mcgehee engineering corp

April 9, 2015

Stephen D. Miles, P.E.
Alabama Surface Mining Commission
P. O. Box 2390
Jasper, AL 35502-2390

RE: **Oak Grove Resources, LLC**
Concord Prep Plant, P-3233

Dear Mr. Miles:

I hereby certify the enclosed detailed design plans for Sediment Basin 027 for the above referenced Mine are in accordance with the Regulations of the Alabama Surface Mining Commission as adopted by Act 81-435 of December 18, 1981 and as amended to date and that the information used in the enclosed basin design plans is true and correct to the best of my knowledge and belief.

If you have any questions or need additional information, please do not hesitate to contact our office.

Sincerely,

McGehee Engineering Corp.

ALABAMA REGISTERED No. 17067 PROFESSIONAL ENGINEER C. W. McGEHEE

C. W. McGehee, P.E.
Alabama Reg. No. 17067

Post Office Box 3431 • 450 19th Street • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • cw@mcgehee.org

SEDIMENT BASIN CONSTRUCTION SPECIFICATIONS

Sediment basins (temporary or permanent) will be designed and constructed using the following as minimum specifications:

1. EMBANKMENT REQUIREMENTS

A) The minimum width of the top of the embankment will under no circumstance be less than twelve (12) feet.

B) The embankment will have a minimum front and back slope no steeper than the slopes listed on the detailed design sheet.

C) The foundation area of the embankment will be cleared and grubbed of all organic matter with no surface slope steeper than 1 horizontal to 1 vertical. The entire wet area, as measured from the upstream toe of the embankment to the normal pool level, will be cleared of trees and large brush.

D) A core will be constructed in a cutoff trench along the centerline of the embankment. The cutoff trench will be of suitable depth and width to attain relatively impervious material.

E) The embankment construction material will be free of sod, roots, stumps, rocks, etc., which exceed six (6") inches in diameter. The embankment material will be placed in layers of twelve (12") inches or less and compacted to ninety five (95%) percent of the standard proctor density, as set forth in ASTM.

F) The embankment, foundation and abutments will be designed and constructed to be stable under normal construction and operating conditions, with a minimum static safety factor of 1.3 at normal pool level with steady seepage saturation conditions.

G) The actual constructed height of the embankment will be a minimum of five (5%) percent higher than the design height to allow for settling over the life of the embankment.

H) The design embankment height for temporary impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater). The design embankment height for permanent impoundments will be a minimum of one (1) foot above the maximum water level anticipated from a 10 Year - 24 Hour or a 25 Year - 6 Hour precipitation event (whichever is greater).

I) For embankments constructed as point source discharges, the embankment will be constructed and abutments keyed into undisturbed, virgin, ground if at all possible. In the event that this can not be achieved, additional design and construction specifications will be submitted in the detailed design plans.

J) The embankment and all areas disturbed in the construction of the embankment will be seeded with a mixture of perennial and annual grasses, fertilized and mulched to prevent erosion and ensure restabilization. Hay dams, silt fences, rock check dams, etc. will be installed, where deemed necessary, as additional erosion prevention methods.

2. DISCHARGE STRUCTURE REQUIREMENTS

A) The primary spillway will be designed to adequately carry the anticipated peak runoff from a 10 Year - 24 Hour precipitation event. The combination primary and secondary (emergency) spillway system will be designed to safely carry the anticipated peak runoff from a 25 Year - 6 Hour precipitation event. When sediment basins are proposed in the drainage course of a public water supply, the spillway system will be designed and constructed to adequately carry the runoff from a 50 Year - 24 Hour precipitation event.

B) Channel linings, for secondary (emergency) spillways will be a trapezoidal open channel constructed in natural ground and planted with a mixture of both annual and perennial grasses being predominantly fescue and bermuda. In the event that the spillway can not be constructed in natural ground the spillway will be lined with riprap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).

C) When consisting of pipe, the primary spillway will be installed according to Class "C" pipe installation for embankment bedding.

D) Sediment basins with a single spillway system, such as a skimmer board, will be a trapezoidal open channel constructed in consolidated, nonerodible material and lined with rip-rap, concrete, asphalt or durable rock (See Detailed Design Plans for Spillway Lining).

E) The primary spillway will be designed and constructed with device to eliminate floating solids from leaving the impoundment. This device will consist of a turned down elbow when using pipe or a skimmer system when using an open channel spillway.

F) When necessary, to prevent erosion of the embankment or discharge area, a splash pad of rip-rap, durable rock, sacrete, etc. will be installed at the discharge end of the primary spillway.

G) The combined spillway systems, for sediment basins constructed in series, will be designed to adequately accommodate the entire drainage area.

3. INSPECTION, MAINTENANCE AND CERTIFICATION REQUIREMENTS

A) Inspections will be conducted regularly during construction of the sediment basin by a qualified registered professional engineer or other qualified person under the direction of a professional engineer. Upon completion of construction, the sediment basin will be certified, by a qualified registered professional engineer, to the Regulatory Authority as having been constructed in accordance with the approved detailed design plans.

B) Sediment basins will be inspected semi-monthly for erosion, instability, etc., with maintenance performed as necessary, until the removal of the structure or until a Phase III Bond Release is granted.

C) Sediment basins will be examined quarterly for structural weakness, instability, erosion, slope failure, or other hazardous conditions with maintenance performed as necessary.

D) Formal inspections will be made annually, by a qualified registered professional engineer or other qualified person under the direction of a professional engineer, including any reports or modifications, in accordance with 880-X- 10C- .20[1(j)] of the Alabama Surface Mining Regulations.

E) Retained sediment will be removed from each sediment basin when the accumulated sediment reaches the maximum allowable sediment volume as set forth in the detailed design plans.

4. BASIN REMOVAL REQUIREMENTS

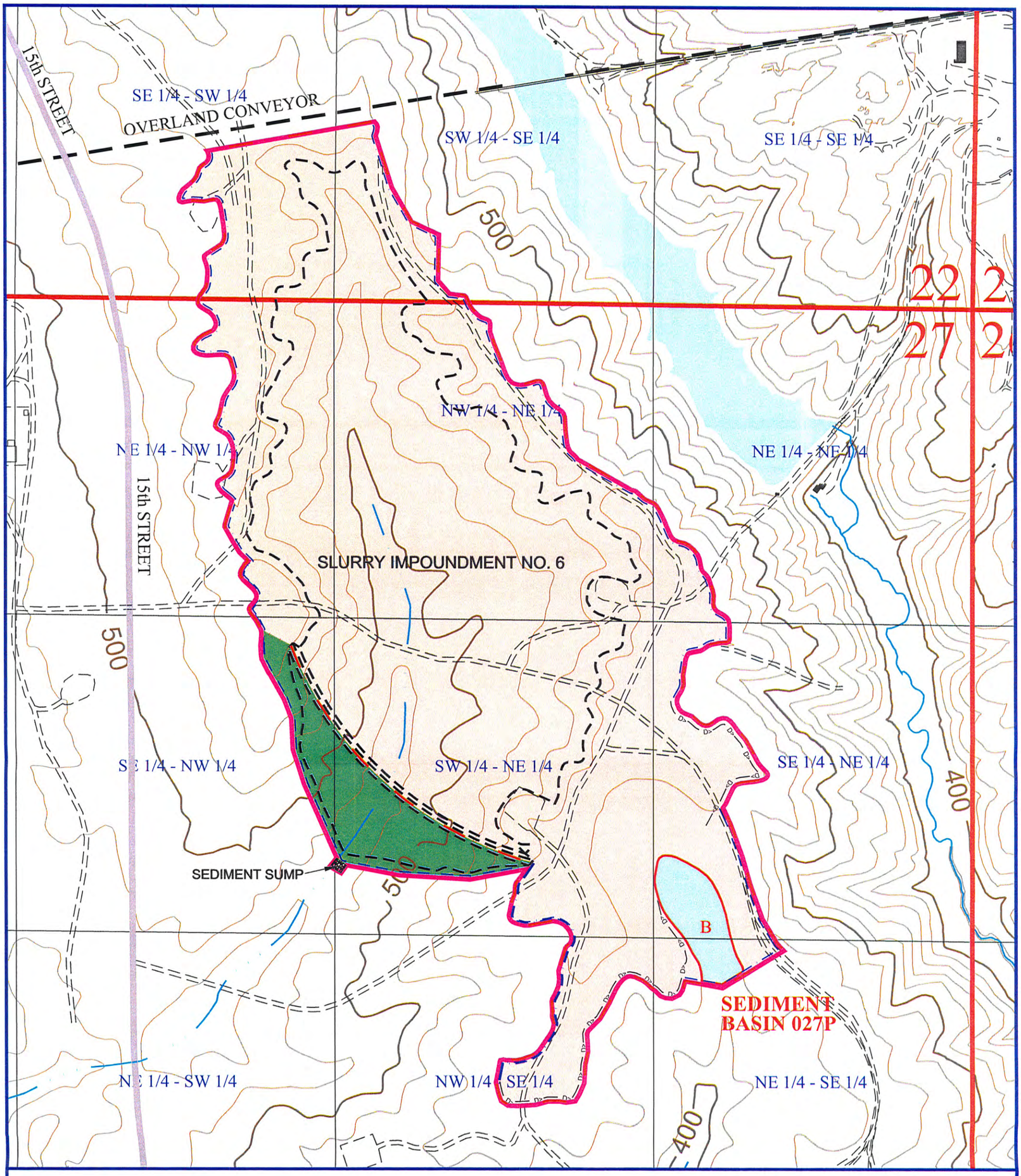
A) Upon completion of mining, reclamation, restabilization and effluent standards being met, each sediment basin not proposed as a permanent water impoundment will be dewatered in a controlled manner by either pumping or siphoning. Upon successful dewatering, a determination will be made as to the retained sediment level in the basin. After determining the retained sediment level, a channel will be cut into the embankment down to the retained sediment level on the side of the embankment deemed most suitable to reach natural ground without encountering prohibiting rock. The embankment material removed from this newly constructed channel will be spread and compacted over the previous impoundment (wet area) area to prevent erosion and ensure restabilization. The newly constructed channel will be of adequate width (minimum 30 feet) and sloped to a grade (approximately 1% to 3%) which will cause all surface drainage to travel across this area in sheet flow, minimizing the possibility of erosion. Also, where necessary, hay dams will be installed in strategic locations across the width of the channel to retain sediment and slow the water velocity to a favorable rate. Upon removal of the embankment section, all disturbed areas will be graded in such a manner to ensure slope stability, successful restabilization and to minimize erosion. All disturbed areas will be seeded with a mixture of annual and perennial grasses, fertilized and mulched. No slope, existing or created in the removal of the sediment basin, will be left on a grade that will slip or slough.

