

**HYDROLOGY STUDY FOR
OAK GROVE RESOURCES, LLC.**

**OAK GROVE MINE
P-3232 / REVISION R-38
JEFFERSON COUNTY, ALABAMA**

BY

**PERC ENGINEERING CO., INC.
1606 HWY. 78 WEST
JASPER, ALABAMA 35501**

**ANCILLARY ROADS 1P, 2P AND 3P
ATTACHMENT III-B-5**

May 14, 2013

**SPECIFICATIONS FOR THE CONSTRUCTION, MAINTENANCE
AND RECLAMATION OF ANCILLARY ROADS**

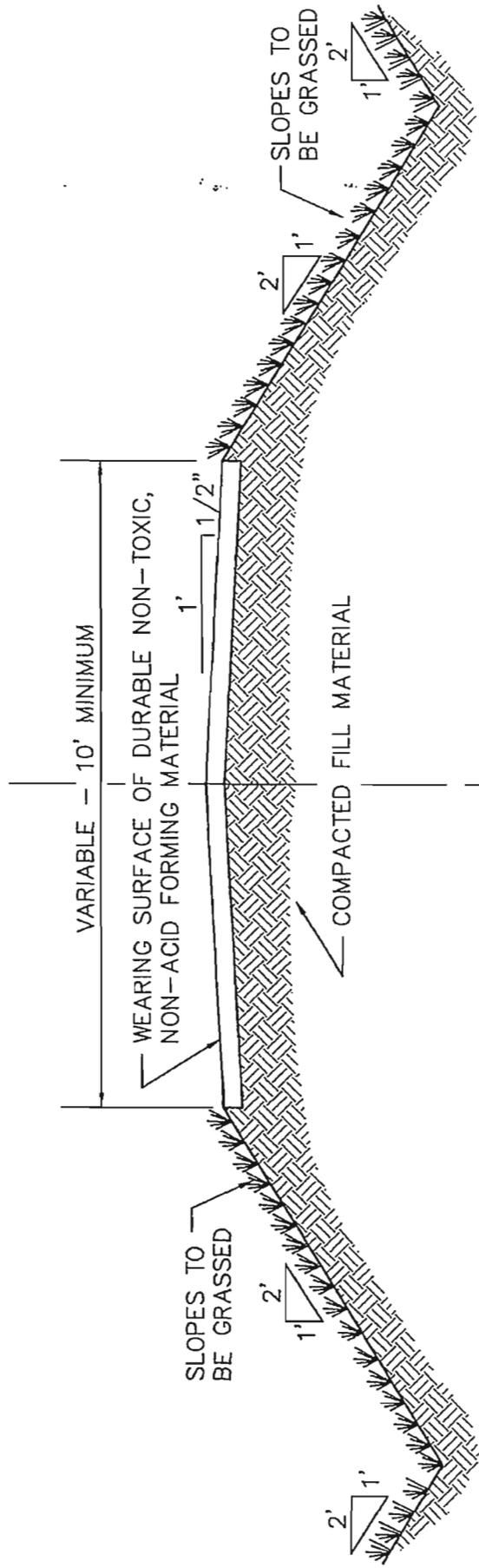
1. To the extent possible, roads will be located on ridges or on the most stable available slopes to prevent or minimize erosion, downstream sedimentation and flooding in an effort to prevent adverse effects to fish, wildlife and related environmental values.
2. To the extent possible, roads will be located above the sediment basins to be constructed for the mining operation in an effort to control or prevent additional contributions of suspended solids to stream flow or runoff outside the permit area and to comply with State and Federal water quality standards applicable to receiving waters and avoid the alteration of the normal flow of water in streambeds or drainage channels while preventing or controlling damage to public or private property. Where it is not possible or is impractical to locate roads in this manner, sediment control devices such as silt fencing, hay bale check dams and rock filter check dams will be used as necessary to maintain water quality.
3. Prior to construction, the roadway will be cleared, grubbed and will have the topsoil removed. The clearing limits will be kept to the minimum necessary to accommodate the roadbed and associated ditch construction.
4. Roads will be constructed of suitable subgrade material compacted to ninety-five percent of the standard proctor density and will have a minimum width of ten feet and a maximum width necessary to accommodate the largest equipment traveling the road.
5. Roadbeds will be cut to consolidated non-erodible material or will be surfaced with durable non-toxic, non-acid forming substances. It is anticipated that durable sandstone overburden on site will be utilized as surfacing material. If there should not be adequate sandstone on site, then a durable sandstone material, chert, crushed limestone, crushed concrete, crushed asphalt, red rock, ironore refuse, gravel, or other durable non-toxic, non-acid forming material approved by the Regulatory Authority will be hauled in from off site and placed on the roadbed to a depth of two inches.
6. No sustained grades will exceed ten percent unless deemed necessary, in which case appropriate sediment control facilities will be constructed. If grades in excess of fifteen percent are required, cross drains, ditch relief drains and road drainways will be located at a minimum distance of three-hundred feet.
7. Roads will be constructed so as to have adequate drainage utilizing ditches, cross drains and ditch relief drains. Roads will not be located in the channel of an intermittent or perennial stream unless specifically approved by the Alabama Surface Mining Commission. Additionally, no relocation and/or alteration of an intermittent or perennial stream will be done unless specifically approved by the Alabama Surface Mining Commission. In the event that it becomes evident that any drainage structures including culverts, bridges and/or low water crossings will be required in order to cross an intermittent or perennial stream, the structure will be designed in accordance with Alabama Surface Mining Commission requirements and prudent engineering practice and the approval of the design(s) will be acquired prior to the commencement of construction. Hay bale check dams and silt fences will be used at strategic locations when necessary to control sediment runoff. Immediately upon completion of construction, the side slopes of

the road embankments and/or cuts will be fertilized, seeded with annual and perennial grasses and mulch will be added to aid in the prevention of erosion and to enhance seed germination. The seed mix will consist of, but is not limited to, some combination of the following species: bermuda grass, fescue, lespedeza, rye grass, brown top millet, clover and vetch. The particular species to be planted will vary with the planting season at the time of seed application.

8. Routine maintenance will be required to assure that the road continually meets performance standards and will consist of periodic grading, resurfacing, dust suppression and maintenance of sediment control facilities. Dust suppression will consist of the application of water, chemical binders and/or other dust suppressants. No oil will be utilized in this process. Spot seeding, fertilizing and mulching will be performed as necessary to improve vegetative cover on roadway slopes. A road damaged by a catastrophic event shall be repaired as soon as practicable after the damage has occurred.
9. Roads not to be retained as part of the post mine land use shall be reclaimed in accordance with the approved reclamation plan for this permit as soon as practicable after they are no longer needed as part of the mining and reclamation operation, using the following procedures:
 - a. The road will be closed to traffic.
 - b. All bridges, culverts and other drainage structures not approved as part of the post mine land use will be removed.
 - c. All road surfacing materials that are not compatible with the post mine land use or revegetation requirements will be properly disposed of on-site or removed from the site for re-use.
 - d. Roadway cut and fill slopes shall be regraded and reshaped to be compatible with the post mine land use and to compliment the natural drainage pattern of the surrounding terrain.
 - e. The natural drainage patterns shall be protected from surface runoff and erosion utilizing the installation of dikes and/or cross drains as necessary.
 - f. The roadbed shall be ripped or scarified as necessary, the topsoil or substitute or approved growing medium shall be replaced and revegetated in accordance with the approved reclamation plan for this permit.
10. The following drawings illustrate typical roadbed configurations for ancillary roads.

