HYDROLOGY STUDY

QUALITY COAL CO., INC.

DUTTON HILL MINE NO. 2

P-

WALKER COUNTY, ALABAMA

BASIN 013

DETAILED DESIGN PLANS

ATTACHMENT III-B-2(a)

JULY 30, 2014

Quality Coal, Inc.

P.O. Box 2705 • Jasper, AL 35502-2705
Phone: (205) 384-6300 • Fax (205) 384-6040

July 30, 2014

Mr. Gary Heaton, P.E.
Alabama Surface Mining Commission
PO Box 2390
Jasper, AL 35502-2390

RE: Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P-

Dear Gary,

I hereby certify the attached detailed design plans for Basin 013 for the above referenced mine are in accordance with the current engineering practices and the Regulations of the Alabama Surface Mining Commission and are true and correct to the best of my knowledge, information and belief.

If you have any questions or require additional information please give me a call at (205) 388-7376 or email at sdmiles7@gmail.com.

Sincerely,

Stephen Miles, P.E.

ALABAMA LICENSED No. 33253 PROFESSIONAL ENGINEER STEPHEN MILES

Pond Construction Criteria

The embankment for sediment basins (temporary and permanent) shall be designed and built using the following as minimum criteria:

1. The top of the dam shall be no less than 12 feet wide.

2. See design sheet for maximum and minimum embankment slopes.

3. The foundation and abutments for the impounding structure shall be designed to be stable under all conditions of construction and operation of the impoundments, with a minimum static safety factor of 1.3 for the normal pool with steady seepage saturation conditions.

4. The dam shall be constructed with a cutoff trench based upon prudent engineering practices for the site. The cutoff shall be located on the dam centerline and be of sufficient depth to extend into a relatively impervious material from which the core of the dam shall also be constructed.

5. The embankment foundation area shall be cleared of all organic matter, all surfaces sloped to no steeper than 1v : 1h, and the entire foundation surface scarified.

6. The entire embankment and cutoff trench shall be compacted to 95 percent density, based on standard proctor as outlined in ASTM.

7. The material placed in the embankment shall be free of sod, roots, stones over 6 inches in diameter, and other objectionable materials. The fill material shall be placed and spread over the entire fill area, starting at the lowest point of the foundation, in layers not to exceed 12 inches in thickness. Construction of the fill shall be undertaken only at such times that the moisture content of the fill material will permit satisfactory compaction in accordance with paragraph 5.

8. The pool area of all basins will be cleared of timber and large undergrowth.

9. The primary decant system when consisting of a pipe shall be installed according to Class C pipe installation for embankment bedding.

10. The primary decant system shall be equipped with a device, or constructed, such as to insure that subsurface withdrawal is accomplished to prevent discharge of floating solids. If a channel is used as the primary decant a skimmer shall be installed to prevent floating solids from discharging.

11. A splash pad or riprap may be required under the discharge of the primary decant system where necessary to insure that the discharge does not erode the embankment.

12. The combination primary and secondary decant system shall be designed to safely carry the expected peak flow from a 25 year - 6 hour storm. The entire emergency overflow spillway channel will be a stabilized channel and will be stabilized upon completion of construction as specified within the detailed design plans using prudent engineering measures. These measures may consist of lining the spillway with concrete or a durable rock riprap, or the spillway being constructed in consolidated non-erodible material and planted with a mixture or both annual and perennial grasses, or a combination of any or all of the above.

13. Sediment basins using a single spillway system shall be an open channel of non-erodible construction consisting of concrete, durable rock riprap or its being constructed in consolidated non-erodible material as specified in the detailed design plans.

14. The settled embankment for temporary impoundments shall be a minimum of 1.0 foot above the maximum water elevation for the runoff from a 25 year - 6 hour, or a 10 year - 24 hour precipitation event (whichever has the greatest runoff). The settled embankment for permanent impoundments shall be a minimum of 1.0 foot above the maximum water elevation for the runoff from a 25 year - 6 hour, or a 10 year - 24 hour precipitation event or greater event as specified by the Regulatory Authority.(whichever has the greatest runoff).

15. If basins are built in series, then the combined decant system for each shall be designed to accommodate the entire contributing drainage area.

16. The dam and all disturbed areas shall be seeded with both perennial and annual grasses, fertilized and mulched in order to insure erosion is minimized. Hay bales or riprap may be placed at the toe of the dam immediately upon completion of construction.

17. The constructed height of the dam shall be increased a minimum of 5 percent over the design height to allow for settlement over the life of the embankment.

18. Final graded slopes of the entire permanent water impoundment area shall not exceed 2.5H-1.0V to provide for adequate safety and access for proposed water users.

19. Prior to Phase II bond release, additional data concerning water quality, water quantity, depth, size, configuration, post-mining land use, etc., for each proposed permanent water impoundment, shall be submitted to the Regulatory Authority for permanent water impoundment approval.

20. All sediment basins will be inspected for stability, erosion, etc. two (2) times a month until removal of the structure or release of the reclamation bond.

21. The embankment and spillway will be maintained by repairing any damage such as erosion, slope failure or spillway damage until removal of the structure or release of the performance bond.

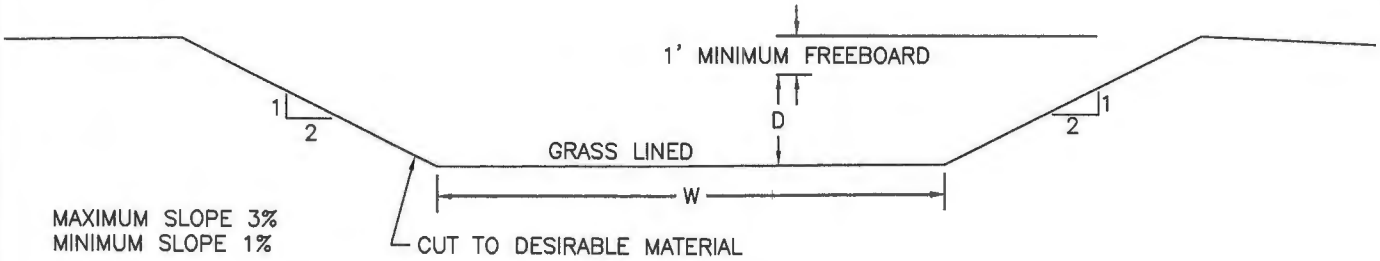
22. All ponds shall be examined quarterly for structural weakness, instability, erosion, or other hazardous conditions and maintenance performed as necessary. Formal inspections shall be made on an annual basis, including any reports or modifications, in accordance with 880-X-10C-.20[l(j)] of the Alabama Surface Mining Commission Regulations.

