Attachment 2.05.3(3)-6

Pond 013

Engineering and Hydrologic Design

Note: Ponds 011 and 012 have been removed from this Attachment. Pond 011 is addresses in Attachment 2.05.3(3)-14 and Pond 012 is addressed in Attachments 2.05.3(3)-12 for design details and 2.05.3(3)-13 for as built details. Pond 010 has been removed from the permit.

Pond 013 was initially designed for the 2000 Permit Amendment. The pond was constructed in 2007. The as built report is included in attachment 2.05.3(3)-21. Due to the decision by WFC to eliminate Pond 010, Ponds 011 and 013 will receive a greater drainage area. This revised design of Pond 013 will demonstrate that the as built pond is sufficient to handle the revised drainage area.

Pond 013 is a partially incised pond designed to contain the flow from a 10 year 24 hour storm below the emergency spillway. the valve on the principal spillway pipe is normally held shut. The principal spillway design is an 18-24" diameter CMP or other pipe which will have a valve on the entrance. This pipe will be stopped down in the inlet side to a 6" valve which will be controlled by a wheel on the pond embankment. During normal conditions, the valve will be shut to provide 24 hour detention time for each pond during the large events. When a large event occurs, the operator will wait a minimum of 36 hours after the storm has ceased to check the water still detained by the pond. An Imhoff cone will only be used to determine if the water can be discharged. If an Imhoff cone shows that the water meets the effluent standard of 0.5ml settleable solids per liter, the valve will be opened until the water has dissipated to the valve level. It will then be shut to allow detention time for subsequent storms. Full sampling and laboratory analyses of the discharge will take place for all discharges, according to the NPDES permit.

Pond 013 Design

Pond 013 must be able to hold the volume of water runoff and sediment load of the worst case scenario. In order to determine the worst case, a comparison of pre mine and post mine drainage patterns, sediment load, and pit pumping is conducted.

Pre Mine Calculations

- 72.4 acre drainage area (See Map 2.05.3(3)-1)
- Pit water is pumped to Pond 011. No contribution to water volume in Pond 013.
- Curve Number (CN) to use: From SEDCAD 4 for Windows Help menu :
    I. Curve Numbers for Other Agricultural Land Category
    II. Cover type: Pasture, grassland, or range -- continuous forage for grazing

III. Hydrologic Condition: Good (Good: >75% ground cover)

IV. Hydrologic Soil Group = C

V. CN=74

Runoff Curve Number and Runoff (SurvCAD)

==========

Project: Pond 013 By: B Langenfeld Date: 08/18/09

Location: New Horizon #2 Checked: Date:

Present

1. Runoff Curve Number (CN)

Cover description	CN	Soil Type	Area(Acre)
Pasture Grassland Range (Good)	74	C	5.242
Pasture Grassland Range (Good)	74	C	6.160
Pasture Grassland Range (Good)	74	C	42.023
Pasture Grassland Range (Good)	74	C	18.967

CN (weighted): 74.0

Total Area: 72.392 Acre

2. Runoff

Return Period:	10-Year	
Rainfall, P:	2.00	in
Runoff, Q:	0.3498	in
Runoff Volume:	2.1104	Acre-Ft

The pond volume below the emergency spillway will be comprised of three design needs:

1) 10 year storm inflow of 2.1 acre feet, as described above

3) 3 year sediment delivery of 0.1 acre feet, as based on the calculations shown below.

Therefore, the total design volume below the emergency spillway is 2.1+ 0.1 ac-ft which is 2.2 acre feet. As is shown on the stage storage relationship for the as built pond, the bottom of the emergency spillway is 5559', which has a volume of 9.9 acre-ft at this elevation.