TYPICAL HAUL ROAD FILL SECTION

NO SCALE



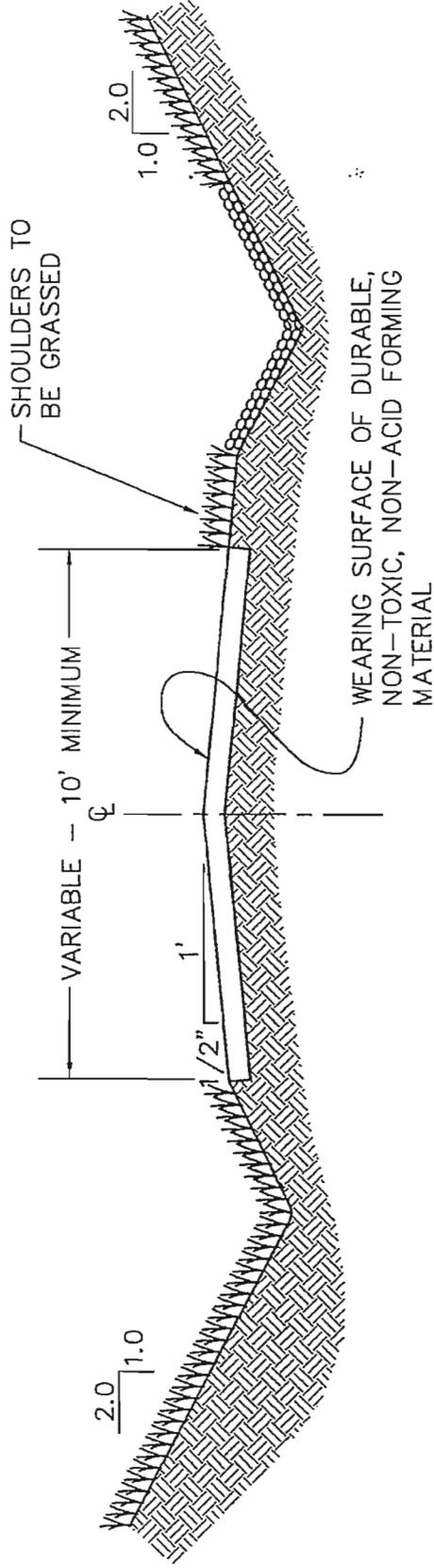
TYPICAL FILL SECTION ANCILLARY HAUL ROAD

DRAWN BY:	K.D.P.	DATE:	2-3-97
DWG. NAME:	TYPHAULA		
APPROVED BY:	S.R.I.	SCALE:	NONE

ATTACHMENT III.-B.-5.

TYPICAL HAUL ROAD CUT SECTION

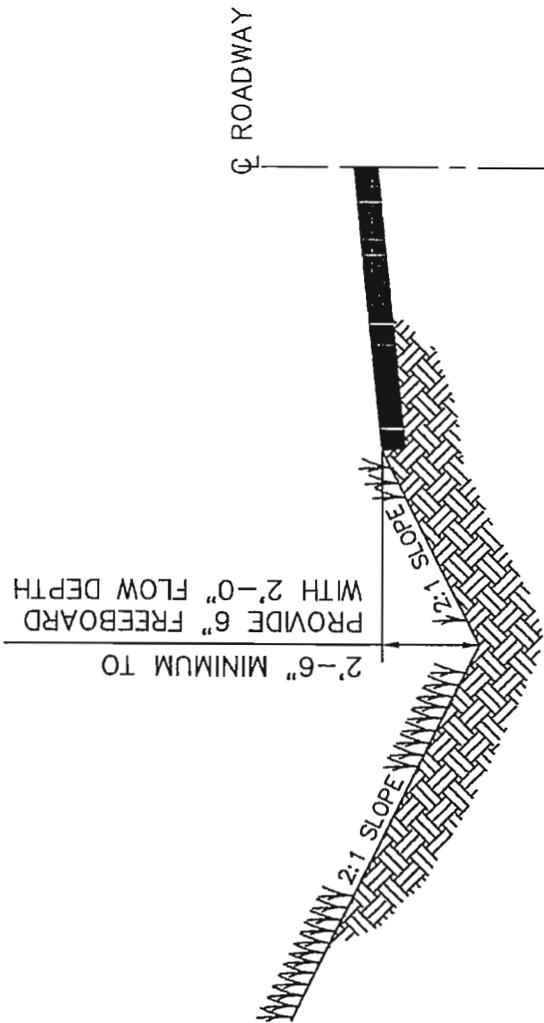
NO SCALE



TYPICAL CUT SECTION ANCILLARY HAUL ROAD

DRAWN BY: K.D.P.	DATE: 2-3-97
DWG. NAME: TYPHAULB	
APPROVED BY: S.R.I.	SCALE: NONE

ATTACHMENT III - B. - 5.



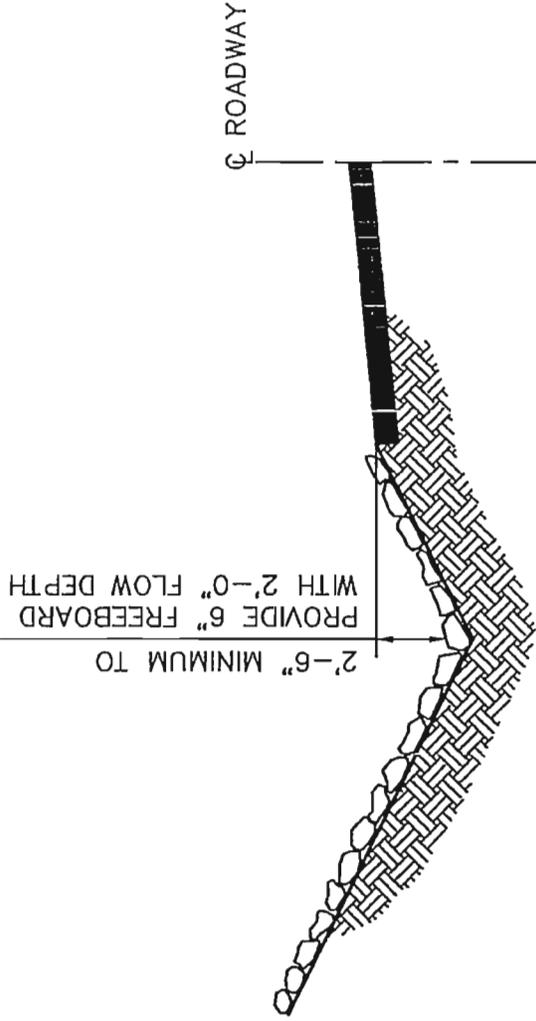
MINIMUM DITCH GRADIENT = 1%
 MAXIMUM DITCH GRADIENT = 5%

DITCH CHANNEL TO BE VEGETATED WITH
 A MIXTURE OF BERMUDA GRASS, FESCUE,
 AND LESPEDEZA TO CONFORM TO CLASS
 "D" RETARDANT CLASS.



TYPICAL ANCILLARY ROADWAY DITCH CROSS SECTION

DRAWN BY: K.D.P.	DATE: 2-4-97
DWG. NAME: ANCIROAD	
APPROVED BY: R.E.P.	SCALE: NONE



DITCH GRADIENT 5% TO 10%

DITCH CHANNEL TO BE LINED WITH NON-ERODIBLE
 NON-TOXIC, NON-ACID FORMING SANDSTONE OR
 LIMESTONE RIP-RAP. THE RIP-RAP WILL BE "CLASS 1"
 RIP-RAP AND HAVE A MINIMUM THICKNESS OF 12".



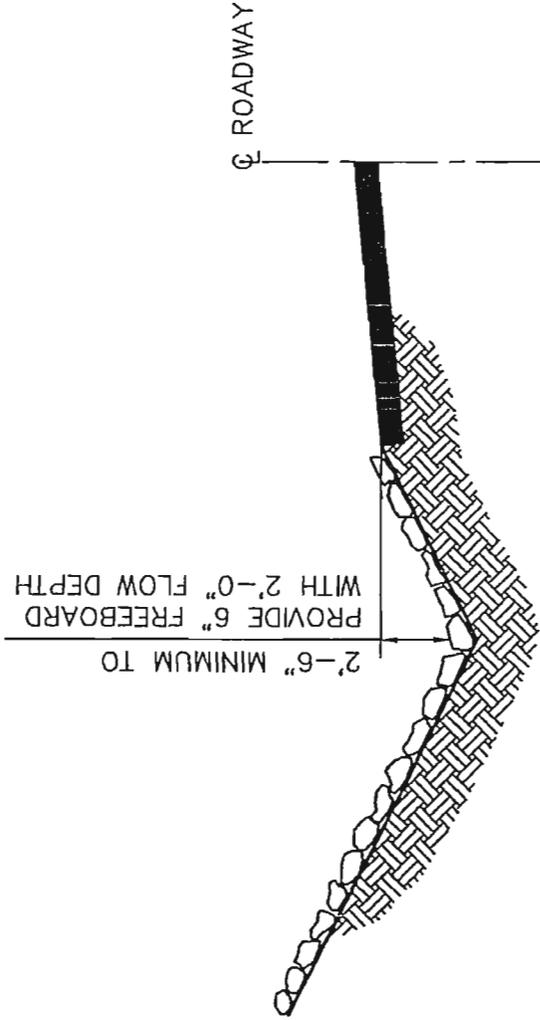
**TYPICAL ANCILLARY ROADWAY DITCH
 CROSS SECTION**

DRAWN BY: K.D.P.
 DWG. NAME: PRIMRD1

DATE: 2-4-97

APPROVED BY: R.E.P.