23. Sediment will be removed from each pond when the accumulated sediment reaches the sediment storage volume as shown on the detailed design sheet.

24. Upon completion of mining, successful reclamation and effluent standards being met, each sediment basin not remaining as a permanent water impoundment will be dewatered in an environmentally safe manner (such as siphoning, pumping, etc.) and reclaimed to approximate original contours by the following procedure: A permanent diversion channel (designed for a 10 year - 24 hour precipitation event) shall be cut along the outer edge of the basin to re-route drainage around the basin and back through the stabilized spillway to allow reclamation of the sediment basin. The diversion channel shall be designed and grassed as per enclosed information. (See permanent diversion for basin disposal).Upon completion of the diversion channel the back slope of the dam shall be graded to a minimum 3H to 1V slope. The dewatered sediment basin area shall be seeded with some combination of the following: Fescue, Bermuda, rye grass, canary grass and willows. After seeding the area shall be mulched. Any additional sediment or embankment material not used to meet original contour, if non-toxic, shall be spread in thin layers within the permit area and vegetated as stated in the approved reclamation plan. All toxic material encountered in the basin disposal shall be buried and covered with 4 feet of non-toxic material and vegetated as stated in the approved reclamation plan.

25. A qualified registered professional engineer or other qualified professional specialist, under the direction of the professional engineer shall conduct regular inspections during construction and upon completion shall inspect each basin for certification purposes.

26. Point source discharge embankments shall be constructed and abutments keyed into desirable material if at all possible. In the event that undesirable material is encountered, addition design and construction criteria shall be submitted prior to certification.



$$Q = \frac{1.49}{N} A R^{2/3} S^{1/2}$$

N(LOOSE STONE OR GRASS LINED) = 0.035

A = AREA

R = AREA/WETTED PERIMETER

S = SLOPE

* GRASS LINING: FESCUE, BERMUDA &/OR RYE GRASS

DIVERSION CHANNEL DEPTH (D) FOR WIDTH (W) 8.0 FT.	
PEAK FLOW Q (CFS)	DEPTH D (FT)
0–15	0.5
15–50	1.0
50–100	1.5
100–180	2.0
180–270	2.5

DIVERSION CHANNEL DEPTH (D) FOR WIDTH (W) 10.0 FT.	
PEAK FLOW Q (CFS)	DEPTH D (FT)
0–15	0.5
15–60	1.0
60–120	1.5
120–210	2.0
210–320	2.5

DIVERSION CHANNEL DEPTH (D) FOR WIDTH (W) 12.0 FT.	
PEAK FLOW Q (CFS)	DEPTH D (FT)
0–20	0.5
20–70	1.0
70–150	1.5
150–250	2.0
250–383	2.5

DIVERSION CHANNEL DEPTH (D) FOR WIDTH (W) 15.0 FT.	
PEAK FLOW Q (CFS)	DEPTH D (FT)
0–25	0.5
25–90	1.0
90–180	1.5
180–300	2.0
300–450	2.5

