HYDROLOGY STUDY FOR
GUNNER-REILLY, CORP.

CANE CREEK MINE
P-3952
WALKER COUNTY, ALABAMA

BY

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

PRIMARY ROAD 2P, 3P & 4P

DESIGN PLANS

ATTACHMENT III-B-5

JULY 28, 2011

PERC
ENGINEERING CO., INC.

Telephone: (205) 384-5553
Facsimile: (205) 295-3114 - Main Building
(205) 295-3115 - Water Lab
Web Address: www.percengineering.com

July 28, 2011

Mr. Michael Harrison, P.E.
Alabama Surface Mining Commission
Post Office Box 2490
Jasper, Alabama 35502-2490

RE: Gunner-Reilly, Corp.
Cane Creek Mine
P-3952

Dear Michael:

I hereby certify the attached detailed design plans for Primary Road 2P, 3P & 4P for the above referenced mine are in accordance with current prudent engineering practices and the Regulations of the Alabama Surface Mining Commission and are true and correct to the best of my knowledge and belief.

If you have any questions or required additional information, please feel free to call.

Sincerely,
PERC Engineering Co., Inc.

Leslie G. Stephens, P.E., P.L.S.
Alabama Registration No. 14117-E

ALABAMA PROFESSIONAL ENGINEER AND LAND SURVEYOR REGISTERED No.14117 LESLIE G. STEPHENS

P.O. Box 1712 • Jasper, Alabama 35502 • 1606 Highway 78 West • Jasper, Alabama 35501

SPECIFICATIONS FOR THE CONSTRUCTION, MAINTENANCE AND RECLAMATION OF PRIMARY ROADS

1. Primary roads shall be designed by or under the direction of a registered professional engineer in accordance with the Alabama Surface Mining Commission rules and regulations and prudent engineering practice.

2. Each roadway embankment will be designed and constructed so as to have a minimum static safety factor of 1.3.

3. 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.

4. 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. No fording of intermittent or perennial streams will be conducted unless specifically approved by the Alabama Surface Mining Commission as temporary routes to be used during road construction.

5. 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.

6. Roads will be constructed of suitable compacted subgrade material. The material will be free of sod, roots, stones over 12 inches in diameter, and other objectionable materials. The material will be placed and spread over the entire fill area, starting at the lowest point in layers not to exceed 12 inches in thickness. The material will be compacted to 95 percent of the density, based on standard proctor as outlined in ASTM.

7. Primary roads will have a minimum width of eighteen feet and a maximum width necessary to accommodate the largest equipment traveling the road.

8. Roadbeds will be cut to consolidated non-erodible material or will be surfaced with durable non-toxic, non-acid forming substances. The wearing surface will consist of durable sandstone, 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. The wearing surface will be placed on the roadbed to a depth of four inches.

9. 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.

10. Roads will be constructed so as to have adequate drainage utilizing ditches, culverts, cross drains and ditch relief drains designed to safely pass the peak runoff from a ten year, six hour precipitation event. Drainage pipes and culverts shall be installed as designed and will be maintained in a free and operating condition to prevent and control erosion at inlets and outlets. Culverts have been designed to support the load of the heaviest equipment to travel the road and are based on the Handbook of Steel Drainage and Highway Construction Products by the American Iron and Steel Institute and the equipment specifications. Drainage ditches will be constructed and maintained in accordance with the approved design to prevent uncontrolled drainage over the road surface and embankment. 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 and constructed 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. Upon completion of construction of each phase of the roadway the construction will be certified to the Alabama Surface Mining Commission as having been done in accordance with the approved plans for the roadway and associated facilities.

11. 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.

12. 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.

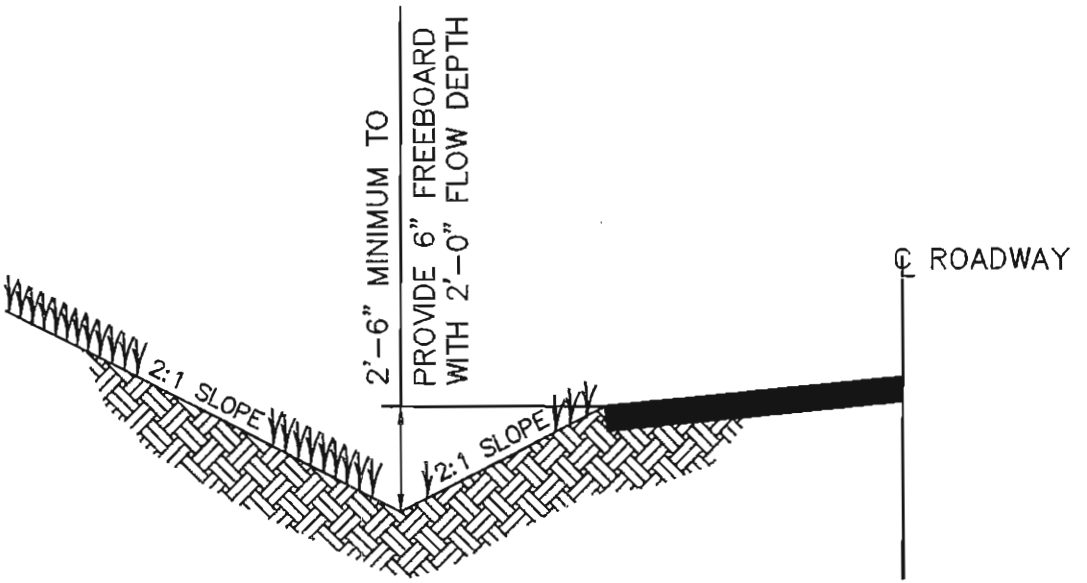
    c. All road surfacing materials that are not compatible with the post mine land use or revegetation requirements will be properly disposed of on-site or removed from the site for re-use.

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.

13. The drawings and data contained in the specific design plans illustrate typical roadbed configurations for primary roads as well as site specific design of drainage structures, stability analysis and ditch sections.



MINIMUM DITCH GRADIENT = 1%

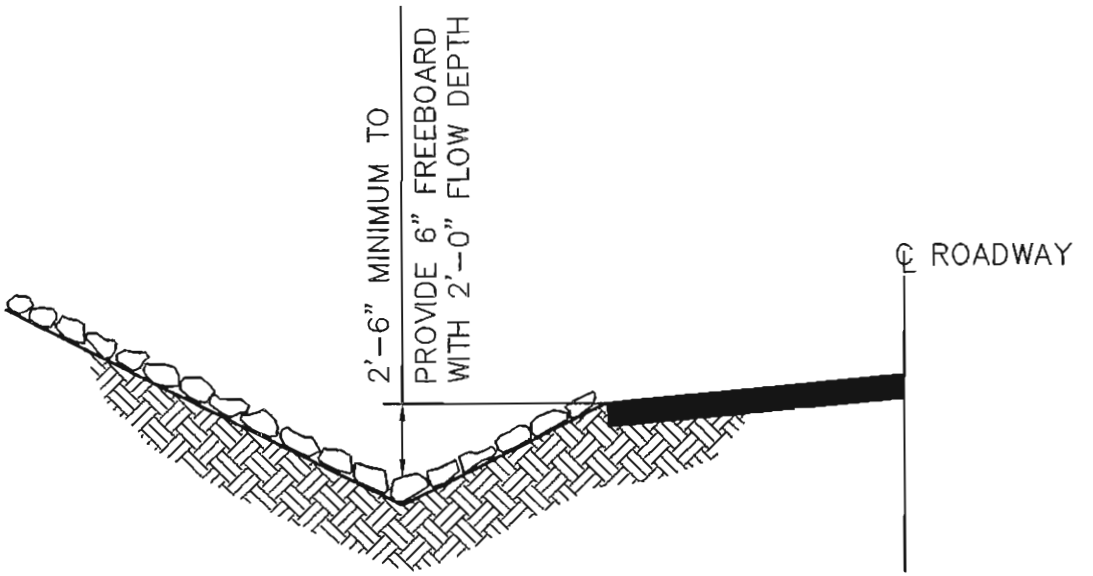
MAXIMUM DITCH GRADIENT = 5%

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

PERC ENGINEERING CO., INC.

TYPICAL PRIMARY ROADWAY DITCH CROSS SECTION

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



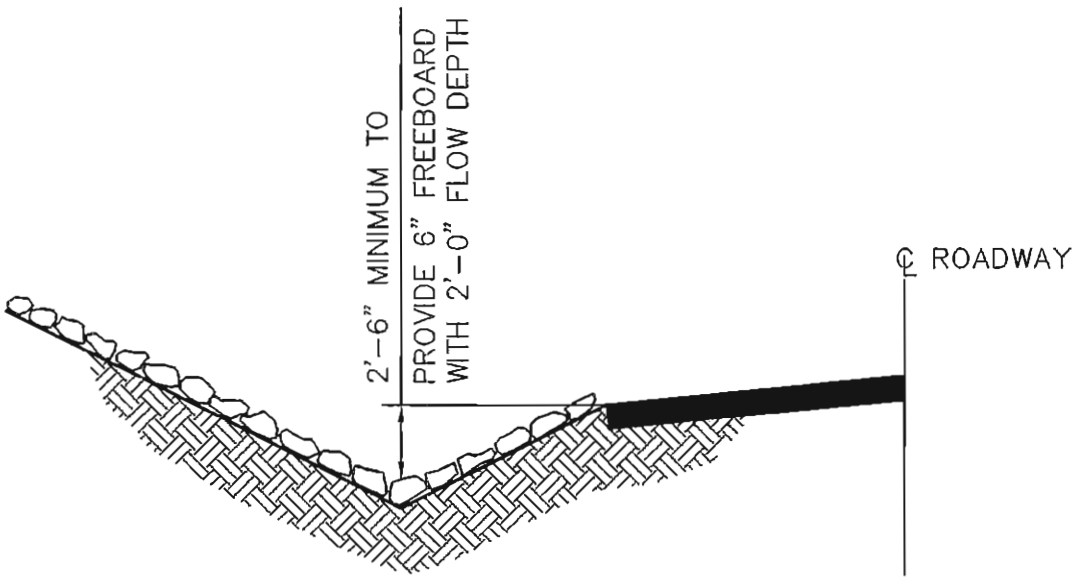
DITCH GRADIENT 11% TO 17%

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".

PERC ENGINEERING CO., INC.

TYPICAL PRIMARY ROADWAY DITCH CROSS SECTION

DRAWN BY:	K.D.P.	DATE:	2-4-97
DWG. NAME:	PRIMRD2		
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".

PERC ENGINEERING CO., INC.

TYPICAL PRIMARY ROADWAY DITCH CROSS SECTION

DRAWN BY: K.D.P. DWG. NAME: PRIMRD1	DATE: 2-4-97
APPROVED BY: R.E.P.	SCALE: NONE

NOTES

Primary Road 2P

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

2) Drainage structure PR2C1 is an existing 48" reinforced concrete pipe which is to remain in place.

3) Drainage structure PR2C2 is an existing 24" reinforced concrete pipe, which is to remain in place, with an additional 24" reinforced concrete pipe parallel to the existing one with a minimum separation of 2 feet. Additional fill material is required to be place along the roadway embankment from station 33+71 to station 35+72 to maintain minimum crest elevation (354.50) with 1' of dry freeboard and side slopes of 2H:1V or flatter.

4) Drainage structure PR2C3 is an existing 18" corrugate metal pipe, which is to remain in place, and an additional 18" corrugate metal pipe parallel to the existing one with a minimum separation of 2 feet. Additional fill material is required to be place along the roadway embankment from station 39+69 to station 41+08 to maintain minimum crest elevation (362.90) with 1' of dry freeboard and side slopes of 2H:1V or flatter.

Primary Road 3P

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

2) Drainage structure PR3C1 is a proposed 42" corrugated metal pipe which is to be place within the roadway of Primary Road 3P at approximately station 5+28.

3) Drainage structure PR3C2 is a proposed 6'x3' reinforced concrete box culvert which is to be place within the roadway of Primary Road 3P and is a portion of Diversion Ditch 1-2.

Primary Road 4P

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

2) Drainage structure PR4C1 is a proposed 6'x3' reinforced concrete box culvert which is to be place within the roadway of Primary Road 4P and is a portion of Diversion Ditch 5-6.

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

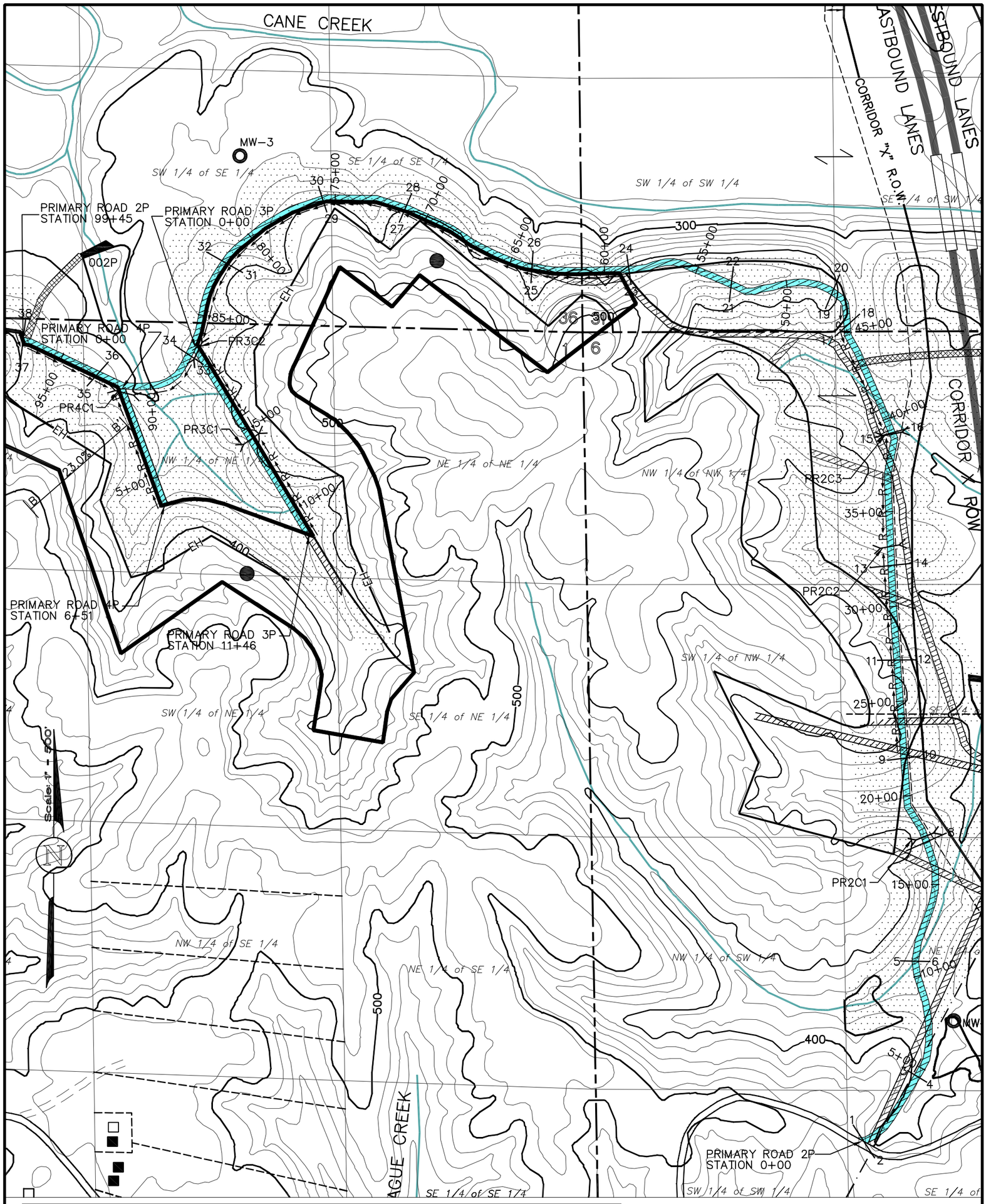
No more than 10% of the stone will have a diameter greater than twenty two (22) inches; no more than 50% of the stone will have a diameter less than sixteen (16) inches; and no more than 10% of the stone will have a diameter of less than eight (8) inches. The thickness of the rip-rap liner will be no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



