

**FILE COPY**

July 20, 1986

TO: Memo to File

FROM: Rick Summers, Reclamation Hydrologist

RE: Castle Gate Coal Company, Surface Facilities Minor Modification, Hardscrabble Canyon, ACT/007/002, Folder No. 3, Carbon County, Utah

SUMMARY

The above referenced submittal was reviewed relative to hydrology concerns on July 17, 1986. This submittal was in response to the Division's February 19, 1986 response to Castle Gate Coal Company's submittal of December 16, 1985. Basically, the submittal proposes the following:

1. a new sewer treatment facility,
2. a parking facility and infiltration pond constructed on previously undisturbed area,
3. remodeling of the bathhouse and warehouse.

In summary the deficiencies noted in the February 19, 1986 submittal are as follows:

1. the Division requested a design storm of a 25-year, 24-hour event be used for the design of diversion D-7,
2. details were requested for sediment control for all newly disturbed area,
3. designs were requested for the energy dissipators for the all proposed culverts,
4. designs were requested for riprap or channel stabilization measures for D-7,
5. designs were requested for routing undisturbed drainage to the north of the proposed parking facilities and infiltration ponds,

6. clarification of designs for watershed HC-1 and clarification of the velocity calculations for diversion D-7 (i.e., the slope discrepancies) were requested,
7. clarification of the designs for the proposed 24 inch CMP were requested.

Recommendations:

Respond to the operator with a letter approving the modification with the following stipulations:

Stipulation 817.43-(1)-RPS

The applicant must submit complete designs (including channel sizing and channel stability measures) for the portion of diversion D-7 in the vicinity of the proposed infiltration pond 30 days prior to construction of the pond. These designs must be based upon a 25 year -24 hour precipitation event. In the event the pond is not to be constructed, the proposed designs for a 10 year -24 hour design event must be implemented.

Stipulation 817.43-(2)-RPS

The operator must utilize a 33 inch CMP for installation at location C-8. This installation must be completed with an available headwall depth of 4.5 feet. At the operator's option, clarification for the proposed designs contained in the May 6, 1986 submittal may be submitted for review. Details of the Division's analysis will be provided at the operator's request.

Stipulation 817.43-(3)-RPS

The proposed filter blanket for Diversion D-7 must be installed prior to the placement of the riprap in the channel. If the condition of the excavated channel indicates a filter blanket is not required, justification (including calculations and particle size analysis) must be submitted to and approved by the Division prior to placement of the riprap.

Stipulation 817.43-(4)-/RPS

The applicant must submit revised designs for diversion D-8 that insure the stability of the channel within 20 days of formal approval. These designs must utilize a manning's n-value that is reflective of the proposed construction.

Stipulation 817.47-RPS

The operator must utilize a riprap size of 26 inches for the construction of the energy dissipator for culvert C-7. At the operator's option, clarification for the proposed designs contained in the May 6, 1986 submittal may be submitted within 30 days of the effective date of this approval. At the operator's request, the Division will notify the operator of the details of the Division's analysis.

Body:

Original DOGM comments are underlined.

1. All pages in the submittal must be dated and numbered. Correspondence and referencing is difficult as submitted.

The operator's response is adequate.

2. Based on probability theory, a 10-year design event has a 90 percent chance of failure within the projected 20 year life of the facilities. Due to the location of the proposed infiltrating pond, (e. g. at the head of development in the channel bottom) the Division requests that a design storm of at least a 25-year, 24-hour precipitation event be used for the design of diversion of D-7. This design storm has approximately 50 percent chance of success in a 20 year period.

Castle Gate Coal Company responded that a 25-year, 24-hour design storm would be used for diversion ditch D-7 around the infiltration pond and a 10-year event would be used downstream from the pond. This was agreed upon in a meeting held at the Division offices in May, 1986. No designs were submitted for the 25-year event around the infiltration pond. Subsequent discussions with the operator revealed the probability of the infiltration pond being installed was low due to concerns by the state Health Department. Since the probability of this pond being built is low, it is felt that the Division can stipulate the design for the 25 year event channel in case the operator decides to install and construct the infiltration pond. Therefore stipulation #1 is required for approval.