ATTACHMENT III–B–2(a)
TYPICAL PERMANENT DIVERSION FOR BASIN DISPOSAL

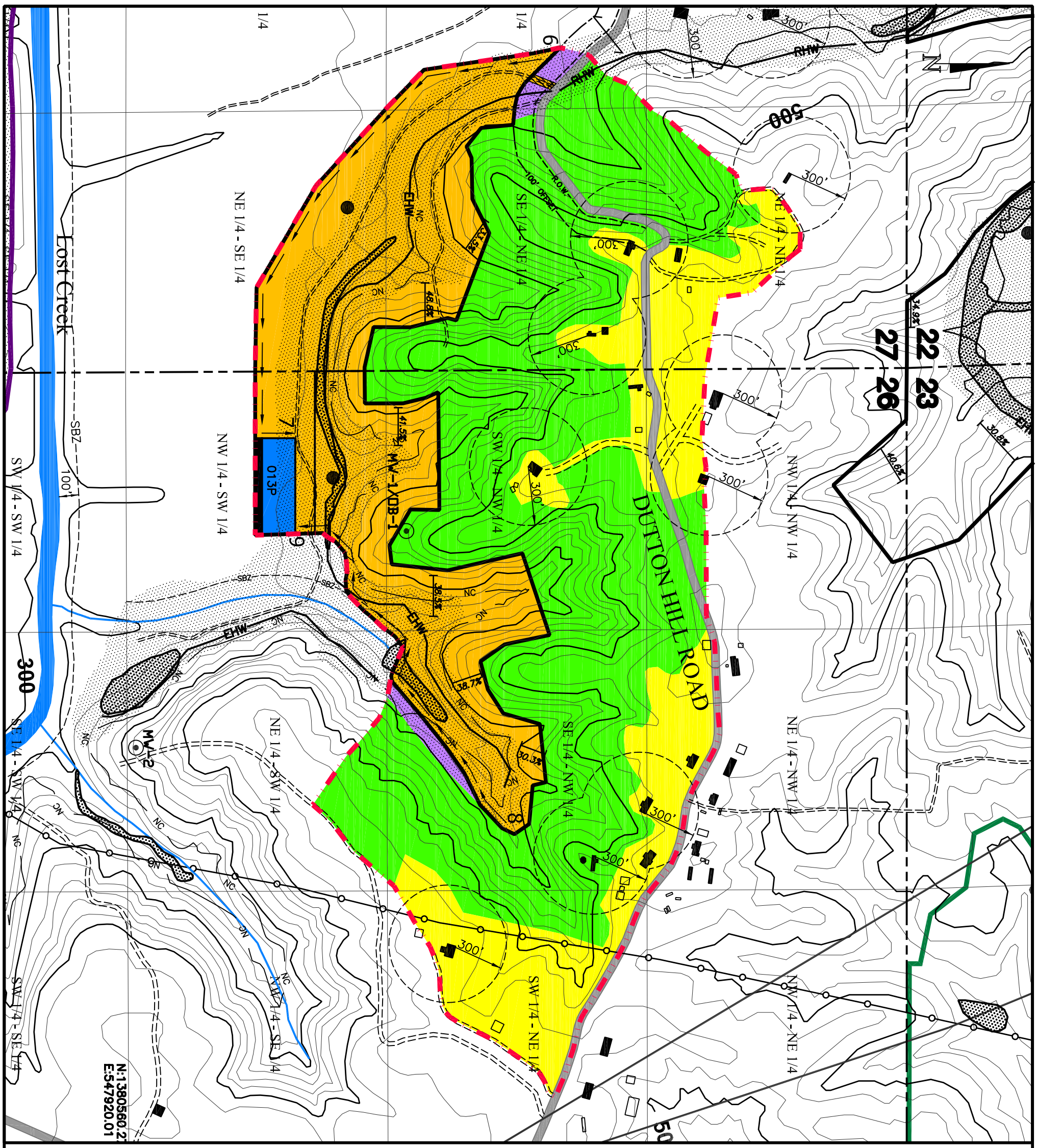
NOTES

1) The primary spillway of Basin 013 will consist of a 10 feet wide open channel lined with 4 inches of concrete reinforced with 6X6-W2.9XW2.9 concrete reinforcement wire. The channel lining will extend back to the existing drainage course. A 12′ X 12′ X 4″ concrete splash pad reinforced with 6X6-W2.9XW2.9 welded wire fabric will be located at the exit point of the tail section of the channel.

2) If there is any coal located within the proposed pool area of Basin 013, the coal will be excavated during the time of construction of the pool area.

3) Due to Basin 013 being constructed in spoil material, the interior of the basin will be lined with 1.0 foot (minimum) of clay material with a permeability no greater the 1×10^{-6} cm/sec up to the emergency spillway elevation to minimize infiltration and to provide a stable pool level. The material will be placed in horizontal lifts not to exceed 6 inches and compacted to 95% of the standard proctor.

4) Due to Basin 013 being incised there is no stability analysis required.



MAP LEGEND

- Permit Boundary
- Surface Contour
- Sediment Basin
- Existing Highwall
- Reclaimed Highwall
- Diversion Ditch
- County Road (Paved unless otherwise designated)
- Road (Private unless otherwise shown)
- Property Line (Other Than Forty Line or Road)
- Area Previously Surface Mined
- Unoccupied Dwelling (Barn, Shed, Etc.)
- Occupied Dwelling
- Primary Road
- Ancillary Road
- ASMC Permit P–3920
- ASMC Permit P–3793
- Perennial Stream
- Watershed Boundary

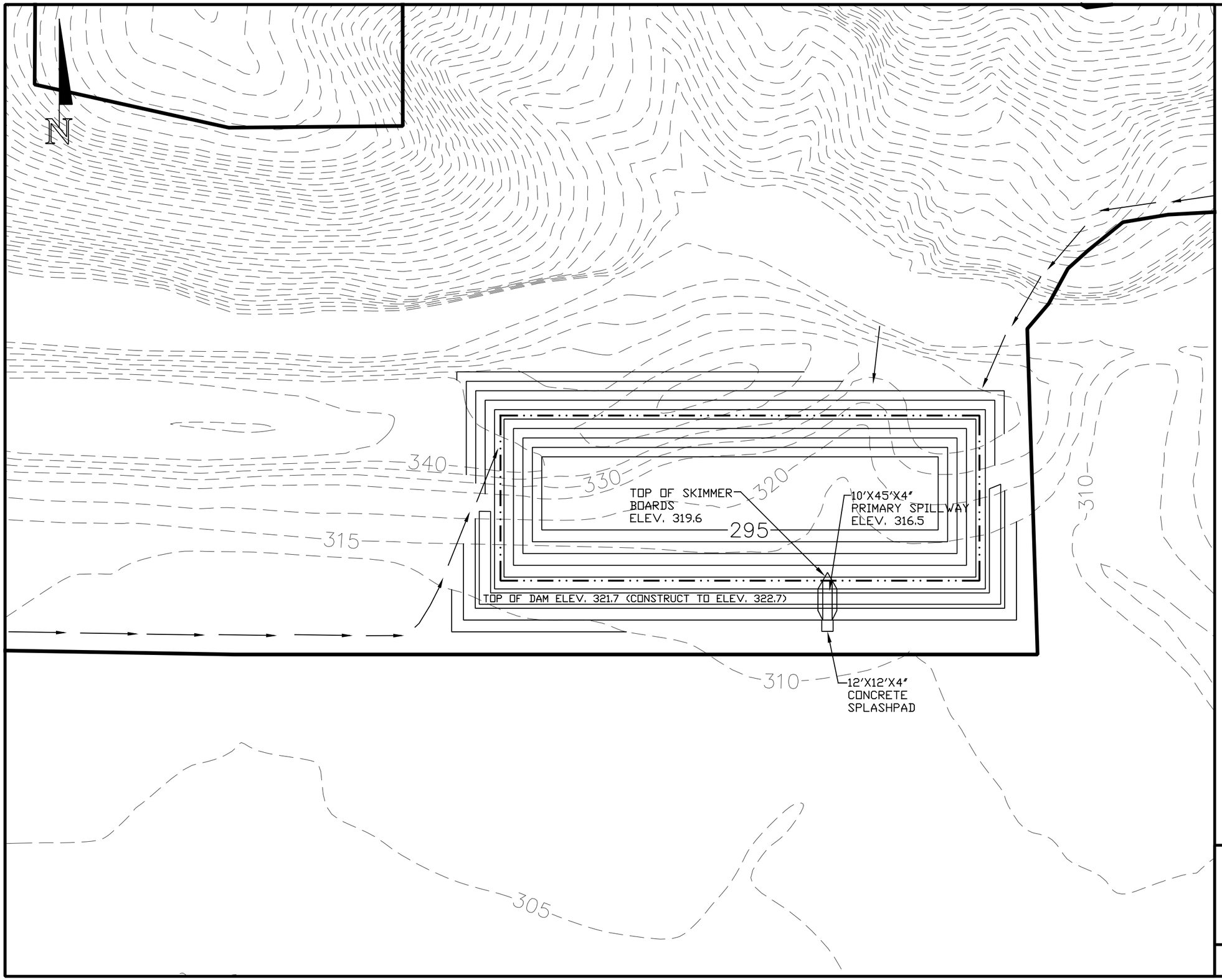
CURVE NUMBER INFORMATION

- Previously Mined Area, Curve No. 68
- Unmanaged Timberland, Curve No. 70
- Residential & Open Spaces, Curve No. 75
- Graded & Bare, Curve No. 81
- Gravel Road, Curve No. 95
- Sediment Basin, Curve No. 100