LEGEND

- Permit Boundary/Increment Boundary
- P-3742
- EH — Existing Highwall taken from Aerial Photo, 2009 Terrain Navigator Pro
- 600 — Surface Contour
- 001P — Sediment Basin
- Primary Road/P-3742
- Ancillary Roads
- Perennial Stream as per Cordova U.S.G.S. Quadrangle Map
- Intermittent Stream as per Cordova U.S.G.S. Quadrangle Map
- Public Road (Paved unless otherwise designated)
- Road (Private unless otherwise shown)
- Previously Surface Mined
- Known Extents Of Underground Mine
- Occupied Dwelling
- Unoccupied Dwelling (Barn, Shed, ect.)
- Drainage Structure/Culvert
- Diversion Ditch/Berm
- Primary Road
- R — Roadside Ditch

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

Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road Location Map

DRAWN BY:	J.W.T.	DATE:	03/15/2011
DWG. NAME:	CCMHR2LM		
APPROVED BY:	L.G.S.	SCALE:	1" = 500'

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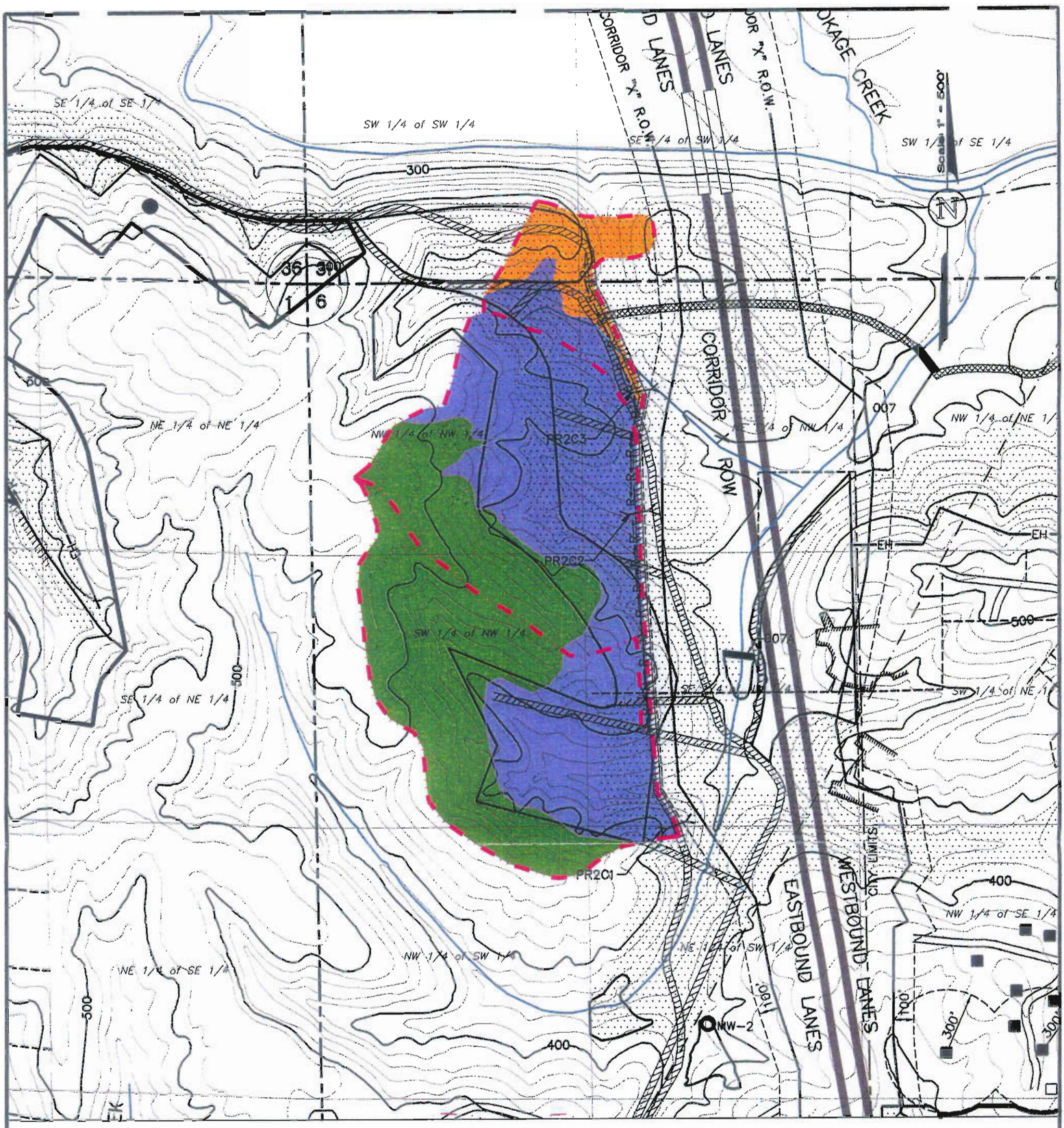

LEGEND

- Permit Boundary/Increment Boundary
- P-3742
- Primary Road
- EH — Existing Highwall taken from Aerial Photo, 2009 Terrain Navigator Pro
- 600 — Surface Contour
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- Road (Private unless otherwise shown)
- Previously Surface Mined
- Known Extents Of Underground Mine
- Occupied Dwelling
- Unoccupied Dwelling (Barn, Shed, ect.)
- Watershed Boundary
- Drainage Structure/Culvert
- Diversion Ditch/Berm
- R — Roadside Ditch

LANDUSE INFORMATION

- Unmanaged Timberland, Curve Number 70
- Graded & Bare, Curve Number 81
- Previously Disturbed, Curve Number 68

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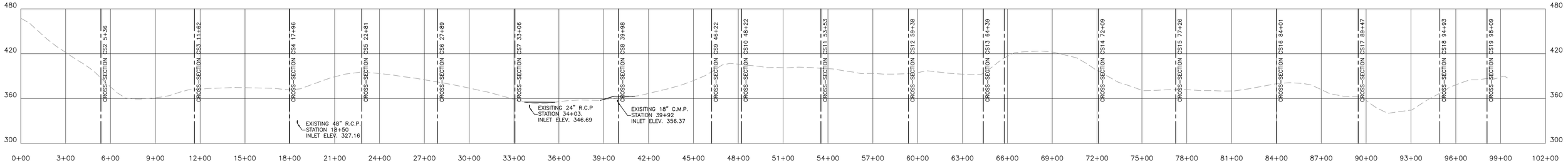
Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P Watershed Map

DRAWN BY: J.W.T.	DATE: 03/08/2011
DWG. NAME: HR2 WSM	
APPROVED BY: L.G.S.	SCALE: 1" = 500'



LEGEND

EXISTING GRADE

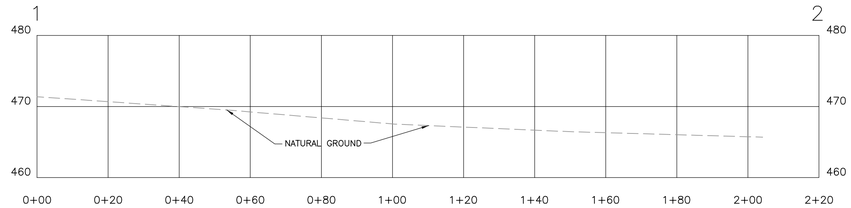
PROPOSED FINISHED GRADE

VERTICAL SCALE: 1" = 60'
HORIZONTAL SCALE: 1" = 300'

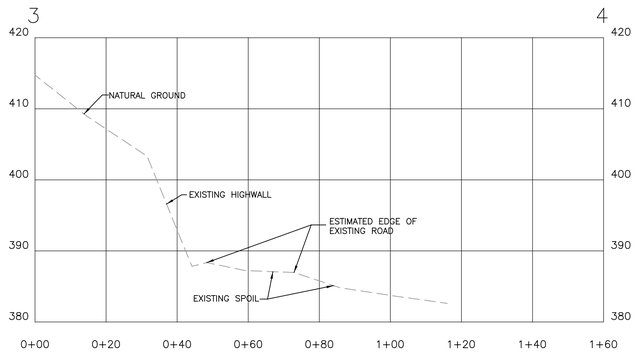
PERC ENGINEERING CO., INC.
P.O. BOX 1179 PRESCOTT, ARIZONA 86302
(928) 445-5900 OFFICE (928) 445-5904 FAX

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Primary Road 2P Profile

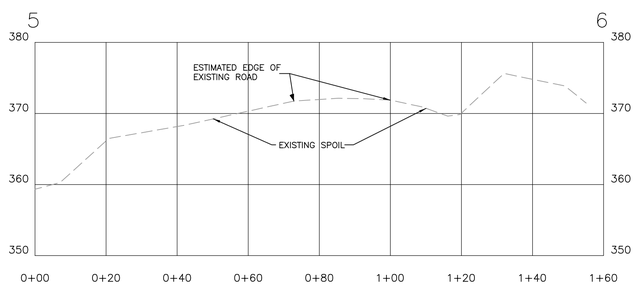
DRAWN BY: J.W.T. DWG. NAME: HR2 Profile	DATE: 03/15/2011
APPROVED BY: L.G.S.	SCALE: AS NOTED