SCALE: NONE



DITCH GRADIENT 11% TO 17%

DITCH CHANNEL TO BE LINED WITH NON-ERODIBLE
NON-TOXIC, NON-ACID FORMING SANDSTONE OR
LIMESTONE RIP-RAP. THE RIP-RAP WILL BE "CLASS 2"
RIP-RAP AND HAVE A MINIMUM THICKNESS OF 16".



**TYPICAL ANCILLARY ROADWAY DITCH
CROSS SECTION**

DRAWN BY: K.D.P.
DWG. NAME: PRIMRD2

DATE: 2-4-97

APPROVED BY: R.E.P.

SCALE: NONE

NOTES

- 1) Due to there being no significant cut or fill section, no stability analysis is required.

RIP-RAP CLASSIFICATION SPECIFICATIONS

CLASS 1 RIP-RAP

No more than 10% of the stone will have a diameter greater than twelve (12) inches; no more than 50% of the stone will have a diameter less than ten (10) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than twelve (12) inches.

CLASS 2 RIP-RAP

No more than 10% of the stone will have a diameter greater than sixteen (16) inches; no more than 50% of the stone will have a diameter less than twelve (12) inches; and no more than 10% of the stone will have a diameter of less than six (6) inches. The thickness of the rip-rap liner will be no less than sixteen (16) inches.

CLASS 3 RIP-RAP

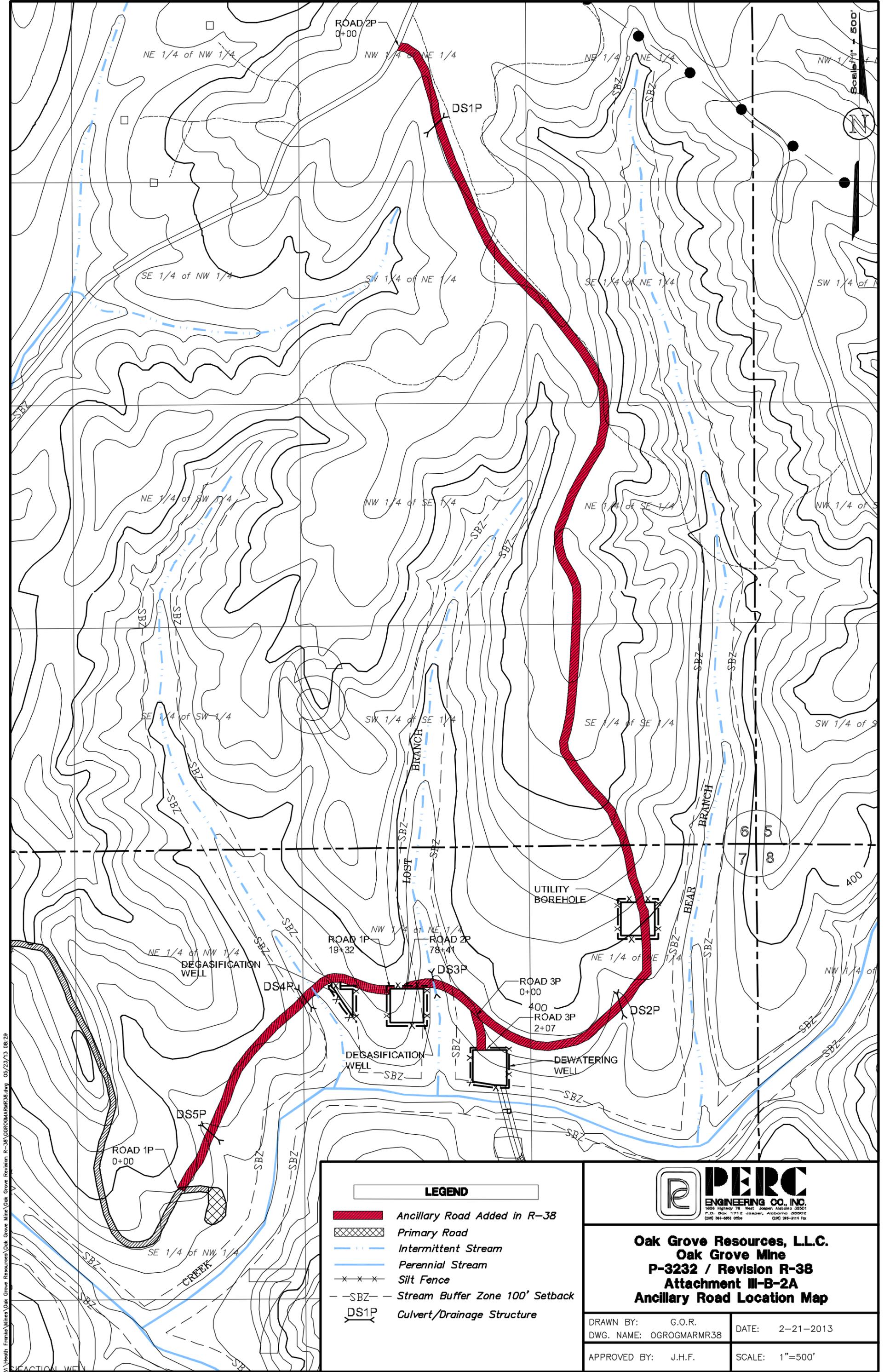
No more than 10% of the stone will have a diameter greater than twenty two (22) inches; no more than 50% of the stone will have a diameter less than sixteen (16) inches; and no more than 10% of the stone will have a diameter of less than eight (8) inches. The thickness of the rip-rap liner will be no less than twenty two (22) inches.

CLASS 4 RIP-RAP

No more than 10% of the stone will have a diameter greater than twenty seven (27) inches; no more than 50% of the stone will have a diameter less than twenty two (22) inches; and no more than 10% of the stone will have a diameter of less than ten (10) inches. The thickness of the rip-rap liner will be no less than twenty seven (27) inches.

CLASS 5 RIP-RAP

No more than 10% of the stone will have a diameter greater than thirty four (34) inches; no more than 50% of the stone will have a diameter less than twenty seven (27) inches; and no more than 10% of the stone will have a diameter of less than sixteen (16) inches. The thickness of the rip-rap liner will be no less than thirty four (34) inches.



Scale: 1" = 500'