5. PERMANENT WATER IMPOUNDMENT REQUIREMENTS

A) Prior to a request for a Phase II Bond Release, all sediment basins being left as permanent water impoundments will have supplemental data submitted to the Regulatory Authority concerning water quality, water quantity, size, depth, configuration, postmining land use, etc.

B) Final grading slopes of the entire permanent water impoundment area will not exceed a slope of 2 Horizontal to 1 Vertical to provide for safety and access for future water users.

DETAILED DESIGN PLANS
SEDIMENT BASIN 027



CONTOUR INTERVAL: 20 FT.

N
W E
S

MAP LEGEND

- SEDIMENT BASIN, C.N. 100
- REVEGETATED, C.N. 70
- GRADED AND BARE, C.N. 81
- PERMIT BOUNDARY
- DRAINAGE DIVIDE
- DIVERISON DITCH
- SILT FENCE
- RECLAIMED SLURRY IMP. 6 BOUNDARY

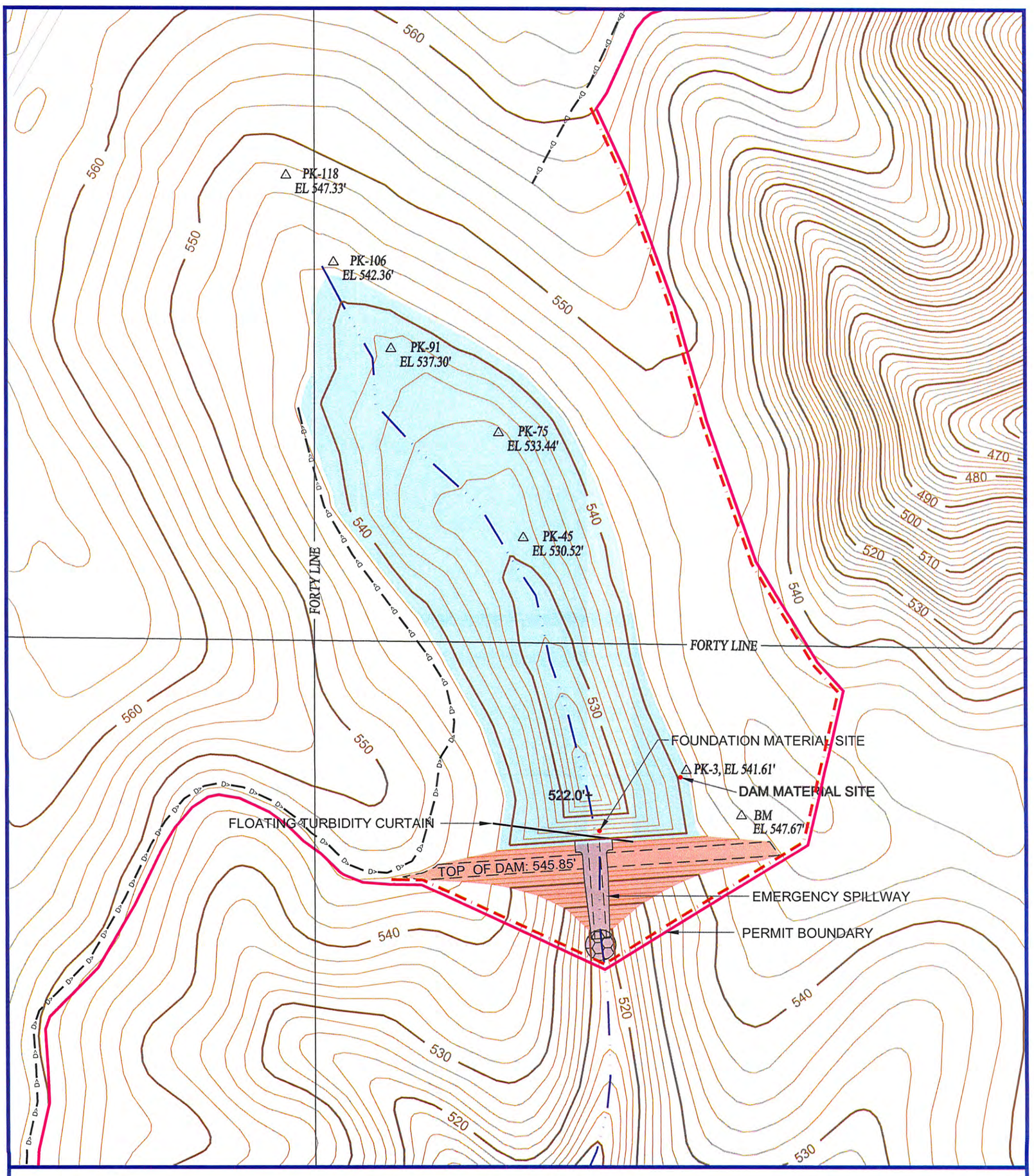
OAK GROVE RESOURCES, LLC

CONCORD PREP PLANT, P-3233

Watershed Map Basin 027

FILE:	SCALE:	JOB NO.:
Basin027WSMap	1" = 400'	N/A
APPROVED BY:	DATE:	SHEET:
C.W.M.	04-08-15	1 OF 1

mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: staff@mcgehee.org



CONTOUR INTERVAL = 2 FEET

OAK GROVE RESOURCES, LLC

CONCORD PREP PLANT, P-3233

SEDIMENT BASIN 027
PLAN VIEW DRAWING
SCALE: 1" = 100'

UPSTREAM TOE ELEV.: 522.0'
SEDIMENT REMOVAL ELEV.: 538.95'
PRIMARY SPILLWAY ELEV.: 541.5'
EMERGENCY SPILLWAY ELEV.: 541.5'
**MAXIMUM WATER ELEV.: 543.63'
TOP OF DAM ELEV.: 544.7' DESIGN
TOP OF DAM ELEV.: 545.85' CONSTRUCT.