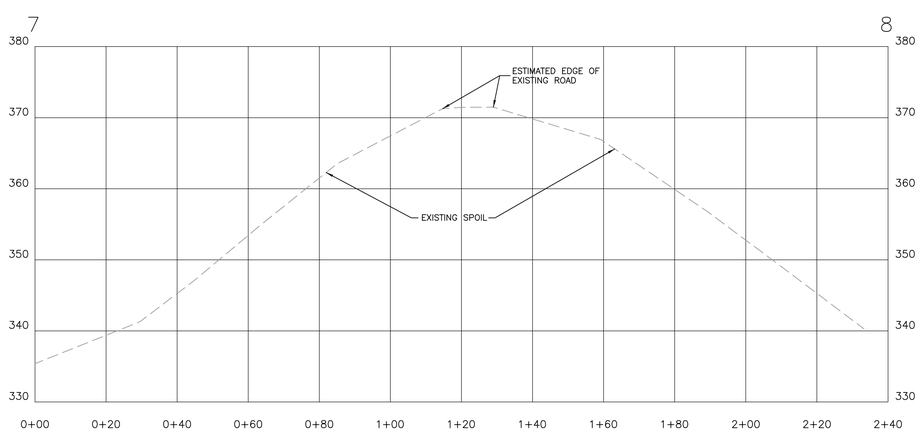
CS1 0+00



CS2 5+36



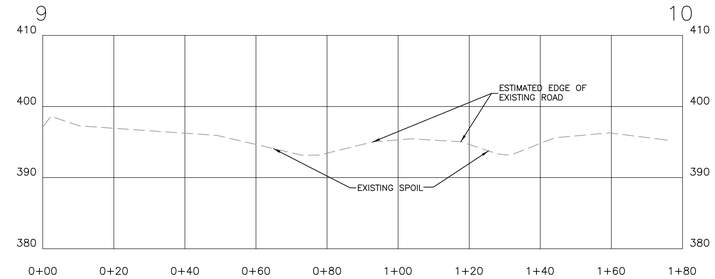
CS3 11+62



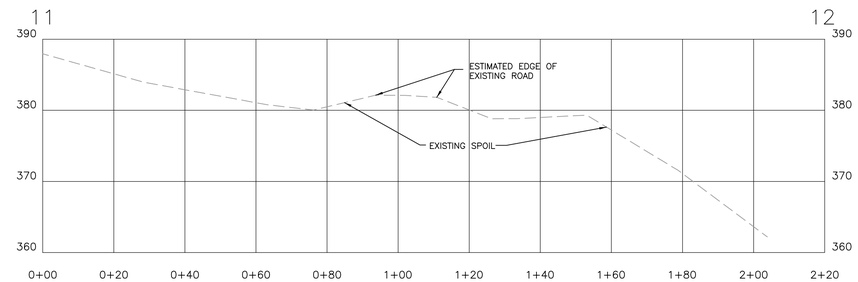
CS4 17+96

LEGEND

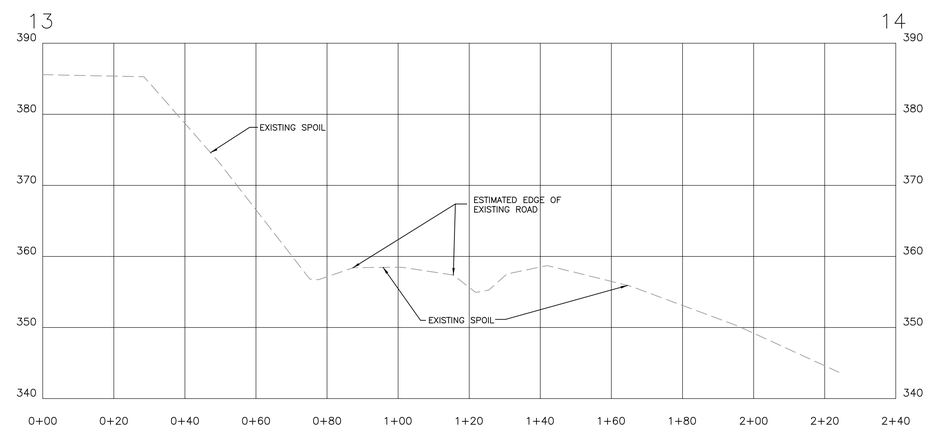
PROPOSED CENTERLINE OF DIVERSION DITCH



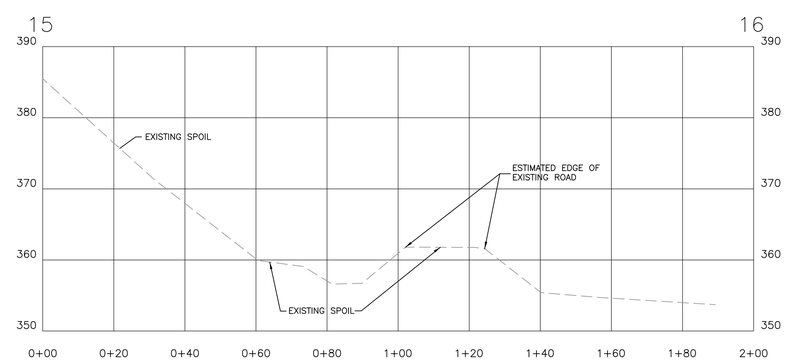
CS5 22+81



CS6 27+89



CS7 33+06



CS8 39+98

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

REVISIONS

NO.	DATE	NATURE OF REVISION
1		
2		
3		
4		
5		
6		

Initial Drawing Date: March 18, 2011 HR2 Cross-Sections.DWG

Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Cross-Sections CS1 - CS8

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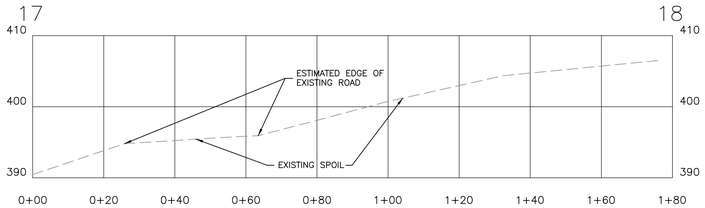
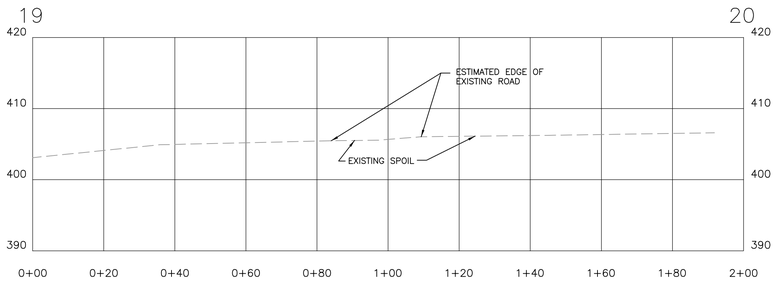
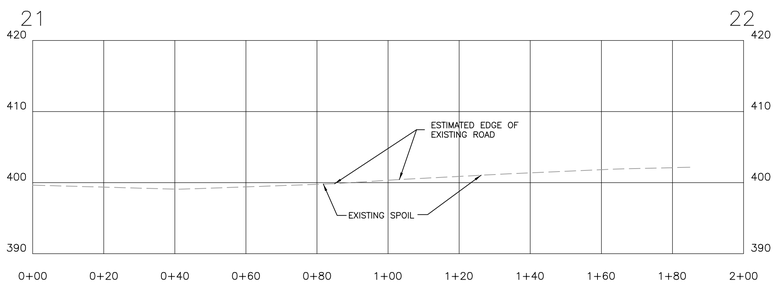


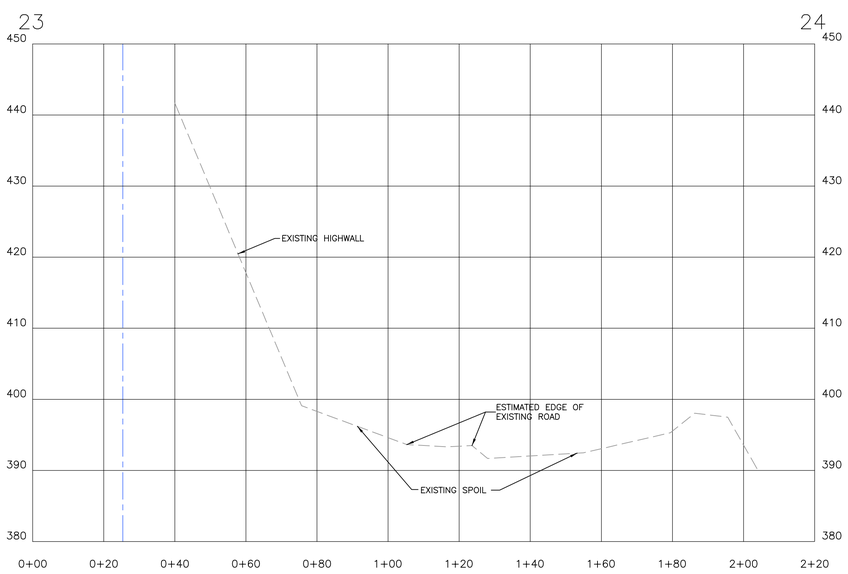
CS9 46+22



CS10 48+22



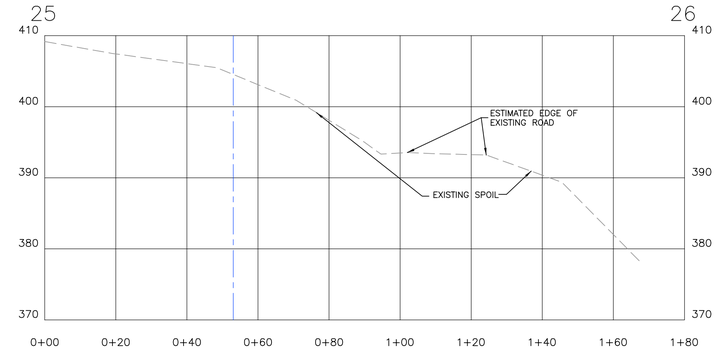
CS11 53+53



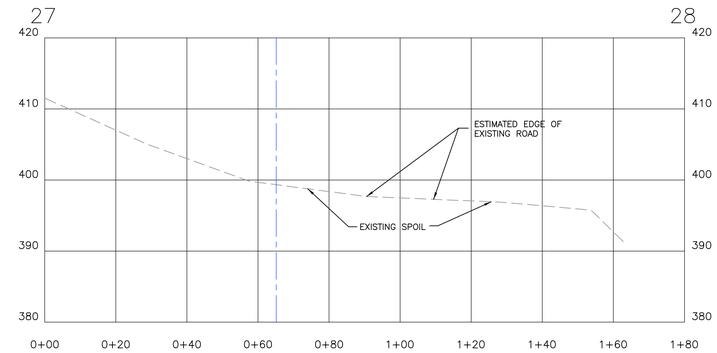
CS12 59+38

LEGEND

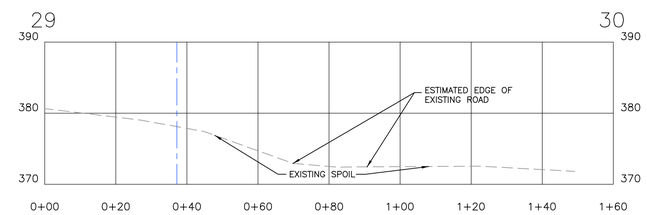
PROPOSED CENTERLINE OF DIVERSION DITCH



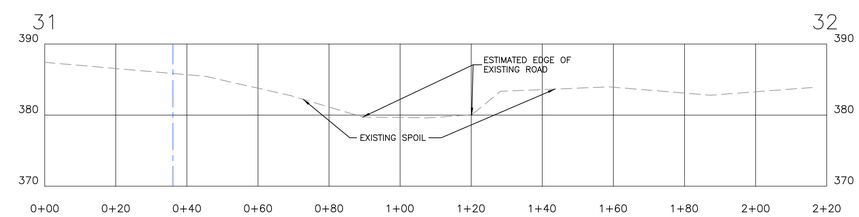
CS13 64+39



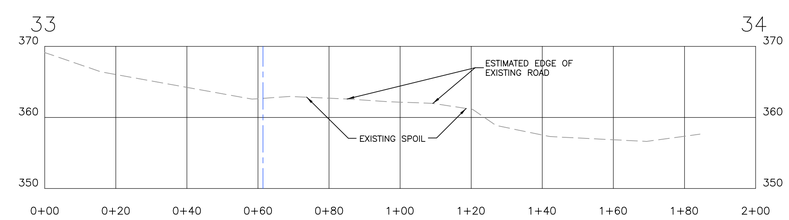
CS14 72+09



CS15 77+26



CS16 84+01



CS17 89+47

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

REVISIONS

NO.	DATE	NATURE OF REVISION
1		
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6		

Initial Drawing Date: March 18, 2011 HR2 Cross-Sections.DWG

Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Cross-Sections CS9 - CS17

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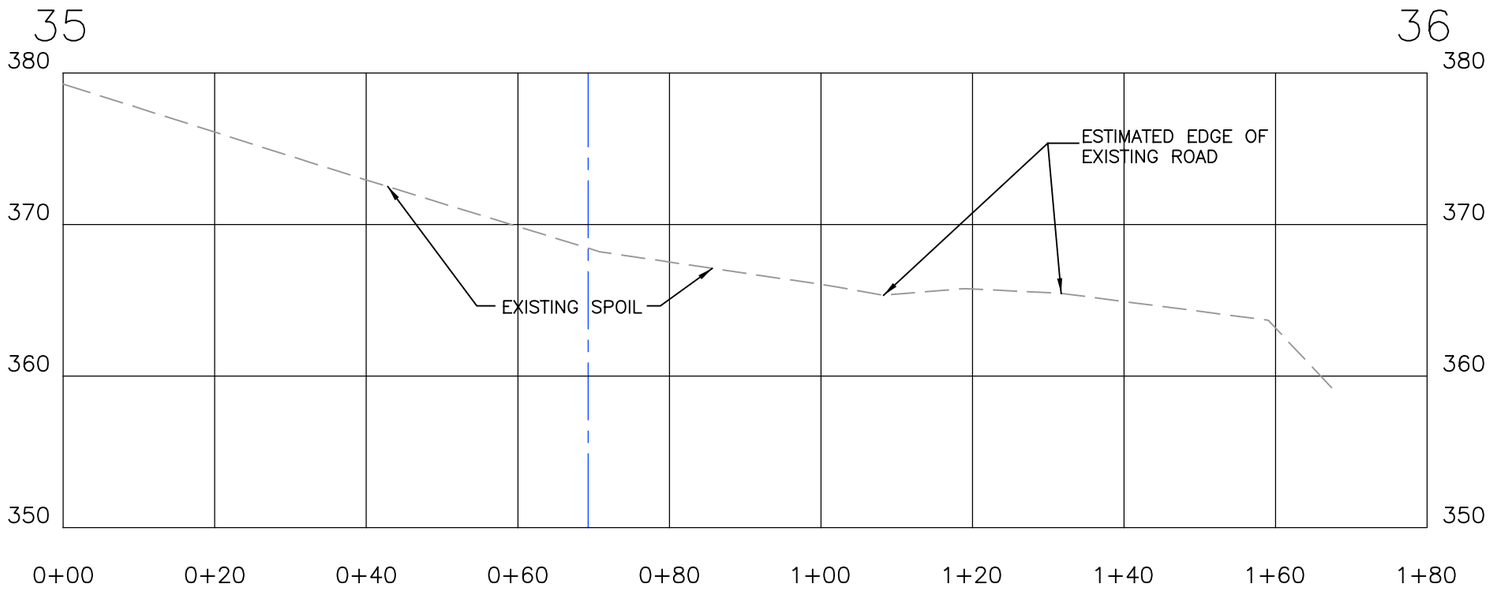
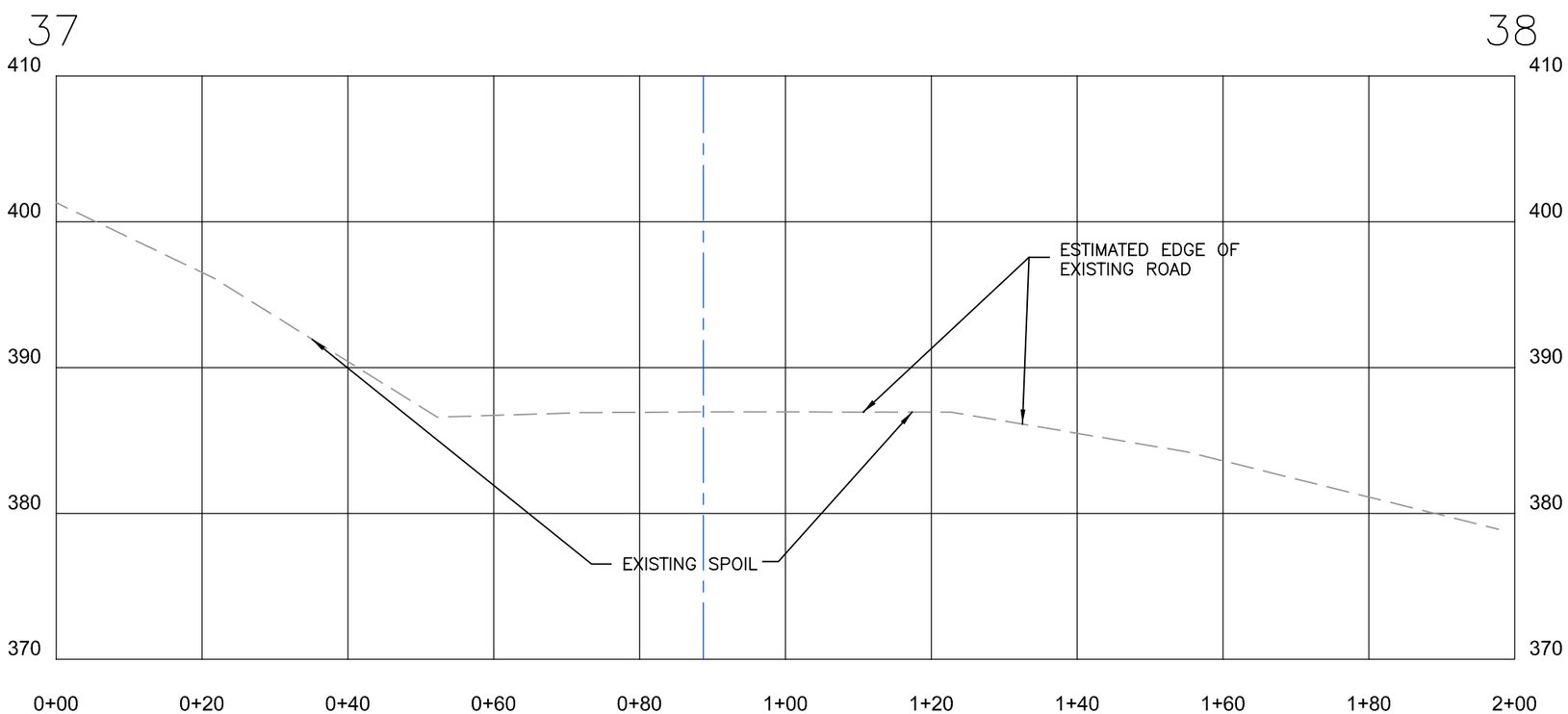


