APPENDIX 11-W

LOWE / DIXON TEMPORARY DIVERSION, INLET REDESIGN SEDCAD BACKUP

(10/11/95)

APPENDIX 11-W
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+ - denotes new modified inlets for As-Builts.

(10/11/95;8/8/97)

LOWE / DIXON TEMPORARY DIVERSION - INLET REDESIGN

1.0 LOCATION AND FUNCTION:

The Lowe / Dixon Temporary Diversion, is currently located on the eastern portion of the Lowe / Dixon lease boundary and was constructed in 1994 and 1995. The approved discussion in the NM-0003D PAP, CHAPTER 11, TABLE 11-9; and EXHIBIT's 11-68 through 11-72 contain the design criteria for the diversion. The structure was constructed as a means to divert water from entering the Lowe and Dixon Pits, as well as other mine areas.

2.0 BACKGROUND AND CONCERN:

During an inspection on September 14, 1995, by the Office of Surface Mining/Albuquerque Field Office (OSM/AFO), minor erosion was noted on all four of the inlets on the east side of the diversion (inlets 3 and 4 having the most erosion). A breach (south of inlet four) was also discovered in the berm which currently diverts water along the top edge of the diversion to inlet structure 4 and a natural drainage south of inlet structure four. The designs for inlets 1 through 4 were deemed to be inadequate and AFO requested that they be redesigned. Thus, a submittal containing corrective updates would be made to Navajo Mine's "Operation Plan" portion of the NM-0003D PAP pertaining to the diversion.

The areas of concern are the four inlets (drop structures) on the east side of the diversion and an area where an old road approaches the diversion (south of inlet four). Navajo Mine has evaluated the four inlets located on the east side of the diversion, based on the enclosed redesign criteria. These changes will not alter the function of the diversion or change the purpose of the drop structures.

3.0 UPGRADE DESIGNS (Surface Water Drainage and Corrective Action):

The current Lowe / Dixon Temporary Diversion water drainage was designed using a SCSII storm type. In our re-evaluation, a SCSII-65 storm type (the appropriate storm type) was utilized which increases the peak flows (cfs) contributing to the inlets and the diversion itself. The inlet slopes used to calculate the rip-rap size required was also under estimated. The proper slope to be used is the maximum encountered which is slightly higher in all cases. Using these new parameters in SEDCAD+ Version 3, the design rip-rap sizes changed for 3 of the inlets (inlets two through four).

- For inlet two the design rip-rap D_{50} went from 1.5" to 3.0", fortunately inlet two has been constructed with the appropriate sized rip-rap.

- Inlet three was constructed with the 1.5" D_{50} material on the upper portion and 6" - 9" D_{50} material on the lower portions. From the new SEDCAD the upper rip-rap should be increased from 1.5" D_{50} material to 6.0" D_{50} material (some of this has already been placed) and shows that the rip-rap placed on the lower portion is adequate.

- Inlet four has the same design problem as inlet three and has also already had some of the larger required material placed.

Inlets one and two, will have 3.0" rip-rap[1] added to the upper portions and any location containing rip-rap smaller than 3.0" D_{50} material will be upgraded with at least 3.0" or greater D_{50} material. Inlets three and four, will have 6.0" rip-rap[1] added to the upper portions and any location containing rip-rap smaller than 6.0" D_{50} material will be upgraded with at least 6.0" or greater D_{50} material.

Another factor that was addressed is how the flows enter the inlets. The inlets were designed and built to receive water from the top end, but currently the diversion berms are setup to route flows to the inlet structures causing a good portion of the designed capacity to enter the sides of the inlets. Entry points were evaluated and will require larger rip-rap and its placement made to suit field conditions. Another measure to control the flows will be to add short diversion berms parallel to the inlets along the upper portions of the inlets, this will route all incoming flows to properly rip-rapped receiving points (this berm material, a relatively small quantity will come directly from the diversion site). Updated EXHIBIT 11-72B attached to this submittal, provides the new hydrologic parameters, rip-rap sizes, and design drawings of alteration on inlets one through four. New APPENDIX 11-W contains the backup calculations for the alterations.

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[1] Rip-rap for remaining changes will come from one of two locations. Either from existing acceptable sources for rip-rap on the mine; or from off-site sources such as ARCO (an aggregate sales company).

In order to address the site where the old road meets the safety berm (previously breached), the berm size will be increased, and the catch drain on the east side of the berm will be re-cut so that flows from the road will drain north towards inlet four, and south towards natural drainage.

For the integrity of the diversion itself, there were no problems seen, and is currently capable of accommodating even higher design flows. The approved reclamation measures outlined in CHAPTER 12 of the PAP, Section 12.3.5, "Reclamation of Diversion Structures", will still apply. As a result of the re-evaluation, the only change that needs to be addressed for the diversion are current NM-0003D, CHAPTER 11 items: text page 11-71 (TABLE 11-9) and page 11-76a; plus EXHIBIT's 11-72A and 11-72B. It should be noted that design revisions per AFO's immediate corrective action request have been added to the current "As-Built" maps included with this letter.

CIVIL SOFTWARE DESIGN

SEDCAD+ Version 3

LOWE DIVERSION WATERSHED ANALYSIS

by

Name: DJR

Company Name: BHP MINERALS
File Name: C:\SEDCAD3\LOWDV_DR

Date: 10-01-1995

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LOWDV_DR User: DJR
Date: 10-01-1995 Time: 14:51:34
LOWE DIVERSION WATERSHED ANALYSIS
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

GENERAL INPUT TABLE

STORM #1:

User-Defined Distribution

Label: type II-65

	Accumulated Time (hrs)	Accumulated Dimensionless Depth
1	0.0	0.000
2	0.5	0.006
3	1.0	0.012
4	1.5	0.019
5	2.0	0.026
6	2.5	0.034
7	3.0	0.043
8	3.5	0.055
9	4.0	0.067
10	4.5	0.083
11	5.0	0.105
12	5.5	0.139
13	6.0	0.711
14	6.5	0.789
15	7.0	0.819
16	7.5	0.837
17	8.0	0.851
18	8.5	0.861
19	9.0	0.872
20	9.5	0.880
21	10.0	0.888
22	10.5	0.894
23	11.0	0.900
24	11.5	0.905
25	12.0	0.910
26	12.5	0.915
27	13.0	0.920
28	13.5	0.925
29	14.0	0.930
30	14.5	0.934
31	15.0	0.938
32	15.5	0.943
33	16.0	0.947
34	16.5	0.951
35	17.0	0.954
36	17.5	0.958
37	18.0	0.962

38	18.5	0.966
39	19.0	0.969
40	19.5	0.973
41	20.0	0.976
42	20.5	0.979
43	21.0	0.982
44	21.5	0.985
45	22.0	0.988
46	22.5	0.991
47	23.0	0.994
48	23.5	0.997
49	24.0	1.000

****

Civil Software Design -- SEDCAD+ Version 3.1
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Company Name: BHP MINERALS
Filename: C:\SEDCAD3\LOWDV_DR User: DJR
Date: 10-01-1995 Time: 14:51:34
LOWE DIVERSION WATERSHED ANALYSIS
Storm: 1.30 inches, 10 year- 6 hour, type II-65
Hydrograph Convolution Interval: 0.1 hr

SUBWATERSHED/STRUCTURE INPUT/OUTPUT TABLE

-Hydrology-

JBS	SWS	Area (ac)	CN	UHS	Tc (hrs)	K (hrs)	X	Base-Flow (cfs)	Runoff Volume (ac-ft)	Peak Discharge (cfs)
111	1	131.20	80	M	0.470	1.251	0.273	0.0	2.12	22.59
111	2	49.20	83	M	0.560	1.251	0.273	0.0	1.11	11.01
111	3	94.90	88	M	0.310	1.038	0.254	0.0	3.49	51.45
111	4	86.90	89	M	0.330	0.925	0.252	0.0	3.51	50.14
111	5	53.30	89	M	0.190	1.038	0.254	0.0	2.15	39.20
111	6	77.30	89	M	0.350	0.739	0.230	0.0	3.12	43.33
111	7	72.40	89	M	0.300	0.739	0.230	0.0	2.92	43.73
111	8	102.30	80	M	0.300	0.557	0.170	0.0	1.65	23.08
		Type: Null			Label: Main Inlet					
111 Structure		667.50							20.07	
111 Total IN/OUT		667.50							20.07	166.29
112	1	116.20	84	M	0.570	0.764	0.221	0.0	2.90	28.88
112	2	68.10	88	M	0.460	0.249	0.267	0.0	2.50	29.82
		Type: Null			Label: Main Inlet Wing					
112 Structure		184.30							25.47	
112 Total IN/OUT		851.80							25.47	202.05
111 to 112 Routing						0.000	0.000			
121	1	76.80	79	M	0.350	0.000	0.000	0.0	1.10	13.85
		Type: Null			Label: Inlet @ 17+50					
121 Structure		76.80							1.10	
121 Total IN/OUT		76.80							1.10	13.85
211	1	66.70	80	M	0.350	0.000	0.000	0.0	1.08	13.77
		Type: Null			Label: Inlet @ 27+30					
211 Structure		66.70							27.65	
211 Total IN/OUT		995.30							27.65	193.32
112 to 211 Routing						0.390	0.146			
[illegible]	1	87.20	80	M	0.310	0.000	0.000	0.0	1.41	19.30
		Type: Null			Label: Inlet @ 40+10					
212 Structure		87.20							29.06	

```
212 Total IN/OUT  1082.50                                                    29.06    183.50
==================================================================================================
211 to 212 Routing                                  0.510 0.146
==================================================================================================
  1                262.10   80  M   0.600  0.000 0.000     0.0     4.24     38.48
                      Type: Null   Label: Inlet @ 62+00
213 Structure      262.10                                                    33.30
--------------------------------------------------------------------------------------------------
213 Total IN/OUT  1344.60                                                    33.30    173.29
==================================================================================================
212 to 213 Routing                                  0.870 0.146
==================================================================================================
```

SEDCAD+ ERODIBLE CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #1

Limiting Velocity Technique
Sediment-laden Water

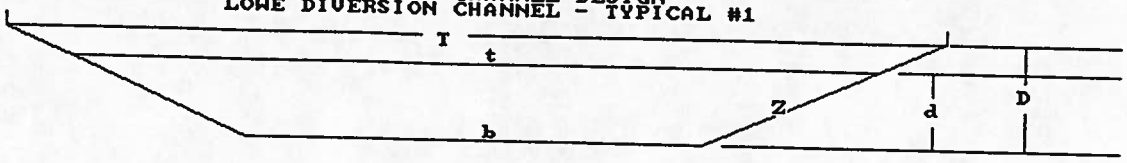
INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	202.05 cfs	
Slope	0.30 %	
Sideslopes	2.30:1 (L)	2.50:1 (R)
Bottom Width	80.20 ft	
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	202.05 cfs
Depth	0.85 ft
with Freeboard	1.85 ft
Top Width	84.29 ft
with Freeboard	89.09 ft
Velocity	2.88 fps
Cross Sectional Area	70.15 sq ft
Hydraulic Radius	0.83 ft
Froude Number	0.56

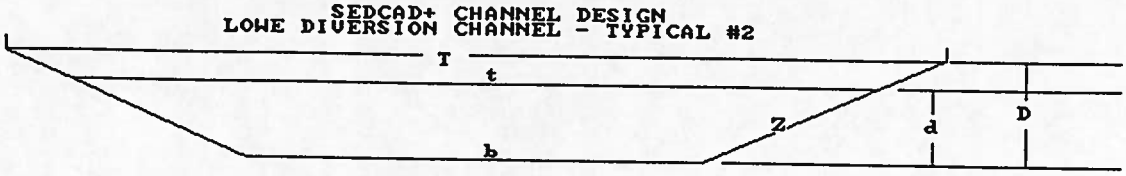
SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #1



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	= 202.05 cfs	Depth (d)	= 0.85	w/ Freeboard: (D =	1.85) ft
Bottom (b)	= 80.20 ft	Top width (t)	= 84.29	(T =	89.09) ft
Side slopes (Z)	= 2.3:1(L) 2.5:1(R)	Velocity	= 2.88 fps		
Bed Slope	= 0.30 %	Hydraulic Radius	= 0.83 ft		
Manning's n	= 0.025	Froude number	= 0.56		

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #2



MATERIAL:
Limiting Variable: Velocity = 5.000 fps
Sediment-laden Water

Discharge	= 202.05 cfs	Depth (d)	= 2.14	w/ Freeboard: (D =	3.14) ft
Bottom (b)	= 15.30 ft	Top width (t)	= 26.02	(T =	31.02) ft
Side slopes (Z)	= 2.5:1(L) 2.5:1(R)	Velocity	= 4.56 fps		
Bed Slope	= 0.30 %	Hydraulic Radius	= 1.65 ft		
Manning's n	= 0.025	Froude number	= 0.62		

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #3

INPUT VALUES:

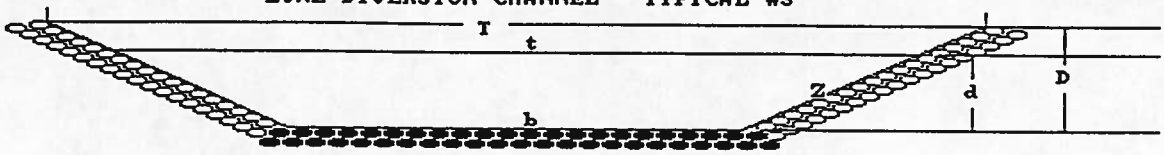
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.40:1	2.80:1
Bottom Width	15.50 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	2.44 ft
with Freeboard	3.44 ft
Top Width	28.20 ft
with Freeboard	33.40 ft
Velocity	3.25 fps
Cross Sectional Area	53.37 sq ft
Hydraulic Radius	1.83 ft
Manning's n	0.038
Froude Number	0.42
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #3



Riprap - Mild Slope Design

Discharge	= 173.29 cfs	Depth (d)	= 2.44	w/ Freeboard: (D = 3.44)	ft
Bottom (b)	= 15.50 ft	Top width (t)	= 28.20	(T = 33.40)	ft
Side slopes (Z)	= 2.4:1(L) 2.8:1(R)	Velocity	= 3.25	fps	
Bed Slope	= 0.30 %	Hydraulic Radius	= 1.83	ft	
Manning's n	= 0.038	Froude number	= 0.42		

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #4

INPUT VALUES:

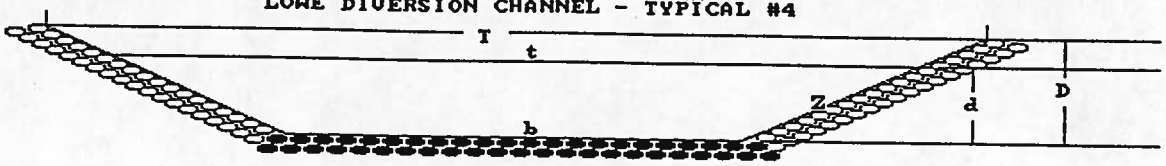
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	6.00 %	
Sideslopes (L and R)	1.50:1	1.20:1
Bottom Width	11.10 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.46 ft
with Freeboard	2.46 ft
Top Width	15.03 ft
with Freeboard	17.73 ft
Velocity	9.11 fps
Cross Sectional Area	19.03 sq ft
Hydraulic Radius	1.19 ft
Manning's n	0.045
Froude Number	1.43
Dmax	0.938 ft (11.25 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #4



Riprap - Steep Slope Design - PADER Method

Discharge	= 173.29 cfs	Depth (d)	= 1.46	w/ Freeboard: (D = 2.46)	ft
Bottom (b)	= 11.10 ft	Top width (t)	= 15.03	(T = 17.73)	ft
Side slopes (Z)	= 1.5:1(L) 1.2:1(R)	Velocity	= 9.11	fps	
Bed Slope	= 6.00 %	Hydraulic Radius	= 1.19	ft	
Manning's n	= 0.045	Froude number	= 1.43		

Dmax = 0.94 ft (11.25 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #5

INPUT VALUES:

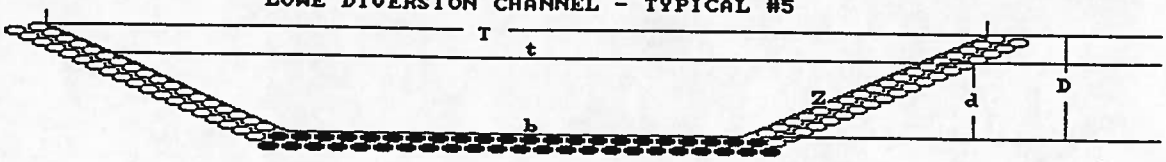
Shape	TRAPEZOIDAL	
Discharge	173.29 cfs	
Slope	2.20 %	
Sideslopes (L and R)	2.50:1	3.60:1
Bottom Width	14.90 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	1.38 ft
with Freeboard	2.38 ft
Top Width	23.31 ft
with Freeboard	29.41 ft
Velocity	6.58 fps
Cross Sectional Area	26.34 sq ft
Hydraulic Radius	1.11 ft
Manning's n	0.036
Froude Number	1.09
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION CHANNEL - TYPICAL #5



Riprap - Steep Slope Design - PADER Method

Discharge	= 173.29 cfs		Depth (d)	= 1.38	w/ Freeboard: (D = 2.38) ft
Bottom (b)	= 14.90 ft		Top width (t)	= 23.31	(T = 29.41) ft
Side slopes (Z)	= 2.5:1(L)	3.6:1(R)	Velocity	= 6.58 fps	
Bed Slope	= 2.20 %		Hydraulic Radius	= 1.11 ft	
Manning's n	= 0.036		Froude number	= 1.09	

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

SEDCAD+ ERODIBLE CHANNEL DESIGN

LOWE DIVERSION CHANNEL - TYPICAL #2

Limiting Velocity Technique
Sediment-laden Water

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	202.05 cfs	
Slope	0.30 %	
Sideslopes	2.50:1 (L)	2.50:1 (R)
Bottom Width	15.30 ft	
Manning's n	0.025	
Max. Velocity	5.00 fps	
Material		
Freeboard	1 ft	

RESULTS:

Actual Discharge	202.05 cfs
Depth	2.14 ft
with Freeboard	3.14 ft
Top Width	26.02 ft
with Freeboard	31.02 ft
Velocity	4.56 fps
Cross Sectional Area	44.32 sq ft
Hydraulic Radius	1.65 ft
Froude Number	0.62

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION - MAIN INLET

INPUT VALUES:

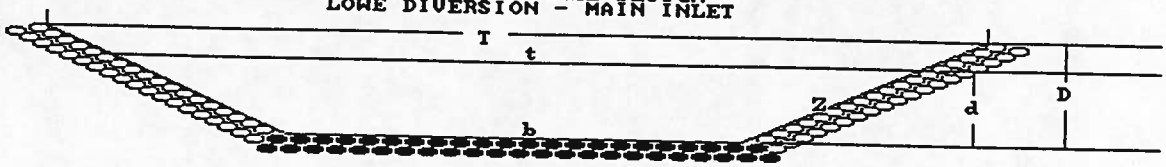
Shape	TRAPEZOIDAL	
Discharge	166.29 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.50:1	2.50:1
Bottom Width	15.00 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	2.43 ft
with Freeboard	3.43 ft
Top Width	27.17 ft
with Freeboard	32.17 ft
Velocity	3.24 fps
Cross Sectional Area	51.34 sq ft
Hydraulic Radius	1.83 ft
Manning's n	0.038
Froude Number	0.42
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION - MAIN INLET



Riprap - Mild Slope Design

Discharge	= 166.29 cfs	Depth (d)	= 2.43	w/ Freeboard: (D =	3.43) ft
Bottom (b)	= 15.00 ft	Top width (t)	= 27.17	(T =	32.17) ft
Side slopes (Z)	= 2.5:1(L) 2.5:1(R)	Velocity	= 3.24 fps		
Bed Slope	= 0.30 %	Hydraulic Radius	= 1.83 ft		
Manning's n	= 0.038	Froude number	= 0.42		

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION - MAIN INLET WING

INPUT VALUES:

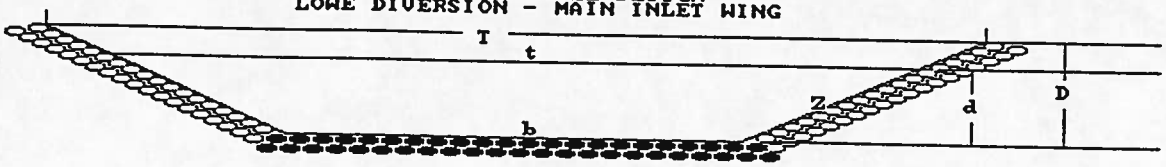
Shape	TRAPEZOIDAL	
Discharge	35.76 cfs	
Slope	0.30 %	
Sideslopes (L and R)	2.50:1	5.00:1
Bottom Width	12.00 feet	
Freeboard	1 ft	

RESULTS:

Mild Slope Design

Depth	1.12 ft
with Freeboard	2.12 ft
Top Width	20.37 ft
with Freeboard	27.87 ft
Velocity	1.98 fps
Cross Sectional Area	18.05 sq ft
Hydraulic Radius	0.87 ft
Manning's n	0.038
Froude Number	0.37
Dmax	1.500 ft (18.00 in)
D50	0.750 ft (9.00 in)
D10	0.250 ft (3.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION - MAIN INLET WING



Riprap - Mild Slope Design

Discharge	= 35.76 cfs	Depth (d)	= 1.12	w/ Freeboard: (D =	2.12) ft
Bottom (b)	= 12.00 ft	Top width (t)	= 20.37	(T =	27.87) ft
Side slopes (Z)	= 2.5:1(L) 5.0:1(R)	Velocity	= 1.98 fps		
Bed Slope	= 0.30 %	Hydraulic Radius	= 0.87 ft		
Manning's n	= 0.038	Froude number	= 0.37		

Dmax = 1.50 ft (18.00 in)
D50 = 0.75 ft (9.00 in)
D10 = 0.25 ft (3.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 18+00

INPUT VALUES:

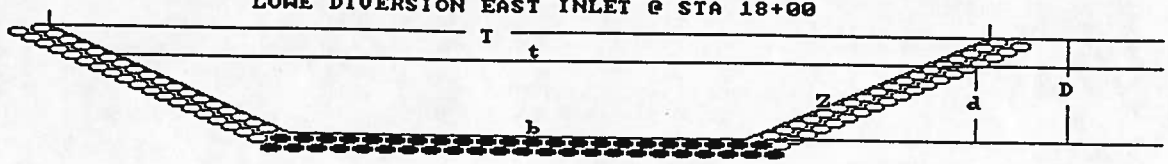
Shape	TRAPEZOIDAL	
Discharge	13.85 cfs	
Slope	20.75 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	12.50 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.24 ft
with Freeboard	1.24 ft
Top Width	13.45 ft
with Freeboard	17.45 ft
Velocity	4.51 fps
Cross Sectional Area	3.07 sq ft
Hydraulic Radius	0.23 ft
Manning's n	0.056
Froude Number	1.66
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 18+00



Riprap - Steep Slope Design - PADER Method

Discharge	= 13.85 cfs	Depth (d)	= 0.24	w/ Freeboard: (D = 1.24)	ft
Bottom (b)	= 12.50 ft	Top width (t)	= 13.45	(T = 17.45)	ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Velocity	= 4.51	fps	
Bed Slope	= 20.75 %	Hydraulic Radius	= 0.23	ft	
Manning's n	= 0.056	Froude number	= 1.66		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 18+00

INPUT VALUES:

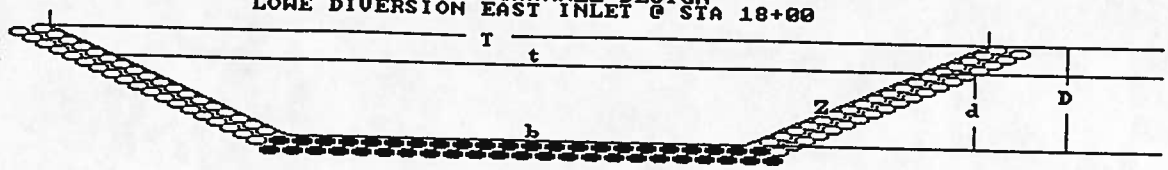
Shape	TRAPEZOIDAL	
Discharge	13.85 cfs	
Slope	20.75 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	6.25 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.34 ft
with Freeboard	1.34 ft
Top Width	7.59 ft
with Freeboard	11.59 ft
Velocity	5.96 fps
Cross Sectional Area	2.32 sq ft
Hydraulic Radius	0.30 ft
Manning's n	0.051
Froude Number	1.90
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 18+00



Riprap - Steep Slope Design - PADER Method

Discharge	=	13.85 cfs	Depth (d)	=	0.34	w/ Freeboard: (D = 1.34) ft
Bottom (b)	=	6.25 ft	Top width (t)	=	7.59	(T = 11.59) ft
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	5.96 fps	
Bed Slope	=	20.75 %	Hydraulic Radius	=	0.30 ft	
Manning's n	=	0.051	Froude number	=	1.90	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 24+45

INPUT VALUES:

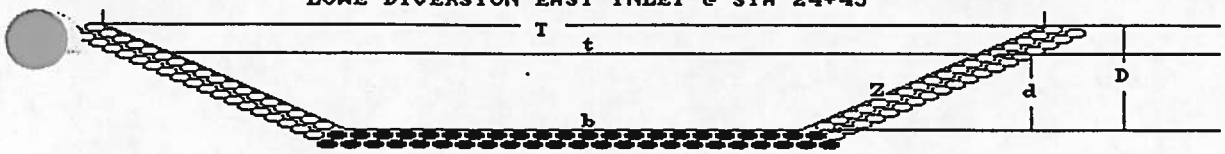
Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	21.45 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	12.20 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.24 ft
with Freeboard	1.24 ft
Top Width	13.16 ft
with Freeboard	17.16 ft
Velocity	4.53 fps
Cross Sectional Area	3.04 sq ft
Hydraulic Radius	0.23 ft
Manning's n	0.057
Froude Number	1.66
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 24+45



Riprap - Steep Slope Design - PADER Method

					w/ Freeboard:
Discharge	= 13.77 cfs		Depth (d)	= 0.24	(D = 1.24) ft
Bottom (b)	= 12.20 ft		Top width (t)	= 13.16	(T = 17.16) ft
Side slopes (Z)	= 2.0:1(L)	2.0:1(R)	Velocity	= 4.53 fps	
Bed Slope	= 21.45 %		Hydraulic Radius	= 0.23 ft	
Manning's n	= 0.057		Froude number	= 1.66	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 24+45

INPUT VALUES:

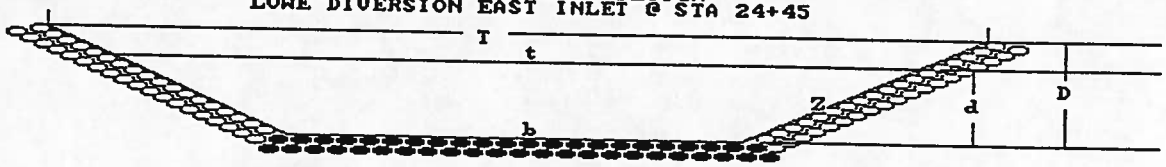
Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	21.45 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	6.10 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.34 ft
with Freeboard	1.34 ft
Top Width	7.44 ft
with Freeboard	11.44 ft
Velocity	6.05 fps
Cross Sectional Area	2.27 sq ft
Hydraulic Radius	0.30 ft
Manning's n	0.051
Froude Number	1.93
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 24+45



Riprap - Steep Slope Design - PADER Method

Discharge	= 13.77 cfs		Depth (d)		w/ Freeboard:
Bottom (b)	= 6.10 ft		Top width (t)	= 7.44	(D = 1.34) ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Velocity	= 6.05 fps	(T = 11.44) ft
Bed Slope	= 21.45 %		Hydraulic Radius	= 0.30 ft	
Manning's n	= 0.051		Froude number	= 1.93	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 39+64

INPUT VALUES:

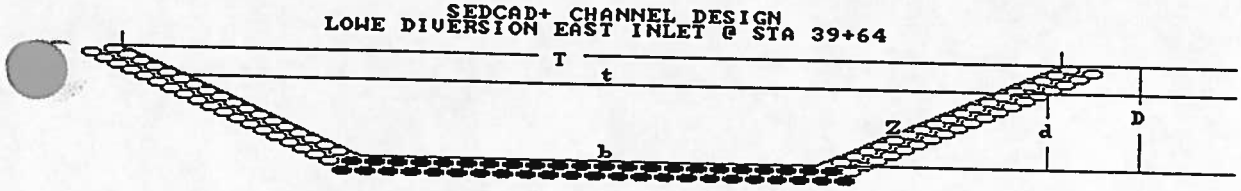
Shape	TRAPEZOIDAL	
Discharge	19.30 cfs	
Slope	28.41 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	10.80 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.28 ft
with Freeboard	1.28 ft
Top Width	11.92 ft
with Freeboard	15.92 ft
Velocity	6.06 fps
Cross Sectional Area	3.19 sq ft
Hydraulic Radius	0.26 ft
Manning's n	0.054
Froude Number	2.06
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 39+64



Riprap - Steep Slope Design - PADER Method

Discharge	=	19.30 cfs	Depth (d)	=	0.28	w/ Freeboard: (D = 1.28) ft
Bottom (b)	=	10.80 ft	Top width (t)	=	11.92	(T = 15.92) ft
Side slopes (Z)	=	2.0:1(L) 2.0:1(R)	Velocity	=	6.06 fps	
Bed Slope	=	28.41 %	Hydraulic Radius	=	0.26 ft	
Manning's n	=	0.054	Froude number	=	2.06	

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 39+64

INPUT VALUES:

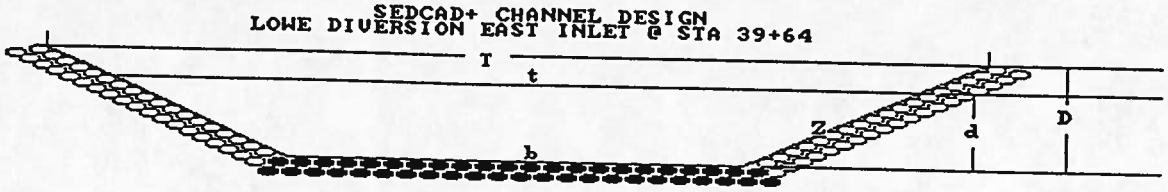
Shape	TRAPEZOIDAL	
Discharge	19.30 cfs	
Slope	28.41 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	5.40 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.46 ft
with Freeboard	1.46 ft
Top Width	7.26 ft
with Freeboard	11.26 ft
Velocity	6.56 fps
Cross Sectional Area	2.94 sq ft
Hydraulic Radius	0.39 ft
Manning's n	0.065
Froude Number	1.82
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 39+64



Riprap - Steep Slope Design - PADER Method

Discharge	= 19.30 cfs		Depth (d)	= 0.46	w/ Freeboard: (D = 1.46) ft
Bottom (b)	= 5.40 ft		Top width (t)	= 7.26	(T = 11.26) ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Velocity	= 6.56 fps	
Bed Slope	= 28.41 %		Hydraulic Radius	= 0.39 ft	
Manning's n	= 0.065		Froude number	= 1.82	

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

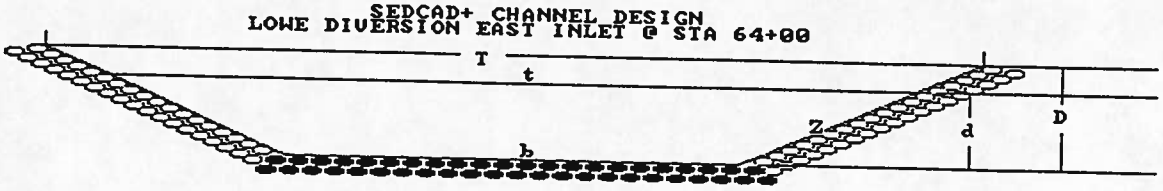
Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	15.73 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	16.50 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.37 ft
with Freeboard	1.37 ft
Top Width	17.98 ft
with Freeboard	21.98 ft
Velocity	6.02 fps
Cross Sectional Area	6.40 sq ft
Hydraulic Radius	0.35 ft
Manning's n	0.049
Froude Number	1.78
Dmax	0.313 ft (3.75 in)
D50	0.250 ft (3.00 in)
D10	0.083 ft (1.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 64+00



Riprap - Steep Slope Design - PADER Method

Discharge	= 38.48 cfs	Depth (d)	= 0.37	w/ Freeboard: (D =	1.37) ft
Bottom (b)	= 16.50 ft	Top width (t)	= 17.98	(T =	21.98) ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)	Velocity	= 6.02 fps		
Bed Slope	= 15.73 %	Hydraulic Radius	= 0.35 ft		
Manning's n	= 0.049	Froude number	= 1.78		

Dmax = 0.31 ft (3.75 in)
D50 = 0.25 ft (3.00 in)
D10 = 0.08 ft (1.00 in)

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

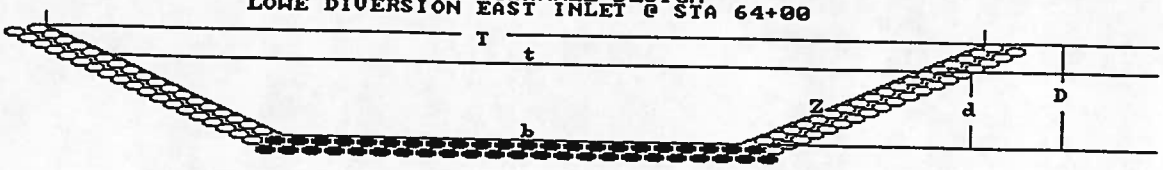
Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	15.73 %	
Sideslopes (L and R)	2.00:1	2.00:1
Bottom Width	8.25 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.62 ft
with Freeboard	1.62 ft
Top Width	10.72 ft
with Freeboard	14.72 ft
Velocity	6.57 fps
Cross Sectional Area	5.85 sq ft
Hydraulic Radius	0.53 ft
Manning's n	0.059
Froude Number	1.57
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

SEDCAD+ CHANNEL DESIGN
LOWE DIVERSION EAST INLET @ STA 64+00



Riprap - Steep Slope Design - PADER Method

Discharge	= 38.48 cfs		Depth (d)	= 0.62	w/ Freeboard: (D = 1.62) ft
Bottom (b)	= 8.25 ft		Top width (t)	= 10.72	(T = 14.72) ft
Side slopes (Z)	= 2.0:1(L) 2.0:1(R)		Velocity	= 6.57 fps	
Bed Slope	= 15.73 %		Hydraulic Radius	= 0.53 ft	
Manning's n	= 0.059		Froude number	= 1.57	

Dmax = 0.63 ft (7.50 in)
D50 = 0.50 ft (6.00 in)
D10 = 0.17 ft (2.00 in)

Civil Software Design

SEDCAD+ Version 3

LOWE DIVERSION INLET @ STA. 26+45 AS-BUILT ANALYSIS

by

Name: BH

Company Name: BHP MINERALS

Date: 08-08-97

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ 26+45

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	13.77 cfs	
Slope	17.52 %	
Sideslopes (L and R)	2.00:1	2.10:1
Bottom Width	9.30 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - Simons/OSM Method

Depth	0.13 ft
with Freeboard	1.13 ft
Top Width	9.85 ft
with Freeboard	13.95 ft
Velocity	10.72 fps
Cross Sectional Area	1.28 sq ft
Hydraulic Radius	0.13 ft
Manning's n	0.035
Froude Number	5.23
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)

Civil Software Design

SEDCAD+ Version 3

LOWE DIVERSION INLET @ STA. 64+00 AS-BUILT ANALYSIS

by

Name: BH

Company Name: BHP MINERALS

Date: 08-08-97

SEDCAD+ RIPRAP CHANNEL DESIGN

LOWE DIVERSION EAST INLET @ STA 64+00

INPUT VALUES:

Shape	TRAPEZOIDAL	
Discharge	38.48 cfs	
Slope	11.70 %	
Sideslopes (L and R)	2.71:1	1.62:1
Bottom Width	5.00 feet	
Freeboard	1 ft	

RESULTS:

Steep Slope Design - PADER Method

Depth	0.81 ft
with Freeboard	1.81 ft
Top Width	8.52 ft
with Freeboard	12.85 ft
Velocity	6.99 fps
Cross Sectional Area	5.50 sq ft
Hydraulic Radius	0.62 ft
Manning's n	0.053
Froude Number	1.53
Dmax	0.625 ft (7.50 in)
D50	0.500 ft (6.00 in)
D10	0.167 ft (2.00 in)