November 26, 1986

TO: Technical File

FROM: Dave Cline, Reclamation Hydrologist DJC

RE: Submittal of October 22, 1986, Hardscrabble Canyon Diversion D-6, Castlegate Coal Company, ACT/007/004, #2 & #7, Carbon County, Utah

Summary:

On April 21, 1986 the Division granted conditional approval to the Castlegate Coal Company to construct the proposed drainage control modifications in Hardscrabble Canyon. The major portion of the drainage control modifications consisted of reconstructing Diversion D-6 in order to allow the passage of the 10-year 24-hour precipitation event. The operator reconstructed Diversion D-6 during July of 1986. The reconstructed diversion channel was not constructed in accordance with the approved design. On August 21, 1986 the Division sent a letter to the operator requesting designs and calculations demonstrating that the as-built diversion channel is capable of safely passing the 10-year 24-hour precipitation event, the rip rap used in the channel is capable of withstanding the design velocities, and that the rip rap gradation used in the channel is adequate without a filter blanket. The operator was given a September 19, 1986 deadline to submit complete and adequate information demonstrating the above items. On September 23, 1986 Castlegate submitted information addressing the diversion channel capacity, rip rap sizing requirements, and filter blanket requirements. The Division sent a deficiency letter to Castlegate on October 15, 1986 stating that the information submitted on September 23, 1986 was not adequate. Additional information on the HEC-2 computer printout, the rip rap gradation, and the fill material gradation was requested.

On October 22, 1986 Castlegate submitted information addressing the October 15, 1986 deficiency letter. After review of this submittal it has been determined that Castlegate has supplied the necessary information required to demonstrate that Diversion D-6 is capable of passing the 10-year 24-hour precipitation event as required by the August 21, 1986 Division letter.

Additionally, Castlegate has submitted information demonstrating that the rip rap used in the channel is capable of withstanding the design velocities and that the rip rap gradation used in the channel is adequate without a filter blanket. Therefore, Castlegate has now demonstated that Diversion D-6, as built, meets the necessary requirements of the regulations for stream channel diversions.

Body:

1.) The operator has sent a copy of the input paramaters table for the HEC-2 computer program as requested. The operator has also included an output summary at each cross section After review of the input table and the output summaries, it has been determined that Diversion D-6 has the capacity to pass the 10-year 24-hour precipitation event runoff.

2.) The operator has calculated the rip rap sizing requirements based on the HEC-2 computer model as requested. The calculations submitted by the operator show that the rip rap is adequately sized to withstand the design velocity.

3.) The operator has submitted the bank sieve analysis and the rip rap sieve analysis as requested. This information has been reviewed and it has been determined that the rip rap is adequate without the need for a filter blanket.

Recommendations:

The October 22, 1986 submittal from Castlegate has been reviewed and it has been determined to be complete and adequate. The information provided by Castlegate in the September 23, 1986 submittal and the October 22, 1986 submittal demonstrate that Diversion D-6, as-built, is capable of safely passing the 10-year 24-hour precipitation event runoff. Additionally, Diversion D-6, as-built, is in compliance with UMC 817.44 and addresses all concerns in the August 21, 1986 letter from the Division to Castlegate.

cc: Sue Linner
Wayne Hedberg
Dave Lof
Dave Darby
Rick Summers

7000R-40

November 26, 1986

TO: Technical File

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cc: Sue Linner
Wayne Hedberg
Dave Lof
Dave Darby
Rick Summers

7000R-40

Castlegate Coal Co. - Hardscrabble Canyon
Diversion D-6
Filter blanket requirement