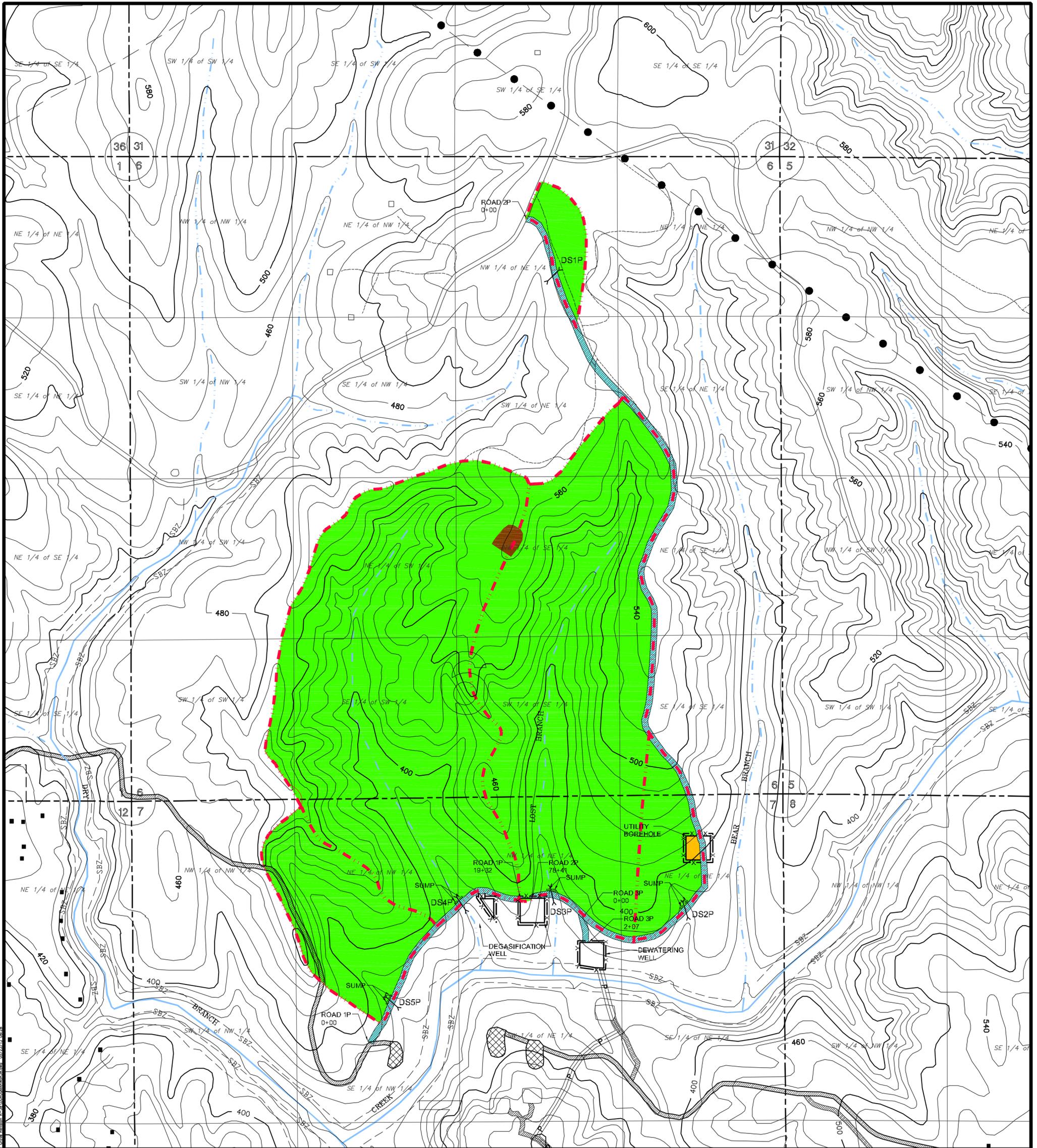
LEGEND	
	Ancillary Road Added in R-38
	Primary Road
	Intermittent Stream
	Perennial Stream
	Silt Fence
	Stream Buffer Zone 100' Setback
	Culvert/Drainage Structure



Oak Grove Resources, L.L.C.
Oak Grove Mine
P-3232 / Revision R-38
Attachment III-B-2A
Ancillary Road Location Map

DRAWN BY: G.O.R.	DATE: 2-21-2013
DWG. NAME: OGROGMARMR38	
APPROVED BY: J.H.F.	SCALE: 1"=500'

V:\Health Files\Oak Grove Resources\Oak Grove Mine\Oak Grove Revision R-38\OGROGMARMR38.dwg 05/23/13 08:29



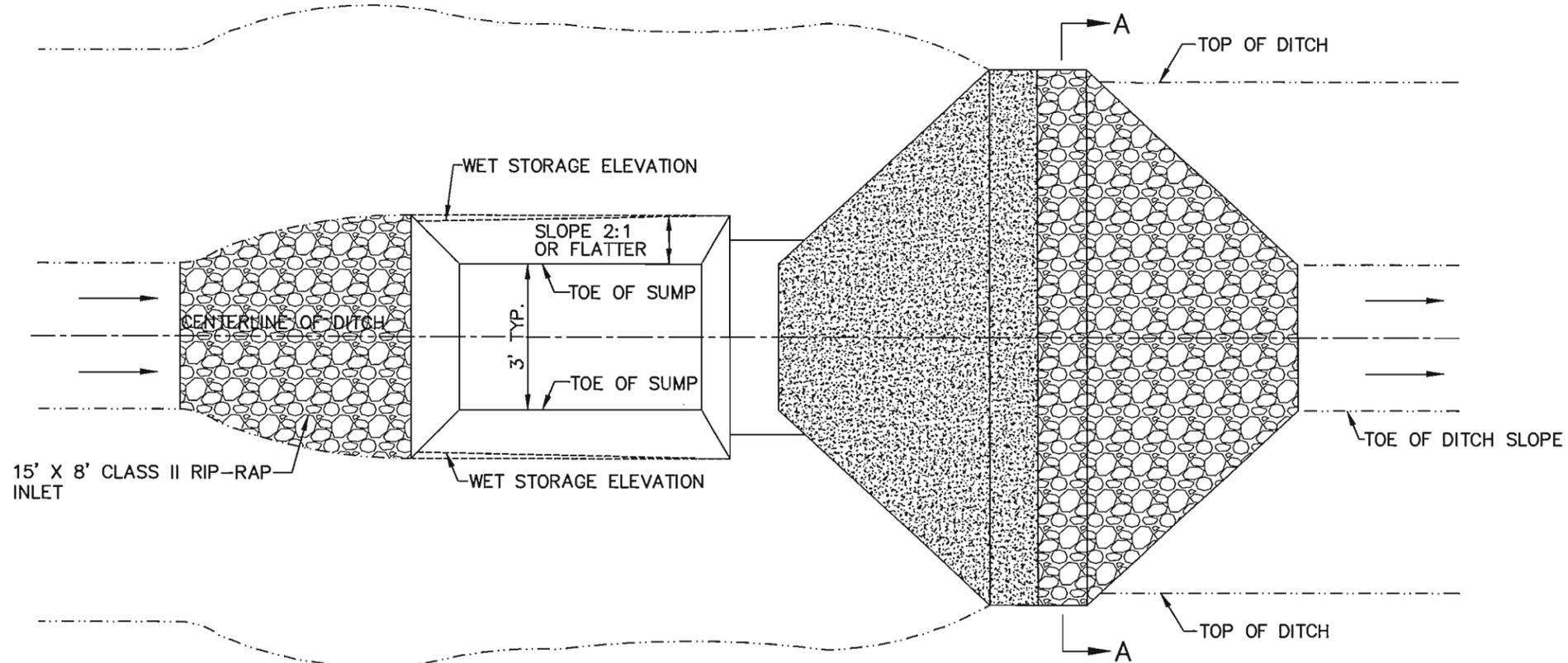
LEGEND

	Unmanaged Timberland, Curve Number 70
	Open Spaces, Curve Number 75
	Graded and Bare, Curve Number 81
	Ancillary Road Added in R-38
	DS1P
	Culvert/Drainage Structure
	Intermittent Stream
	Perennial Stream
	Silt Fence
	Watershed Boundary
	Stream Buffer Zone 100' Setback

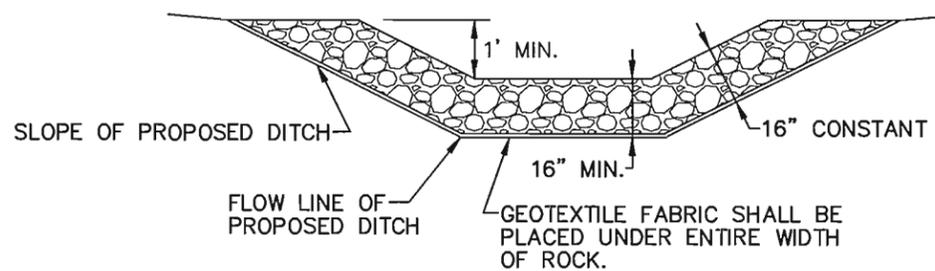
PERC
ENGINEERING CO., INC.
1606 Hwy. 78 West Jasper, AL 35501/P.O. Box 1712-35502
(205) 384-5553 Office (205) 295-3114 Fax

drawn by: _____ L.G.S. _____ job number: _____ - _____
 checked by: _____ L.G.S. _____ initial date: _____ 3-5-13 _____
 scale: _____ 1"=500' _____ f.b./page: _____ - _____
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 rev no./date: _____ - _____ rev no./date: _____ - _____