ATTACHMENT III–B–2(a)
BASIN 013 WATERSHED MAP
QUALITY COAL CO., INC.
DUTTON HILL MINE NO. 2
P–

DATE: 7/30/2014

SCALE: 1"=500'



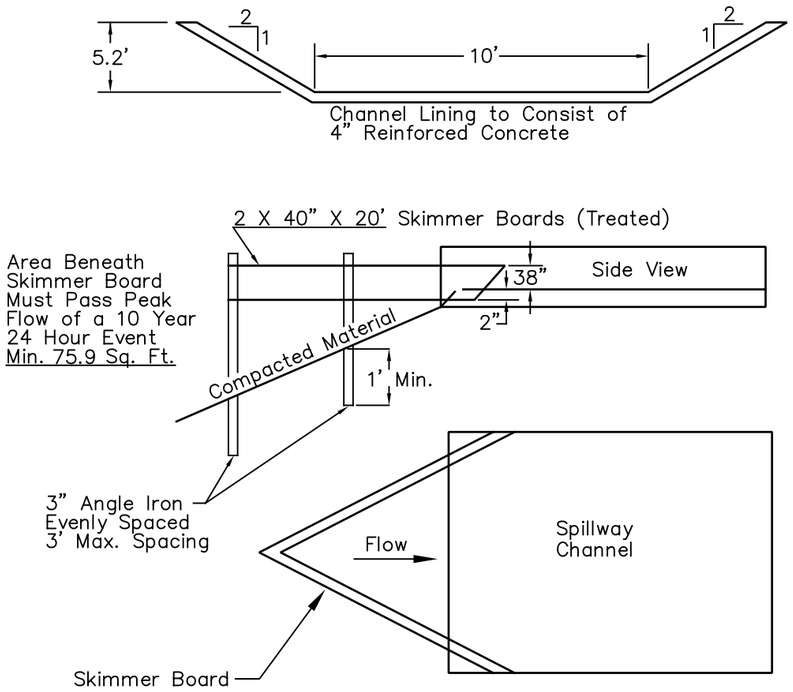
MAP LEGEND

- Permit Boundary
- 320 Existing Contour
- 300 Proposed Contour
- Major Inflow/Diversion
- Normal Pool Elevation 316.5

Attachment III–B–2(a)
Basin 013 Planview
Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P–

DATE: 7/30/2014

SCALE: 1"=100'

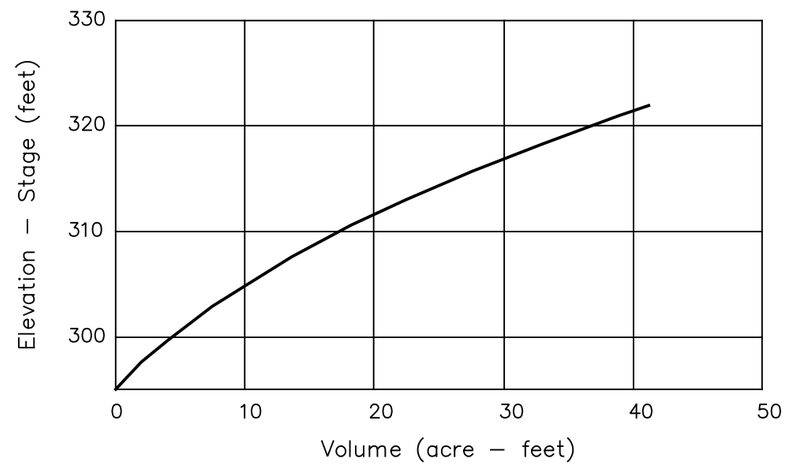


Skimmer Board Detail

Spillway Control Section Gradient shall be Approximately 0.1%

Spillway Tail Section Gradient shall be Approximately 40%

Stage – Storage Curve

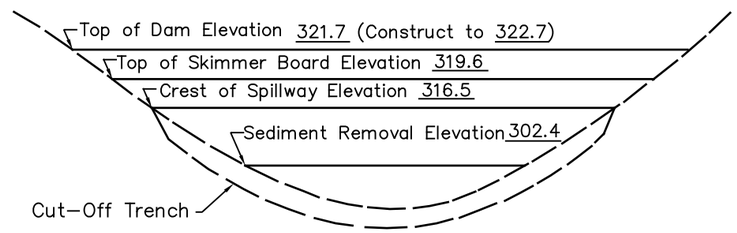


Storage Information

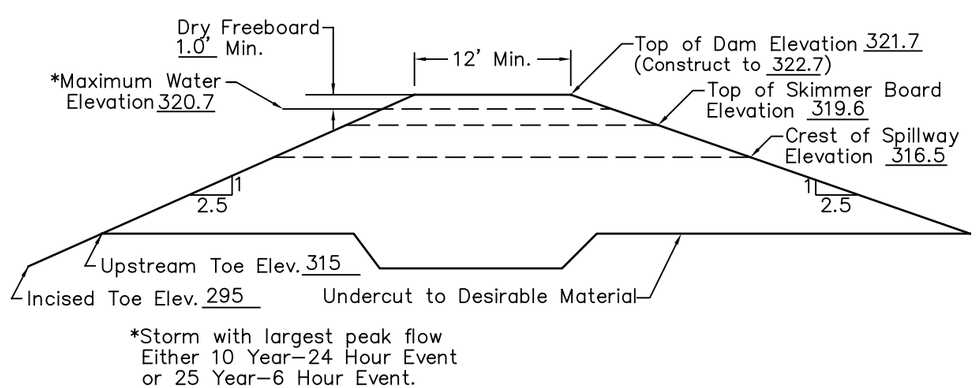
Elev. (Feet)	Area (Acres)	Interval (Feet)	Volume (Acre–Feet)	Acc. Volume (Acre–Feet)
295	0.747			0.000
300	1.010	5	4.376	4.376
305	1.294	5	5.745	10.121
310	1.600	5	7.222	17.343
315	1.923	5	8.795	26.138
320	2.268	5	10.466	36.604
322	2.400	2	4.667	41.271