Rip rap - D_{15} - 100 mm
D_{50} - 220 mm
D_{85} - 350 mm

Base - D_{15} - 7.8 mm
D_{50} - 30 mm
D_{85} - 68 mm

$\frac{30}{30} = 1$ and $\frac{220}{30} = 7.33$

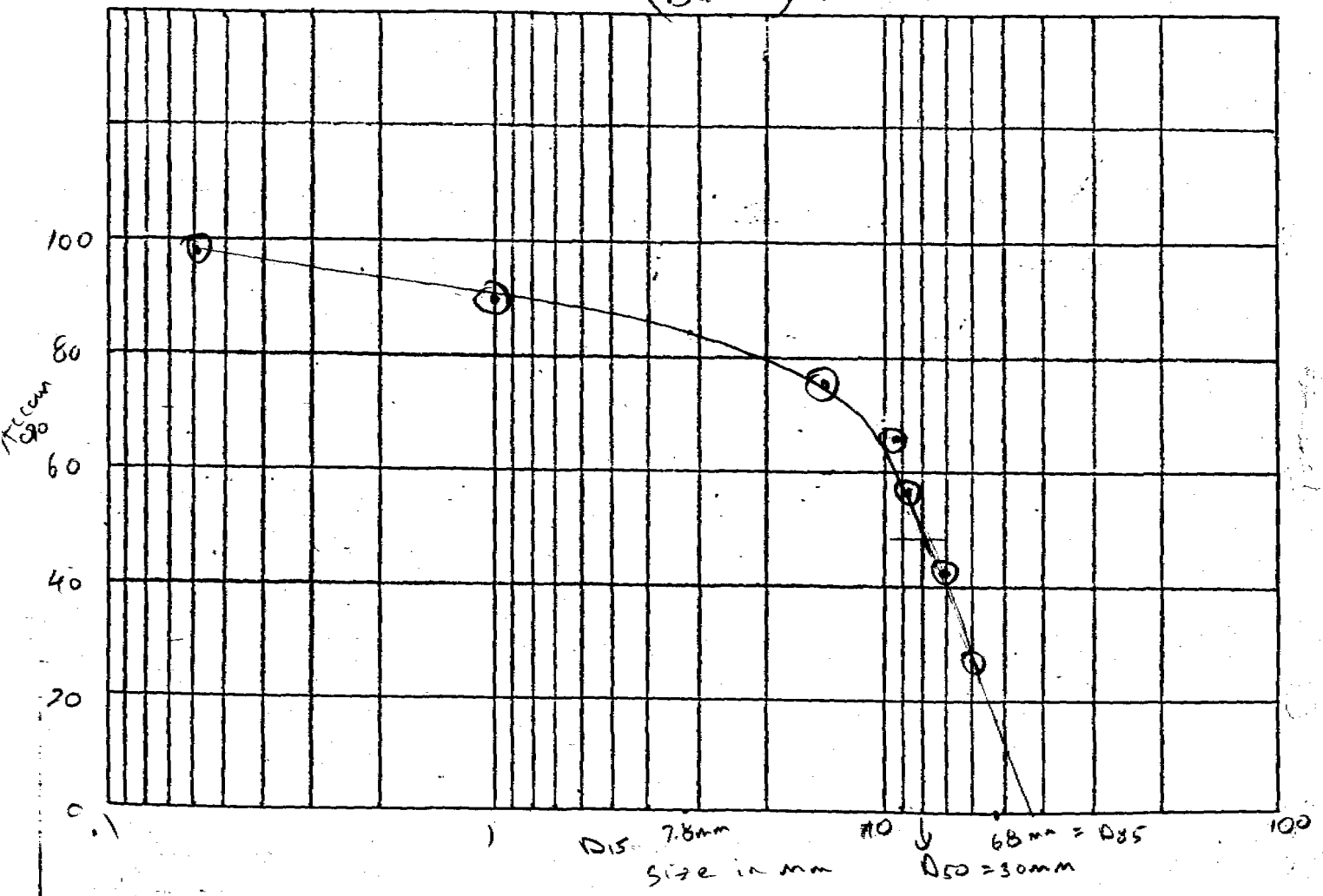
$\frac{7.8}{7.8} = 1$ and $\frac{100}{7.8} = 12.8$

$\frac{7.8}{68} = .11$ and $\frac{100}{68} = 1.47$

∴ The base material and rip rap meet the size distribution criteria w/o the need for a filter blanket