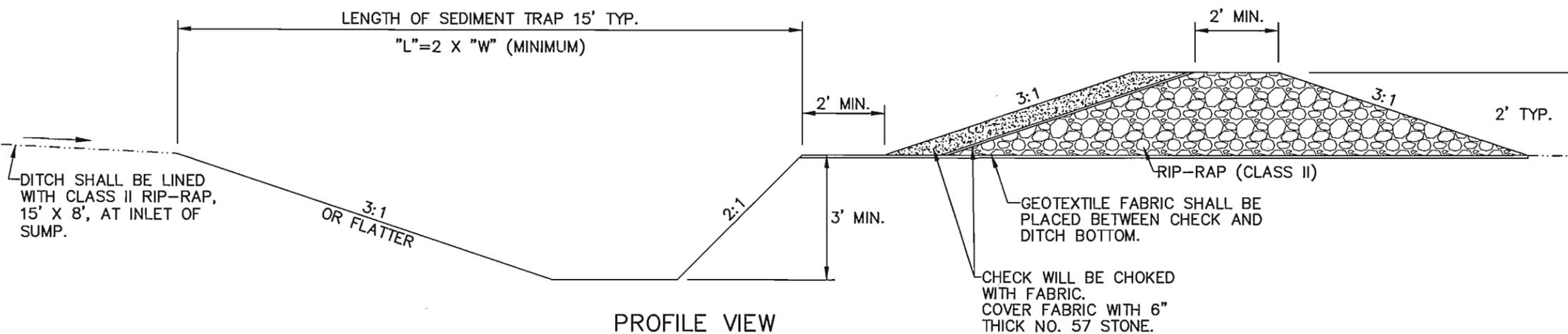
Oak Grove Resources, L.L.C.
Oak Grove Mine
P-3232 / Revision R-38
Attachment III-B-5
Ancillary Road Watershed Map



PLAN VIEW



SECTION A-A



PROFILE VIEW

NOTES

- 1) TO BE PLACED AT DITCH DRAIN INTO STREAM CROSSING, ON UPHILL CUT SECTION DITCH OUTLET, 100' FROM STREAM BANK.
- 2) SEDIMENT TO BE REMOVED AND HAULED TO BREAKER ROCK NO.3 DISPOSAL AREA WHEN 50% FULL.

V:\Health_Franka\Miner\Oak
 sources\Oak Grove Mine\Oak Grove Revision R-38\OGROGMARSCT.dwg 02/27/13 10:18
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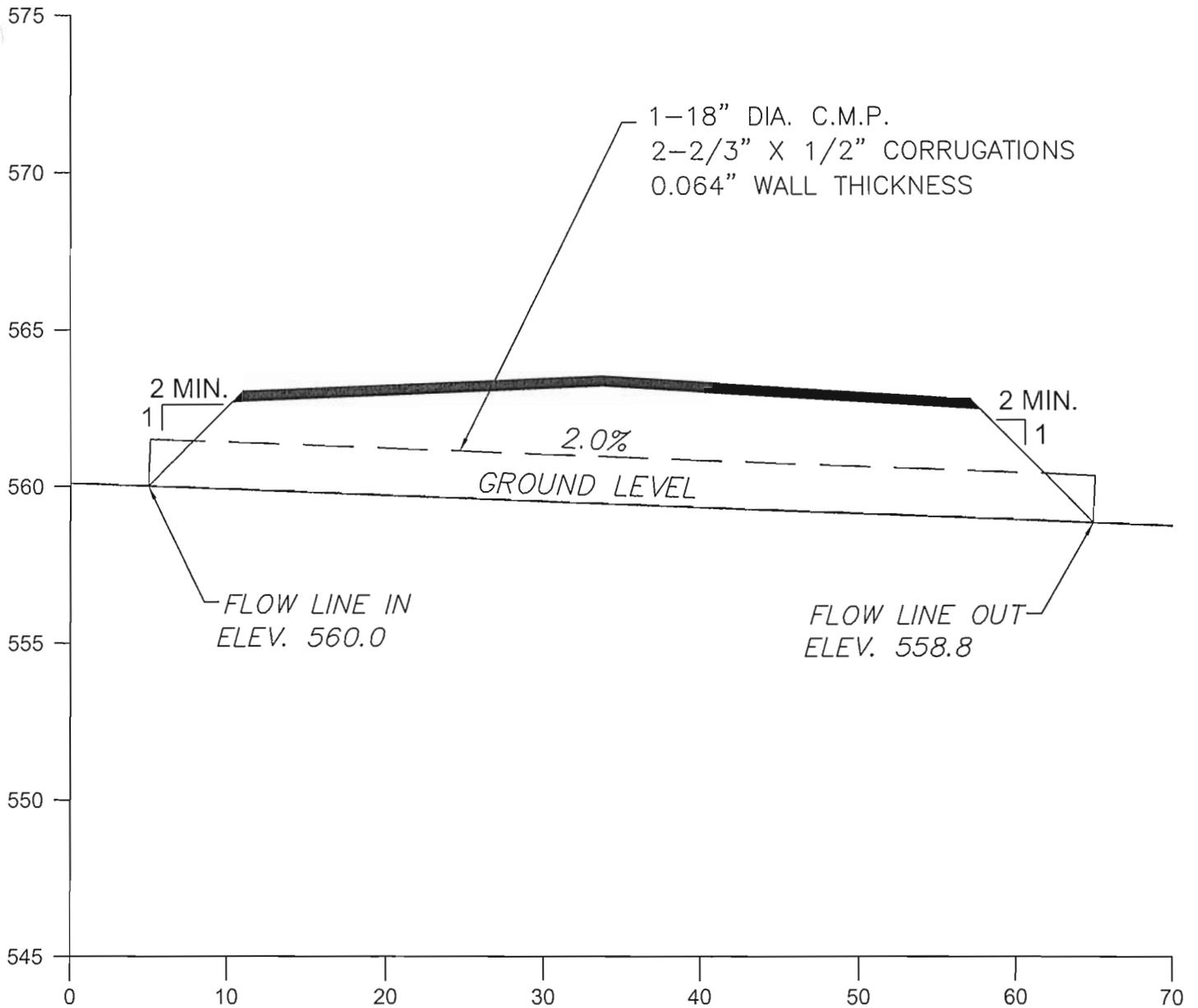
Oak Grove Resources, LLC
Oak Grove Mine
Ancillary Road
Erosion Control Sump
Stream Crossing Typical
P-3232 R-38

DRAWN BY: G.R.
 DWG. NAME: OGROGMARSCT

DATE: 02-27-11

APPROVED BY: L.G.S.

SCALE: Not To Scale



Hydraulics Information

Drainage Area = 6.8 Acres
 10 YR.-6 HR., Q = 6.2 C.F.S.
 Maximum Water Elev. = 561.8
 Minimum Fill Elev. = 562.8
 Minimum Freeboard = 1'
 Maximum Allowable Cover 18" C.M.P. 166'
 Minimum Allowable Cover 18" C.M.P. = 1'
 Wall Thickness = 0.064"



PERC ENGINEERING CO., INC. <small>1608 Highway 78 West Jasper, Alabama 35501 P.O. Box 1712 Jasper, Alabama 35502 (205) 384-2553 office (205) 384-4951 fax</small>	
OAK GROVE RESOURCES, LLC OAK GROVE MINE P-3232 REVISION R-38 ANCILLARY ROAD 2P CROSS SECTION DS1P 5+42	
DRAWN BY: S.D.M. DWG. NAME: OGROGMHRCS	DATE: 3/8/2013
APPROVED BY: L.G.S.	SCALE: AS NOTED

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Oak Grove Resources, LLC
Oak Grove Mine
P-3232 Revision R-38
DS1P 5+42

4.3 Inches, 10 Year - 6 Hour
SCS 6 Hour Event

SDM

PERC Engineering Co., Inc.
1606 Highway 78 West
Jasper, AL 35501

Phone: (205) 384-5553
Email: smiles@percengineering.com

General Information

Storm Information:

Storm Type:	Rainfall Event
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Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1510
1.00	0.3440
1.50	0.5810
2.00	0.9890
2.50	2.5800
3.00	3.0100
3.50	3.3540
4.00	3.5910
4.50	3.8060
5.00	3.9780
5.50	4.1500
6.00	4.3000

Peak 30-minute Intensity: 3.182 in/hr

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	DS1P 5+42

#1 <i>Culvert</i>

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	6.800	6.800	6.22	0.70

Structure Detail:

Structure #1 (Culvert)

DS1P 5+42

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	2.00	0.0240	1.80	0.00	0.90

Culvert Results:

Design Discharge = 6.22 cfs

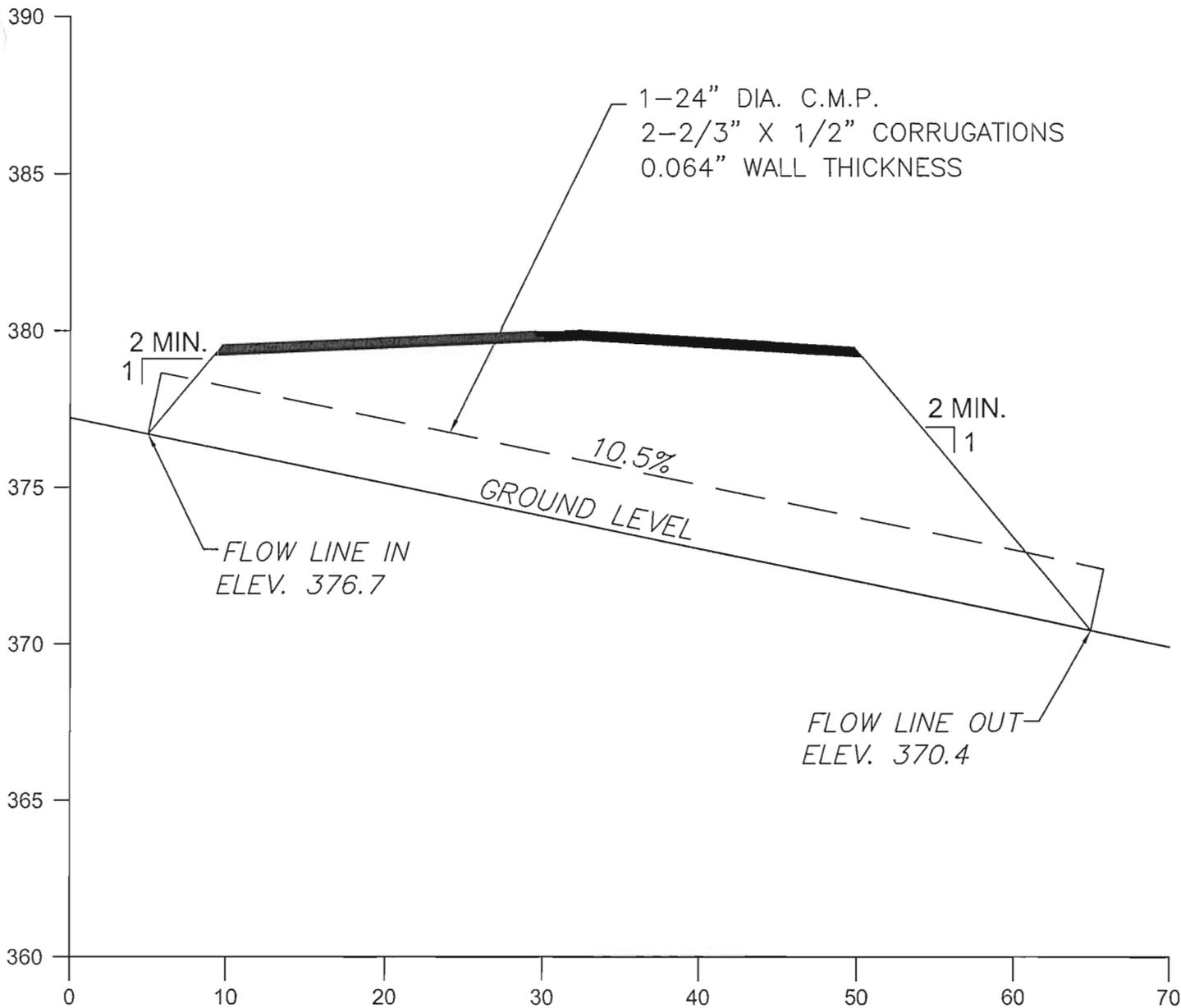
Minimum pipe diameter: 1 - 18 inch pipe(s) required

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	6.800	0.191	0.000	0.000	70.000	M	6.22	0.699
Σ		6.800						6.22	0.699

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	2.50	5.00	200.00	0.400	0.138
		8. Large gullies, diversions, and low flowing streams	0.91	5.00	550.00	2.860	0.053
#1	1	Time of Concentration:					0.191



Hydraulics Information

Drainage Area = 14.7 Acres
 10 YR.-6 HR., $Q = 14.1$ C.F.S.
 Maximum Water Elev. = 379.0
 Minimum Fill Elev. = 380.0
 Minimum Freeboard = 1'
 Maximum Allowable Cover 24" C.M.P. 124'
 Minimum Allowable Cover 24" C.M.P. = 1'
 Wall Thickness = 0.064"



OAK GROVE RESOURCES, LLC
OAK GROVE MINE
P-3232 REVISION R-38
ANCILLARY ROAD 2P CROSS SECTION
DS2P 63+66

DRAWN BY: S.D.M.
 DWG. NAME: OGROGMHRC5

DATE: 3/8/2013

APPROVED BY: L.G.S.

SCALE: AS NOTED

Oak Grove Resources, LLC
Oak Grove Mine
P-3232 Revision R-38
DS2P 63+66

4.3 Inches, 10 Year - 6 Hour
SCS 6 Hour Event

SDM

PERC Engineering Co., Inc.
1606 Highway 78 West
Jasper, AL 35501

Phone: (205) 384-5553
Email: smiles@percengineering.com

General Information

Storm Information:

Storm Type:	Rainfall Event
-------------	----------------

Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1510
1.00	0.3440
1.50	0.5810
2.00	0.9890
2.50	2.5800
3.00	3.0100
3.50	3.3540
4.00	3.5910
4.50	3.8060
5.00	3.9780
5.50	4.1500
6.00	4.3000

Peak 30-minute Intensity: 3.182 in/hr

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	DS2P 63+66

#1 Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	14.700	14.700	14.06	1.53

Structure Detail:

Structure #1 (Culvert)

DS2P 63+66

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	10.50	0.0240	2.30	0.00	0.90

Culvert Results:

Design Discharge = 14.06 cfs

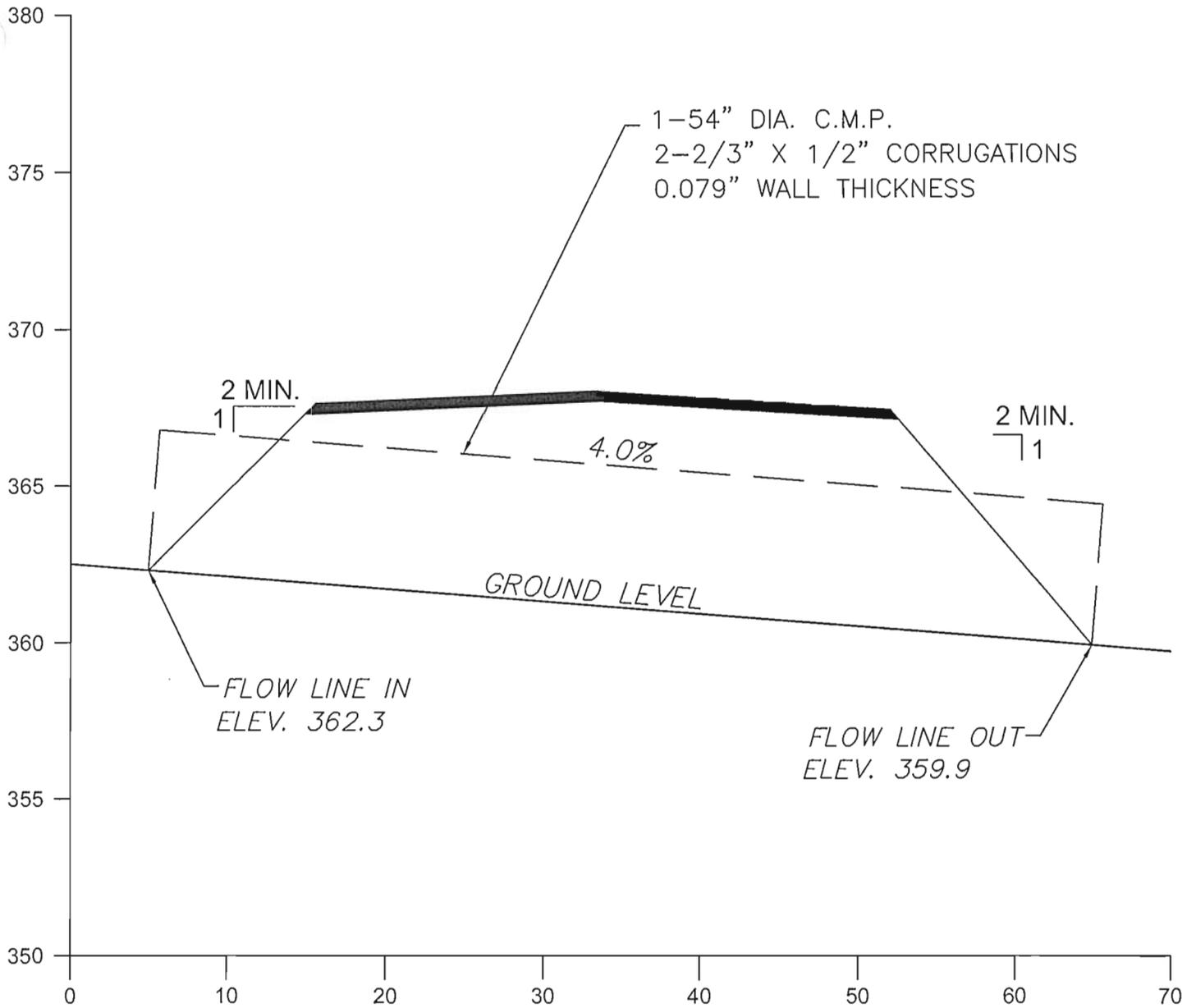
Minimum pipe diameter: 1 - 24 inch pipe(s) required