PRIMARY/EMERGENCY SPILLWAY: 12' WIDE TRAPEZOIDAL CONCRETE LINED OPEN CHANNEL

N
W E
S

mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: cw@mcgehee.org

ENERGY DISSIPATER (CLASS II SANDSTONE RIPRAP)

** 25 YEAR - 6 HOUR PRECIPITATION EVENT.

D> DIVERSION DITCH
ORIGINAL DRAINAGE PATH
SILT FENCE
NORMAL POOL AREA

Copyright 1998-2010 Pamela J. Schwab

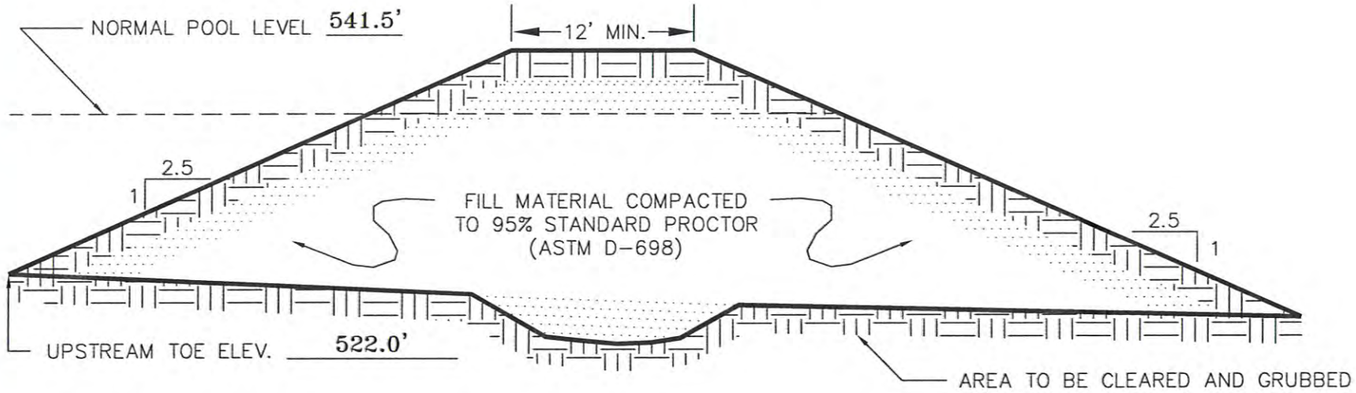
Concord Prep Plant, P-3233 - Sediment Basin 027

Elevation-Area-Capacity Table

Elevation (ft)	Area (ac)	Capacity (ac-ft)
522.00	0.000	0.000
522.50	0.001	0.000
523.00	0.005	0.002
523.50	0.012	0.006
524.00	0.022	0.015
524.50	0.032	0.028
525.00	0.044	0.047
525.50	0.057	0.072
526.00	0.073	0.105
526.50	0.092	0.146
527.00	0.112	0.197
527.50	0.135	0.258
528.00	0.160	0.332
528.50	0.195	0.421
529.00	0.234	0.528
529.50	0.276	0.655
530.00	0.322	0.805
530.50	0.389	0.982
531.00	0.462	1.195
531.50	0.542	1.446
532.00	0.628	1.738
532.50	0.717	2.074
533.00	0.813	2.456
533.50	0.914	2.888
534.00	1.021	3.371
534.50	1.115	3.905
535.00	1.214	4.487
535.50	1.316	5.119
536.00	1.423	5.804
536.50	1.530	6.542
537.00	1.642	7.335
537.50	1.757	8.184
538.00	1.876	9.093
538.50	2.000	10.061
539.00	2.128	11.093
539.50	2.260	12.190
540.00	2.396	13.354
540.50	2.532	14.586

Elevation (ft)	Area (ac)	Capacity (ac-ft)
541.00	2.672	15.887
541.50	2.816	17.258
542.00	2.963	18.703
542.50	3.175	20.237
543.00	3.393	21.879
543.50	3.620	23.632
544.00	3.853	25.499
544.50	4.083	27.483
545.00	4.320	29.584
545.50	4.564	31.804
546.00	4.814	34.149
546.50	5.057	36.616
547.00	5.306	39.207
547.50	5.561	41.923
548.00	5.822	44.769

EMBANKMENT CROSS-SECTION



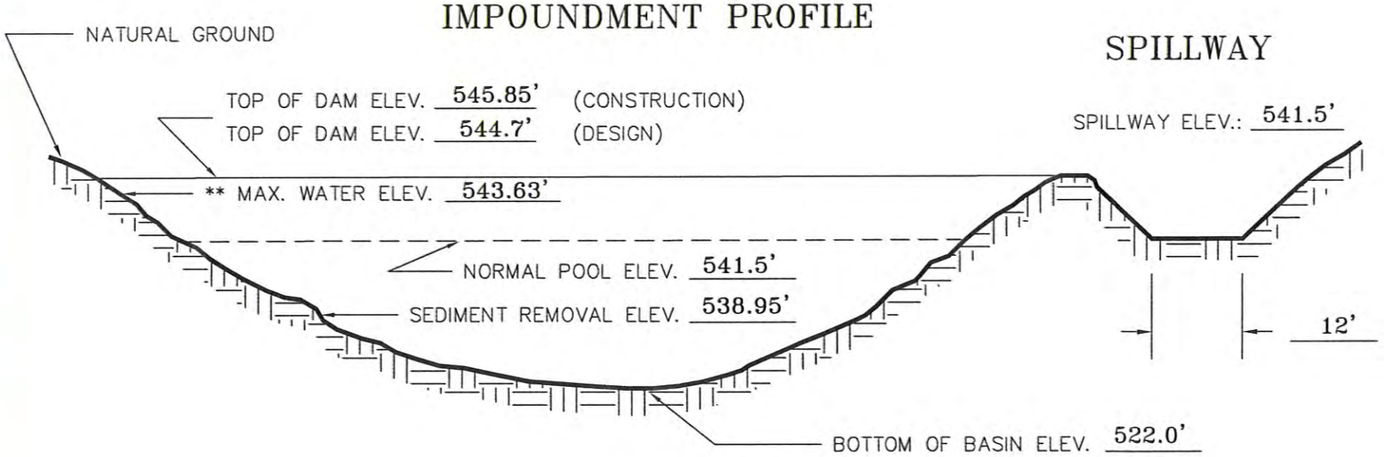
COMPANY: OAK GROVE RESOURCES, LLC

MINE NAME: CONCORD PREP PLANT

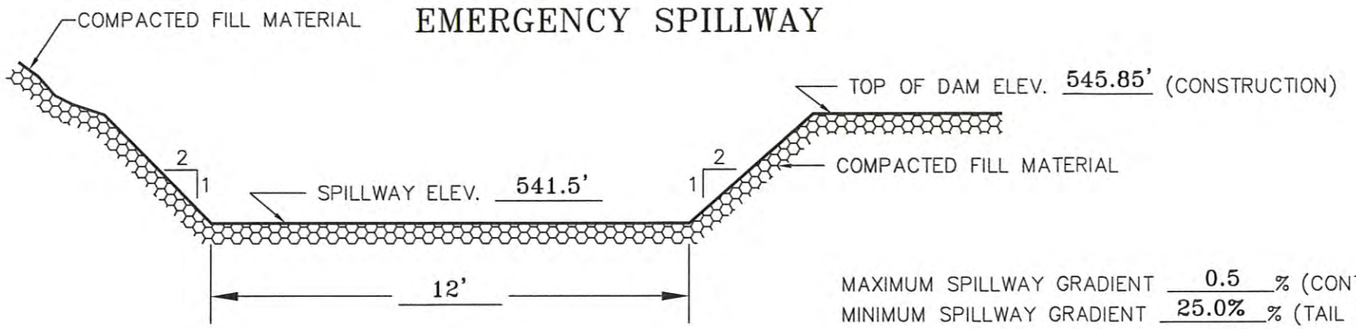
PERMIT #: P-3233

BASIN I.D. #: SEDIMENT BASIN 027

IMPOUNDMENT PROFILE



EMERGENCY SPILLWAY



MAXIMUM SPILLWAY GRADIENT 0.5 % (CONTROL SECTION)
MINIMUM SPILLWAY GRADIENT 25.0% % (TAIL DITCH SECTION)
MAXIMUM SPILLWAY GRADIENT 40.0% % (TAIL DITCH SECTION)

SEE SPILLWAY CONTROL SECTION AND TAIL DITCH DESIGN FOR CHANNEL LINING REQUIREMENTS.