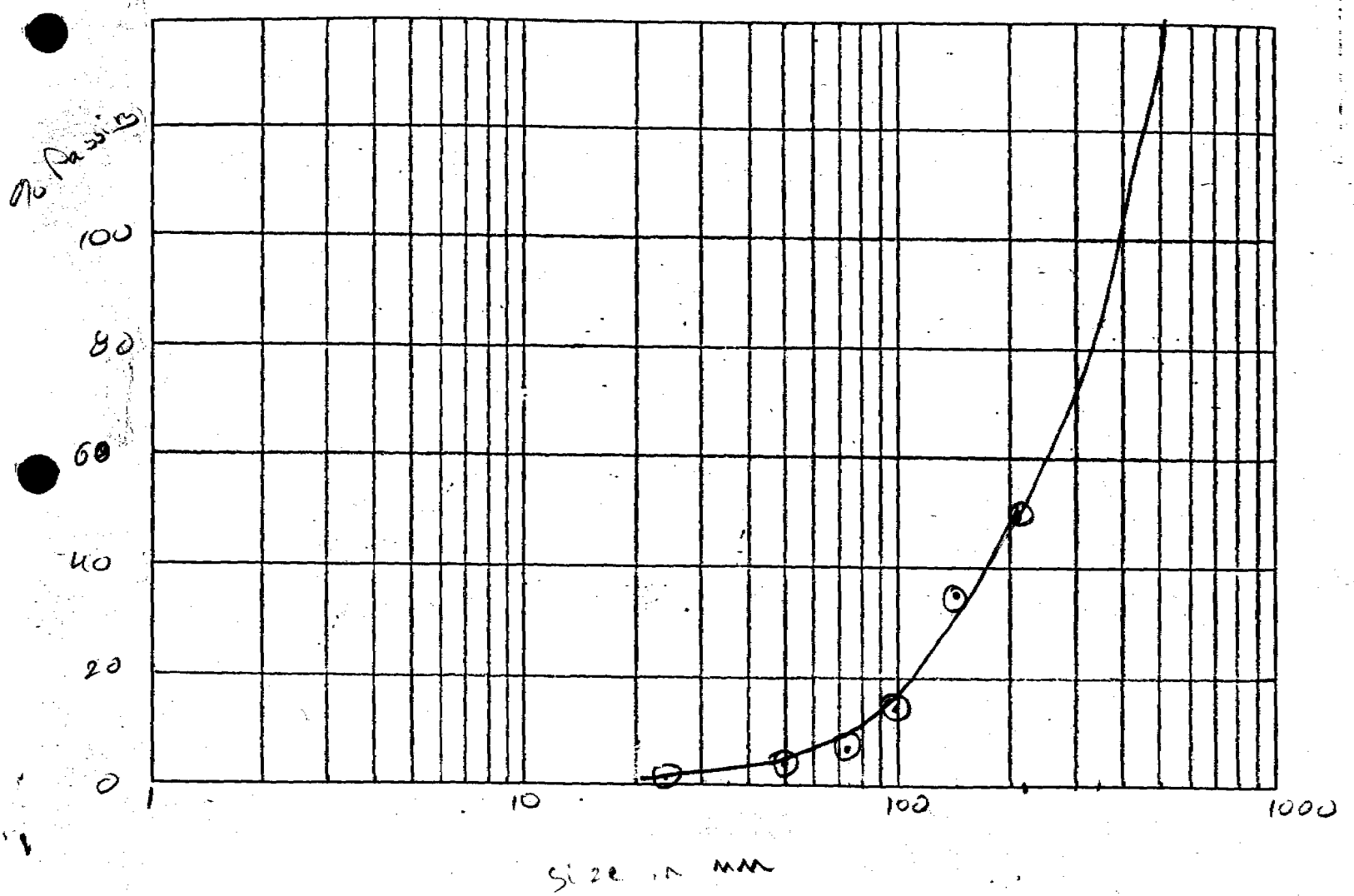
Fill Material (Base)

D15 = 7.8 mm
D50 = 30 mm
D85 = 68 mm



Rip Rap

D_{15} = 100 m
D_{50} = 200 mm
D_{85} = 350 mm



Letter - Mine F

copy letter w/ Enclosures: S. Linner

RECEIVED
OCT 2
DIV. OIL, GAS, MINING

CASTLE GATE
COAL COMPANY

October 22, 1986

Mr. Lowell Braxton, Administrator
Division of Oil, Gas and Mining
Three Triad Center, Suite 350
Salt Lake City, UT 84180-1203

Re: Drainage Control Diversion D-6

Dear Mr. Braxton:

The attached additional information is being submitted to you pursuant to your letter dated 15 October 1986.