3. The operator must submit details for sediment control for all newly disturbed areas.

The applicant proposes to use berms to route the drainage from the disturbed area to pond 009 for treatment. Pond 009 is currently oversized and has adequate volume to treat the runoff. The applicant's response is adequate.

4. The operator must submit calculations used to determine the designs of the energy dissipators for the all proposed culverts.

The applicant's proposed designs were reviewed using an alternate standard methodology (the Division does not have the cited methodology documentation available for its reference) and the designs for two of the three proposed dissipators were found to be inadequate. In lieu of the operator's desire to finalize approval expediently so construction can be completed this season, it is proposed that stipulation #2 be incorporated into the final approval. It is the intent of this stipulation to provide the operator with an option to either accept the values derived by the Division (with attendant liabilities) or provide more information and accept the additional review time necessary to complete the approval of the proposed plans.

5. The application is unclear relative to the design for the 24 inch CMP proposed. Design details must be submitted.

The applicant submitted the design details requested. The review of the design resulted in several deficiencies. A design discharge of 28 cfs was used to design the culvert (C-8). This flow value was obtained from the original MRP and is basically the discharge from pond 007. The proposed culvert is located down canyon from this discharge point and drainage from several more watersheds ultimately reports to this culvert. During the course of this review, the best estimate of the drainage area to the culvert was determined and a new peak flow value was computed. Details of this work are attached. The analysis resulted in a peak flow for the 10 year- 24 hour event of 40.6 cfs versus the applicant's value of 28 cfs. It should be additionally

noted that the applicant's value was for a 25 year-24 hour event and the Division determined the value for the 10 year - 24 hour event. Again, as an effort to expedite approval stipulation #3 will be required for final approval. The intent of this stipulation is to give the operator an option for using the Division's value or provide response to the concerns raised during the analysis.

6. The submittal references Table 7-14(a) for details of the design flow calculations for HC-1. This table is not included in the submittal. This table or specific reference to the previous drainage plan should be included for clarification.

The applicant's response is adequate.

7. Table 3.3-5(B) states that the proposed slope of the diversion D-7 is 0.1 FT/FT. Map 3.3-4a shows the existing slope to be approximately 16% across the proposed parking area and 11% from the head of the infiltration pond to the existing road. The submittal should clarify the situation. A Manning's n-value of 0.045 was used for the calculations of the channel velocity for D-7. Typically a value of 0.035 is used for riprap lined channels.

The applicant responded that the slope of the diversion was determined from field survey data. This is acceptable to the Division. Considering the overall change in elevation across the proposed pad (16%), it is recommended that the final slope of the channel be verified following completion of construction to insure design success. The applicant feels that a diversion of 10% can be constructed and still achieve the necessary elevational change. The applicant's response is adequate.

8. Calculations and designs (including justification for all assumptions) for riprap or other channel stabilization measures for diversion D-7 must be submitted.

Figure 3.3-12(P) (revised 5-9-86) depicts the proposed channel cross section for diversion D-7. This cross-section depicts the channel bottom and right hand bank as being excavated in bedrock. Onsite investigation conducted by Randy Harden, Dave Cline and myself indicated that the channel is not entirely in bedrock. Additionally, a Manning's n value of 0.045 was used to calculate the channel velocity for diversion D-7. This value is inflated for diversions excavated in bedrock. In order for the applicant's proposal to be valid, a riprap lining will be required for all areas of the channel that are not excavated in bedrock. The applicant also proposes utilizing a filter fabric under the riprap only if determined necessary after conducting an on-site inspection in conjunction with Division personnel. The need for filter fabric can only be determined following excavation for the channel and assessing the particle size distribution of the excavated material and the possibility that the channel will be excavated in bedrock. Therefore, stipulation #4 is required for formal approval.

9. Reclamation and regrading plans requested by other DOGM staff must include details for channel reclamation and restoration (UMC 817.44) for the proposed channel thru the parking area.

The applicant's response is adequate. Designs have been submitted for a final channel capable of passing the 100 year - 24 hour event.

10. The plan must address the undisturbed drainage to the north of the proposed parking facilities and infiltration pond.