Basin Parameters

Drainage Area	211	Acres
Disturbed Area	61	Acres
Sediment Storage	7.0	Acre–Feet
Detention Storage	22.1	Acre–Feet
Permanent Pool Capacity	29.1	Acre–Feet
Total Basin Capacity	38.2	Acre–Feet
Peak Inflow	415	CFS
Peak Outflow	312	CFS



Typical Profile Looking Downstream



Typical Spillway Cross Section

Notes:

1. Sediment shall be removed from the pool area of the basin when the accumulated sediment reaches the maximum sediment elevation.
2. The outer slopes of the embankment shall be grassed.
3. Embankment fill material shall be placed in 12" lifts and compacted to 95% of the standard proctor.
4. The surface beneath the embankment shall be stripped of undesirable material.
5. Upon the completion of mining, reclamation and maintenance of the water quality standards, the basin will be de–watered and reclaimed or remain as a permanent water impoundment, fish and wildlife habitat.
6. See the attached pond construction criteria.
7. See the attached drawings and specifications for diversions.
8. Elevations are based on assumed datum.
9. The channel lining within the control section of the spillway channel will extend to the maximum water elevation.

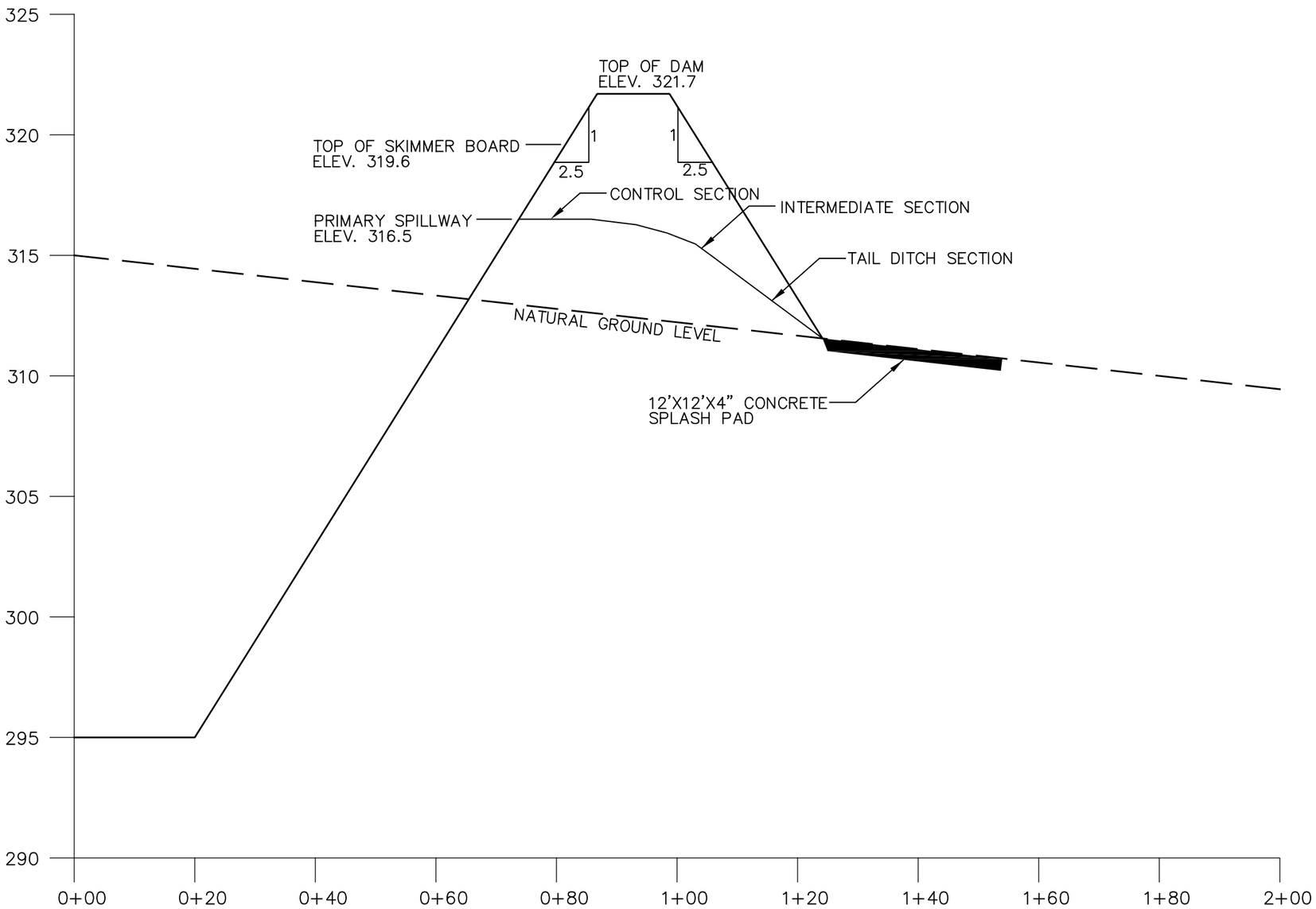
Stephen Miles, P.E.
Alabama License No. 33253

Date

Attachment III–B–2(a)
Basin 013 Detail Sheet
Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P–

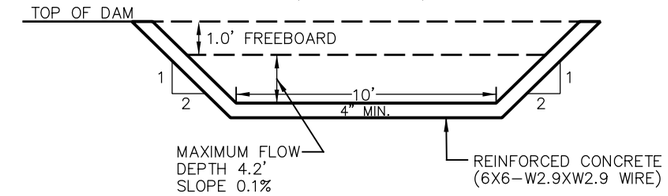
DATE: 7/30/2014

SCALE: Not to Scale



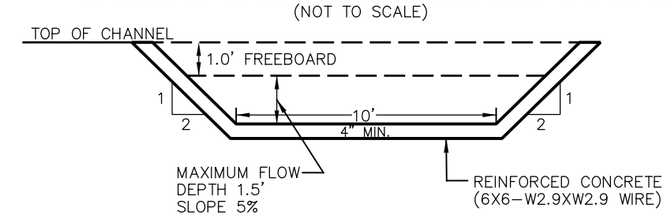
SPILLWAY CONTROL SECTION TYPICAL

(NOT TO SCALE)