Pond Sediment Volume Calculation based on Universal Soil Loss Equation (SurvCAD)

Input Data

Landuse	Area (ft^2)	Rainfall Factor	Erod-ability	Length (ft)	Slope (%)	Ls	Cf	Pf
Pasture	3153395.5	50.0	0.37	1482.0	5.0	2.05	0.04	1.00

Runoff = 0.350 inch.
Sediment Density = 175.000
Time = 3.0 years
Drainage Ratio = 0.84

Total Area = 72.392 acres
Gross Erosion = 109.983 tons/yr.
Total Yield = 92.385 tons/yr.
Runoff Volume = 2.110 acre-ft
Sediment Volume = 0.073 acre-ft (3-year total)
Total Volume = 2.183 acre-ft

* The Cf factor is determined from the chart on the following page, shown *in Design Hydrology and Sedimentology for Small Catchments* by Haan, Barfield and Hayes. Based on an approximate ground cover of 70% for permanent pasture, a Cf factor of 0.04 was used, which is conservative.

The pond volume below the primary spillway will be comprised of two design needs:
1) 3 year sediment delivery of 0.1 acre-ft, as based on the calculations above.
This is a total volume of 0.1 acre-ft.

As seen in the stage storage relationship, the pond has 3.7 acre-ft of storage at (5555') the primary spillway. Detention time of 24 hours is shown in the SEDCAD outputs, which are at the end of this section.

Table 8.8 Selected USLE *C* Values for Construction, Mining, and Forest Lands.

Condition	*C* factor	References
1. Bare soil conditions		
Undisturbed except scraped	0.66–1.30	[a]
Compacted		
Smooth	1.00–1.40	[a,b]
Root raked	0.90–1.20	[a]
Disk tillage		
Fresh	1.00	[a]
After one rain	0.89	[a]
2. Mulch		
Straw		
0.5 tons/ac	0.30	[a,d]
1.0 tons/ac	0.18	[a,d]
2.0 tons/ac	0.09	[a,d]
4.0 tons/ac	0.02	[a,d]
Wood chips		
0.5 tons/ac	0.90	[a,d]
2.0 tons/ac	0.70	[a,d]
4.0 tons/ac	0.42	[a,d]
6.0 tons/ac	0.22	[a,d]
3. Chemical binders		
Asphalt emulsion, 605 gal/ac	0.14-0.52	[a]
Aquatan, Terra-tack	0.67	[a]
4. Seedings		
No prepared seedbed		
New planting	0.64	[a]
After 60 days	0.54	[a]
Prepared seedbed		
New planting	0.40	[a]
After 60 days	0.05	[a]
5. Undisturbed forest		
100–75% canopy, 100–90% litter	0.0001–0.001	[c]
35–20% canopy, 70–40% litter	0.003–0.009	[c]
6. Permanent pasture and brush cover		
0% canopy, 80% ground cover		
Grass	0.013	[c]
Weeds	0.043	[c]
50% Brush, 80% ground cover		
Grass	0.012	[c]
7. Mechanically prepared woodland sites		
Burned, 10% cover at ground		
Good soil	0.240	[c]
Poor soil	0.360	[c]
Burned, 0% cover at ground		
Good soil	0.260	[c]
Poor soil	0.450	[c]
Disked, 0% cover at ground		
Good soil	0.720	[c]
Poor soil	0.940	

Note. Additional values are given in Appendix 8B.
[a]Transportation Research Board (1980).
[b]Barfield *et al.* (1988).
[c]Wischmeier and Smith (1978).
[d]Meyer *et al.* (1972). C factors for mulch vary depending on slope length and steepness. Slope length limits apply (see Appendix 8B, Table 8B.5).

Post Mine Drainage Calculations

- 103.1 acre drainage area (See Map 2.05.3(3)-1-2)
- No pit pumping
- Curve Number (CN) to use: From SEDCAD 4 for Windows Help menu :
    I. Curve Numbers for Other Agricultural Land Category
    II. Cover type: Pasture, grassland, or range -- continuous forage for grazing
    III. Hydrologic Condition: Good (Good: >75% ground cover)
    IV. Hydrologic Soil Group = D
    V. CN=80

Runoff Curve Number and Runoff (SurvCAD)

Project: Pond 013 By: B Langenfeld Date: 08/18/09

Location: New Horizon #2 Checked: Date:

Present

1. Runoff Curve Number (CN)

Cover description	CN	Soil Type	Area(Acre)
Pasture Grassland Range (Good)	80	D	0.926
Pasture Grassland Range (Good)	80	D	82.914
Pasture Grassland Range (Good)	80	D	11.808
Pasture Grassland Range (Good)	80	D	7.466

CN (weighted): 80.0

Total Area: 103.114 Acre

2. Runoff

Return Period:	10-Year	
Rainfall, P:	2.00	in
Runoff, Q:	0.5625	in
Runoff Volume:	4.8335	Acre-Ft

The pond volume below the emergency spillway will be comprised of two design needs:
1) 10 year storm inflow of 4.8 acre-ft, as described above
2) 3 year sediment delivery of 0.1 acre-ft, as based on the calculations shown below.

Therefore, the total design volume below the emergency spillway is 4.8 + 0.1 ac-ft which is 4.9 acre-ft. As is shown on the stage storage relationship, the bottom of the emergency spillway is 5559', which has a volume of 9.9 acre-ft at this elevation.

Pond Volume Calculation based on Universal Soil Loss Equation (SurvCAD)

Input Data

Landuse	Area (ft^2)	Rainfall Factor	Erod-ability	Length (ft)	Slope (%)	Ls	Cf	Pf
Reclamat	4491645.8	50.0	0.37	4840.0	3.7	1.73	0.04	1.00

Runoff = 0.563 inch.
Sediment Density = 175.000
Time = 3.0 years
Drainage Ratio = 0.84

Total Area = 103.114 acres
Gross Erosion = 131.772 tons/yr.
Total Yield = 110.688 tons/yr.
Runoff Volume = 4.838 acre-ft
Sediment Volume = 0.087 acre-ft (3-year total)
Total Volume = 4.925 acre-ft

* The Cf factor is determined from the chart on page 5, shown *in Design Hydrology and Sedimentology for Small Catchments* by Haan, Barfield and Hayes. Based on an approximate ground cover of 70% for permanent pasture, a Cf factor of 0.04 was used, which is conservative.

The pond volume below the primary spillway will be comprised of one design need:
1) 3 year sediment delivery of 0.2 acre-ft, as based on the calculations above.

As seen in the stage storage relationship, the pond has 3.7 acre-ft of storage at (5555') the primary spillway. Detention time of 24 hours is shown in the SEDCAD outputs, which are at the end of this section.

The pre mine volume required to be stored is 2.1 acre-ft. The post mine volume that must be stored in Pond 013 is 4.9 acre-ft. The post mine conditions are the worst case, and therefore are used to determine if Pond 013 is sufficient. As shown by the SEDCAD calculations, Pond 013 has 9.9 acre-ft of capacity at the emergency spillway, and will be able to hold the worst case (post mine) conditions.

Pond 013 Report

From Pond 013 topography in SurvCAD

Water Elev	Storage(AcreFt)	(C.Y.)	(C.F.)	Area(Acre)	
5552.00	0.00000	0.0	0.0	1.150	
5552.50	0.57715	931.1	25140.8	1.194	
5553.00	1.17669	1898.4	51256.7	1.234	
5553.50	1.79594	2897.5	78231.2	1.273	
5554.00	2.43472	3928.0	106056.6	1.312	
5554.50	3.09322	4990.4	134740.6	1.352	
5555.00	3.77176	6085.1	164298.0	1.392	Primary Spillway
5555.50	4.47034	7212.2	194728.2	1.432	
5556.00	5.18900	8371.6	226032.9	1.473	
5556.50	5.92824	9564.2	258234.1	1.515	
5557.00	6.68848	10790.7	291350.2	1.557	Emergency Spillway
5557.50	7.46991	12051.5	325389.3	1.601	
5558.00	8.27280	13346.8	360363.2	1.644	
5558.50	9.09708	14676.6	396269.0	1.686	
5559.00	9.94302	16041.4	433118.1	1.731	
5559.50	10.81123	17442.1	470937.2	1.778	
5560.00	11.70305	18880.9	509784.8	1.805	

The pond design does not meet MSHA Impoundment criteria, as shown below, since it does not have a storage volume of 20 acre-ft and does not have an elevation of 20 feet.