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	14.700	0.134	0.000	0.000	70.000	M	14.06	1.527
Σ		14.700						14.06	1.527

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	5.00	10.00	200.00	0.560	0.099
		8. Large gullies, diversions, and low flowing streams	11.74	155.00	1,320.00	10.280	0.035
#1	1	Time of Concentration:					0.134



Hydraulics Information

Drainage Area = 111.1 Acres
 10 YR.-6 HR., Q = 94.6 C.F.S.
 Maximum Water Elev. = 367.0
 Minimum Fill Elev. = 368.0
 Minimum Freeboard = 1'
 Maximum Allowable Cover 54" C.M.P. 66'
 Minimum Allowable Cover 54" C.M.P. = 1'
 Wall Thickness = 0.079"



OAK GROVE RESOURCES, LLC
OAK GROVE MINE
P-3232 REVISION R-38
ANCILLARY ROAD 2P CROSS SECTION
DS3P 76+67

DRAWN BY: S.D.M.
 DWG. NAME: OGROGMHRCS

DATE: 3/8/2013

APPROVED BY: L.G.S.

SCALE: AS NOTED

Oak Grove Resources, LLC

Oak Grove Mine

P-3232 Revision R-38

DS3P 76+67

4.3 Inches, 10 Year - 6 Hour

SCS 6 Hour Event

SDM

PERC Engineering Co., Inc.
1606 Highway 78 West
Jasper, AL 35501

Phone: (205) 384-5553
Email: smiles@percengineering.com

General Information

Storm Information:

Storm Type:	Rainfall Event
-------------	----------------

Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1510
1.00	0.3440
1.50	0.5810
2.00	0.9890
2.50	2.5800
3.00	3.0100
3.50	3.3540
4.00	3.5910
4.50	3.8060
5.00	3.9780
5.50	4.1500
6.00	4.3000

Peak 30-minute Intensity: 3.182 in/hr

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	DS3P 76+67

#1 <i>Culvert</i>

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	111.100	111.100	94.55	11.43

Structure Detail:

Structure #1 (Culvert)

DS3P 76+67

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	4.00	0.0240	4.70	0.00	0.90

Culvert Results:

Design Discharge = 94.55 cfs

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

Subwatershed Hydrology Detail:

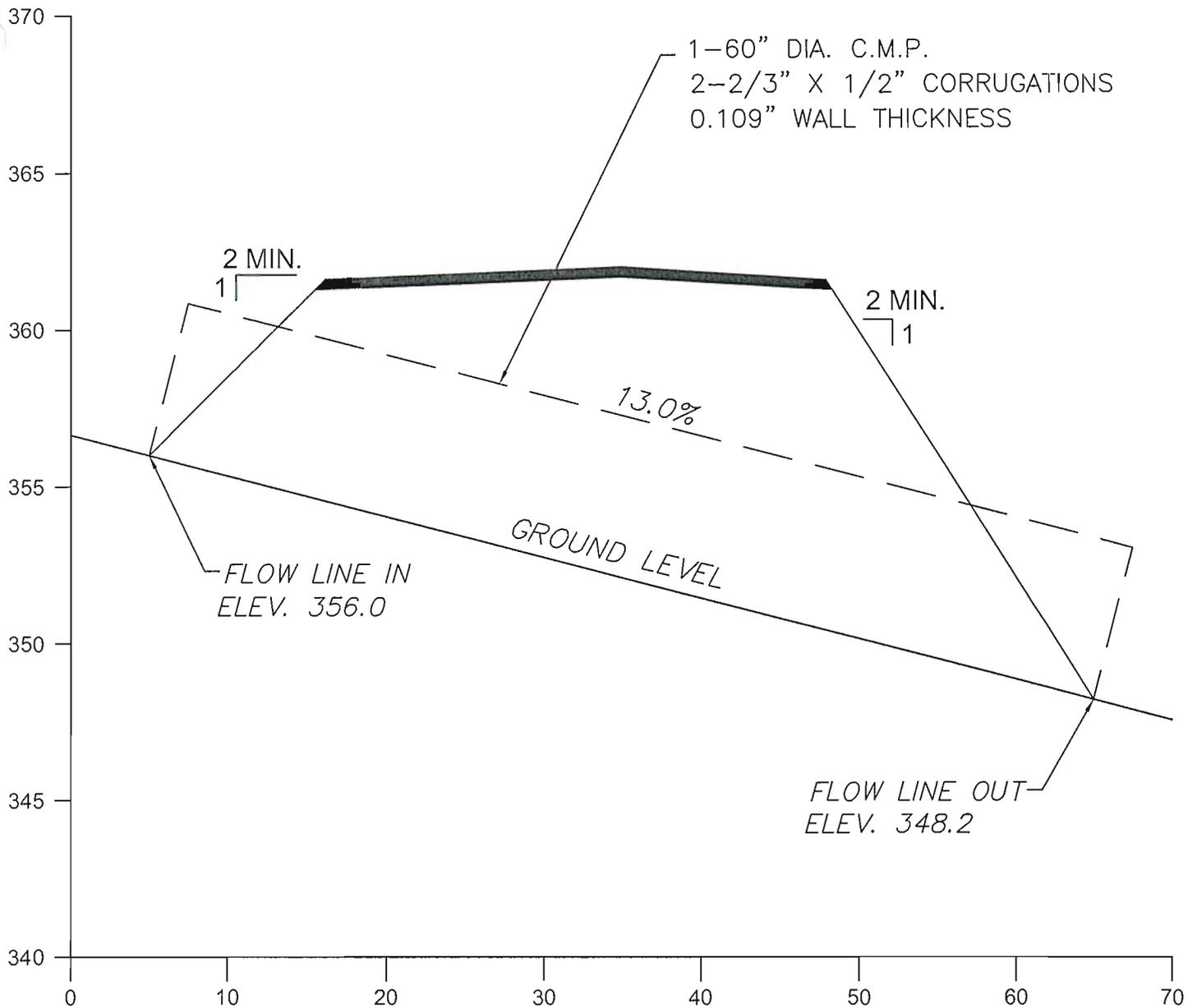
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.200	0.005	0.125	0.409	75.000	M	0.37	0.031
	2	110.900	0.241	0.000	0.000	70.000	M	94.35	11.397
	Σ	111.100						94.55	11.429

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	16.67	10.00	60.00	3.260	0.005
#1	1	Time of Concentration:					0.005
#1	2	1. Forest with heavy ground litter	10.00	20.00	200.00	0.800	0.069
		8. Large gullies, diversions, and low flowing streams	4.88	200.00	4,100.00	6.620	0.172
#1	2	Time of Concentration:					0.241

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	6.43	220.00	3,420.00	7.600	0.125
#1	1	Muskingum K:					0.125



Hydraulics Information

Drainage Area = 128.0 Acres
 10 YR.-6 HR., Q = 106.1 C.F.S.
 Maximum Water Elev. = 361.0
 Minimum Fill Elev. = 362.0
 Minimum Freeboard = 1'
 Maximum Allowable Cover 60" C.M.P. 79'
 Minimum Allowable Cover 60" C.M.P. = 1'
 Wall Thickness = 0.109"



OAK GROVE RESOURCES, LLC
OAK GROVE MINE
P-3232 REVISION R-38
ANCILLARY ROAD 1P CROSS SECTION
DS4P 13+92

DRAWN BY: S.D.M.
 DWG. NAME: OGROGMHRCS

DATE: 3/8/2013

APPROVED BY: L.G.S.

SCALE: AS NOTED

Oak Grove Resources, LLC
Oak Grove Mine
P-3232 Revision R-38
DS4P 13+92

4.3 Inches, 10 Year - 6 Hour
SCS 6 Hour Event

SDM

PERC Engineering Co., Inc.
1606 Highway 78 West
Jasper, AL 35501

Phone: (205) 384-5553
Email: smiles@percengineering.com

General Information

Storm Information:

Storm Type:	Rainfall Event
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Accumulated Time (hrs)	Accumulated Depth (in)
0.00	0.0000
0.50	0.1510
1.00	0.3440
1.50	0.5810
2.00	0.9890
2.50	2.5800
3.00	3.0100
3.50	3.3540
4.00	3.5910
4.50	3.8060
5.00	3.9780
5.50	4.1500
6.00	4.3000

Peak 30-minute Intensity: 3.182 in/hr

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	DS4P 13+92

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	128.000	128.000	106.09	13.14

Structure Detail:

Structure #1 (Culvert)

DS4P 13+92

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	13.00	0.0240	5.00	0.00	0.90

Culvert Results:

Design Discharge = 106.09 cfs

Minimum pipe diameter: 1 - 60 inch pipe(s) required

Subwatershed Hydrology Detail:

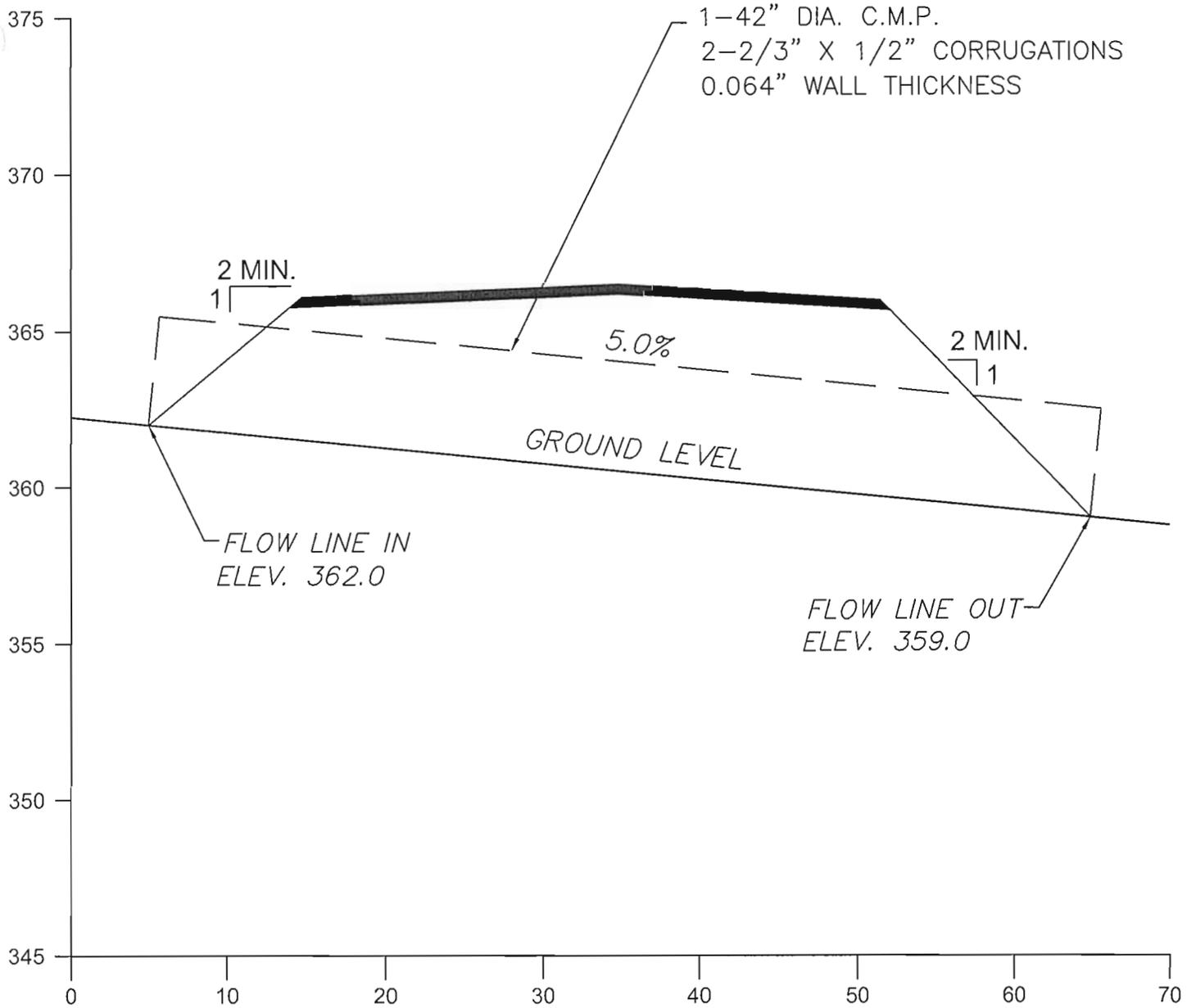
Stru #	SWS #	SWS Area (ac)	Time of Conc (hrs)	Musk K (hrs)	Musk X	Curve Number	UHS	Peak Discharge (cfs)	Runoff Volume (ac-ft)
#1	1	0.700	0.054	0.142	0.405	75.000	M	1.31	0.110
	2	127.300	0.260	0.000	0.000	70.000	M	105.28	13.030
	Σ	128.000						106.09	13.140

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	3. Short grass pasture	2.17	5.00	230.00	1.170	0.054
#1	1	Time of Concentration:					0.054
#1	2	1. Forest with heavy ground litter	10.00	20.00	200.00	0.800	0.069
		8. Large gullies, diversions, and low flowing streams	4.55	200.00	4,400.00	6.390	0.191
#1	2	Time of Concentration:					0.260

Subwatershed Muskingum Routing Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	8. Large gullies, diversions, and low flowing streams	5.88	220.00	3,740.00	7.270	0.142
#1	1	Muskingum K:					0.142



Hydraulics Information

Drainage Area = 28.1 Acres
 10 YR.-6 HR., Q = 43.0 C.F.S.
 Maximum Water Elev. = 365.5
 Minimum Fill Elev. = 366.5
 Minimum Freeboard = 1'
 Maximum Allowable Cover 42" C.M.P. 71'
 Minimum Allowable Cover 42" C.M.P. = 1'
 Wall Thickness = 0.064"



OAK GROVE RESOURCES, LLC
OAK GROVE MINE
P-3232 REVISION R-38
ANCILLARY ROAD 1P CROSS SECTION
DS5P 3+80

DRAWN BY: S.D.M.	DATE: 3/8/2013
DWG. NAME: OGROGMHRCS	
APPROVED BY: L.G.S.	SCALE: AS NOTED

Oak Grove Resources, LLC
Oak Grove Mine
P-3232 Revision R-38
DS5P 3+80

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SCS 6 Hour Event

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2.50	2.5800
3.00	3.0100
3.50	3.3540
4.00	3.5910
4.50	3.8060
5.00	3.9780
5.50	4.1500
6.00	4.3000

Peak 30-minute Intensity: 3.182 in/hr

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	DS5P 3+80

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	28.100	28.100	43.04	3.57

Structure Detail:

Structure #1 (Culvert)

DS5P 3+80

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
60.00	5.00	0.0240	3.50	0.00	0.90

Culvert Results:

Design Discharge = 43.04 cfs

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

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	28.100	0.106	0.000	0.000	70.000	M	43.04	3.567
Σ		28.100						43.04	3.567

Subwatershed Time of Concentration Details:

Stru #	SWS #	Land Flow Condition	Slope (%)	Vert. Dist. (ft)	Horiz. Dist. (ft)	Velocity (fps)	Time (hrs)
#1	1	1. Forest with heavy ground litter	20.00	40.00	200.00	1.130	0.049
		8. Large gullies, diversions, and low flowing streams	7.56	130.00	1,720.00	8.240	0.057
#1	1	Time of Concentration:					0.106