CS18 94+93

LEGEND

PROPOSED CENTERLINE OF DIVERSION DITCH

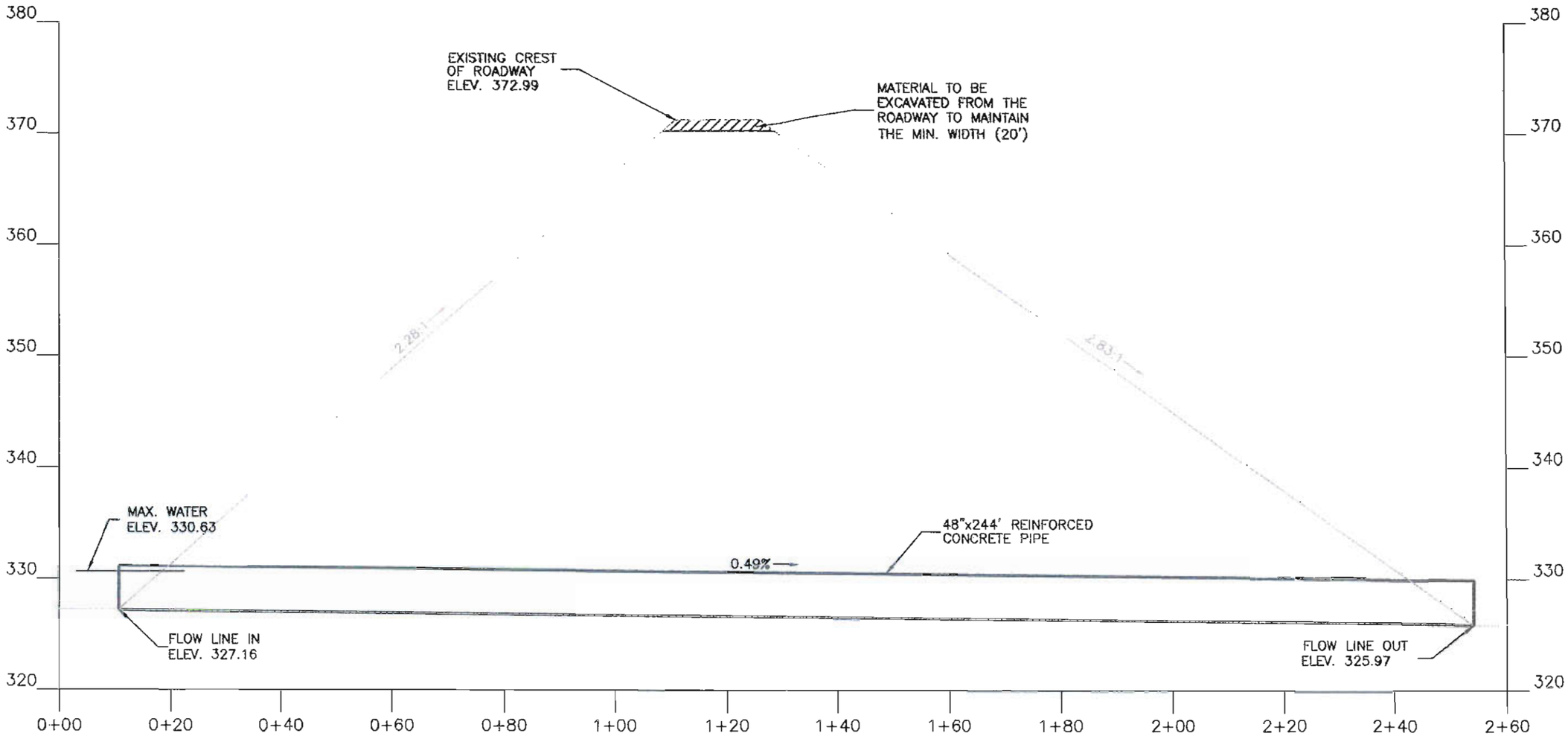


CS19 98+09

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

Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Cross-Sections CS18 - CS19

Y:\Eng105\Mines\GUNNER-REILLY\haulroads\Yr2\YR2 Cross-Sections.dwg 05/03/11 11:03



HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 10'

HYDRAULICS INFORMATION

Drainage Area = 35.48 Acres
10 YR.–6 HR., Q = 59.31 C.F.S.
Maximum Water Elev. = 330.63
Minimum Fill Elev. = 331.63
Wall Thickness = 5.75"
Minimum Freeboard = 1'

NOTE:
DRAINAGE STRUCTURE HR2C1 IS AN EXISTING STRUCTURE INSTALLED BY ALDOT CONTRACTOR.

PERC ENGINEERING CO., INC.

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR2C1
Primary Road 2P 17+50
NE 1/4 of SW 1/4 &
SE 1/4 of NW 1/4 of Section 6,
Township 15 South,
Range 6 West,
Walker County, Alabama

DRAWN BY: J.W.T. DWG. NAME: HR2CCS	DATE: 03/14/2011
APPROVED BY: L.G.S.	SCALE: AS NOTED

Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Drainage Structure PR2C1

4.3 Inch, 10 Year-6 Hour

NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haulroad 2P-Culvert 1

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	35.480	35.480	59.31	3.86

Structure Detail:

Structure #1 (Culvert)

Haulroad 2P-Culvert 1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
244.00	0.50	0.0160	5.50	0.00	0.90

Culvert Results:

Design Discharge = 59.31 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	21.470	0.165	0.051	0.400	70.000	M	34.37	2.230
	2	14.010	0.064	0.000	0.000	68.000	F	33.90	1.626
	Σ	**35.480**						**59.31**	**3.856**

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	12.99	140.00	1,078.00	10.810	0.027
#1	**1**	**Time of Concentration:**					**0.165**
#1	2	2. Minimum tillage cultivation	5.00	10.00	200.00	1.110	0.050
		9. Small streams flowing bankfull	5.14	55.00	1,069.00	20.410	0.014
#1	**2**	**Time of Concentration:**					**0.064**

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	5.12	65.00	1,269.00	6.780	0.051
#1	**1**	**Muskingum K:**					**0.051**

CURRENT DATE: 03-08-2011 FILE DATE: 03-08-2011
CURRENT TIME: 11:11:26 FILE NAME: CCHR2C1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	327.16	325.97	243.64	1	RCP	4.00	4.00	.016	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCHR2C1 DATE: 03-08-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
327.16	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
328.20	6.5	6.5	0.0	0.0	0.0	0.0	0.0	0.00	1
328.66	13.0	13.0	0.0	0.0	0.0	0.0	0.0	0.00	1
329.02	19.5	19.5	0.0	0.0	0.0	0.0	0.0	0.00	1
329.33	26.0	26.0	0.0	0.0	0.0	0.0	0.0	0.00	1
329.61	32.5	32.5	0.0	0.0	0.0	0.0	0.0	0.00	1
329.88	39.0	39.0	0.0	0.0	0.0	0.0	0.0	0.00	1
330.13	45.5	45.5	0.0	0.0	0.0	0.0	0.0	0.00	1
330.36	52.0	52.0	0.0	0.0	0.0	0.0	0.0	0.00	1
330.60	58.5	58.5	0.0	0.0	0.0	0.0	0.0	0.00	1
330.63	59.3	59.3	0.0	0.0	0.0	0.0	0.0	0.00	1
372.99	381.3	381.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCHR2C1 DATE: 03-08-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
327.16	0.000	0.00	0.00	0.00
328.20	0.000	6.50	0.00	0.00
328.66	0.000	13.00	0.00	0.00
329.02	0.000	19.50	0.00	0.00
329.33	0.000	26.00	0.00	0.00
329.61	0.000	32.50	0.00	0.00
329.88	0.000	39.00	0.00	0.00
330.13	0.000	45.50	0.00	0.00
330.36	0.000	52.00	0.00	0.00
330.60	0.000	58.50	0.00	0.00
330.63	0.000	59.31	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 03-08-2011 FILE DATE: 03-08-2011
CURRENT TIME: 11:11:26 FILE NAME: CCHR2C1

PERFORMANCE CURVE FOR CULVERT 1 - 1(4.00 (ft) BY 4.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	327.16	0.00	0.00	0-NF	0.00	0.00	0.00	1.00	0.00	0.00
6.50	328.20	0.99	1.04	3-M1t	0.75	0.72	1.00	1.00	2.62	0.00
13.00	328.66	1.43	1.49	2-M2c	1.06	1.04	1.04	1.00	4.99	0.00
19.50	329.02	1.77	1.86	2-M2c	1.32	1.29	1.29	1.00	5.56	0.00
26.00	329.33	2.08	2.17	2-M2c	1.55	1.50	1.50	1.00	6.04	0.00
32.50	329.61	2.37	2.45	2-M2c	1.75	1.69	1.69	1.00	6.45	0.00
39.00	329.88	2.64	2.72	2-M2c	1.94	1.85	1.85	1.00	6.84	0.00
45.50	330.13	2.88	2.96	2-M2c	2.13	2.02	2.02	1.00	7.16	0.00
52.00	330.36	3.11	3.20	2-M2c	2.31	2.16	2.16	1.00	7.53	0.00
58.50	330.60	3.33	3.44	2-M2c	2.50	2.30	2.30	1.00	7.84	0.00
59.31	330.63	3.35	3.47	2-M2c	2.53	2.31	2.31	1.00	7.88	0.00

El. inlet face invert 327.16 ft El. outlet invert 325.97 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	327.16 ft
OUTLET STATION	243.64 ft
OUTLET ELEVATION	325.97 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0049
CULVERT LENGTH ALONG SLOPE	243.64 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	4.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.016
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END PROJECTION
INLET DEPRESSION	NONE

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CURRENT DATE: 03-08-2011                               FILE DATE: 03-08-2011
CURRENT TIME: 11:11:26                                 FILE NAME: CCHR2C1

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           CONSTANT WATER SURFACE ELEVATION
                     326.97

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ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ  ROADWAY OVERTOPPING DATA  ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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      ROADWAY SURFACE                          GRAVEL
      EMBANKMENT TOP WIDTH                      25.00 ft
      CREST LENGTH                             100.00 ft
      OVERTOPPING CREST ELEVATION              372.99 ft

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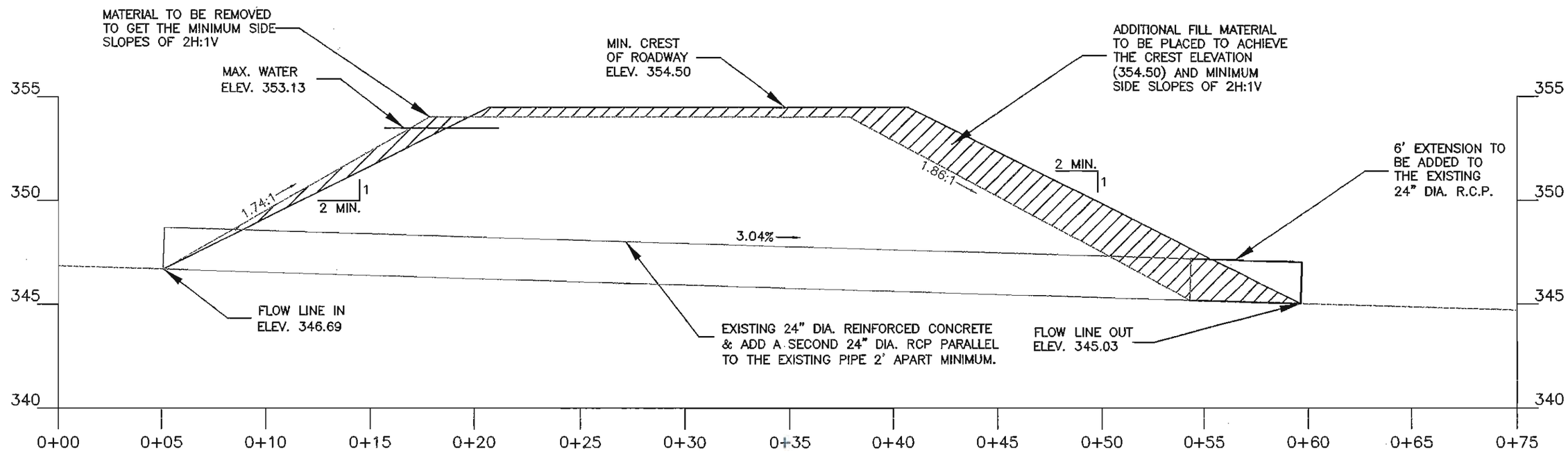

HYDRAULICS INFORMATION

Drainage Area = 34.23 Acres
10 YR.–6 HR., Q = 70.62 C.F.S.
Maximum Water Elev. = 353.13
Minimum Fill Elev. = 354.50
Maximum Allowable Cover 24" R.C.P. = 16'
Minimum Allowable Cover 24" R.C.P. = 1'
Wall Thickness = 2.500"
Minimum Freeboard = 1'

PERC ENGINEERING CO. INC.