30CFR77.216 Water, sediment, or slurry impoundment and impounding structures; general.
(a) Plans for the design, construction, and maintenance of structures which impound water, sediment, or slurry shall be required if such an existing or proposed impounding structure can:

1. Impound water, sediment, or slurry to an elevation of five feet or more above the upstream toe of the structure and can have a storage volume of 20 acre-feet or more; or
2. Impound water, sediment, or slurry to an elevation of 20 feet or more above the upstream toe of the structure; or
3. As determined by the District Manager, present a hazard to coal miners.

013 POND
10YR-24 HR EVENT

Post Mine

103 AC

CN 80

Ross L. Gubka, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 24 hr
Rainfall Depth:	2.000 inches

Particle Size Distribution:

Size (mm)	NEW HORIZON MINE 1 PARTICAL SIZE DISTRIBUTION
2.0000	100.000%
1.0000	70.000%
0.5000	67.000%
0.2500	58.000%
0.1250	52.000%
0.0630	38.000%
0.0160	21.000%
0.0040	11.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	

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	In	103.100	103.100	20.78	3.85	19.8	6,471	3.16	1.85
	Out			0.67	1.86	0.8	404	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	100.000%	100.000%
0.5000	100.000%	100.000%
0.2500	100.000%	100.000%
0.1250	100.000%	100.000%
0.0630	82.649%	100.000%
0.0160	45.675%	100.000%
0.0040	23.925%	100.000%

Structure Detail:

Structure #1 (Pond)

Pond Inputs:

Initial Pool Elev:	5,552.00 ft
Initial Pool:	2.54 ac-ft
*Sediment Storage:	0.01 ac-ft
Dead Space:	0.30 %

Sediment capacity based on Average Annual R of 12.0 for 2 year(s)

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
24.00	6.00	24.00	100.00	0.01	0.0150	5,555.00	1

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Pond Results:

Peak Elevation:	5,554.55 ft
H'graph Detention Time:	15.39 hrs
Pond Model:	CSTRS

Dewater Time:	3.49 days
Trap Efficiency:	95.77 %

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)	
5,548.20	0.089	0.000	0.000		Top of Sed. Storage
5,548.50	0.225	0.046	0.000		
5,549.00	0.358	0.190	0.000		
5,549.50	0.487	0.401	0.000		
5,550.00	0.618	0.676	0.000		
5,550.50	0.764	1.021	0.000		
5,551.00	0.992	1.459	0.000		
5,551.50	1.098	1.981	0.000		
5,552.00	1.147	2.542	0.000		Low hole SPW #1
5,552.50	1.191	3.127	0.297	23.80*	
5,553.00	1.228	3.732	0.420	17.41*	
5,553.50	1.273	4.357	0.515	14.70*	
5,554.00	1.320	5.005	0.594	13.20*	
5,554.50	1.360	5.675	0.664	12.90	
5,554.55	1.361	5.738	0.670	1.65	Peak Stage
5,555.00	1.396	6.364	0.728		Spillway #1
5,555.50	1.437	7.072	6.886		
5,556.00	1.475	7.800	15.127		
5,556.50	1.512	8.547	18.526		
5,557.00	1.562	9.315	21.392		Spillway #2 Spillway #3 Spillway #4
5,557.50	1.606	10.107	27.251		
5,558.00	1.651	10.922	35.625		
5,558.50	1.694	11.758	45.621		
5,559.00	1.740	12.616	55.528		
5,559.50	1.786	13.498	63.505		
5,560.00	1.805	14.396	70.343		

