0.000	81.000	F	128.36	12.829
	3	59.000	0.279	0.000	0.000	70.000	S	50.33	6.946
	4	15.400	0.125	0.000	0.000	70.000	S	16.03	1.827
	Σ	**561.300**						**476.97**	**90.043**

Subwatershed Sedimentology Detail:

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
#5	1	0.320	200.00	14.00	0.0030	1.0000	1	25.3	1,992	1.06	0.69
	2	0.240	200.00	24.00	0.9000	1.0000	2	6,648.0	592,335	397.47	271.62
	Σ							**6,673.3**	**313,206**	**210.00**	**123.93**
#1	1	0.320	200.00	13.00	0.9000	1.0000	1	1,634.4	392,714	244.09	161.40
	2	0.240	200.00	11.00	0.0030	1.0000	1	1.3	841	0.45	0.29

Stru #	SWS #	Soil K	L (ft)	S (%)	C	P	PS #	Sediment (tons)	Peak Sediment Conc. (mg/l)	Peak Settleable Conc (ml/l)	24VW (ml/l)
	Σ							**1,635.7**	**334,011**	**207.58**	**116.22**
#4	1	0.320	200.00	18.00	0.0030	1.0000	1	9.3	2,356	1.25	0.82
	2	0.240	200.00	30.00	0.0500	1.0000	1	110.0	50,964	31.68	19.43
	3	0.320	200.00	21.00	0.0030	1.0000	1	6.5	2,634	1.40	0.93
	4	0.240	200.00	19.00	0.0500	1.0000	2	132.6	33,472	22.83	13.97
	5	0.320	200.00	15.00	0.0030	1.0000	1	3.0	1,679	0.89	0.60
	6	0.240	200.00	17.00	0.0500	1.0000	2	68.4	27,249	18.59	11.59
	7	0.240	200.00	18.00	0.0500	1.0000	2	267.2	34,085	23.25	14.23
	8	0.320	200.00	19.00	0.0030	1.0000	1	5.9	2,373	1.26	0.83
	Σ							**7,396.3**	**194,293**	**127.99**	**57.21**
#2	1	0.300	200.00	26.00	0.1400	1.0000	2	417.9	145,845	99.47	62.96
	Σ							**417.9**	**145,845**	**99.47**	**62.96**
#3	1	0.240	200.00	18.00	0.9000	1.0000	1	1,784.5	429,394	266.89	178.29
	2	0.300	200.00	13.00	0.9000	1.0000	1	5,153.1	384,654	229.03	155.35
	3	0.320	200.00	21.00	0.0030	1.0000	2	16.6	2,558	1.54	1.06
	4	0.320	200.00	19.00	0.0030	1.0000	1	3.7	2,258	1.20	0.79
	Σ							**8,230.1**	**277,889**	**143.72**	**33.85**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	7. Paved area and small upland gullies	5.24	110.00	2,100.00	4.600	0.126
#1	**1**	**Time of Concentration:**					**0.097**
#1	2	7. Paved area and small upland gullies	2.00	20.00	1,000.00	2.840	0.097
#1	**2**	**Time of Concentration:**					**0.125**
#3	2	7. Paved area and small upland gullies	2.42	80.00	3,300.00	3.130	0.292
#3	**2**	**Time of Concentration:**					**0.292**
#4	1	7. Paved area and small upland gullies	5.24	110.00	2,100.00	4.600	0.126
#4	**1**	**Time of Concentration:**					**0.125**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#3	1	7. Paved area and small upland gullies	8.18	90.00	1,100.00	5.750	0.053
#3	**1**	**Muskingum K:**					**0.053**