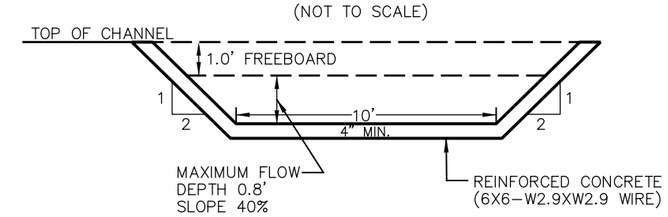
SPILLWAY INTERMEDIATE SECTION TYPICAL

(NOT TO SCALE)



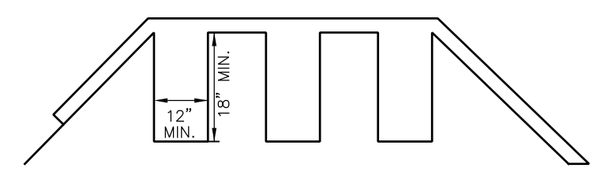
SPILLWAY TAIL DITCH SECTION TYPICAL

(NOT TO SCALE)



ANTI–SEEP DEVICE TYPICAL (CUT OFF TRENCHES)

(NOT TO SCALE)



Quality Coal Co., Inc.
Dutton Hill Mine No. 2
P–
Basin 013
Dam Details Sheet

DATE: 1/23/2014	SCALE: H: 1"=20' V: 1"=5'

Basin 013 Spillway Control Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	0.1	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	311.70 cfs	
Depth:	4.15 ft	5.15 ft
Top Width:	26.59 ft	30.59 ft
Velocity:	4.11 fps	
X-Section Area:	75.86 sq ft	
Hydraulic Radius:	2.657 ft	
Froude Number:	0.43	

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Basin 013 Spillway Intermediate Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	5.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	311.70 cfs	
Depth:	1.46 ft	2.46 ft
Top Width:	15.84 ft	19.84 ft
Velocity:	16.53 fps	
X-Section Area:	18.85 sq ft	
Hydraulic Radius:	1.141 ft	
Froude Number:	2.67	

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Basin 013 Spillway Tail Ditch Section

Material: Concrete, Rubble

Trapezoidal Channel

Bottom Width (ft)	Left Sideslope Ratio	Right Sideslope Ratio	Slope (%)	Manning's n	Freeboard Depth (ft)	Freeboard % of Depth	Freeboard Mult. x (VxD)
10.00	2.0:1	2.0:1	40.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	311.70 cfs	
Depth:	0.80 ft	1.80 ft
Top Width:	13.22 ft	17.22 ft
Velocity:	33.35 fps	
X-Section Area:	9.34 sq ft	
Hydraulic Radius:	0.687 ft	
Froude Number:	6.99	

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Quality Coal Co., Inc.

Dutton Hill Mine No. 2

P-

Basin 013

6.0 Inch, 10 Year - 24 Hour

DRN 58

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

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%	100.000%
2.0000	96.000%	91.000%
1.0000	85.000%	84.000%
0.5000	76.000%	62.000%
0.3000	63.000%	49.000%
0.2000	53.000%	40.000%
0.1000	44.000%	33.000%
0.0500	33.000%	26.000%
0.0300	27.000%	18.000%
0.0200	24.000%	14.000%
0.0100	15.000%	12.000%
0.0050	10.000%	8.000%
0.0030	7.000%	4.000%
0.0010	4.000%	2.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Basin 013

#1
Pond

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	210.800	210.800	230.87	57.20	12,090.6	310,456	215.96	100.46
	Out			218.90	57.18	1,331.5	26,995	0.53	0.41

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	94.972%	100.000%
1.0000	87.636%	100.000%
0.5000	64.796%	100.000%
0.3000	51.235%	100.000%
0.2000	41.838%	100.000%
0.1000	34.518%	100.000%
0.0500	27.182%	100.000%
0.0300	18.854%	100.000%
0.0200	14.689%	100.000%
0.0100	12.544%	100.000%
0.0050	8.362%	75.934%
0.0030	4.198%	38.121%
0.0010	2.103%	19.099%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Basin 013

Pond Inputs:

Initial Pool Elev:	316.50 ft
Initial Pool:	22.10 ac-ft
*Sediment Storage:	7.00 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
316.50	12.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	319.55 ft
H'graph Detention Time:	0.83 hrs
Pond Model:	CSTRS
Dewater Time:	0.78 days
Trap Efficiency:	88.99 %

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)	
302.44	1.144	0.000	0.000		Top of Sed. Storage
302.50	1.148	0.072	0.000		
303.00	1.176	0.653	0.000		
303.50	1.205	1.248	0.000		
304.00	1.234	1.858	0.000		
304.50	1.264	2.483	0.000		
305.00	1.294	3.122	0.000		
305.50	1.323	3.777	0.000		
306.00	1.353	4.445	0.000		
306.50	1.382	5.129	0.000		
307.00	1.413	5.828	0.000		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
307.50	1.443	6.542	0.000		
308.00	1.474	7.271	0.000		
308.50	1.505	8.016	0.000		
309.00	1.536	8.776	0.000		
309.50	1.568	9.552	0.000		
310.00	1.600	10.344	0.000		
310.50	1.631	11.152	0.000		
311.00	1.662	11.975	0.000		
311.50	1.694	12.814	0.000		
312.00	1.726	13.669	0.000		
312.50	1.758	14.539	0.000		
313.00	1.790	15.426	0.000		
313.50	1.823	16.330	0.000		
314.00	1.856	17.250	0.000		
314.50	1.889	18.186	0.000		
315.00	1.923	19.139	0.000		
315.50	1.956	20.109	0.000		
316.00	1.990	21.095	0.000		
316.50	2.024	22.099	0.000		Spillway #1
317.00	2.058	23.119	2.032	6.08*	
317.50	2.092	24.156	27.918	6.00	
318.00	2.127	25.211	59.514	5.15	
318.50	2.162	26.283	100.201	0.90	
319.00	2.197	27.372	150.727	0.35	
319.50	2.232	28.480	211.367	0.20	
319.55	2.236	28.599	218.901	0.05	Peak Stage
320.00	2.268	29.605	282.455		
320.50	2.301	30.747	364.353		
321.00	2.334	31.905	457.432		
321.50	2.367	33.080	562.063		
322.00	2.400	34.272	678.615		