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

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,548.20	0.000	0.000	0.000	0.000	0.000
5,548.50	0.000	0.000	0.000	0.000	0.000
5,549.00	0.000	0.000	0.000	0.000	0.000
5,549.50	0.000	0.000	0.000	0.000	0.000
5,550.00	0.000	0.000	0.000	0.000	0.000
5,550.50	0.000	0.000	0.000	0.000	0.000
5,551.00	0.000	0.000	0.000	0.000	0.000
5,551.50	0.000	0.000	0.000	0.000	0.000
5,552.00	4.00>0.000	0.000	0.000	0.000	0.000
5,552.50	0.297	0.000	0.000	0.000	0.297
5,553.00	0.420	0.000	0.000	0.000	0.420
5,553.50	0.515	0.000	0.000	0.000	0.515
5,554.00	0.594	0.000	0.000	0.000	0.594
5,554.50	0.664	0.000	0.000	0.000	0.664
5,555.00	0.728	0.000	0.000	0.000	0.728
5,555.50	6.886	0.000	0.000	0.000	6.886
5,556.00	15.127	0.000	0.000	0.000	15.127
5,556.50	18.526	0.000	0.000	0.000	18.526
5,557.00	21.392	0.000	0.000	0.000	21.392
5,557.50	23.917	(3)>1.111	(3)>1.111	(3)>1.111	27.251
5,558.00	26.200	(3)>3.142	(3)>3.142	(3)>3.142	35.625
5,558.50	28.299	(3)>5.774	(3)>5.774	(3)>5.774	45.621
5,559.00	30.253	(5)>8.425	(5)>8.425	(5)>8.425	55.528
5,559.50	32.089	(5)>10.472	(5)>10.472	(5)>10.472	63.505
5,560.00	33.824	(5)>12.173	(5)>12.173	(5)>12.173	70.343

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	103.100	0.700	0.700	0.265	80.000	M	22.33	3.849
	Σ	**103.100**						**20.78**	**3.849**

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	0.320	4,841.00	3.70	0.0400	1.0000	1	23.4	7,627	4.06	2.38
	Σ							**19.8**	**6,471**	**3.16**	**1.85**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.70	179.11	4,841.00	1.920	0.700
#1	**1**	**Time of Concentration:**					**0.700**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.70	179.11	4,840.81	1.920	0.700
#1	**1**	**Muskingum K:**					**0.700**

013 POND
25YR-24 HR EVENT

Post Mine

103 AC

CN 80

Ross L. Gubka, P.E.

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	25 yr - 24 hr
Rainfall Depth:	2.400 inches

Particle Size Distribution:

Size (mm)	NEW HORIZON MINE 1 PARTICAL SIZE DISTRIBUTION
2.0000	100.000%
1.0000	70.000%
0.5000	67.000%
0.2500	58.000%
0.1250	52.000%
0.0630	38.000%
0.0160	21.000%
0.0040	11.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	

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	In	103.100	103.100	31.92	5.61	31.2	6,938	3.46	2.03
	Out			2.53	3.07	2.1	613	0.00	0.00

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
2.0000	100.000%	100.000%
1.0000	100.000%	100.000%
0.5000	100.000%	100.000%
0.2500	100.000%	100.000%
0.1250	100.000%	100.000%
0.0630	79.437%	100.000%
0.0160	43.899%	100.000%
0.0040	22.995%	100.000%

Structure Detail:

Structure #1 (Pond)

Pond Inputs:

Initial Pool Elev:	5,552.00 ft
Initial Pool:	2.54 ac-ft
*Sediment Storage:	0.02 ac-ft
Dead Space:	0.30 %

**Sediment capacity based on Average Annual R of 12.0 for 2 year(s)*

Perforated Riser

Riser Diameter (in)	Riser Height (ft)	Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Number of Holes per Elev
24.00	6.00	24.00	100.00	0.01	0.0150	5,555.00	1

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Straight Pipe

Barrel Diameter (in)	Barrel Length (ft)	Barrel Slope (%)	Manning's n	Spillway Elev (ft)	Entrance Loss Coefficient	Tailwater Depth (ft)
18.00	20.00	2.00	0.0150	5,557.00	0.50	0.00

Pond Results:

Peak Elevation:	5,555.15 ft
H'graph Detention Time:	12.11 hrs
Pond Model:	CSTRS

Dewater Time:	4.22 days
Trap Efficiency:	93.11 %

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)	
5,548.21	0.094	0.000	0.000		Top of Sed. Storage
5,548.50	0.225	0.045	0.000		
5,549.00	0.358	0.190	0.000		
5,549.50	0.487	0.400	0.000		
5,550.00	0.618	0.676	0.000		
5,550.50	0.764	1.020	0.000		
5,551.00	0.992	1.458	0.000		
5,551.50	1.098	1.981	0.000		
5,552.00	1.147	2.542	0.000		Low hole SPW #1
5,552.50	1.191	3.126	0.297	23.80*	
5,553.00	1.228	3.731	0.420	17.41*	
5,553.50	1.273	4.356	0.515	14.70*	
5,554.00	1.320	5.004	0.594	13.20*	
5,554.50	1.360	5.674	0.664	12.20*	
5,555.00	1.396	6.363	0.728	12.00	Spillway #1
5,555.15	1.410	6.571	2.533	7.95	Peak Stage
5,555.50	1.437	7.072	6.886		
5,556.00	1.475	7.800	15.127		
5,556.50	1.512	8.546	18.526		
5,557.00	1.562	9.315	21.392		Spillway #2 Spillway #3 Spillway #4
5,557.50	1.606	10.107	27.251		
5,558.00	1.651	10.921	35.625		
5,558.50	1.694	11.757	45.621		
5,559.00	1.740	12.616	55.528		
5,559.50	1.786	13.497	63.505		
5,560.00	1.805	14.395	70.343		

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

Detailed Discharge Table

Elevation (ft)	Perf. Riser (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Straight Pipe (cfs)	Combined Total Discharge (cfs)
5,548.21	0.000	0.000	0.000	0.000	0.000
5,548.50	0.000	0.000	0.000	0.000	0.000
5,549.00	0.000	0.000	0.000	0.000	0.000
5,549.50	0.000	0.000	0.000	0.000	0.000
5,550.00	0.000	0.000	0.000	0.000	0.000
5,550.50	0.000	0.000	0.000	0.000	0.000
5,551.00	0.000	0.000	0.000	0.000	0.000
5,551.50	0.000	0.000	0.000	0.000	0.000
5,552.00	4.00>0.000	0.000	0.000	0.000	0.000
5,552.50	0.297	0.000	0.000	0.000	0.297
5,553.00	0.420	0.000	0.000	0.000	0.420
5,553.50	0.515	0.000	0.000	0.000	0.515
5,554.00	0.594	0.000	0.000	0.000	0.594
5,554.50	0.664	0.000	0.000	0.000	0.664
5,555.00	0.728	0.000	0.000	0.000	0.728
5,555.50	6.886	0.000	0.000	0.000	6.886
5,556.00	15.127	0.000	0.000	0.000	15.127
5,556.50	18.526	0.000	0.000	0.000	18.526
5,557.00	21.392	0.000	0.000	0.000	21.392
5,557.50	23.917	(3)>1.111	(3)>1.111	(3)>1.111	27.251
5,558.00	26.200	(3)>3.142	(3)>3.142	(3)>3.142	35.625
5,558.50	28.299	(3)>5.774	(3)>5.774	(3)>5.774	45.621
5,559.00	30.253	(5)>8.425	(5)>8.425	(5)>8.425	55.528
5,559.50	32.089	(5)>10.472	(5)>10.472	(5)>10.472	63.505
5,560.00	33.824	(5)>12.173	(5)>12.173	(5)>12.173	70.343

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	103.100	0.700	0.700	0.265	80.000	M	34.20	5.614
	Σ	**103.100**						**31.92**	**5.614**

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	0.320	4,841.00	3.70	0.0400	1.0000	1	36.7	8,166	4.43	2.60
	Σ							**31.2**	**6,938**	**3.46**	**2.03**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.70	179.11	4,841.00	1.920	0.700
#1	**1**	**Time of Concentration:**					**0.700**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	5. Nearly bare and untilled, and alluvial valley fans	3.70	179.11	4,840.81	1.920	0.700
#1	**1**	**Muskingum K:**					**0.700**