(1) Channel Capacity: Attachment No. 1 is the original HEC-2 computer output for the as built cross-section. Attachment No. 2 is a certified copy of cross-sections of the existing as-built channel as requested.

(2) Clarify Rip-Rap Sizing Requirements: The riprap design was sized using the 10.5 feet per second velocity in the original submittal. However, the as-built HEC-2 computed model shows a lower peak velocity of 8.91 feet per second at section 7&00. Intuitively, if a riprap design will withstand 10.5 feet per second, then it will withstand the 8.91 feet per second velocity at station 7&00. Attachment No. 3 recalculates the riprap design based on as-built worst case at station 7&00 of the cross sections.

(3) Filter Blanket Requirements: Attachments No. 4 and No. 5 are the sieve analyses done by Lowdermilk Rock Products and Commercial Testing.

This design was originally submitted in December of 1985. The Division has questioned many design and field judgements made by the professional engineering staff at Castle Gate Coal Company in regard to diversion D-6 hydraulic,riprap and bedding design. Numerical methods for hydraulic design should be tempered by judgements of qualified engineers. All hydraulic programs, riprap sizing, etc., have large factors of safety and do not consider such aspects in the field such as infiltration or show how well riprap is compacted into the bedding. The proof of any design is how well the system performs.

cc4.1103

P. O. Box 449 • Helper, Utah 84526 • 801/472-5523

On September 23th and 24th, Hardscrabble Canyon received a storm event of 1.9" in 24 hours. In 36 hours, 2.2 inches of rain fell in the Canyon. This amount of precipitation is in excess of the 10 year/24 hour design strom for diversion D-6. During the peak of this storm, no more than 1" of water could be detected in the D-6 diversion. In fact, in most areas of the diversion the water was flowing in between the riprap. The conclusion which should be drawn from this actual field test of the D-6 system is that the diversion is over-designed and can handle precipitation events many times in excess of theoretical design.

Sincerely,

Richard H. Allison Jr.

Richard H. Allison, Jr., P.E.
Project Supervisor

RHA:sk

cc: David Miller
Chrono
Project File

cc4.1103

THIS RUN EXECUTED 09/09/86 15:42:58

```
*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAR. 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
*****************************************************
```

MESSAGE SUMMARY: MESSAGE NUMBER - COUNT

187 1

SUMMARY OF ERRORS AND SPECIAL NOTES

```
CAUTION  SECNO=   70.000  PROFILE= 1  CRITICAL DEPTH ASSUMED

CAUTION  SECNO=  290.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  290.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  290.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=  700.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  700.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  700.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO=  900.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO=  900.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO=  900.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO= 1300.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO= 1300.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO= 1300.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL

CAUTION  SECNO= 1575.000  PROFILE= 1  CRITICAL DEPTH ASSUMED
CAUTION  SECNO= 1575.000  PROFILE= 1  PROBABLE MINIMUM SPECIFIC ENERGY
CAUTION  SECNO= 1575.000  PROFILE= 1  20 TRIALS ATTEMPTED TO BALANCE WSEL
```

```
*****************************************************
*  WATER SURFACE PROFILES                           *
*  VERSION OF NOVEMBER 1976                         *
*  UPDATED MARCH 1982                               *
*                                                   *
*  RUN DATE  09/09/86  TIME  15:42:51               *
*****************************************************
```

```
*****************************************
  ARMY CORPS OF ENGINEERS               *
 HYDROLOGIC ENGINEERING CENTER          *
 SECOND STREET, SUITE D                 *
VIS, CALIFORNIA 95616                   *
.6) 440-2105 (FTS) 448-2105             *
*****************************************
```

```
X     X  XXXXXXX   XXXXX              XXXXX
X     X  X        X     X            X     X
X     X  X        X                  X     X
XXXXXXX  XXXX     X          XXXXX    XXXXX
X     X  X        X                 X
X     X  X        X     X           X
X     X  XXXXXXX   XXXXX            XXXXXXX
```