KEY BASIN PARAMETERS

DRAINAGE AREA	110.0	ACRES
DISTURBED AREA	107.5	ACRES
SEDIMENT STORAGE	11.00	AC.FT.
DETENTION STORAGE	6.26	AC.FT.
PERMANENT POOL CAPACITY	17.26	AC.FT.
* TOTAL BASIN STORAGE CAPACITY	23.34	AC.FT.
** PEAK INFLOW	186.56	C.F.S.
** PEAK OUTFLOW	122.28	C.F.S.

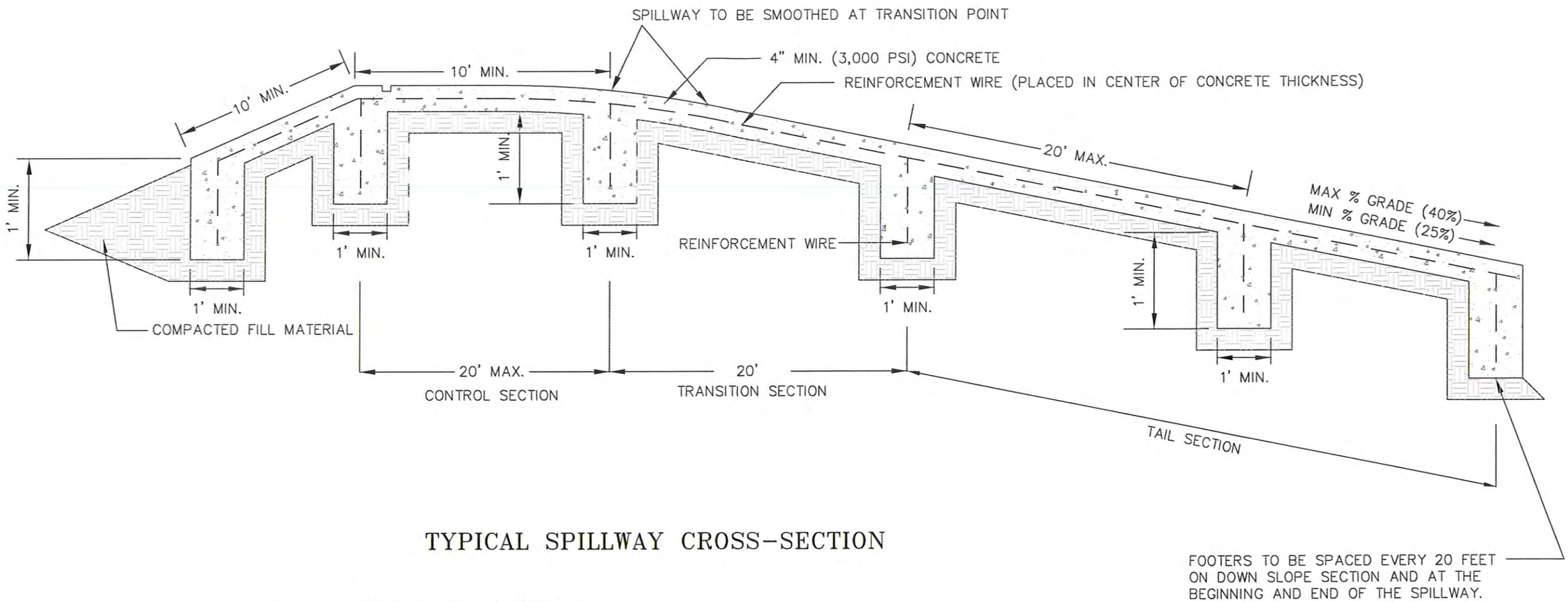
NOTE: ALL ELEVATIONS ASSUMED.

* 10 YEAR – 24 HOUR PRECIPITATION EVENT.

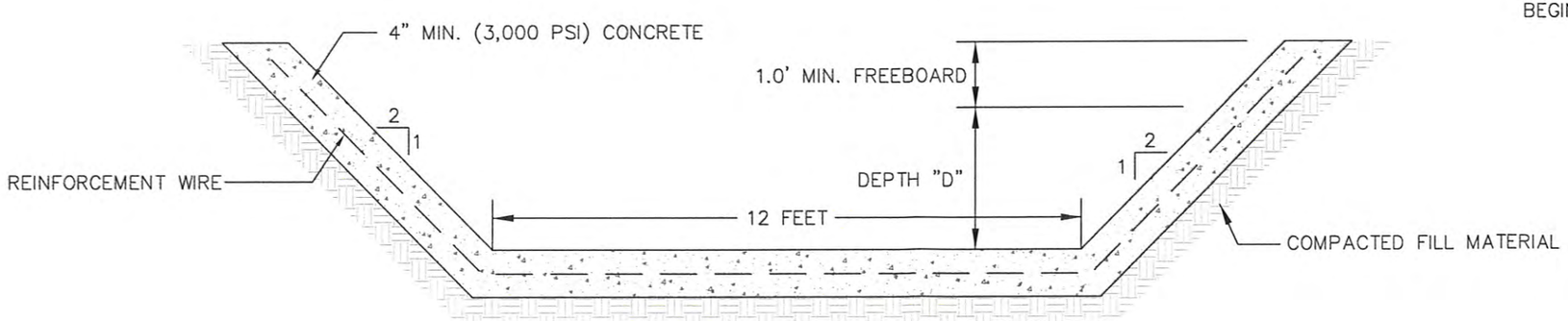
** 25 YEAR – 6 HOUR PRECIPITATION EVENT.

mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: cw@mcgehee.org

SEDIMENT BASIN 027 SPILLWAY PROFILE



TYPICAL SPILLWAY CROSS-SECTION



SPILLWAY FLOW DEPTH "D" = 2.2 FEET (CONTROL SECTION)

SPILLWAY FLOW DEPTH "D" = 0.75 FEET (TAIL DITCH SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 3.2 FEET (CONTROL SECTION)

TOTAL SPILLWAY DEPTH "D+1" = 1.75 FEET (TAIL DITCH SECTION)

NOTE: TOTAL SPILLWAY DEPTH IN TRANSITION SECTION VARIES FROM 3.2 FEET TO 1.75 FEET

mcgehee engineering corp
post office box 3431
jasper, alabama 35502-3431
telephone: (205) 221-0686 fax: 221-7721
email: cw@mcgehee.org

Copyright 1998-2010 Pamela J. Schwab

P-3233 - Basin 027 - 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)
12.00	2.0:1	2.0:1	0.5	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	130.00 cfs	
Depth:	1.56 ft	2.56 ft
Top Width:	18.22 ft	22.22 ft
Velocity:	5.53 fps	
X-Section Area:	23.51 sq ft	
Hydraulic Radius:	1.240 ft	
Froude Number:	0.86	

P-3233 - Basin 027 - 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)
12.00	2.0:1	2.0:1	25.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	130.00 cfs	
Depth:	0.50 ft	1.50 ft
Top Width:	14.00 ft	18.00 ft
Velocity:	20.05 fps	
X-Section Area:	6.48 sq ft	
Hydraulic Radius:	0.456 ft	
Froude Number:	5.19	

P-3233 - Basin 027 - 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)
12.00	2.0:1	2.0:1	40.0	0.0220	1.00		

	w/o Freeboard	w/ Freeboard
Design Discharge:	130.00 cfs	
Depth:	0.43 ft	1.43 ft
Top Width:	13.74 ft	17.74 ft
Velocity:	23.28 fps	
X-Section Area:	5.58 sq ft	
Hydraulic Radius:	0.401 ft	
Froude Number:	6.43	

SPILLWAY CHANNEL SPECIFICATIONS
SEDIMENT BASIN 027

The entire control section and tail ditch section of the emergency spillway will be cut into the compacted fill of the embankment and lined with a minimum of 4 inches of reinforced concrete. All concrete will be reinforced with 10 gauge, 6" x 6" welded wire mesh. Fibermesh may be added to the concrete for additional strength, however, the addition of fibermesh shall not be used in place of the required 6" x 6" welded wire.

The gradient of the control section of the emergency spillway will not exceed two (2.0%) percent. The gradient of the tail ditch section of the emergency spillway will not exceed forty (40%) percent. For the purpose of designing a conservative concrete lined channel depth in the tail ditch section a twenty five (25%) percent gradient was used.

The control section and tail ditch section of the emergency spillway will extend from the inner face of the embankment, past the centerline of the embankment and be carried out beyond the downstream slope of the embankment.