The applicant proposes diverting this undisturbed area drainage by diversion D-8 which discharges into diversion D-7 which is routed to D-6 (the main undisturbed diversion channel for the site). The designs for this diversion have been reviewed and have been determined to be inadequate. The applicant used a manning's n-value of 0.045 for the calculation of the channel velocity. This value is appropriate for channels that are heavily riprapped. Since the applicant proposed no riprap for the channel, an n-value of 0.025 was used to review the design. Division calculations resulted in a predicted velocity of 14.4 fps (compared to the proposed 2.7 fps). This indicates that a riprap lining will be required for diversion D-8. Designs for this riprap lining will be needed prior to completion of construction. Therefore, stipulation #5 will be

required to finalize approval. Drainage from diversion D-8 will be routed to D-7 by the use of a culvert labeled C-9. The design for this culvert have been reviewed and been determined to be adequate.

11. The submittal states that the channel along the length of the main valley floor is blocked and has been cleaned up as much as possible and will be reclaimed. Is this diversion D-6? If so, the submittal should be clarified to correspond with the recent proposed changes to the Hardscrabble drainage plan (i.e. channel will be reconstructed and reclaimed following abandonment of the area).

The applicants response to this comment is adequate.

The calculations (including assumptions) that form the basis of this review are attached to this memo.

jvb  
cc: S. Linner  
D. Lof  
D. Cline  
6000R-39

42.381 100 SHEETS 5 SQUARE  
 42.382 100 SHEETS 5 SQUARE  
 42.383 100 SHEETS 5 SQUARE  
 42.384 100 SHEETS 5 SQUARE  
 42.385 100 SHEETS 5 SQUARE  
 NATIONAL

Project: Castlegate Coal Co., Hardscrabble Canyon modification,  
 Design for Culvert C-8,

Date: 7-21-86

Reviewer: R. Summers, Hydrology

Assumptions:

- 1) OSM did correct job in analysis of original MRP.
- 2) POND 008 discharge is 28 cfs
- 3) Drainage to POND 008 includes (reference Page 3-141 original MRP., Vol. F)

- maintenance Area	}	13.8 AC	
- Dry Flat			
- warehouse storage			
- HC-12		9.5 AC	8.49
- HC-13		2.4 AC	1.3
- POND 007 discharge			
- HC-10		6.2 AC	6.5
- HC-18		1.5 AC	4.65
- subst. area	}	7.0 AC	
- No. 4 portul area			
- maintenance area			
		<u>40.4 AC</u>	

new submit

4) Areas to be included  
 the CCC did not include

Based on dimension table 3.5-5 of 6/21/86 mod. for drainage plan on hardscrabble, used all WS that werent listed as diverted	* - HC-15 - Road area below 008 - HC-19 - HC-12 - HC-13	19.31 AC	clin verif.
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So, digitize Red line on plate 7.3(A) rec'd 1-16-86  
 HC-15, HC-18, HC-19  
 HC-12, HC-10, HC-13, + Yard area

63.904 ACRES

Handwritten, C-8 (cont.)

42 SHEETS 5 SQUARE  
100 SHEETS 5 SQUARE  
200 SHEETS 5 SQUARE  
NATIONAL  
MADE IN U.S.A.

Inputs	<u>DOCM</u>	<u>CCC</u> not submitted
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Area	63.91 AC	
Hydro. length	985' = 4,925' = .933 mi	
Δ elev.	7610' - 6600' = 1,010'	
Tc*	0.167 hrs.	

$$T_c = \left[ \frac{11.9 L^{.385}}{H} \right]$$

CN\* WS = 79.133 } 82.344  
 DISTURBED = 90 } say 83

\* Wt'd of CN  
 from values on  
 Table 7-13(A)  
 (1-16-86)

Ppt. 1241-244 1.9"

WS TOTALS = 41.3  
 DISTURBED AREA =  
 63.91 - 41.3 = 22.61 AC

output

Q <sub>10-24</sub>	40.61 cfs
Q <sub>depth</sub>	.6256

culvert size required =

ALLOW = 4.5' (from C-8 design sheet, dated 11-21-85)  
 = 54"

TRY 36" pipe, HW = 1.5, Q<sub>cap</sub> = 48 cfs

33" pipe, HW = 1.64, Q<sub>cap</sub> = 43 cfs Accept.

PREC STIPS & comments

- 1) running draw. for C-7, C-8 revise
- 4) D-8 ryprap  $\rightarrow$  used 0.04 instead 0.035  
14.76ps vs. 2.725.

use.

- 3) D-7 ryprap placed.  $\rightarrow n=0.045$
- 4) Certified as-butts. or certify plus
- 5) update MRP.
- 6) C-8 current undersized.
- 7) C-7 needs material inlet.  
Question type of inlet

comment # 2 continued:

Deficiencies:

- 3) channel alignment @ infiltrat. pond head.
- 4) liner - evidence of current instability
- 5) cross-sections showing amt. of cut.
- 6) " " showing rip rap in place - will add another 1.5' to cut.
- 7) consider culvert 4' x 2", 320' vs. rip rap source.

\* 8) cut by drawing 3-3-12(B)

comment # 3:

sediment control & runoff from newly disturbed areas:

$A_{100} = 0.35$  (DOCN) use  $0.4$  (AMAX) MAP. 3.3-9a  
 $P_{100} = 1.9"$  (10yr-24hr)  
 $CN = 90.0$

$R.O. Vol = 0.034 A E$   
 $= 1,465. \text{ ft}^3$

sed. vol. req'd:

$(0.4 \text{ Ac.}) (0.1 \text{ AE/acre}) = 0.04 \text{ AE}$   
 $= 1,742.4 \text{ ft}^3$  (appx. 50' x 10' x 3.5' deep)

TOTAL VOLUME REQ'D = 3,208.4 ft<sup>3</sup> DOCN

submitted value 1452 ft<sup>3</sup> AMAX

- no sed. volume submitted
- changes in channel levels of pond.

POND VOL available 6206 ft<sup>3</sup>

reference  
 Table 3.3-9 in check  
 MRP.

APPROVE DRAINAGE TO POND

Volume available = 2,997.6 ft<sup>3</sup>

- must update appropriate sections of MRP - esp. Table 3.3-9

Project: PRC Upgrade of surface facilities - May 21, 1984

Date: June 10, 1986

Reviewer: Rick Summers, Hydrology

Comment #1 - Adequate

Comment #2 - Deficiencies

- STIP → extent of 25 yr flow channel on exhibit 3.3.2b (part 1 of 2).
- STIP → 25 yr designs are not submitted
  - x-sec.
  - depths
  - velocities
  - riprap.

Tech review of 10 yr - 24 hr event section D.7

$$Q_{10} = 85 \text{ cfs}$$

$$\text{depth} = 2' \text{ (from dmax)}$$

$$n = 0.045 \text{ (dmax) -}$$

$$\text{slope} = 0.80\%$$

$$\begin{aligned} \text{Area} &= \frac{1}{2} d^2 (x + y) + 2 d \\ &= \frac{1}{2} (2)^2 (0.5 + 1.5) + 2(2) \\ &= 8.0 \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} W_p &= d (\sqrt{1+y^2} + \sqrt{1+x^2}) + 2 \\ &= 2 (\sqrt{1+0.5^2} + \sqrt{1+1.5^2}) + 2 \end{aligned}$$

$$= 7.842 \text{ ft}$$

$$R = \frac{8.042}{7.842 \text{ ft}} = 1.020 \text{ ft}$$

comment.  
verified by D. Clune  
for sure drainage approval.

Problem - no riprap proposed  
so n value is inflated.  
can't maintain for entire  
length.

→ STIPULATE

$$\begin{aligned} n &= 0.395 D_{50}^{1/6} \\ &= 0.395 (1.5)^{1/6} \\ &= 0.041 \end{aligned}$$

$$V = \left( \frac{1.49}{0.045} \right) (1.020)^{2/3} (0.1)^{1/2} = 10.574 \text{ fps } \alpha \text{ approve}$$

Rip Rap chart shows 15.5" riprap  $\alpha$  approve  
Vanna 0.041 = 11.64 fps. needs riprap of 19"

Project: diversion D-7, final reclamation

Date: 7-17-86

Reviewer: R. Sumner, Hydrology

### I. Inputs

	DOGM	CC	comments
Q <sub>100-yr</sub>	142.5	207	
slope	0.1	0.1	
Bottom width	10'	10'	
n-value	0.041	0.045	n = 0.0395053 <sup>1/2</sup> = 0.041
sideslopes	3:1	3:1	
Depth (ft)	1.06	1.4	
area	14.0	19.83	
W perimeter	16.72	18.85	
Velocity (fps)	10.21	10.82	
Riprap	17"	15"	R is well graded

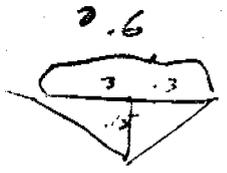
Project: DIVERSION D-8 & Culvert C-9

Date: 7-17-85

Reviewer: R. Summers, Hydrology

I. Assumptions

	DOCM	CC	comment
Q <sub>10-24</sub>	0.53	0.6	
Slope	0.1	0.1	Triangular
Bottom width	0.0	0.0	
side slope	2:1	2:1	excavated, work
n-value	0.025	0.04	0.025 barrel on no rip rap, recent excavated
depth	0.15	0.3	
area	0.045	0.13	
Wet Perimeter	0.671	1.12	
Velocity	14.43	2.72	< Not approvable at
Rip rap	30"	none	
Q =	0.671	0.6	



$$V = \frac{1.49}{0.025} \left( \frac{0.45}{0.671} \right)^{2/3} (0.1)^{1/2} = 14.4 \text{ fps}$$

$$Q = (14.4 \text{ fps}) (0.045 \text{ ft}^2) = 0.650 \text{ cfs}$$

as rip rap req'd 30, use 0.045, <sup>40</sup> increase depth to 0.34

$$\left. \begin{aligned} V &= 1.728 \\ Q &= 0.078 \end{aligned} \right\} \text{none}$$

$$\begin{aligned} n &= 0.231 \\ \text{W.P.R} &= 1.521 \quad R = 0.285 \\ V &= 2.781 \\ Q &= 0.687 \end{aligned}$$

n.o. comment = 12" no HW = 2.1 cfs > 0.6 cfs APPROVE

Project: Peak Flow, Division D-5, Handicapped

Date: 2-17-86

Reviewer: R. Summers, Hydrologist

I. Inputs

	DCM	CC	Comment
Ppt.	1.9	1.9	Cline verified w/ previous drain
CN	78	78	same
Area	1.043	0.84	digitize map 33-4a
Hydro. length	390'	Not given	map 33-4a
Δ elev.	245'	not given	6720'-6685' (had to estimate contour not visible)
Tc	0.015	0.02	Kirpich's

$$T_c = \left[ \frac{11.9(0.07)^3}{245} \right]^{0.385} = 0.015$$

II. output

	DCM	CC	
Q <sub>10-24</sub>	0.53	0.6	approx
Q <sub>depth</sub>	0.425		

42-381 50 SHEETS 5 SQUARE  
42-382 100 SHEETS 5 SQUARE  
42-383 200 SHEETS 5 SQUARE  
NATIONAL

Project: Peak Flow Diversion D-7, Hand scribble Cyn.

Date: 7-17-84

Reviewer: R. Summers Hydrology

I. Inputs

	DOGM	CC	Comments
Ppt 2yr.	1.9	1.9	Verified by client previous submit
Ppt. 100 yr	2.9	2.9	"
cn	.78	.78	"
Area	127.5	126.4	digitize map. 7.3(A)
Hyd. length	3900.0'	Not given	
Δ elev.	1140'	Not given	7740'-6600' = 1140'
$T_c$	0.122	0.09	Kirpich's

$$T_c = \left[ \frac{11.9 (0.739)^3}{1140'} \right]^{.385} = 0.122$$

II. Output

	DOGM	CC	Comments
$Q_{10-24}$	57.62	85	approve
$Q_{100-24}$	142.40	207.1 cfs	approve
$Q_{depth 10yr}$	24268		



Project: Culverts C-9, C-8, Hardmountain Canyon  
Energy dissipator design

DATE: 7-17-96

Reviewer: R. Summers, Hydro 1-99

I. Determine outlet velocity.

Assumptions	C-7	C-8	DOGN	C-9
Peak flow	352 cfs	28 <sup>?</sup> cfs	40	0.6 cfs
n-value	0.024	0.024	0.024	0.024
Pipe size	9' 4" x 6' 3"	24"	33"	12"
K-SEC AREA	45 ft <sup>2</sup>	3.142 ft <sup>2</sup>	5.940	0.785 ft <sup>2</sup>
Wet Perimeter	1.81 (Hyd. R. only)	6.283 ft	8.639	3.14 ft
Slope	0.0675 ft/ft	0.05 ft/ft	0.05	0.02 ft/ft
Full capacity (Manning's eqn)	1,078.16	27.475	64.238	2.735
Capacity Ratio ( $\frac{\text{Design Peak}}{\text{Capacity Peak}}$ )	0.327	1.019	0.623	0.219
Velocity	23.956	8.745	10.914	3.484
Chart 20 Ratio (prop. to velocity)	0.80	1.15	1.04	0.815
Depth	0.38	0.84	0.56	0.315
Exit Velocity (Chart 20 x Velocity)	19.1 fps	9.794 fps	11.25 fps	8.34 fps
	no approve	no approve	increase energy diss. size to 15"	OT
Prop size	26"	15"	9" or	none required

Planimeter program Date: 07-17-1986 Time: 10:44:00

Region 1 (MAP SCALE: 1 inch= 100 feet) *Distr. area p. Lot u/road*

AREA		total	PERIMETER		total
SQ. MILES:	0.001	0.001	MILES:	0.172	0.172
ACRES:	0.469	0.469	YARDS	303.152	303.152
SQ. FEET:	20,431.520	20,431.520	FEET:	909.456	909.456
SQ. YARDS:	2,270.169	2,270.169	METERS:	277.189	277.189
SQ IN(map)	2.043	2.043	INCHES (map):	9.095	9.095
SQ. METER:	1,898.150	1,898.150			

Region 2 (MAP SCALE: 1 inch= 100 feet) *road leg*

AREA		total	PERIMETER		total
SQ. MILES:	0.000	0.001	MILES:	0.071	0.243
ACRES:	0.084	0.553	YARDS	124.773	427.925
SQ. FEET:	3,675.520	24,107.040	FEET:	374.318	1,283.774
SQ. YARDS:	408.391	2,678.560	METERS:	114.087	391.275
SQ IN(map)	0.368	2.411	INCHES (map):	3.743	12.838
SQ. METER:	341.467	2,239.617			

Region 3 (MAP SCALE: 1 inch= 100 feet) *Drainage to D-8*

AREA		total	PERIMETER		total
SQ. MILES:	0.002	0.002	MILES:	0.176	0.419
ACRES:	1.043	1.596	YARDS	309.587	737.512
SQ. FEET:	45,427.520	69,534.560	FEET:	928.762	2,212.537
SQ. YARDS:	5,047.502	7,726.062	METERS:	283.073	674.348
SQ IN(map)	4.543	6.953	INCHES (map):	9.288	22.125
SQ. METER:	4,220.355	6,459.972			

Region 1 (MAP SCALE: 1 inch= 500 feet)

AREA		total	PERIMETER		total
SQ. MILES:	0.202	0.202	MILES:	1.861	1.861
ACRES:	129.035	129.035	YARDS	3,275.741	3,275.741
SQ. FEET:	5,620,760.000	5,620,760.000	FEET:	9,827.224	9,827.224
SQ. YARDS:	624,528.900	624,528.900	METERS:	2,995.192	2,995.192
SQ IN(map)	22.483	22.483	INCHES (map):	19.654	19.654
SQ. METER:	522,185.700	522,185.700			

Region 2 (MAP SCALE: 1 inch= 500 feet) *redone*

AREA		total	PERIMETER		total
SQ. MILES:	0.006	0.207	MILES:	0.361	2.222
ACRES:	3.624	132.659	YARDS	634.504	3,910.245
SQ. FEET:	157,852.000	5,778,612.000	FEET:	1,903.512	11,730.740
SQ. YARDS:	17,539.110	642,068.000	METERS:	580.162	3,575.354
SQ IN(map)	0.631	23.114	INCHES (map):	3.807	23.461
SQ. METER:	14,664.930	536,850.600			