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

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
302.44	0.000	0.000
302.50	0.000	0.000
303.00	0.000	0.000
303.50	0.000	0.000
304.00	0.000	0.000
304.50	0.000	0.000
305.00	0.000	0.000
305.50	0.000	0.000
306.00	0.000	0.000
306.50	0.000	0.000
307.00	0.000	0.000
307.50	0.000	0.000
308.00	0.000	0.000
308.50	0.000	0.000
309.00	0.000	0.000
309.50	0.000	0.000
310.00	0.000	0.000
310.50	0.000	0.000
311.00	0.000	0.000
311.50	0.000	0.000
312.00	0.000	0.000
312.50	0.000	0.000
313.00	0.000	0.000
313.50	0.000	0.000
314.00	0.000	0.000
314.50	0.000	0.000
315.00	0.000	0.000
315.50	0.000	0.000
316.00	0.000	0.000
316.50	0.000	0.000
317.00	2.032	2.032
317.50	27.918	27.918
318.00	59.514	59.514
318.50	100.201	100.201
319.00	150.727	150.727
319.50	211.367	211.367
320.00	282.455	282.455
320.50	364.353	364.353
321.00	457.432	457.432
321.50	562.063	562.063

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
322.00	678.615	678.615

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	61.200	0.254	0.000	0.000	81.000	F	73.63	18.854
	2	100.600	0.057	0.113	0.375	70.000	M	101.66	23.477
	3	39.200	0.046	0.116	0.397	75.000	M	44.96	10.705
	4	2.000	0.001	0.000	0.000	100.000	F	3.15	0.999
	5	2.200	0.031	0.228	0.337	68.000	M	2.10	0.479
	6	5.600	0.035	0.099	0.412	98.000	F	8.78	2.686
	Σ	**210.800**						**230.87**	**57.200**

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	36.70	0.9000	1.0000	2	11,979.6	621,139	432.26	265.67
	2	0.300	200.00	33.20	0.0030	1.0000	1	59.6	3,308	2.20	1.24
	3	0.240	200.00	22.40	0.0100	1.0000	1	42.8	5,178	3.44	1.95
	4	0.001	200.00	0.01	0.0010	1.0000	2	0.0	0	0.00	0.00
	5	0.240	200.00	28.20	0.0500	1.0000	2	8.7	23,256	16.28	9.24
	6	0.001	200.00	5.50	0.0010	1.0000	1	0.0	0	0.00	0.00
	Σ							**12,090.6**	**310,456**	**215.96**	**100.46**

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	2.50	5.00	200.00	1.580	0.035
		8. Large gullies, diversions, and low flowing streams	1.30	35.00	2,700.00	3.410	0.219
#1	**1**	**Time of Concentration:**					**0.254**
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	15.52	90.00	580.00	11.810	0.013
#1	**2**	**Time of Concentration:**					**0.057**
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	14.06	90.00	640.00	11.250	0.015

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Time of Concentration:**					**0.046**
#1	5	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
#1	**5**	**Time of Concentration:**					**0.031**
#1	6	7. Paved area and small upland gullies	2.50	5.00	200.00	3.180	0.017
		8. Large gullies, diversions, and low flowing streams	3.85	15.00	390.00	5.880	0.018
#1	**6**	**Time of Concentration:**					**0.035**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	2.88	60.00	2,080.01	5.090	0.113
#1	**2**	**Muskingum K:**					**0.113**
#1	3	8. Large gullies, diversions, and low flowing streams	4.74	130.00	2,740.00	6.530	0.116
#1	**3**	**Muskingum K:**					**0.116**
#1	5	8. Large gullies, diversions, and low flowing streams	1.38	40.00	2,900.00	3.520	0.228
#1	**5**	**Muskingum K:**					**0.228**
#1	6	8. Large gullies, diversions, and low flowing streams	7.04	200.00	2,840.00	7.960	0.099
#1	**6**	**Muskingum K:**					**0.099**

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Quality Coal Co., Inc.

Dutton Hill Mine No. 2

P-

Basin 013

4.8 Inch, 25 Year - 6 Hour

SCS 6 Hour

Stephen Miles, P.E.

Quality Coal Co., Inc.
PO Box 2705
Jasper, Alabama 35502

General Information

Storm Information:

Storm Type:	Rainfall Event

Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1680
1.00	0.3840
1.50	0.6480
2.00	1.1040
2.50	2.8800
3.00	3.3600
3.50	3.7440
4.00	4.0080
4.50	4.2480
5.00	4.4400
5.50	4.6320
6.00	4.8000

Peak 30-minute Intensity: 3.552 in/hr

Particle Size Distribution:

Size (mm)	Topsoil	Spoil
3.0000	100.000%	100.000%
2.0000	96.000%	91.000%
1.0000	85.000%	84.000%
0.5000	76.000%	62.000%
0.3000	63.000%	49.000%
0.2000	53.000%	40.000%
0.1000	44.000%	33.000%
0.0500	33.000%	26.000%
0.0300	27.000%	18.000%
0.0200	24.000%	14.000%
0.0100	15.000%	12.000%
0.0050	10.000%	8.000%

Size (mm)	Topsoil	Spoil
0.0030	7.000%	4.000%
0.0010	4.000%	2.000%
0.0001	0.000%	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Basin 013

#1
Pond

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	210.800	210.800	415.28	40.04	14,018.5	472,478	324.89	158.14
	Out			311.71	40.04	1,651.0	38,789	0.74	0.66

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
3.0000	100.000%	100.000%
2.0000	100.000%	100.000%
1.0000	94.482%	100.000%
0.5000	69.849%	100.000%
0.3000	55.228%	100.000%
0.2000	45.097%	100.000%
0.1000	37.207%	100.000%
0.0500	29.301%	100.000%
0.0300	20.320%	100.000%
0.0200	15.830%	100.000%
0.0100	13.522%	100.000%
0.0050	9.014%	76.539%
0.0030	4.524%	38.413%
0.0010	2.266%	19.242%
0.0001	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Basin 013

Pond Inputs:

Initial Pool Elev:	316.50 ft
Initial Pool:	22.10 ac-ft
*Sediment Storage:	7.00 ac-ft
Dead Space:	20.00 %

**Sediment capacity was entered by user*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
316.50	12.00	2.00:1	2.00:1	10.00

Pond Results:

Peak Elevation:	320.18 ft
H'graph Detention Time:	0.66 hrs
Pond Model:	CSTRS
Dewater Time:	1.73 days
Trap Efficiency:	88.22 %