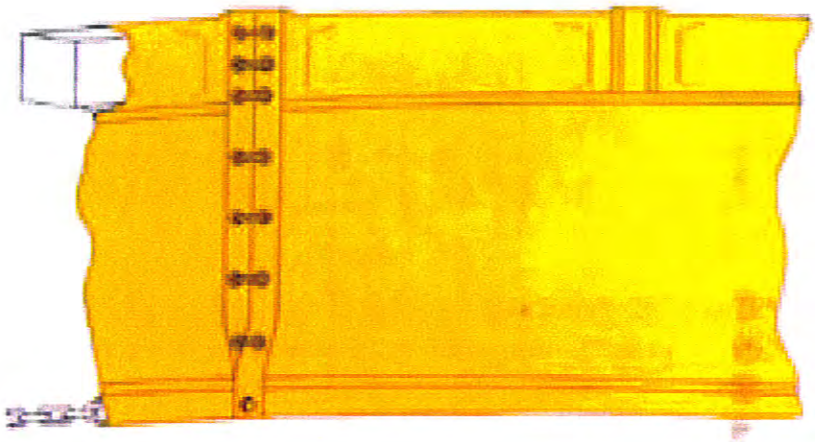
The concrete liner of the control section of the emergency spillway will be a minimum of 3.2 feet as measured vertically, allowing 2.2 feet for the maximum anticipated flow and 1.0 feet of dry freeboard. The concrete liner of the tail ditch section of the emergency spillway will be a minimum of 1.75 feet as measured vertically, allowing 0.75 feet for the maximum anticipated flow and 1.0 foot of dry freeboard. There will be a transition zone of at least 20 feet in length between the control section and the tail section. The minimum depth at the beginning of the transition will be 3.2 feet and 1.75 feet at the end of the transition. The flow line of the spillway will be smoothed at the transition to avoid abrupt changes in the flow line slope.

See enclosed SEDCAD 4.0 spillway tail ditch section design and attached Plan Sheet cross-section for the minimum and maximum emergency spillway construction requirements.

A floating silt fence (lightweight turbidity curtain) will be installed near the entrance to the spillway to accomplish sub-surface withdrawal. The floating silt fence (lightweight turbidity curtain) will be set at normal pool and will be anchored at the 10 Year – 24 Hour Event peak stage with steel fence posts.

SUBSURFACE WITHDRAWAL DEVICE AND FLOATING SILT BOOM

Lightweight Turbidity Curtain
Application: Calm waters with little current, such as lakes, ponds, canals and shoreline areas.



Specifications

- Curtain to be anchored at the maximum anticipated peak stage elevation (10 Year – 24 Hour Precipitation Event).
- PVC coated floatations - ultraviolet resistant
- Geotextile fabric screens
- Chain ballast with connectors
- Double sewn seams with grommets
- Depths per requirements ' 50' sections = Minimum 24" deep
- Fabric - Polyester reinforced vinyl high visibility yellow
- Connector - Sections are laced together through grommets and load lines are bolted together.
- Flotation - 6" expanded polystyrene over 9 lbs./ft. buoyancy.
- Ballast - 1/4" galvanized chain (.7 lbs/ft).

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
10 YEAR - 24 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 027

Copyright 1998 -2010 Pamela L Schwab

Oak Grove Resources, LLC.
Concord Preparation Plant

Sediment Basin 027

10 Year - 24 Hour Precipitation Event

C W McGehee, P.E.

General Information

Storm Information:

Storm Type:	DRN 58
Design Storm:	10 yr - 24 hr
Rainfall Depth:	6.100 inches

Particle Size Distribution:

Size (mm)	cover soil
4.7500	100.000%
3.0000	78.000%
2.0000	63.000%
1.0000	47.000%
0.5000	30.500%
0.3000	19.900%
0.2000	14.300%
0.1000	7.400%
0.0500	5.000%
0.0300	3.700%
0.0200	1.900%
0.0100	0.800%
0.0050	0.350%
0.0030	0.270%
0.0010	0.190%
0.0000	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 027

#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	110.000	110.000	119.69	34.77	1,108.8	40,893	32.32	18.48
	Out			100.23	34.70	8.9	392	0.02	0.01

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
4.7500	100.000%	100.000%
3.0000	86.643%	100.000%
2.0000	69.981%	100.000%
1.0000	52.208%	100.000%
0.5000	33.879%	100.000%
0.3000	22.105%	100.000%
0.2000	15.884%	100.000%
0.1000	8.220%	100.000%
0.0500	5.554%	100.000%
0.0300	4.110%	100.000%
0.0200	2.111%	100.000%
0.0100	0.889%	100.000%
0.0050	0.389%	48.253%
0.0030	0.300%	37.224%
0.0010	0.211%	26.194%
0.0000	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 027

Pond Inputs:

Initial Pool Elev:	541.50 ft
Initial Pool:	6.26 ac-ft
*Sediment Storage:	11.00 ac-ft
Dead Space:	20.00 %

**Sediment capacity calculated from 0.100 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
541.50	20.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	543.41 ft
H'graph Detention Time:	1.57 hrs
Pond Model:	CSTRS
Dewater Time:	0.87 days
Trap Efficiency:	99.19 %

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)	
538.95	2.116	0.000	0.000		Top of Sed. Storage
539.00	2.128	0.096	0.000		
539.50	2.260	1.193	0.000		
540.00	2.396	2.357	0.000		
540.50	2.532	3.588	0.000		
541.00	2.672	4.889	0.000		
541.50	2.816	6.261	0.000		Spillway #1
542.00	2.963	7.706	2.189	7.98*	
542.50	3.175	9.240	30.064	10.60	
543.00	3.393	10.881	63.036	1.40	
543.41	3.582	12.335	100.226	0.80	Peak Stage
543.50	3.620	12.634	107.884		

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
544.00	3.853	14.502	163.374	
544.50	4.083	16.486	229.657	
545.00	4.320	18.586	306.985	
545.50	4.564	20.807	395.659	
546.00	4.814	23.151	496.003	
546.50	5.057	25.619	608.353	
547.00	5.306	28.209	733.049	
547.50	5.561	30.926	870.430	
548.00	5.822	33.771	1,020.832	

**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)
538.95	0.000	0.000
539.00	0.000	0.000
539.50	0.000	0.000
540.00	0.000	0.000
540.50	0.000	0.000
541.00	0.000	0.000
541.50	0.000	0.000
542.00	2.189	2.189
542.50	30.064	30.064
543.00	63.036	63.036
543.50	107.884	107.884
544.00	163.374	163.374
544.50	229.657	229.657
545.00	306.985	306.985
545.50	395.659	395.659
546.00	496.003	496.003
546.50	608.353	608.353
547.00	733.049	733.049
547.50	870.430	870.430
548.00	1,020.832	1,020.832

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	107.500	0.675	0.000	0.000	81.000	F	118.15	33.497
	2	2.500	0.101	0.000	0.000	100.000	F	4.00	1.270
	$\sum$	**110.000**						**119.69**	**34.766**

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	400.00	2.00	0.9000	1.0000	1	1,108.8	41,416	32.73	19.01
	2	0.240	100.00	0.01	0.0010	1.0000	1	0.0	2	0.00	0.00
	$\sum$							**1,108.8**	**40,893**	**32.32**	**18.48**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	6. Grassed waterway	1.00	22.00	2,200.00	1.500	0.407
#1	**1**	**Time of Concentration:**					**0.675**

HYDROLOGY AND SEDIMENTOLOGY PREDICTION
25 YEAR - 6 HOUR PRECIPITATION EVENT
SEDIMENT BASIN 027

Copyright 1998 -2010 Pamela J. Schwab

Oak Grove Resources, LLC.
Concord Preparation Plant

Sediment Basin 027

25 Year - 6 Hour Precipitation Event

C W McGehee, P.E.