ATTACHMENT NO. 1

THIS RUN EXECUTED 09/09/86 15:42:52

```
*****************************************************
  HEC2 RELEASE DATED NOV 76 UPDATED MAR. 1982
  ERROR CORR -  01,02,03,04,05
  MODIFICATION -  50,51,52,53,54,55
*****************************************************
```

T1 CASTLE GATE COAL COMPANY HYDRAULIC STUDY OF HARDSCRABBLE CANYON
T2 WATER SURFACE PROFILE FOR 10 YR/ 24 HR STORM EVENT ** AS-BUILT **
T3 DIVERSION D-6 AS-BUILT ** J.W. BUCK **

J1	ICHECK	INQ	NINV	IDIR	STRT	METRIC	HVINS	Q	WSEL	FQ
	0.	0.	0.	0.	0.060100	0.00	0.0	368.	6587.500	0.000

J2	NPROF	IPLOT	PRFVS	XSECV	XSECH	FN	ALLDC	IBW	CHNIM	ITRACE
	-1.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

NC	0.045	0.045	0.045	0.100	0.300	0.000	0.000	0.000	0.000	0.000
X1	70.000	5.000	0.000	24.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	6587.699	0.000	6584.398	8.000	6583.801	12.000	6583.801	19.000	6588.898	24.000
X1	290.000	6.000	0.000	26.500	220.000	220.000	220.000	0.000	0.000	0.000
GR	6604.301	0.000	6601.398	10.000	6600.301	15.000	6599.801	18.000	6600.102	22.000
GR	6604.500	26.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	700.000	5.000	0.000	19.500	410.000	410.000	410.000	0.000	0.000	0.000
X2	352.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
GR	6627.500	0.000	6623.898	7.500	6623.000	12.500	6623.000	14.500	6627.898	19.500
X1	900.000	5.000	0.000	19.000	200.000	200.000	200.000	0.000	0.000	0.000
GR	6640.898	0.000	6637.199	6.500	6637.000	12.000	6637.102	14.000	6642.000	19.000
X1	1300.000	6.000	0.000	27.500	400.000	400.000	400.000	0.000	0.000	0.000
GR	6667.801	0.000	6664.699	7.000	6663.898	11.500	6664.301	15.000	6668.000	25.000
GR	6670.500	27.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
X1	1575.000	6.000	0.000	26.500	275.000	275.000	275.000	0.000	0.000	0.000
GR	6697.199	0.000	6694.301	13.000	6693.602	17.000	6693.801	21.000	6697.898	24.000
GR	6700.102	26.500	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
EJ	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

```
   SECNO     DEPTH     CWSEL     CRIWS     WSELK     EG        HV        HL        OLOSS    BANK ELEV
   Q         QLOB      QCH       QROB      ALOB      ACH       AROB      VOL       TWA    LEFT/RIGHT
   TIME      VLOB      VCH       VROB      XNL       XNCH      XNR       WTN       ELMIN       SSTA
   SLOPE     XLOBL     XLCH      XLOBR     ITRIAL    IDC       ICONT     CORAR     TOPWID      ENDST

*PROF 1

CCHV=   0.100 CEHV=   0.300
*SECNO 70.000
3720 CRITICAL DEPTH ASSUMED
    70.00      3.01  6586.81  6586.81  6587.50  6587.93      1.11      0.00      0.00  6587.70
     368.        0.     368.       0.       0.      43.        0.        0.        0.  6588.90
     0.00      0.00      8.47     0.00    0.045    0.045     0.045     0.000  6583.80     2.15
 0.025877        0.        0.       0.        0       11         0      0.00     19.80    21.95

*SECNO 290.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
   290.00      3.39  6603.19  6603.19      0.00  6604.25      1.06      5.72      0.00  6604.30
     368.        0.     368.       0.       0.      44.        0.        0.        0.  6604.50
     0.01      0.00      8.28     0.00    0.045    0.045     0.045     0.000  6599.80     3.84
 0.026121      220.      220.     220.       20        8         0      0.00     21.32    25.16

*SECNO 700.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
   700.00      3.74  6626.74  6626.74      0.00  6627.97      1.23     10.96      0.05  6627.50
     352.        0.     352.       0.       0.      40.        0.        1.        0.  6627.90
     0.02      0.00      8.91     0.00    0.045    0.045     0.045     0.000  6623.00     1.58
 0.027400      410.      410.     410.       20        8         0      0.00     16.74    18.32

*SECNO 900.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
   900.00      3.44  6640.44  6640.44      0.00  6641.64      1.20      5.33      0.00  6640.90
     352.        0.     352.       0.       0.      40.        0.        1.        0.  6642.00
     0.03      0.00      8.79     0.00    0.045    0.045     0.045     0.000  6637.00     0.81
 0.025886      200.      200.     200.       20       11         0      0.00     16.60    17.41

*SECNO 1300.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
```

```
  SECNO      DEPTH      CWSEL      CRIWS      WSELK      EG         HV         HL         OLOSS    BANK ELEV
  Q          QLOB       QCH        QROB       ALOB       ACH        AROB       VOL        TWA    LEFT/RIGHT
  TIME       VLOB       VCH        VROB       XNL        XNCH       XNR        WTN        ELMIN       SSTA
  SLOPE      XLOBL      XLCH       XLOBR      ITRIAL     IDC        ICONT      CORAR      TOPWID      ENDST

3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  1300.00      3.39   6667.29   6667.29      0.00   6668.27      0.98      10.03      0.02   6667.80
     352.        0.      352.        0.        0.      44.        0.         1.        1.   6670.50
     0.04      0.00      7.95      0.00     0.045     0.045     0.045      0.000   6663.90      1.15
 0.024298      400.      400.      400.        20         6         0       0.00     21.92     23.08

*SECNO 1575.000
3685 20 TRIALS ATTEMPTED WSEL,CWSEL
3693 PROBABLE MINIMUM SPECIFIC ENERGY
3720 CRITICAL DEPTH ASSUMED
  1575.00      3.30   6696.90   6696.90      0.00   6697.93      1.03       7.09      0.01   6697.20
     352.        0.      352.        0.        0.      43.        0.         1.        1.   6700.10
     0.05      0.00      8.14      0.00     0.045     0.045     0.045      0.000   6693.60      1.35
 0.027421      275.      275.      275.        20         8         0       0.00     21.92     23.27
```