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR2C2
Primary Road 2P 33+25
NE 1/4 of NW 1/4 Section 6,
Township 15 South,
Range 6 West,
Walker County, Alabama

DRAWN BY: J.W.T. DWG. NAME: HR2CCS	DATE: 03/14/2011
APPROVED BY: L.G.S.	SCALE: 1"=5'

Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Drainage Structure PR2C2

4.3 Inch, 10 Year-6 Hour

NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haulroad 2P-Culvert 2

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	34.230	34.230	70.62	3.83

Structure Detail:

Structure #1 (Culvert)

Haulroad 2P-Culvert 2

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
50.00	3.00	0.0160	5.50	0.00	0.90

Culvert Results:

Design Discharge = 70.62 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	11.630	0.127	0.020	0.428	70.000	M	18.62	1.208
	2	22.600	0.035	0.000	0.000	68.000	F	54.68	2.623
	Σ	**34.230**						**70.62**	**3.830**

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	9.61	90.00	937.00	9.290	0.028
#1	**1**	**Time of Concentration:**					**0.127**
#1	2	2. Minimum tillage cultivation	17.50	35.00	200.00	2.090	0.026
		9. Small streams flowing bankfull	10.20	102.00	1,000.00	28.740	0.009
#1	**2**	**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	1	8. Large gullies, diversions, and low flowing streams	11.23	82.00	730.00	10.050	0.020
#1	**1**	**Muskingum K:**					**0.020**

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:06:39 FILE NAME: CCHR2C2

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS	SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	346.69	345.03	54.59	2	RCP	2.00	2.00	.016	CONVENTIONAL
2									
3									
4									
5									
6									

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCHR2C2 DATE: 07-28-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
346.69	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
347.62	7.5	7.5	0.0	0.0	0.0	0.0	0.0	0.00	1
348.09	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.00	1
348.51	22.5	22.5	0.0	0.0	0.0	0.0	0.0	0.00	1
348.94	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
349.45	37.5	37.5	0.0	0.0	0.0	0.0	0.0	0.00	1
350.07	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.00	1
350.81	52.5	52.5	0.0	0.0	0.0	0.0	0.0	0.00	1
351.67	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
352.66	67.5	67.5	0.0	0.0	0.0	0.0	0.0	0.00	1
353.13	70.6	70.6	0.0	0.0	0.0	0.0	0.0	0.00	1
353.24	71.3	71.3	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCHR2C2 DATE: 07-28-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
346.69	0.000	0.00	0.00	0.00
347.62	0.000	7.50	0.00	0.00
348.09	0.000	15.00	0.00	0.00
348.51	0.000	22.50	0.00	0.00
348.94	0.000	30.00	0.00	0.00
349.45	0.000	37.50	0.00	0.00
350.07	0.000	45.00	0.00	0.00
350.81	0.000	52.50	0.00	0.00
351.67	0.000	60.00	0.00	0.00
352.66	0.000	67.50	0.00	0.00
353.13	0.000	70.62	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:06:39 FILE NAME: CCHR2C2

PERFORMANCE CURVE FOR CULVERT 1 - 2(2.00 (ft) BY 2.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	346.69	0.00	0.00	0-NF	0.00	0.00	0.00	0.97	0.00	0.00
7.50	347.62	0.93	0.93	1-S2n	0.45	0.67	0.46	0.97	6.76	0.00
15.00	348.09	1.40	1.40	1-S2n	0.65	0.97	0.66	0.97	8.25	0.00
22.50	348.51	1.82	1.82	1-S2n	0.82	1.20	0.82	0.97	9.33	0.00
30.00	348.94	2.25	2.25	5-S2n	0.96	1.40	0.96	0.97	10.00	0.00
37.50	349.45	2.76	0.00	5-S2n	1.10	1.55	1.10	0.97	10.56	0.00
45.00	350.07	3.38	0.00	5-S2n	1.23	1.68	1.23	0.97	11.04	0.00
52.50	350.81	4.12	0.00	5-S2n	1.38	1.79	1.42	0.97	11.03	0.00
60.00	351.67	4.98	0.00	5-S2n	1.54	1.90	1.54	0.97	11.56	0.00
67.50	352.66	5.97	4.32	5-S2n	1.77	2.00	1.90	0.97	11.03	0.00
70.62	353.13	6.44	4.70	5-S2n	2.00	2.00	2.00	0.97	11.24	0.00

El. inlet face invert 346.69 ft El. outlet invert 345.03 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	346.69 ft
OUTLET STATION	54.56 ft
OUTLET ELEVATION	345.03 ft
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0304
CULVERT LENGTH ALONG SLOPE	54.59 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	2.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.016
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:06:39 FILE NAME: CCHR2C2

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CONSTANT WATER SURFACE ELEVATION
346.00

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ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	25.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	353.24 ft

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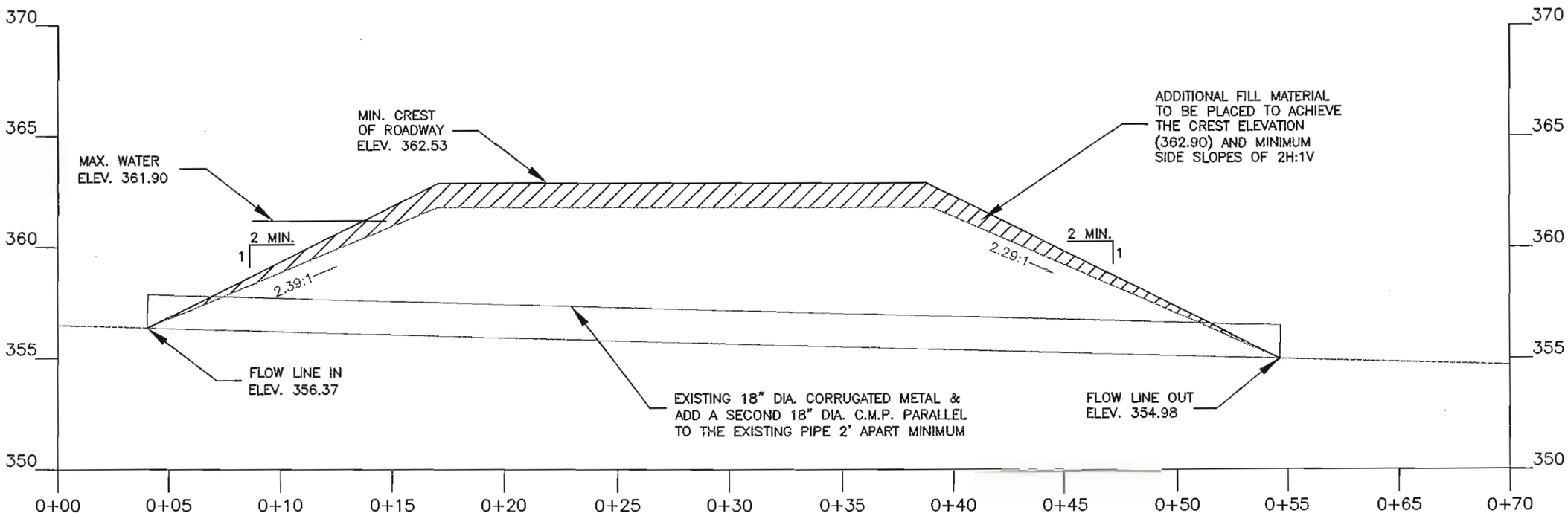

HYDRAULICS INFORMATION

Drainage Area = 9.11 Acres
10 YR.–6 HR., Q = 28.59 C.F.S.
Maximum Water Elev. = 361.53
Minimum Fill Elev. = 362.53
Maximum Allowable Cover 18" C.M.P. = 166'
Minimum Allowable Cover 18" C.M.P. = 1'
Wall Thickness = 0.064"
Minimum Freeboard = 1'

PERC ENGINEERING CO. INC.

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR2C3
Primary Road 2P 39+25
NE 1/4 of NW 1/4 Section 6,
Township 15 South,
Range 6 West,
Walker County, Alabama

DRAWN BY:	J.W.T.	DATE:	03/14/2011
DWG. NAME:	HR2CCS		
APPROVED BY:	L.G.S.	SCALE:	1"=5'

Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 2P
Drainage Structure PR2C3

4.3 Inch, 10 Year-6 Hour

NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	Haulroad 2P-Culvert 3

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	9.110	9.110	28.59	1.51

Structure Detail:

Structure #1 (Culvert)

Haulroad 2P-Culvert 3

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
50.00	2.70	0.0240	3.50	0.00	0.90

Culvert Results:

Design Discharge = 28.59 cfs

Minimum pipe diameter: 1 - 30 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	5.590	0.071	0.000	0.000	81.000	F	20.07	1.103
	2	3.520	0.059	0.000	0.000	68.000	F	8.52	0.408
	Σ	**9.110**						**28.59**	**1.511**

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	2.00	4.00	200.00	1.410	0.039
		8. Large gullies, diversions, and low flowing streams	5.99	51.00	851.00	7.340	0.032
#1	**1**	**Time of Concentration:**					**0.071**
#1	2	2. Minimum tillage cultivation	5.00	10.00	200.00	1.110	0.050
		9. Small streams flowing bankfull	5.70	43.00	754.00	21.490	0.009
#1	**2**	**Time of Concentration:**					**0.059**

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:18:39 FILE NAME: CCHR2C3

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULVERT NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	356.37	354.98	50.02	2 CSP	1.50	1.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCHR2C3 DATE: 07-28-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
356.37	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
357.04	3.0	3.0	0.0	0.0	0.0	0.0	0.0	0.00	1
357.36	6.0	6.0	0.0	0.0	0.0	0.0	0.0	0.00	1
357.65	9.0	9.0	0.0	0.0	0.0	0.0	0.0	0.00	1
357.95	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.00	1
358.30	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.00	1
358.71	18.0	18.0	0.0	0.0	0.0	0.0	0.0	0.00	1
359.20	21.0	21.0	0.0	0.0	0.0	0.0	0.0	0.00	1
359.98	24.0	24.0	0.0	0.0	0.0	0.0	0.0	0.00	1
360.94	27.0	27.0	0.0	0.0	0.0	0.0	0.0	0.00	1
361.53	28.6	28.6	0.0	0.0	0.0	0.0	0.0	0.00	1
361.76	29.2	29.2	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCHR2C3 DATE: 07-28-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
356.37	0.000	0.00	0.00	0.00
357.04	0.000	3.00	0.00	0.00
357.36	0.000	6.00	0.00	0.00
357.65	0.000	9.00	0.00	0.00
357.95	0.000	12.00	0.00	0.00
358.30	0.000	15.00	0.00	0.00
358.71	0.000	18.00	0.00	0.00
359.20	0.000	21.00	0.00	0.00
359.98	0.000	24.00	0.00	0.00
360.94	0.000	27.00	0.00	0.00
361.53	0.000	28.59	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:18:39 FILE NAME: CCHR2C3

PERFORMANCE CURVE FOR CULVERT 1 - 2(1.50 (ft) BY 1.50 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	356.37	0.00	0.00	0-NF	0.00	0.00	0.00	1.02	0.00	0.00
3.00	357.04	0.67	0.67	1-S2n	0.40	0.46	0.40	1.02	3.97	0.00
6.00	357.36	0.99	0.99	1-S2n	0.58	0.65	0.58	1.02	4.76	0.00
9.00	357.65	1.28	1.28	1-S2n	0.73	0.81	0.73	1.02	5.30	0.00
12.00	357.95	1.58	1.58	5-S2n	0.86	0.94	0.87	1.02	5.69	0.00
15.00	358.30	1.93	1.93	5-S2n	1.01	1.06	1.01	1.02	5.94	0.00
18.00	358.71	2.34	2.27	2-M2c	1.17	1.16	1.16	1.02	6.17	0.00
21.00	359.20	2.83	2.67	7-M2c	1.50	1.24	1.24	1.02	6.71	0.00
24.00	359.98	3.41	3.61	7-M2c	1.50	1.31	1.31	1.02	7.37	0.00
27.00	360.94	4.09	4.57	7-M2c	1.50	1.37	1.37	1.02	7.94	0.00
28.59	361.53	4.49	5.16	7-M2c	1.50	1.41	1.41	1.02	8.35	0.00

El. inlet face invert 356.37 ft El. outlet invert 354.98 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	356.37 ft
OUTLET STATION	50.00 ft
OUTLET ELEVATION	354.98 ft
NUMBER OF BARRELS	2
SLOPE (V/H)	0.0278
CULVERT LENGTH ALONG SLOPE	50.02 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	1.50 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:18:39 FILE NAME: CCHR2C3

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CONSTANT WATER SURFACE ELEVATION
356.00

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ROADWAY OVERTOPPING DATA ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	25.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	361.76 ft

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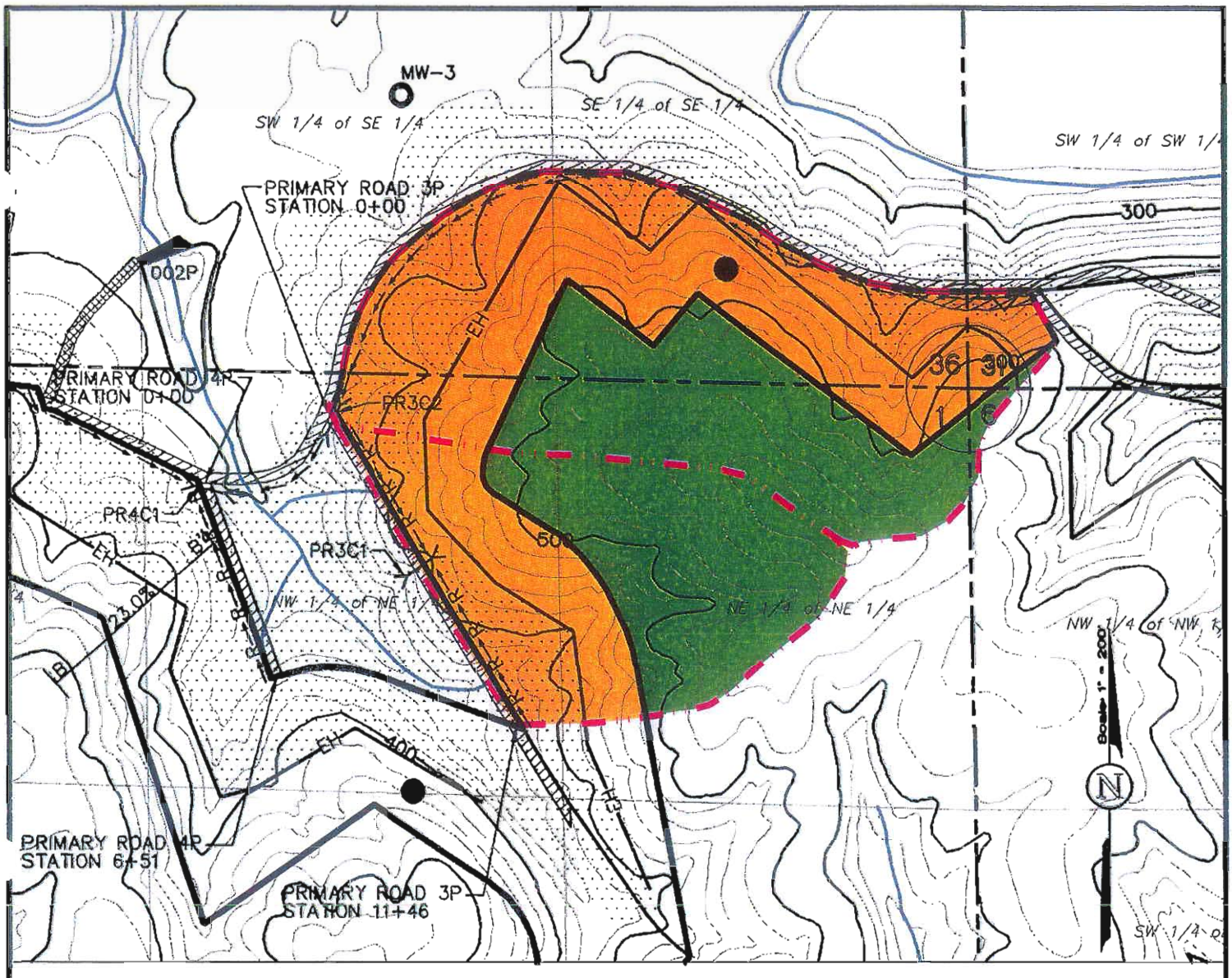