General Information

Storm Information:

Storm Type:	SCS 6 Hour
Design Storm:	25 yr - 6 hr
Rainfall Depth:	4.900 inches

Particle Size Distribution:

Size (mm)	cover soil
4.7500	100.000%
3.0000	78.000%
2.0000	63.000%
1.0000	47.000%
0.5000	30.500%
0.3000	19.900%
0.2000	14.300%
0.1000	7.400%
0.0500	5.000%
0.0300	3.700%
0.0200	1.900%
0.0100	0.800%
0.0050	0.350%
0.0030	0.270%
0.0010	0.190%
0.0000	0.000%

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Pond	#1	==>	End	0.000	0.000	Sediment Basin 027

#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	110.000	110.000	186.56	25.43	1,190.2	49,647	39.14	26.72
	Out			122.28	25.42	14.3	634	0.08	0.05

Particle Size Distribution(s) at Each Structure

Structure #1:

Size (mm)	In	Out
4.7500	100.000%	100.000%
3.0000	100.000%	100.000%
2.0000	84.750%	100.000%
1.0000	63.226%	100.000%
0.5000	41.030%	100.000%
0.3000	26.770%	100.000%
0.2000	19.237%	100.000%
0.1000	9.955%	100.000%
0.0500	6.726%	100.000%
0.0300	4.977%	100.000%
0.0200	2.556%	100.000%
0.0100	1.076%	89.344%
0.0050	0.471%	39.088%
0.0030	0.363%	30.154%
0.0010	0.256%	21.219%
0.0000	0.000%	0.000%

Structure Detail:

Structure #1 (Pond)

Sediment Basin 027

Pond Inputs:

Initial Pool Elev:	541.50 ft
Initial Pool:	6.26 ac-ft
*Sediment Storage:	11.00 ac-ft
Dead Space:	20.00 %

**Sediment capacity calculated from 0.100 times disturbed area*

Emergency Spillway

Spillway Elev	Crest Length (ft)	Left Sideslope	Right Sideslope	Bottom Width (ft)
541.50	20.00	2.00:1	2.00:1	12.00

Pond Results:

Peak Elevation:	543.63 ft
H'graph Detention Time:	1.32 hrs
Pond Model:	CSTRS
Dewater Time:	0.54 days
Trap Efficiency:	98.80 %

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)	
538.95	2.116	0.000	0.000		Top of Sed. Storage
539.00	2.128	0.096	0.000		
539.50	2.260	1.193	0.000		
540.00	2.396	2.357	0.000		
540.50	2.532	3.588	0.000		
541.00	2.672	4.889	0.000		
541.50	2.816	6.261	0.000		Spillway #1
542.00	2.963	7.706	2.189	7.98*	
542.50	3.175	9.240	30.064	1.90	
543.00	3.393	10.881	63.036	1.55	
543.50	3.620	12.634	107.884	1.05	
543.63	3.683	13.119	122.282	0.40	Peak Stage

Elevation	Area (ac)	Capacity (ac-ft)	Discharge (cfs)	Dewater Time (hrs)
544.00	3.853	14.502	163.374	
544.50	4.083	16.486	229.657	
545.00	4.320	18.586	306.985	
545.50	4.564	20.807	395.659	
546.00	4.814	23.151	496.003	
546.50	5.057	25.619	608.353	
547.00	5.306	28.209	733.049	
547.50	5.561	30.926	870.430	
548.00	5.822	33.771	1,020.832	

**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)
538.95	0.000	0.000
539.00	0.000	0.000
539.50	0.000	0.000
540.00	0.000	0.000
540.50	0.000	0.000
541.00	0.000	0.000
541.50	0.000	0.000
542.00	2.189	2.189
542.50	30.064	30.064
543.00	63.036	63.036
543.50	107.884	107.884
544.00	163.374	163.374
544.50	229.657	229.657
545.00	306.985	306.985
545.50	395.659	395.659
546.00	496.003	496.003
546.50	608.353	608.353
547.00	733.049	733.049
547.50	870.430	870.430
548.00	1,020.832	1,020.832

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	107.500	0.675	0.000	0.000	81.000	F	183.99	24.414
	2	2.500	0.101	0.000	0.000	100.000	F	9.50	1.017
	$\sum$	**110.000**						**186.56**	**25.431**

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	400.00	2.00	0.9000	1.0000	1	1,190.2	50,326	39.67	27.82
	2	0.240	100.00	0.01	0.0010	1.0000	1	0.0	3	0.00	0.00
	$\sum$							**1,190.2**	**49,647**	**39.14**	**26.72**

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	6. Grassed waterway	1.00	22.00	2,200.00	1.500	0.407
#1	**1**	**Time of Concentration:**					**0.675**

STABILITY ANALYSIS

STABILITY ANALYSIS PROCEDURE

The computer program used to analyze the slope stability was the REAME Slope Stability Program as developed by Dr. Yang H. Huang, P.E. of the University of Kentucky.

The soil type of the foundation material beneath the proposed embankment structures of Sediment Basin 027 was sampled, analyzed and classified by personnel of McGehee Engineering Corp. The depth to the stiff base of Sediment Basin 027 (2.6') was measured by personnel of McGehee Engineering Corp.

The soil type to be used in the construction of the proposed embankment structures of Sediment Basin 027 were sampled, analyzed and classified by personnel of McGehee Engineering Corp. This sample of material was taken from adjacent ridge top material that is representative of the material to be used as dam material.

SOIL PROPERTIES

USAGE	TYPE	COHESION (psf)	INTERNAL ANGLE OF FRICTION	EFFECTIVE DENSITY (pcf)
027 FOUND	SM	270.0	33.02	132.14
027 DAM	SM	270.0	33.02	132.14

ANALYSIS RESULTS

BASIN	STATIC SAFETY FACTOR
027	2.025

mcgehee engineering corp

SIEVE ANALYSIS

(ASTM C136-96a)

Company Name: Cliffs
Location: Concord
Sample I.D.: Basin 027
Description: Foundation

Sample Date: 6/5/14
Analyzed By: JW/JG
Date Analyzed: 6/6/14
Requested By: J Aldridge

Weight of Oven Dry Sample (W): **1010.0 Grams**

Sieve No.	Sieve + Sample Weight	Sieve Weight	Sample Weight Retained	Percent of Total Retained	Cumulative Weight Percent	Percent Retained	Percent Finer
1"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3/4"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1/2"	538.0	538.0	0.0	0.0	0.0	0.0	100.0
4	518.0	512.0	6.0	0.6	0.6	0.6	99.4
10	469.9	460.0	9.9	1.0	1.6	1.6	98.4
40	581.1	382.0	199.1	19.7	21.3	21.3	78.7
200	793.5	332.0	461.5	45.6	66.9	66.9	33.1
Pan	709.8	375.0	334.8	33.1	100.0	100.0	0.0
		Total Weight (W1):	1011.3				

SOIL CLASSIFICATION

Unified System (ASTM D-2487)

Liquid Limit: N/A
Plastic Limit: N/A
Plasticity Index: N/A

Soil Classification: **SM**

Coarse Grained
Silty Sand

Effective Cohesion: 1.8750 psi
Total Cohesion: 6.528 psi
Permeability: 12.30 ft/yr
Maximum Dry Density: 115.0 pcf
Optimum Moisture: 14.9 %
Effective Cohesion: 270.0 psf
Angle of Internal Friction: 33.02 degrees
Mass Unit Weight: 132.14 pcf

Post Office Box 3431 • 450 19th Street • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • staff@mcgehee.org

mcgehee engineering corp

SIEVE ANALYSIS

(ASTM C136-96a)

Company Name: Cliffs
Location: Concord
Sample I.D.: Basin 027
Description: Dam Material

Sample Date: 6/5/14
Analyzed By: JW/JG
Date Analyzed: 6/6/14
Requested By: J Aldridge

Weight of Oven Dry Sample (W): **1011.0 Grams**

Sieve No.	Sieve + Sample Weight	Sieve Weight	Sample Weight Retained	Percent of Total Retained	Cumulative Weight Percent	Percent Retained	Percent Finer
1"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
3/4"	0.0	0.0	0.0	0.0	0.0	0.0	100.0
1/2"	548.0	538.0	10.0	1.0	1.0	1.0	99.0
4	574.1	512.0	62.1	6.1	7.1	7.1	92.9
10	504.6	460.0	44.6	4.4	11.5	11.5	88.5
40	467.0	382.0	85.0	8.4	19.9	19.9	80.1
200	705.1	332.0	373.1	36.9	56.8	56.8	43.2
Pan	812.0	375.0	437.0	43.2	100.0	100.0	0.0
		Total Weight (W1):	1011.8				

SOIL CLASSIFICATION

Unified System (ASTM D-2487)

Liquid Limit: 15.4
Plastic Limit: 14.0
Plasticity Index: 1.4

Soil Classification: **SM**

Coarse Grained
Silty Sand

Effective Cohesion: 1.8750 psi
Total Cohesion: 6.528 psi
Permeability: 12.30 ft/yr
Maximum Dry Density: 115.0 pcf
Optimum Moisture: 14.9 %
Effective Cohesion: 270.0 psf
Angle of Internal Friction: 33.02 degrees
Mass Unit Weight: 132.14 pcf

Post Office Box 3431 • 450 19th Street • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • staff@mcgehee.org

mcgehee engineering corp

STANDARD PROCTOR COMPACTION TEST (ASTM D-698)

