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CONSULTANTS ENGINEERS  
**LAUGHN  
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ASSOCIATES**

WATERBURY PLAZA - SUITE A  
5620 SOUTH 1475 EAST  
SALT LAKE CITY, UTAH 84121  
(801) 272-5263

December 6, 1983

Mr. Ben Grimes  
Environmental Coordinator  
Plateau Mining Company  
Drawer PMC  
Price, Utah 84501



DIVISION OF  
OIL, GAS & MINING

Dear Ben:

Outlined herein is the basis of our design of energy dissipation at the exit of the 54-inch half round culvert (Ditch No. 14) into the natural channel.

Energy dissipation requirements between the 54-inch half round CMP and the natural stream channel have been analyzed as discussed herein. Flow velocities within the half round 54-inch CMP as shown in Table 1 are in the order of 22 fps. In order to reduce these velocities to the stabilized values which would occur in the downstream section some energy dissipation must occur. By creating a small basin with zero slope, a hydraulic jump is forced to occur thus dissipating excess energy.

Table 1  
Hydraulic Calculations

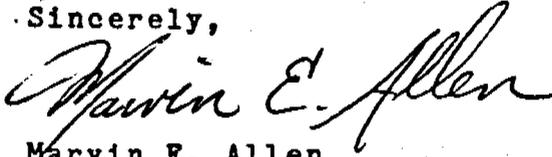
	Area ft <sup>2</sup>	Mannings n	Velocity fps	Depth ft	Fr	Slope %
54" Pipe	2.66	0.023	23.3	1.04	4.8	26
Riprapped Channel	8.14	0.038	7.6	1.12	1.4	5

Computer printouts showing the water surface profile are shown in Tables 2 and 3. In order to locate the position of the hydraulic jump an alternate depth must be calculated for one of the profiles, then compared with the other profile. The hydraulic jump will occur approximately 10 feet downstream of the change in slope from 26 percent to 5 percent where alternate depths equal 0.71 feet and 2.32 feet. Grouted riprap is required throughout the

entire basin to protect against severe erosion created by the dissipation of energy. Complete design details including plan, profile, and cross-section are shown on the appended figure.

Design specifications for the 54-inch CMP and downstream riprapped channel are given in Table 1.

Sincerely,

A handwritten signature in cursive script that reads "Marvin E. Allen". The signature is written in dark ink and is positioned above the typed name.

Marvin E. Allen  
Executive Vice President

MEA/jd

Attachments

Table 2. Water Surface Profile Moving Downstream

Plateau Mining Energy Dissipation Design

Supercritical Flow

54" Pipe	TO TRANSITION TO			Basin	
	N	S	M	B	L
54" Pipe	0.023	0.260	1.0	1.5	0.0
TRANS	0.040	0.260			5.0
Basin	0.040	0.000	2.0	5.0	20.0

Q= 62.00 CFS

DISTANCE (ft)	DEPTH (ft)	DERIVATIVE DY/DX	INCREMENT		STATION (ft)
			DLX	FR2	
+0.000	1.04	-2.516070E-01	+0.250	23.185	1 + 07
+0.250	0.98	-2.216642E-01	+0.250	23.995	↑
+0.500	0.93	-1.966579E-01	+0.250	24.616	TRANSITION
+0.750	0.88	-1.752666E-01	+0.250	25.202	↓
+2.750	0.64	-7.909246E-02	+0.250	27.998	GRADE CHANGE
+4.750	0.53	-4.097728E-02	+0.250	27.649	↑
+5.000	0.52	-3.800208E-02	+0.031	27.403	
+5.031	0.52	+3.307121E-02	+0.031	27.606	
+5.063	0.52	+3.304488E-02	+0.031	27.101	
+5.094	0.52	+3.303592E-02	+0.031	26.929	
+7.094	0.59	+3.262566E-02	+0.031	18.361	1 + 00
+9.094	0.65	+3.252797E-02	+0.031	13.030	
+11.094	0.72	+3.275751E-02	+0.031	9.524	
+13.094	0.78	+3.337235E-02	+0.031	7.112	
+15.094	0.85	+3.449671E-02	+0.031	5.390	
+17.094	0.92	+3.638227E-02	+0.031	4.120	BASIN
+19.094	1.00	+3.958513E-02	+0.031	3.152	
+21.094	1.08	+4.561595E-02	+0.031	2.386	
+23.094	1.19	+6.097929E-02	+0.031	1.739	
+24.875	1.37	+5.005102E-01	+0.004	1.053	
+24.879	1.37	+5.558636E-01	+0.004	1.047	↓
+24.883	1.37	+6.362899E-01	+0.004	1.041	0 + 80

N= Mannings n  
 S= Channel Slope  
 M= Channel Side Slope  
 B= Channel Bottom Width  
 L= Channel Length  
 FR2= Froude Number Squared

Table 3. Water Surface Profile Moving Upstream

Plateau Mining Energy Dissipation Design

Subcritical Flow

Riprap	TO TRANSITION TO Basin				
	N	S	M	B	L
Riprap	0.038	0.050	2.0	5.0	0.0
TRANS	0.040	-.500			1.0
Basin	0.040	0.000	2.0	5.0	20.0

Q= 62.00 CFS

DISTANCE (ft)	DEPTH (ft)	DERIVATIVE DY/DX	INCREMENT DLX	FR2	STATION (ft)
+0.000	1.45	-3.664137E+00	-0.006	0.858	0 + 80
-0.006	1.47	-2.792055E+00	-0.006	0.814	↑
-0.013	1.49	-2.411673E+00	-0.006	0.785	TRANSITION
-0.019	1.50	-2.146829E+00	-0.006	0.758	↓
-1.006	2.29	-4.250308E-03	-0.003	0.161	GRADE CHANGE
-1.009	2.29	-4.250192E-03	-0.003	0.161	↑
-1.013	2.29	-4.250073E-03	-0.003	0.161	
-1.016	2.29	-4.249956E-03	-0.003	0.161	
-3.406	2.30	-4.162262E-03	-0.400	0.158	
-5.806	2.31	-4.078340E-03	-0.800	0.156	
-9.006	2.32	-3.972355E-03	-1.600	0.153	BASIN
-13.806	2.34	-3.824789E-03	-3.200	0.148	↓
-17.006	2.35	-3.733238E-03	-3.200	0.145	
-20.206	2.36	-3.646605E-03	-3.200	0.142	1 + 00
-26.606	2.38	-3.486516E-03	-6.400	0.137	1 + 08

N= Mannings n  
 S= Channel Slope  
 M= Channel Side Slope  
 B= Channel Bottom Width  
 L= Channel Length  
 FR2= Froude Number Squared