LEGEND

- Permit Boundary/Increment Boundary
- P-3742
- Primary Road
- Existing Highwall taken from Aerial Photo, 2009 Terrain Navigator Pro
- Surface Contour
- 001P Sediment Basin
- Primary Road/P-3742
- Ancillary Roads
- Perennial Stream as per Cordova U.S.G.S. Quadrangle Map
- Intermittent Stream as per Cordova U.S.G.S. Quadrangle Map
- Diversion Ditch/Berm
- Public Road (Paved unless otherwise designated)
- Road (Private unless otherwise shown)
- Previously Surface Mined
- Known Extents Of Underground Mine
- Occupied Dwelling
- Unoccupied Dwelling (Barn, Shed, ect.)
- Watershed Boundary
- Drainage Structure/Culvert
- Roadside Ditch

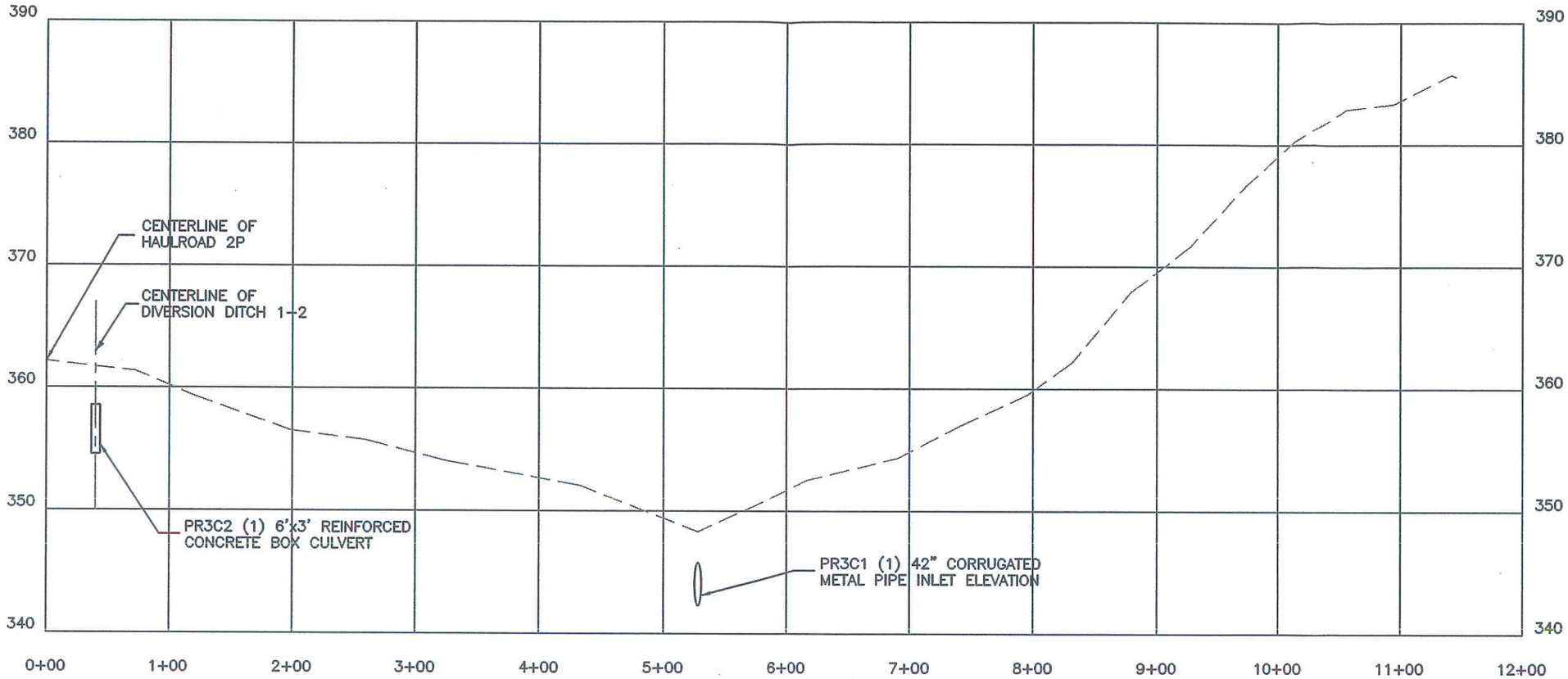
LANDUSE INFORMATION

- Unmanaged Timberland, Curve Number 70
- Graded & Bare, Curve Number 81

PERC ENGINEERING CO. INC.

Attachment III-B-5
Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Primary Road 3P Watershed Map

DRAWN BY: J.W.T.	DATE: 3/2/2011
DWG. NAME: HR3WSM	
APPROVED BY: L.G.S.	SCALE: 1"=500'



LEGEND

— — — EXISTING GRADE

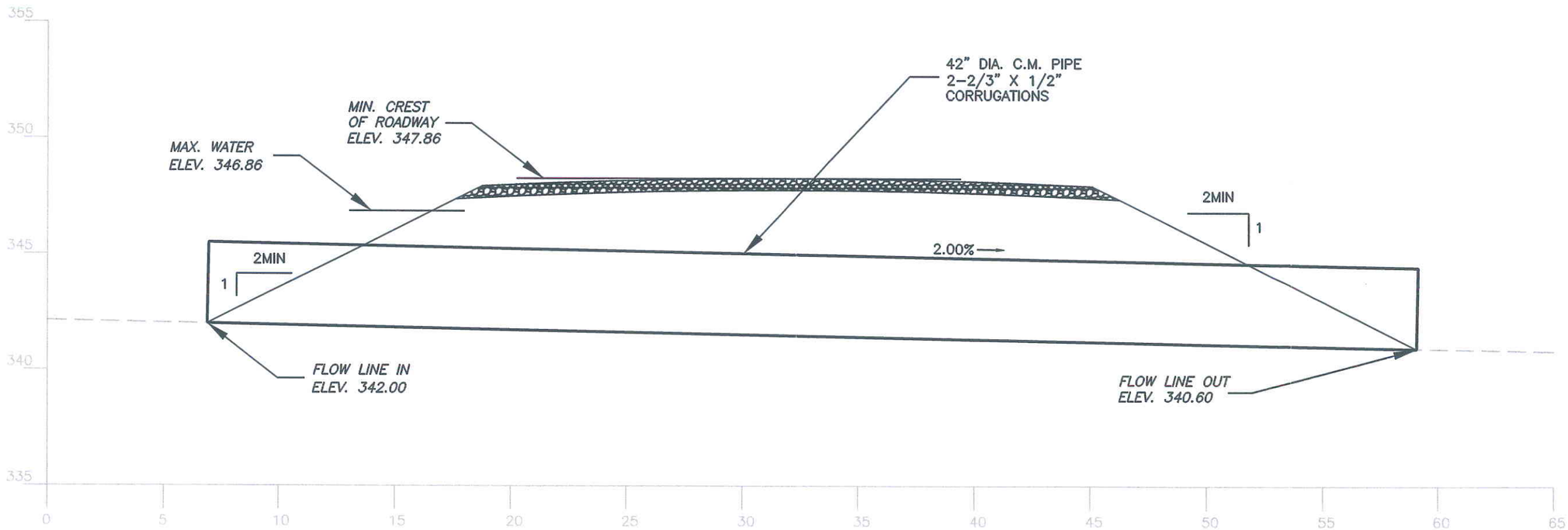
VERTICAL SCALE: 1" = 10'
HORIZONTAL SCALE: 1" = 100'

NOTE:
FINISHED GRADE TO MATCH EXISTING GRADE FOR ENTIRE LENGTH OF ROAD.

PERC ENGINEERING CO., INC.

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Primary Road 3P Profile

DRAWN BY:	J.W.T.	DATE:	03/02/2011
DWG. NAME:	HR3 Profile		
APPROVED BY:	L.G.S.	SCALE:	AS NOTED



PR3C1

HYDRAULICS INFORMATION

Drainage Area = 22.0 Acres
10 YR.-6 HR., Q = 67.15 C.F.S.
Maximum Water Elev. = 346.86
Minimum Fill Elev. = 347.86
Maximum Allowable Cover 42" C.M.P. = 71'
Minimum Allowable Cover 42" C.M.P. = 1'
Wall Thickness = 0.064"
Minimum Freeboard = 1'

PERC ENGINEERING CO., INC.
1009 Highway 78 West Jasper, Alabama 35501
P.O. Box 1718 Jasper, Alabama 35502
(205) 384-6633 Office (205) 384-6691 Fax

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR3C1
Primary Road 3P 5+60
NW 1/4 of NE 1/4 Section 1,
Township 15 South,
Range 7 West,
Walker County, Alabama

DRAWN BY: J.W.T. DWG. NAME: HR3CCS	DATE: 03/03/2011
APPROVED BY: L.G.S.	SCALE: 1"=5'

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Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Primary Road 3P
Drainage Structure PR3C1

4.3 Inch, 10 Year-6 Hour

NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

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

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	22.000	22.000	67.15	3.50

Structure Detail:

Structure #1 (Culvert)

Culvert 1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
52.00	2.00	0.0240	5.00	0.00	0.90

Culvert Results:

Design Discharge = 67.15 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	12.000	0.098	0.022	0.435	70.000	M	31.23	1.527
	2	10.000	0.032	0.000	0.000	81.000	F	35.91	1.973
	Σ	**22.000**						**67.15**	**3.500**

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	7.50	15.00	200.00	0.690	0.080
		8. Large gullies, diversions, and low flowing streams	12.86	90.00	700.00	10.750	0.018
#1	**1**	**Time of Concentration:**					**0.098**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	30.00	60.00	199.99	5.470	0.010
		8. Large gullies, diversions, and low flowing streams	9.60	72.00	750.00	9.290	0.022
#1	**2**	**Time of Concentration:**					**0.032**

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	14.30	132.00	923.00	11.340	0.022
#1	**1**	**Muskingum K:**					**0.022**

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:32:03 FILE NAME: CCMHR3C1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	342.00	340.96	52.01	1 CSP	3.50	3.50	.024	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCMHR3C1 DATE: 07-28-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
342.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
343.19	7.5	7.5	0.0	0.0	0.0	0.0	0.0	0.00	1
343.73	15.0	15.0	0.0	0.0	0.0	0.0	0.0	0.00	1
344.18	22.5	22.5	0.0	0.0	0.0	0.0	0.0	0.00	1
344.60	30.0	30.0	0.0	0.0	0.0	0.0	0.0	0.00	1
345.01	37.5	37.5	0.0	0.0	0.0	0.0	0.0	0.00	1
345.42	45.0	45.0	0.0	0.0	0.0	0.0	0.0	0.00	1
345.87	52.5	52.5	0.0	0.0	0.0	0.0	0.0	0.00	1
346.35	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
346.86	67.2	67.2	0.0	0.0	0.0	0.0	0.0	0.00	1
347.48	75.0	75.0	0.0	0.0	0.0	0.0	0.0	0.00	1
348.28	84.0	84.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCMHR3C1 DATE: 07-28-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
342.00	0.000	0.00	0.00	0.00
343.19	0.000	7.50	0.00	0.00
343.73	0.000	15.00	0.00	0.00
344.18	0.000	22.50	0.00	0.00
344.60	0.000	30.00	0.00	0.00
345.01	0.000	37.50	0.00	0.00
345.42	0.000	45.00	0.00	0.00
345.87	0.000	52.50	0.00	0.00
346.35	0.000	60.00	0.00	0.00
346.86	0.000	67.15	0.00	0.00
347.48	0.000	75.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 07-28-2011 FILE DATE: 07-28-2011
CURRENT TIME: 09:32:03 FILE NAME: CCMHR3C1

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.50 (ft) BY 3.50 (ft)) CSP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	342.00	0.00	0.00	0-NF	0.00	0.00	0.00	0.84	0.00	0.00
7.50	343.19	1.19	1.19	1-S2n	0.73	0.81	0.74	0.84	5.11	0.00
15.00	343.73	1.73	0.00	1-S2n	1.04	1.17	1.05	0.84	6.20	0.00
22.50	344.18	2.18	0.00	1-S2n	1.29	1.45	1.29	0.84	6.94	0.00
30.00	344.60	2.60	0.00	1-S2n	1.51	1.69	1.52	0.84	7.51	0.00
37.50	345.01	3.01	0.00	1-S2n	1.72	1.89	1.72	0.84	7.95	0.00
45.00	345.42	3.42	0.00	1-S2n	1.92	2.09	1.92	0.84	8.31	0.00
52.50	345.87	3.87	0.00	5-S2n	2.12	2.26	2.12	0.84	8.62	0.00
60.00	346.35	4.35	0.00	5-S2n	2.32	2.42	2.32	0.84	8.86	0.00
67.15	346.86	4.86	0.00	5-S2n	2.53	2.56	2.54	0.84	9.00	0.00
75.00	347.48	5.48	5.24	2-M2c	2.78	2.70	2.70	0.84	9.43	0.00

El. inlet face invert 342.00 ft El. outlet invert 340.96 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	342.00 ft
OUTLET STATION	52.00 ft
OUTLET ELEVATION	340.96 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0200
CULVERT LENGTH ALONG SLOPE	52.01 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.50 ft
BARREL MATERIAL	CORRUGATED STEEL
BARREL MANNING'S n	0.024
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	THIN EDGE PROJECTING
INLET DEPRESSION	NONE

CURRENT DATE: 07-28-2011　　　　　　　　　　　FILE DATE: 07-28-2011
CURRENT TIME: 09:32:03　　　　　　　　　　　　FILE NAME: CCMHR3C1

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CONSTANT WATER SURFACE ELEVATION
341.80

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ　ROADWAY OVERTOPPING DATA　ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	25.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	348.28 ft