Company Name: Cliffs
Location: Concord
Sample I.D.: Basin 027
Description: Dam Material

Sampled By: B Justice
Sample Date: 6/5/14
Analyzed By: JW/JG
Date Analyzed: 6/6/14
Requested By: J Aldridge

Weight of Mold (W1): 4,227 Grams

Test No.	Wt. of Mold & Wet Soil (w2) grams	Wt. of wet Soil (w2-w1) grams	Wet Unit Wt. (w2-w1)/c lb/cu-ft	Moisture Content (w) %	Dry Unit Weight lb/cu-ft
1	5,957	1,730	114.4	3.0	111.1
2	6,022	1,795	118.7	4.9	113.2
3	6,101	1,874	123.9	6.7	116.2
4	6,263	2,036	134.7	10.7	121.6
5	6,242	2,015	133.3	13.7	117.2
6	6,216	1,989	131.5	16.1	113.3
7					

Constant C = 15.12 (conversion factor)

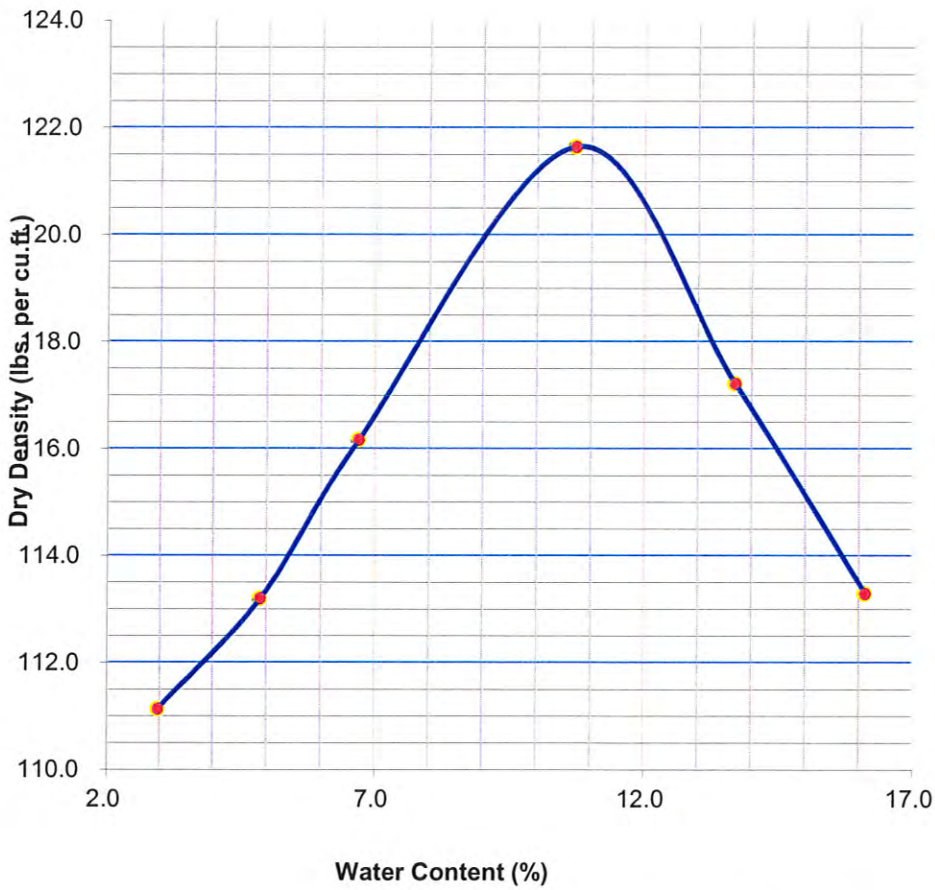
MOISTURE CONTENT DETERMINATION

Test No.	1	2	3	4	5	6	7
Can No.	22	23	24	25	26	27	
Wt. of Can, a, (g)	12.17	12.43	12.49	12.26	12.18	12.45	
Wt. of Can + Wet Soil, b, (g)	58.04	63.77	56.13	61.40	71.87	88.88	
Wt. of Can + Dry Soil, c, (g)	56.72	61.38	53.39	56.65	64.68	78.27	
* Moisture Content, w, (%)	2.96	4.88	6.70	10.70	13.70	16.12	

* Moisture Content, w = (b - c)/(c - a) x 100

Post Office Box 3431 • 450 19th Street • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • staff@mcgehee.org

Cliffs
Concord, Basin 027, Dam Material
Moisture Density Relationship
(Proctor Method)



ASTM D-698 Method A	Water Content %	Specific Gravity	%> No. 4	%< No. 200	LL %	PL %	PI %
			7.1	43.2	15.4	14.0	1.4
Sample Description, Classification and Location				Sample No.:		Basin 027 Dam Material	
Coarse Grained Silty Sand				Optimum Moisture Content=		10.9	
				Maximum Dry Density =		121.6	

Post Office Box 3431 • 450 19th Street • Jasper, Alabama 35502-3431 • 205-221-0686 • Fax 205-221-7721 • staff@mcgehee.org

STABILITY ANALYSIS - COMPUTER OUTPUT
SEDIMENT BASIN 027 - STATIC

REAME
(Rotational Equilibrium Analysis of Multilayered Embankments)

Oak Grove Resources, LLC
Concord Prep Plant, P-3233
Sediment Basin 027
Static Case

Number of cases to be analyzed 1

Case Number 1

Number of boundary lines= 4
Number of points on boundary lines are: 2 2 3 7

On boundary line no. 1 Point no. and coordinates are:
1 .000 11.380 2 500.000 .000

On boundary line no. 2 Point no. and coordinates are:
1 200.000 9.428 2 339.169 6.261

On boundary line no. 3 Point no. and coordinates are:
1 .000 13.980 2 200.000 9.428 3 248.750 28.928

On boundary line no. 4 Point no. and coordinates are:
1 .000 28.928 2 248.750 28.928 3 259.625 33.278 4 271.625 33.278 5 322.168 13.061
6 339.169 6.261 7 500.000 2.600

Line no. and slope of each segment are:
1 -.023
2 -.023
3 -.023 .400
4 .000 .400 .000 -.400 -.400 -.023

No. of radius control zones= 1 Plot or no plot= 1 No. of seepage cases= 1

Total no. of lines at bottom of radius control zones is: 1

For rad. cont. zone no. 1 Radius decrement= .000 No. of Circles= 5 Id no. for first circle=, 1
Line no.= 1 Begin pt. no.= 1 End pt. no.= 2

Soil no.	Cohesion	F. angle	Unit wt.
1	270.000	33.020	132.140
2	270.000	33.020	132.140
3	.000	.000	62.400

Seismic coefficient= .000 Min. depth of tallest slice= .000 Unit weight of water= 62.400

The factors of safety are determined by the SIMPLIFIED BISHOP method

NSPG= 1 NSRCH= 0 No. of slices= 10 No. of add. radii= 2

No. of points on water table for each case= 6

Under seepage condition 1point no. and coordinates of water table are:
1 .000 28.928 2 248.750 28.928 3 278.146 22.694 4 322.168 13.061 5 339.169 6.261
6 500.000 2.600

point1=(273.000, 54.000) point2=(273.000, 34.000) point3=(340.000, 34.000) NJ= 2 NI= 2
Automatic search will follow after grid with XINC= 10.000 and YINC= 10.000

At point (273.000, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
48.821 8.641 43.210 8.807 37.600 8.893 31.989 9.047 26.378 9.691
Lowest factor of safety= 8.641 and occurs at radius = 48.821

At point (273.000, 44.000) under seepage 1,the radius and the corresponding factor of safety are:
38.823 8.738 33.221 8.562 27.618 8.268 22.015 8.154 16.413 8.933
25.750 8.185 23.883 8.140 20.148 8.176 18.280 8.291
Lowest factor of safety= 8.140 and occurs at radius = 23.883

At point (273.000, 34.000) under seepage 1,the radius and the corresponding factor of safety are:
28.826 9.423 23.297 8.859 17.768 8.620 12.239 9.266 6.710 10.435
21.454 8.718 19.611 8.662 15.925 8.730 14.082 9.058
Lowest factor of safety= 8.620 and occurs at radius = 17.768

At point (306.500, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
49.583 2.257 46.105 2.332 42.627 2.560 39.148 3.066 35.670 4.332
Lowest factor of safety= 2.257 and occurs at radius = 49.583