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)	
302.44	1.144	0.000	0.000		Top of Sed. Storage
302.50	1.148	0.072	0.000		
303.00	1.176	0.653	0.000		
303.50	1.205	1.248	0.000		
304.00	1.234	1.858	0.000		
304.50	1.264	2.483	0.000		
305.00	1.294	3.122	0.000		
305.50	1.323	3.777	0.000		
306.00	1.353	4.445	0.000		
306.50	1.382	5.129	0.000		
307.00	1.413	5.828	0.000		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)	
307.50	1.443	6.542	0.000		
308.00	1.474	7.271	0.000		
308.50	1.505	8.016	0.000		
309.00	1.536	8.776	0.000		
309.50	1.568	9.552	0.000		
310.00	1.600	10.344	0.000		
310.50	1.631	11.152	0.000		
311.00	1.662	11.975	0.000		
311.50	1.694	12.814	0.000		
312.00	1.726	13.669	0.000		
312.50	1.758	14.539	0.000		
313.00	1.790	15.426	0.000		
313.50	1.823	16.330	0.000		
314.00	1.856	17.250	0.000		
314.50	1.889	18.186	0.000		
315.00	1.923	19.139	0.000		
315.50	1.956	20.109	0.000		
316.00	1.990	21.095	0.000		
316.50	2.024	22.099	0.000		Spillway #1
317.00	2.058	23.119	2.032	36.50	
317.50	2.092	24.156	27.918	1.25	
318.00	2.127	25.211	59.514	0.60	
318.50	2.162	26.283	100.201	2.00	
319.00	2.197	27.372	150.727	0.65	
319.50	2.232	28.480	211.367	0.35	
320.00	2.268	29.605	282.455	0.15	
320.18	2.279	30.013	311.713	0.05	Peak Stage
320.50	2.301	30.747	364.353		
321.00	2.334	31.905	457.432		
321.50	2.367	33.080	562.063		
322.00	2.400	34.272	678.615		

Detailed Discharge Table

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
302.44	0.000	0.000
302.50	0.000	0.000
303.00	0.000	0.000
303.50	0.000	0.000
304.00	0.000	0.000
304.50	0.000	0.000
305.00	0.000	0.000
305.50	0.000	0.000
306.00	0.000	0.000
306.50	0.000	0.000
307.00	0.000	0.000
307.50	0.000	0.000
308.00	0.000	0.000
308.50	0.000	0.000
309.00	0.000	0.000
309.50	0.000	0.000
310.00	0.000	0.000
310.50	0.000	0.000
311.00	0.000	0.000
311.50	0.000	0.000
312.00	0.000	0.000
312.50	0.000	0.000
313.00	0.000	0.000
313.50	0.000	0.000
314.00	0.000	0.000
314.50	0.000	0.000
315.00	0.000	0.000
315.50	0.000	0.000
316.00	0.000	0.000
316.50	0.000	0.000
317.00	2.032	2.032
317.50	27.918	27.918
318.00	59.514	59.514
318.50	100.201	100.201
319.00	150.727	150.727
319.50	211.367	211.367
320.00	282.455	282.455
320.50	364.353	364.353
321.00	457.432	457.432
321.50	562.063	562.063

Elevation (ft)	Emergency Spillway (cfs)	Combined Total Discharge (cfs)
322.00	678.615	678.615

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	61.200	0.254	0.000	0.000	81.000	F	132.57	13.638
	2	100.600	0.057	0.113	0.375	70.000	M	189.20	15.736
	3	39.200	0.046	0.116	0.397	75.000	M	88.02	7.431
	4	2.000	0.001	0.000	0.000	100.000	F	7.16	0.797
	5	2.200	0.031	0.228	0.337	68.000	M	3.82	0.317
	6	5.600	0.035	0.099	0.412	98.000	F	19.96	2.122
	Σ	**210.800**						**415.28**	**40.040**

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	36.70	0.9000	1.0000	2	13,890.3	805,909	554.33	386.79
	2	0.300	200.00	33.20	0.0030	1.0000	1	67.7	5,225	3.48	2.10
	3	0.240	200.00	22.40	0.0100	1.0000	1	50.9	8,227	5.47	3.34
	4	0.001	200.00	0.01	0.0010	1.0000	2	0.0	0	0.00	0.00
	5	0.240	200.00	28.20	0.0500	1.0000	2	9.6	36,175	25.33	15.50
	6	0.001	200.00	5.50	0.0010	1.0000	1	0.0	0	0.00	0.00
	Σ							**14,018.5**	**472,478**	**324.89**	**158.14**

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	2.50	5.00	200.00	1.580	0.035
		8. Large gullies, diversions, and low flowing streams	1.30	35.00	2,700.00	3.410	0.219
#1	**1**	**Time of Concentration:**					**0.254**
#1	2	1. Forest with heavy ground litter	25.00	50.00	200.00	1.260	0.044
		8. Large gullies, diversions, and low flowing streams	15.52	90.00	580.00	11.810	0.013
#1	**2**	**Time of Concentration:**					**0.057**
#1	3	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
		8. Large gullies, diversions, and low flowing streams	14.06	90.00	640.00	11.250	0.015

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	**3**	**Time of Concentration:**					**0.046**
#1	5	3. Short grass pasture	5.00	10.00	200.00	1.780	0.031
#1	**5**	**Time of Concentration:**					**0.031**
#1	6	7. Paved area and small upland gullies	2.50	5.00	200.00	3.180	0.017
		8. Large gullies, diversions, and low flowing streams	3.85	15.00	390.00	5.880	0.018
#1	**6**	**Time of Concentration:**					**0.035**

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	2	8. Large gullies, diversions, and low flowing streams	2.88	60.00	2,080.01	5.090	0.113
#1	**2**	**Muskingum K:**					**0.113**
#1	3	8. Large gullies, diversions, and low flowing streams	4.74	130.00	2,740.00	6.530	0.116
#1	**3**	**Muskingum K:**					**0.116**
#1	5	8. Large gullies, diversions, and low flowing streams	1.38	40.00	2,900.00	3.520	0.228
#1	**5**	**Muskingum K:**					**0.228**
#1	6	8. Large gullies, diversions, and low flowing streams	7.04	200.00	2,840.00	7.960	0.099
#1	**6**	**Muskingum K:**					**0.099**