DIVERSION D-6 AS-BUILT

SUMMARY PRINTOUT TABLE 150

	SECNO	Q	CWSEL	DIFWSP	DIFWSX	DIFKWS	TOPWID	XLCH
*	70.000	368.00	6586.81	0.00	0.00	-0.69	19.80	0.00
*	290.000	368.00	6603.19	0.00	16.38	0.00	21.32	220.00
*	700.000	352.00	6626.74	0.00	23.55	0.00	16.74	410.00
*	900.000	352.00	6640.44	0.00	13.70	0.00	16.60	200.00
*	1300.000	352.00	6667.29	0.00	26.85	0.00	21.92	400.00
*	1575.000	352.00	6696.90	0.00	29.61	0.00	21.92	275.00

ATTACHMENT 4

F-464

COMMERCIAL TESTING & ENGINEERING CO.

GENERAL OFFICES: 1919 SOUTH HIGHLAND AVE., SUITE 210-B, LOMBARD, ILLINOIS 60148 • (312) 953-9300

PLEASE ADDRESS ALL CORRESPONDENCE TO:
224 SO. CARBON AVE., PRICE UT 84501
OFFICE TEL. (801) 637-7540

SINCE 1908

CASTLE GATE COAL COMPANY
P.O. Box 449
Helper, Utah 84526

September 12, 1986

Sample identification by

Castle Gate Coal Co.