At point (306.500, 44.000) under seepage 1,the radius and the corresponding factor of safety are:
39.586 2.341 36.250 2.444 32.914 2.703 29.579 3.222 26.243 4.557
Lowest factor of safety= 2.341 and occurs at radius = 39.586

At point (306.500, 34.000) under seepage 1,the radius and the corresponding factor of safety are:
29.588 2.622 26.395 2.761 23.202 3.009 20.009 3.536 16.816 4.946
Lowest factor of safety= 2.622 and occurs at radius = 29.588

At point (340.000, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
50.345 3.205 49.203 3.471 48.061 3.860 46.918 4.718 45.776 8.305
Lowest factor of safety= 3.205 and occurs at radius = 50.345

At point (340.000, 44.000) under seepage 1,the radius and the corresponding factor of safety are:
40.348 3.564 39.348 3.888 38.348 4.415 37.348 5.150 36.349 9.204
Lowest factor of safety= 3.564 and occurs at radius = 40.348

At point (340.000, 34.000) under seepage 1,the radius and the corresponding factor of safety are:
30.351 4.114 29.493 4.534 28.636 5.221 27.779 6.190 26.921 10.589
Lowest factor of safety= 4.114 and occurs at radius = 30.351

For piezometric line No. 1

At point (306.500, 54.000) ,RADIUS 49.583
the minimum factor of safety is 2.257

At point (306.500, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
49.583 2.257 46.105 2.332 42.627 2.560 39.148 3.066 35.670 4.332
Lowest factor of safety= 2.257 and occurs at radius = 49.583

At point (316.500, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
49.811 2.110 47.030 2.268 44.249 2.555 41.468 3.160 38.687 4.864
Lowest factor of safety= 2.110 and occurs at radius = 49.811

At point (326.500, 54.000) under seepage 1,the radius and the corresponding factor of safety are:
50.038 2.173 47.955 2.352 45.871 2.703 43.787 3.427 41.703 5.606
Lowest factor of safety= 2.173 and occurs at radius = 50.038

At point (316.500, 64.000) under seepage 1,the radius and the corresponding factor of safety are:
59.808 2.061 56.885 2.204 53.961 2.480 51.038 3.079 48.114 4.667
Lowest factor of safety= 2.061 and occurs at radius = 59.808

At point (316.500, 74.000) under seepage 1,the radius and the corresponding factor of safety are:
69.805 2.074 66.739 2.194 63.673 2.439 60.607 3.020 57.541 4.501
Lowest factor of safety= 2.074 and occurs at radius = 69.805

At point (326.500, 64.000) under seepage 1,the radius and the corresponding factor of safety are:
60.036 2.119 57.809 2.287 55.583 2.626 53.357 3.331 51.131 5.430
Lowest factor of safety= 2.119 and occurs at radius = 60.036

At point (306.500, 64.000) under seepage 1,the radius and the corresponding factor of safety are:
59.581 2.263 55.960 2.341 52.339 2.539 48.718 2.980 45.098 4.168
Lowest factor of safety= 2.263 and occurs at radius = 59.581

At point (319.000, 64.000) under seepage 1,the radius and the corresponding factor of safety are:
59.865 2.048 57.116 2.212 54.367 2.502 51.617 3.120 48.868 4.835
Lowest factor of safety= 2.048 and occurs at radius = 59.865

At point (321.500, 64.000) under seepage 1,the radius and the corresponding factor of safety are:
59.922 2.049 57.347 2.230 54.772 2.532 52.197 3.175 49.622 5.028
Lowest factor of safety= 2.049 and occurs at radius = 59.922

At point (319.000, 66.500) under seepage 1,the radius and the corresponding factor of safety are:
62.364 2.042 59.580 2.199 56.795 2.488 54.010 3.104 51.225 4.788
Lowest factor of safety= 2.042 and occurs at radius = 62.364

At point (319.000, 69.000) under seepage 1,the radius and the corresponding factor of safety are:
64.864 2.037 62.043 2.190 59.223 2.475 56.402 3.089 53.582 4.742
Lowest factor of safety= 2.037 and occurs at radius = 64.864

At point (319.000, 71.500) under seepage 1,the radius and the corresponding factor of safety are:
67.363 2.039 64.507 2.184 61.651 2.460 58.795 3.075 55.939 4.698
Lowest factor of safety= 2.039 and occurs at radius = 67.363

At point (321.500, 69.000) under seepage 1,the radius and the corresponding factor of safety are:
64.921 2.032 62.274 2.203 59.628 2.505 56.982 3.141 54.336 4.925
Lowest factor of safety= 2.032 and occurs at radius = 64.921

At point (324.000, 69.000) under seepage 1,the radius and the corresponding factor of safety are:
64.977 2.050 62.506 2.223 60.034 2.544 57.562 3.209 55.090 5.134
Lowest factor of safety= 2.050 and occurs at radius = 64.977

At point (321.500, 71.500) under seepage 1,the radius and the corresponding factor of safety are:
67.420 2.027 64.738 2.193 62.056 2.492 59.375 3.126 56.693 4.877
Lowest factor of safety= 2.027 and occurs at radius = 67.420

At point (321.500, 74.000) under seepage 1,the radius and the corresponding factor of safety are:
69.919 2.025 67.202 2.186 64.485 2.480 61.767 3.112 59.050 4.830
Lowest factor of safety= 2.025 and occurs at radius = 69.919

At point (321.500, 76.500) under seepage 1,the radius and the corresponding factor of safety are:
72.419 2.027 69.666 2.182 66.913 2.465 64.160 3.098 61.407 4.784
Lowest factor of safety= 2.027 and occurs at radius = 72.419

At point (324.000, 74.000) under seepage 1,the radius and the corresponding factor of safety are:
69.976 2.038 67.433 2.198 64.890 2.519 62.347 3.176 59.804 5.030
Lowest factor of safety= 2.038 and occurs at radius = 69.976

At point (319.000, 74.000) under seepage 1,the radius and the corresponding factor of safety are:
69.862 2.044 66.971 2.181 64.079 2.450 61.187 3.062 58.296 4.655
Lowest factor of safety= 2.044 and occurs at radius = 69.862

For piezometric line No. 1

At point (321.500, 74.000) ,RADIUS 69.919
the minimum factor of safety is 2.025

Cross section in distorted scale. Numerals indicate boundary line no. If there are more than 10 bound. lines, alphabets will then be used. P indicates Piezometric line. If a portion of Piezometric line coincides with the ground or another boundary line, only the ground or boundary line will be shown. X indicates intersection of two boundary lines. * indicates failure surface. **The minimum factor of safety is 2.025.**

```
4.000E+01 X+++++++++X+++++++++X++++++++++X++++++++++X++++++++++X
          +    +                                               +
          +    +                                               +
          +    +                                               +
          +    +                                               +
3.600E+01 X    X    +         +         +         +            X
          +    +                                               +
          +    +                                               +
          +    +               44                              +
          +    +                                               +
3.200E+01 X    X    +         +         +         +            X
          +    +                                               +
          +    +                                               +
          +    +                                               +
          +    444444444444444X                                +
2.800E+01 X    X    +         +         +         +            X
          +    +                 4                             +
          +    +                                               +
          +    +                                               +
          +    +                                               +
2.400E+01 X    X    +         +         +         +            X
          +    +                                               +
          +    +              3 P                              +
          +    +                                               +
          +    +                                               +
2.000E+01 X    X    +         +   4     +         +            X
          +    +                 P                             +
          +    +                                               +
          +    +                 *                             +
          +    +                                               +
1.600E+01 X    X    +        3+   P     +         +            X
          +    +                                               +
          +    +                                               +
          +    333                                             +
          +    +  333              4                           +
1.200E+01 X    X    +33       +         +         +            X
          +    111     333                                     +
          +    +  11      33                                   +
          +    +    11      X2                                 +
          +    +      11      22  *                            +
8.000E+00 X    X    +   111   + 22      +         +            X
          +    +           11     22                           +
          +    +             11     X4                         +
          +    +               11     44                       +
          +    +                 11*    44                     +
4.000E+00 X    X    +         +    111  + 44      +            X
          +    +                      11    44                 +
          +    +                        11    4                +
          +    +                          11                   +
          +    +                            11                 +
 .000E+00 X+++++++++X+++++++++X++++++++++X+++++1+++X++++++++++X
0        -8.00E+01  8.00E+01  2.40E+02  4.00E+02  5.60E+02  7.20E+02
```