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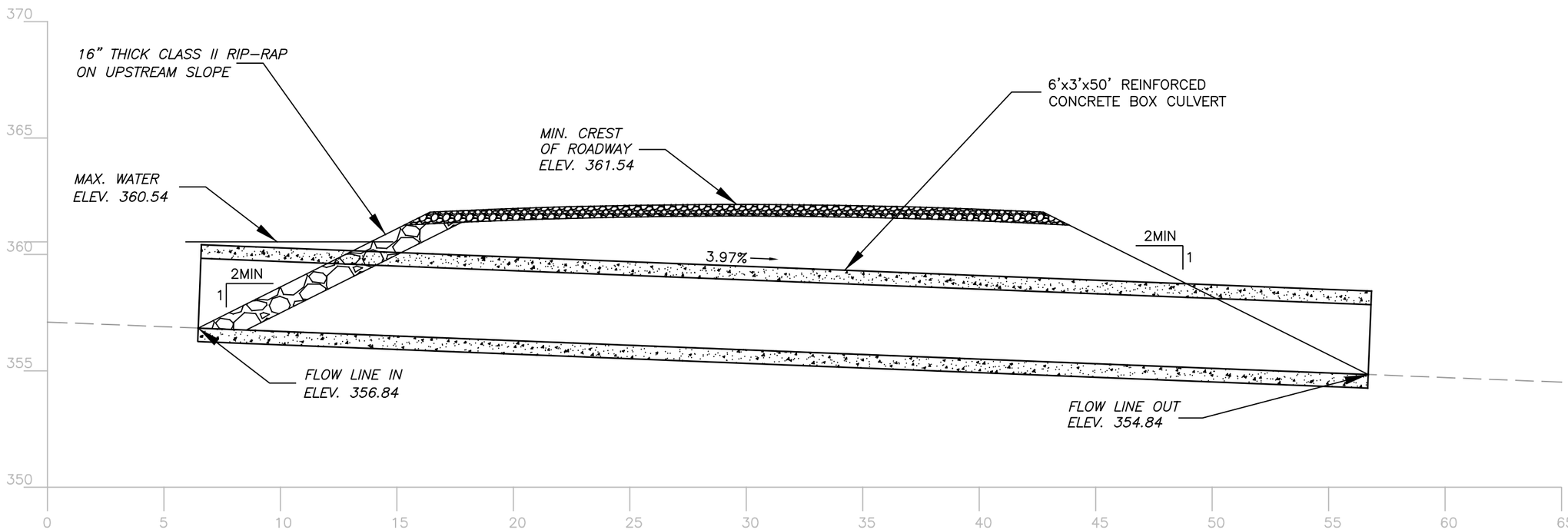
□



PR3C2

HYDRAULICS INFORMATION

Drainage Area = 38 Acres
10 YR.-6 HR., Q = 107.81 C.F.S.
Maximum Water Elev. = 360.5
Minimum Fill Elev. = 361.5
Maximum Allowable Cover 6'X3' R.C.B. = 5'
Minimum Allowable Cover 6'x3' R.C.B. = 1'
Wall Thickness = 7.0"
Minimum Freeboard = 1'

NOTE:
PROVIDE TRUCK LOAD CAPACITY AND MINIMUM/MAXIMUM COVER TO VENDOR WHEN ORDERING CULVERTS.

PERC ENGINEERING CO., INC.
1608 Highway 78 West Jasper, Alabama 35501
P.O. Box 1712 Jasper, Alabama 35502
(205) 384-5333 Office (205) 384-8491 Fax

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR3C2
Primary Road 3P 0+40
NW 1/4 of NE 1/4 Section 1,
Township 15 South,
Range 7 West,
Walker County, Alabama

DRAWN BY:	J.W.T.	DATE:	03/03/2011
DWG. NAME:	HR3CCS		
APPROVED BY:	L.G.S.	SCALE:	1"=5'

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Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 3P
Drainage Sturcture PR3C2

4.3 Inch, 10 Year- 6 Hour

NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

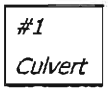
General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	HR3C2



Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	38.000	38.000	107.81	6.36

Structure Detail:

Structure #1 (Culvert)

HR3C2

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
50.00	3.97	0.0160	6.00	0.00	0.50

Culvert Results:

Design Discharge = 107.81 cfs

Minimum pipe diameter: 1 - 48 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	14.000	0.084	0.110	0.406	70.000	M	36.44	1.781
	2	24.000	0.127	0.000	0.000	81.000	F	74.14	4.578
	Σ	**38.000**						**107.81**	**6.360**

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	7.50	15.00	199.99	0.690	0.080
		8. Large gullies, diversions, and low flowing streams	26.02	70.00	269.00	15.300	0.004
#1	**1**	**Time of Concentration:**					**0.084**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	15.00	30.00	199.99	3.870	0.014
		8. Large gullies, diversions, and low flowing streams	5.62	163.00	2,900.00	7.110	0.113
#1	**2**	**Time of Concentration:**					**0.127**

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	5.97	173.00	2,900.00	7.320	0.110
#1	**1**	**Muskingum K:**					**0.110**

CURRENT DATE: 03-04-2011 FILE DATE: 03-04-2011
CURRENT TIME: 09:10:15 FILE NAME: CCHR3C2

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULV NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	356.84	354.84	50.04	1 RCB	6.00	3.00	.016	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCHR3C2 DATE: 03-04-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
356.84	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
357.67	12.0	12.0	0.0	0.0	0.0	0.0	0.0	0.00	1
358.15	24.0	24.0	0.0	0.0	0.0	0.0	0.0	0.00	1
358.55	36.0	36.0	0.0	0.0	0.0	0.0	0.0	0.00	1
358.91	48.0	48.0	0.0	0.0	0.0	0.0	0.0	0.00	1
359.25	60.0	60.0	0.0	0.0	0.0	0.0	0.0	0.00	1
359.57	72.0	72.0	0.0	0.0	0.0	0.0	0.0	0.00	1
359.89	84.0	84.0	0.0	0.0	0.0	0.0	0.0	0.00	1
360.21	96.0	96.0	0.0	0.0	0.0	0.0	0.0	0.00	1
360.54	107.8	107.8	0.0	0.0	0.0	0.0	0.0	0.00	1
360.90	120.0	120.0	0.0	0.0	0.0	0.0	0.0	0.00	1
362.15	156.1	156.1	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCHR3C2 DATE: 03-04-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
356.84	0.000	0.00	0.00	0.00
357.67	0.000	12.00	0.00	0.00
358.15	0.000	24.00	0.00	0.00
358.55	0.000	36.00	0.00	0.00
358.91	0.000	48.00	0.00	0.00
359.25	0.000	60.00	0.00	0.00
359.57	0.000	72.00	0.00	0.00
359.89	0.000	84.00	0.00	0.00
360.21	0.000	96.00	0.00	0.00
360.54	0.000	107.80	0.00	0.00
360.90	0.000	120.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 03-04-2011 FILE DATE: 03-04-2011
CURRENT TIME: 09:10:15 FILE NAME: CCHR3C2

PERFORMANCE CURVE FOR CULVERT 1 - 1(6.00 (ft) BY 3.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	356.84	0.00	0.00	0-NF	0.00	0.00	0.00	1.00	0.00	0.00
12.00	357.67	0.83	0.83	1-S2n	0.26	0.50	0.26	1.00	7.69	0.00
24.00	358.15	1.31	1.31	1-S2n	0.41	0.79	0.41	1.00	9.67	0.00
36.00	358.55	1.71	1.71	1-S2n	0.53	1.04	0.57	1.00	10.59	0.00
48.00	358.91	2.07	2.07	1-S2n	0.65	1.26	0.70	1.00	11.48	0.00
60.00	359.25	2.41	2.41	1-S2n	0.75	1.46	0.82	1.00	12.18	0.00
72.00	359.57	2.73	2.73	1-S2n	0.85	1.65	0.94	1.00	12.75	0.00
84.00	359.89	3.05	3.05	5-S2n	0.94	1.83	1.06	1.00	13.19	0.00
96.00	360.21	3.37	0.00	5-S2n	1.02	2.00	1.18	1.00	13.62	0.00
107.80	360.54	3.70	0.00	5-S2n	1.11	2.16	1.29	1.00	13.96	0.00
120.00	360.90	4.06	0.00	5-S2n	1.19	2.32	1.40	1.00	14.31	0.00

El. inlet face invert 356.84 ft El. outlet invert 354.84 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **********

INLET STATION	0.00 ft
INLET ELEVATION	356.84 ft
OUTLET STATION	50.00 ft
OUTLET ELEVATION	354.84 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0400
CULVERT LENGTH ALONG SLOPE	50.04 ft

***** CULVERT DATA SUMMARY **********

BARREL SHAPE	BOX
BARREL SPAN	6.00 ft
BARREL RISE	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.016
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	SQUARE EDGE (90 DEG.)
INLET DEPRESSION	NONE

CURRENT DATE: 03-04-2011
CURRENT TIME: 09:10:15

FILE DATE: 03-04-2011
FILE NAME: CCHR3C2

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CONSTANT WATER SURFACE ELEVATION
355.84

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ROADWAY OVERTOPPING DATA ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	25.00 ft
CREST LENGTH	25.00 ft
OVERTOPPING CREST ELEVATION	362.15 ft

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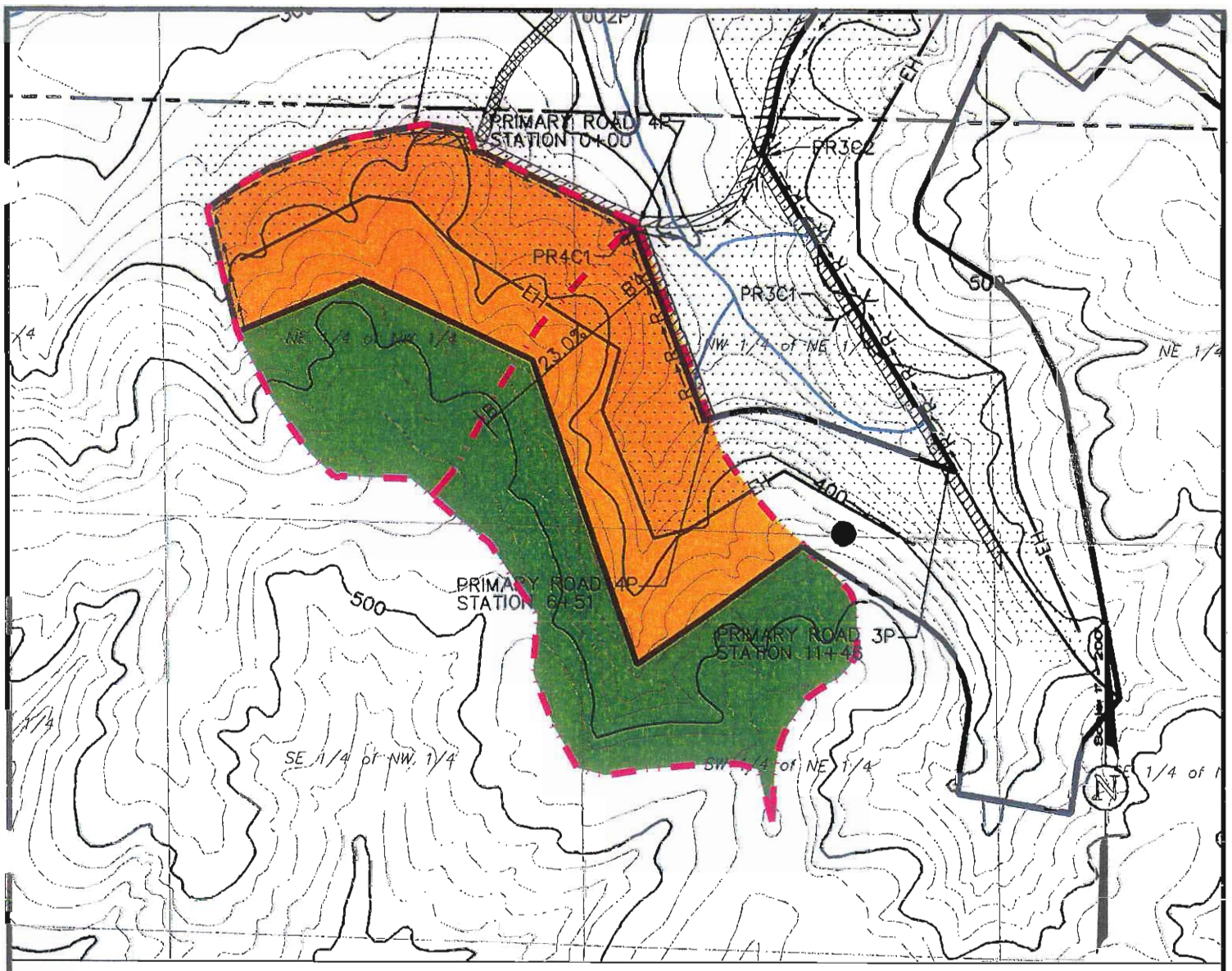


LEGEND

- Permit Boundary/Increment Boundary
- P-3742
- Primary Road
- EH — Existing Highwall taken from Aerial Photo, 2009 Terrain Navigator Pro
- 600 — Surface Contour
- 001P — Sediment Basin
- Primary Road/P-3742
- Ancillary Roads
- Perennial Stream as per Cordova U.S.G.S. Quadrangle Map
- Intermittent Stream as per Cordova U.S.G.S. Quadrangle Map
- Diversion Ditch/Berm
- Public Road (Paved unless otherwise designated)
- Road (Private unless otherwise shown)
- Previously Surface Mined
- Known Extents Of Underground Mine
- Occupied Dwelling
- Unoccupied Dwelling (Barn, Shed, ect.)
- Watershed Boundary
- Drainage Structure/Culvert
- R — Roadside Ditch

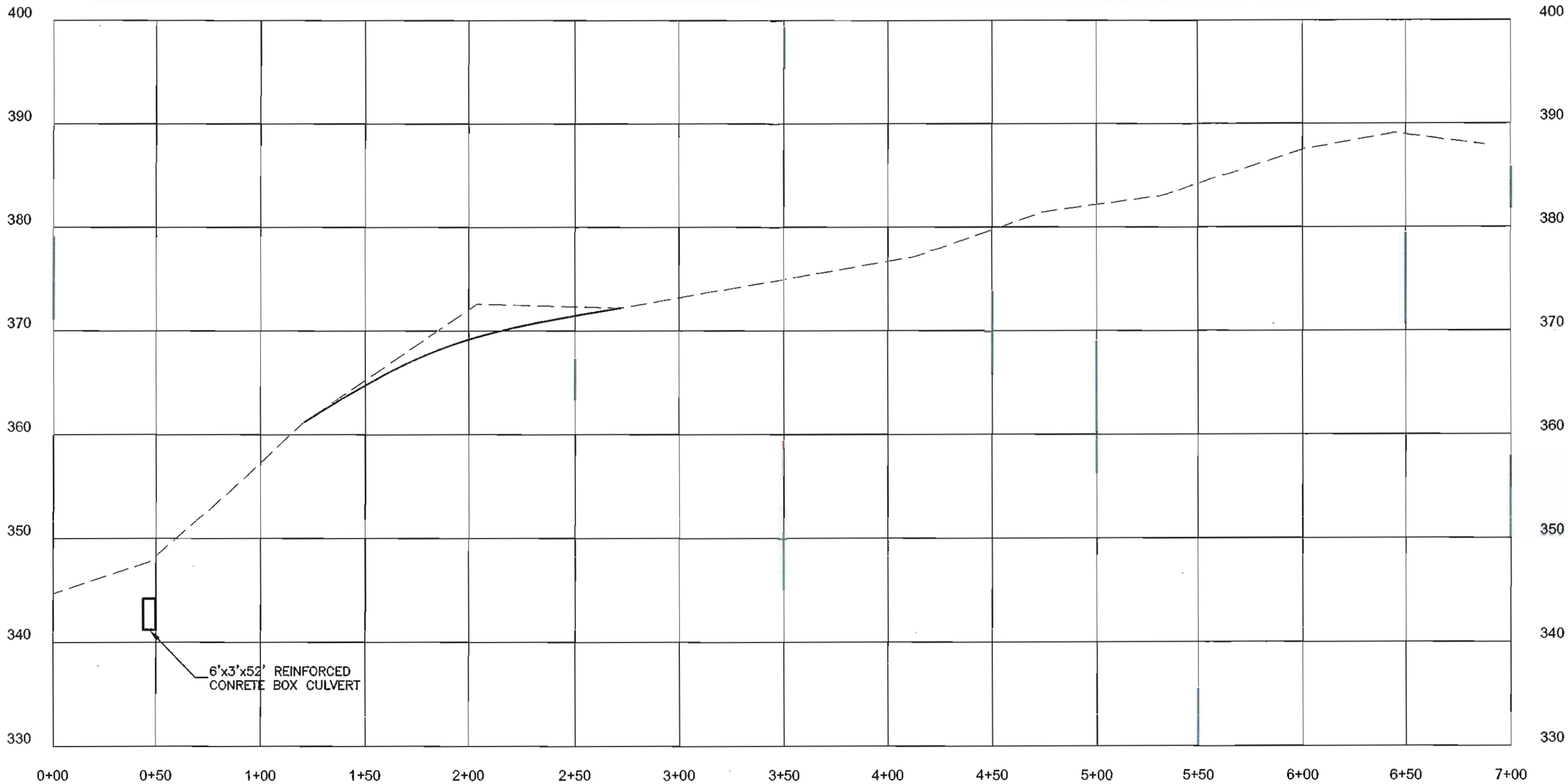
LEGEND

- Unmanaged Timberland, Curve Number 70
- Graded & Bare, Curve Number 81

PERC ENGINEERING CO., INC.

Attachment III-B-5
Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Primary Road 4P Watershed Map

DRAWN BY: J.W.T.	DATE: 3/4/2011
DWG. NAME: HR3.DSM	
APPROVED BY: L.G.S.	SCALE: 1" =500'



HORIZONTAL SCALE: 1"= 50'
VERTICAL SCALE: 1"= 10'

LEGEND

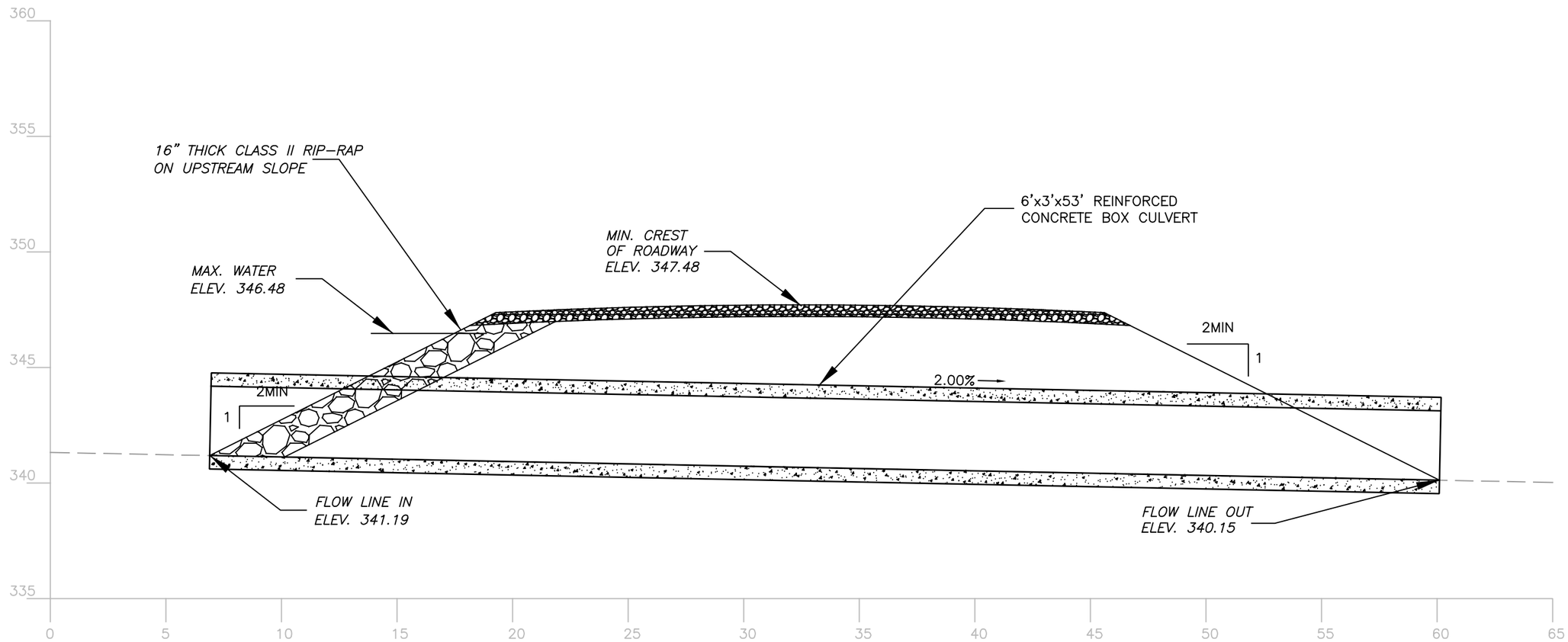
- - - - - EXISTING GRADE

——— PROPOSED FINISHED GRADE

PERC ENGINEERING CO., INC.

Attachment III-B-5
Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 4P Profile

DRAWN BY:	J.W.T.	DATE:	03/07/2011
DWG. NAME:	HR4 Profile		
APPROVED BY:	L.G.S.	SCALE:	AS NOTED



HR4C1

HYDRAULICS INFORMATION

Drainage Area = 52 Acres
10 YR.-6 HR., Q = 154.97 C.F.S.
Maximum Water Elev. = 346.48
Minimum Fill Elev. = 347.48
Maximum Allowable Cover 6'X3' R.C.B. = 5'
Minimum Allowable Cover 6'x3' R.C.B. = 1'
Wall Thickness = 7.0"
Minimum Freeboard = 1'

NOTE:
PROVIDE TRUCK LOAD CAPACITY AND MINIMUM/MAXIMUM COVER TO VENDOR WHEN ORDERING CULVERTS.

PERC ENGINEERING CO., INC.
1606 Highway 78 West Jasper, Alabama 35501
P.O. Box 1712 Jasper, Alabama 35502
(205) 384-5553 Office (205) 384-9491 Fax

Gunner-Reilly Corp.
Cane Creek Mine
P-3952
Drainage Structure PR4C1
Primary Road 4P 0+47
NW 1/4 of NE 1/4 Section 1,
Township 15 South,
Range 7 West,
Walker County, Alabama

DRAWN BY: J.W.T. DWG. NAME: HR4CCS	DATE: 03/03/2011
APPROVED BY: L.G.S.	SCALE: 1"=5'

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Gunner-Reilly Corporation
Cane Creek Mine
P-3952
Primary Road 4P
Drainage Structure PR4C1

4.3 Inch, 10 Year-6 Hour
NRCS Type II

JWT

PERC Engineering Co., Inc.
PO BOX 1712
Jasper, AL 35503

Phone: 205-384-5553
Email: John.Taylor@percengineering.com

General Information

Storm Information:

Storm Type:	NRCS Type II
Design Storm:	10 yr - 6 hr
Rainfall Depth:	4.300 inches

Structure Networking:

Type	Stru #	(flows into)	Stru #	Musk. K (hrs)	Musk. X	Description
Culvert	#1	==>	End	0.000	0.000	HR4C1

#1
Culvert

Structure Summary:

	Immediate Contributing Area (ac)	Total Contributing Area (ac)	Peak Discharge (cfs)	Total Runoff Volume (ac-ft)
#1	52.000	52.000	154.97	8.51

Structure Detail:

Structure #1 (Culvert)

HR4C1

Culvert Inputs:

Length (ft)	Slope (%)	Manning's n	Max. Headwater (ft)	Tailwater (ft)	Entrance Loss Coef. (Ke)
52.00	2.00	0.0240	5.00	0.00	0.90

Culvert Results:

Design Discharge = 154.97 cfs

Minimum pipe diameter: 1 - 84 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	25.000	0.062	0.085	0.390	70.000	M	65.07	3.181
	2	27.000	0.107	0.000	0.000	81.000	F	96.96	5.327
	$\sum$	**52.000**						**154.97**	**8.508**

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	15.00	30.00	200.00	0.970	0.057
		8. Large gullies, diversions, and low flowing streams	38.01	130.00	342.00	18.490	0.005
#1	**1**	**Time of Concentration:**					**0.062**
#1	2	5. Nearly bare and untilled, and alluvial valley fans	16.00	32.00	200.00	4.000	0.013
		8. Large gullies, diversions, and low flowing streams	2.61	43.00	1,649.00	4.840	0.094
#1	**2**	**Time of Concentration:**					**0.107**

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	4.06	75.00	1,849.00	6.040	0.085
#1	**1**	**Muskingum K:**					**0.085**

CURRENT DATE: 03-04-2011 FILE DATE: 03-04-2011
CURRENT TIME: 12:03:10 FILE NAME: CCHR4C1

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.2

CULVERT NO.	SITE DATA: INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET: BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	341.19	340.15	52.01	1 RCB	6.00	3.00	.016	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: CCHR4C1 DATE: 03-04-2011

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
341.19	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	1
342.27	17.5	17.5	0.0	0.0	0.0	0.0	0.0	0.00	1
342.90	35.0	35.0	0.0	0.0	0.0	0.0	0.0	0.00	1
343.42	52.5	52.5	0.0	0.0	0.0	0.0	0.0	0.00	1
343.90	70.0	70.0	0.0	0.0	0.0	0.0	0.0	0.00	1
344.36	87.5	87.5	0.0	0.0	0.0	0.0	0.0	0.00	1
344.84	105.0	105.0	0.0	0.0	0.0	0.0	0.0	0.00	1
345.36	122.5	122.5	0.0	0.0	0.0	0.0	0.0	0.00	1
345.93	140.0	140.0	0.0	0.0	0.0	0.0	0.0	0.00	1
346.48	155.0	155.0	0.0	0.0	0.0	0.0	0.0	0.00	1
347.31	175.0	175.0	0.0	0.0	0.0	0.0	0.0	0.00	1
347.71	183.9	183.9	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: CCHR4C1 DATE: 03-04-2011

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
341.19	0.000	0.00	0.00	0.00
342.27	0.000	17.50	0.00	0.00
342.90	0.000	35.00	0.00	0.00
343.42	0.000	52.50	0.00	0.00
343.90	0.000	70.00	0.00	0.00
344.36	0.000	87.50	0.00	0.00
344.84	0.000	105.00	0.00	0.00
345.36	0.000	122.50	0.00	0.00
345.93	0.000	140.00	0.00	0.00
346.48	0.000	154.97	0.00	0.00
347.31	0.000	175.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 03-04-2011 FILE DATE: 03-04-2011
CURRENT TIME: 12:03:10 FILE NAME: CCHR4C1

PERFORMANCE CURVE FOR CULVERT 1 - 1(6.00 (ft) BY 3.00 (ft)) RCB

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	341.19	0.00	0.00	0-NF	0.00	0.00	0.00	1.00	0.00	0.00
17.50	342.27	1.08	1.08	1-S2n	0.41	0.64	0.43	1.00	6.74	0.00
35.00	342.90	1.71	1.71	1-S2n	0.66	1.02	0.67	1.00	8.76	0.00
52.50	343.42	2.23	2.23	1-S2n	0.86	1.34	0.87	1.00	10.06	0.00
70.00	343.90	2.71	0.00	1-S2n	1.04	1.62	1.05	1.00	11.08	0.00
87.50	344.36	3.17	0.00	5-S2n	1.22	1.88	1.32	1.00	11.02	0.00
105.00	344.84	3.65	0.00	5-S2n	1.38	2.12	1.51	1.00	11.56	0.00
122.50	345.36	4.17	0.00	5-S2n	1.53	2.35	1.70	1.00	12.01	0.00
140.00	345.93	4.74	0.00	5-S2n	1.68	2.57	1.88	1.00	12.42	0.00
154.97	346.48	5.29	0.00	5-S2n	1.81	2.75	2.03	1.00	12.74	0.00
175.00	347.31	6.12	0.00	5-S2n	1.97	2.98	2.22	1.00	13.12	0.00

El. inlet face invert 341.19 ft El. outlet invert 340.15 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

```
***** SITE DATA ***** CULVERT INVERT **************
      INLET STATION                          0.00 ft
      INLET ELEVATION                      341.19 ft
      OUTLET STATION                        52.00 ft
      OUTLET ELEVATION                     340.15 ft
      NUMBER OF BARRELS                      1
      SLOPE (V/H)                            0.0200
      CULVERT LENGTH ALONG SLOPE            52.01 ft

***** CULVERT DATA SUMMARY ************************
      BARREL SHAPE          BOX
      BARREL SPAN             6.00 ft
      BARREL RISE             3.00 ft
      BARREL MATERIAL       CONCRETE
      BARREL MANNING'S n    0.016
      INLET TYPE            CONVENTIONAL
      INLET EDGE AND WALL   SQUARE EDGE  (90 DEG.)
      INLET DEPRESSION      NONE
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CURRENT DATE: 03-04-2011   FILE DATE: 03-04-2011
CURRENT TIME: 12:03:10   FILE NAME: CCHR4C1

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ   TAILWATER   ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
ÄÄ
ÄÄ

CONSTANT WATER SURFACE ELEVATION
341.15

ÄÄ
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ ROADWAY OVERTOPPING DATA ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
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ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	25.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	347.71 ft

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