Soil Test #2

Kind of sample reported to us	Soil
Sample taken at	Castle Gate Coal Co.
Sample taken by	Richard Allison
Date sampled	xxxxx
Date received	9-9-86

Analysis report no. 57-22079

SCREEN ANALYSIS

	PERCENT	ACCUMULATIVE PERCENT
RETAINED ON +4" ROUND, PASSING - - -	0.0	0.0
RETAINED ON 2" ROUND, PASSING +4" ROUND	27.0	27.0
RETAINED ON 1 1/2" ROUND, PASSING 2" ROUND	16.2	43.2
RETAINED ON 1" ROUND, PASSING 1 1/2" ROUND	13.5	56.7
RETAINED ON 3/4" ROUND, PASSING 1" ROUND	8.1	64.8
RETAINED ON 3/8" ROUND, PASSING 3/4" ROUND	9.5	74.3
RETAINED ON +4 MESH, PASSING 3/8" ROUND	4.0	78.3
RETAINED ON 16 MESH, PASSING +4 MESH	6.3	84.6
RETAINED ON 35 MESH, PASSING 16 MESH	2.3	86.9
RETAINED ON 200 MESH, PASSING 35 MESH	10.7	97.6
RETAINED ON - - -, PASSING 200 MESH	2.4	100.0

ATTACHMENT NO. 4

Respectfully submitted,
COMMERCIAL TESTING & ENGINEERING CO.

Manager, Price Laboratory

Original Copy Watermarked For Your Protection

WH/rf

Charter Member

ELBERT LOWDERMILK INC.

P.O. Box 509 - Helper, Utah 84526
Telephone (801) 472-5531

September 12, 1986

Castle Gate Coal Company
P. O. Box 449
Helper, Utah 84526

Attention: Mr. Richard Alison:

Sieve analysis for 1200 tons of 8" rock

Size	% Passing
8"	47.3
6"	36.6
4"	15.6
3	8.1
2"	4.3
1"	1.6

ATTACHMENT NO. 5

DESIGN OF RIPRAP BLANKET FOR DIVERSION D-6

(From Use of Riprap for Bank Protection, Hydraulic Engineering Circular No. 11, U.S. Department of Transportation, Bureau of Public Roads, June 1967)

CHANNEL CHARACTERISTICS

BOTTOM WIDTH (B)	= 5 FEET AVERAGE WIDTH FOR SECTION 7&00 (ATTACHMENT #2)
SIDE SLOPES	= 3H:1V (RIGHT) & 1H:1V (LEFT)
FLOW DEPTH (D)	= 3.7 FEET
AVERAGE VELOCITY (V)	= 8.9 FEET/SECOND

DETERMINE STONE SIZE REQUIRED TO RESIST DISPLACEMENT

ASSUME K (d50 STONE SIZE) = 0.66 FEET = 8 INCHES

K/D = 0.66/3.7 = 0.18

∴ Vs/V = 0.57 (FROM FIGURE 1, HEC-11)

∴ Vs = 0.57 x 8.9 = 5.07 FEET/SECOND

HEC-11 RECOMMENDS MULTIPLYING Vs BY A FACTOR BETWEEN 1.0 AND 2.0 TO ACCOUNT FOR CHANNEL SINUOUSITY (1.0 FOR STRAIGHT CHANNELS & 2.0 FOR VERY SINUOUS CHANNELS).

DUE TO SLIGHT BENDS IN CHANNEL, INCREASE Vs BY 1.5 TIMES

∴ Vs = 1.5 x 5.07 = 7.6 FEET/SECOND

FROM FIGURE 2 (HEC-11) FOR Vs = 7.6 AND 3:1 SIDE SLOPES, d50 = 0.4 FEET

THE ACTUAL STONE SIZE (0.66 FEET) IS GREATER THAN COMPUTED STONE SIZE (0.40 FEET)

∴ ACTUAL STONE SIZE, d50 = .66 FEET EXCEEDS DESIGN REQUIREMENTS

ATTACHMENT NO. 3

Document Information Form

Mine Number: C/007/004

File Name: Internal Castle Gate.

To: Technical File

From:

Person Dave Cline

Company DOGM

Date Received: 11-26-86

Explanation: Graph - Diversion Ditch D-6 Attachment #2

cc: