0046

ACT/007/006 #2

CONSULTANTS/ENGINEERS
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June 18, 1992

Mr. Ben Grimes
Plateau Mining Company
P.O. Drawer PMC
Price, Utah

RE: Re-evaluation of Ditches 51, 57 & 58.

Dear Ben:

Enclosed please find a copy of the calculation details for Ditches 51, 57 & 58 wherein the 10 year, 6 hour runoff event was evaluated. As indicated by phone, Ditch 51 shows only a small reduction in flow over the previous estimate due to the old method of calculation which was previously used. Because the flow reduction is minor, riprap would still be required for this ditch as shown in the calculation details.

A re-evaluation of Ditches 57 & 58 for the 10 year, 6 hour runoff event has shown a sizable reduction in total flow over the previous 24 hour estimate. According to our evaluation, Ditch 57 does not require a lining. In order to show a "no lining" requirement for Ditch 58 the flow area had to be broken into two sections. Since the upper two thirds of the runoff area contained the steep channel sections for the roadside ditch, an estimate of runoff for that portion was obtained and used in the channel design evaluation. Under these conditions, lining is not required on either the upper or lower portions of the ditch.

If these evaluations are to be added to the permit the design tables will have to be modified in both the text as well as on the appropriate runoff channel mapping. Should you have any questions please call.

Sincerely,

David E. Hansen

David E. Hansen, Ph.D.,P.E.
Project Manager

HANSEN ALLEN & LUCE INC

CLIENT CPWC
PROJECT
FEATURE DITCHES 51, 57 & 58 RE-EVALUATION
PROJECT NO. 002.08.300

SHEET 1 OF
COMPUTED DEH
CHECKED
DATE 17 JUN 92

RE-EVALUATE EROSION POTENTIALS FOR DITCHES 51, 57 & 58 BASED ON NEW DOGWI CRITERIA THAT RUNOFF IS TO BE CONTROLLED FOR THE 10 YR, 6 HR STORM.

DITCHES WERE PREVIOUSLY DESIGNED FOR THE 24 HR EVENT

DESIGN FLOW DATA TAKEN DIRECTLY FROM PREVIOUS RUNOFF CALCULATION PRINTOUTS.

DESIGN DATA

	DITCH		
	51	57	58
AREA (ac)	57.1	16.3	27.5
SLOPE (%)	65.0	65.2	69.3
CN	76.0	76.9	75.9
PRECIP (10 YR, 24 HR)	2.6	2.1	2.1
(10 YR, 6 HR)	1.5	1.5	1.5
HYD. LENGTH (ft)	3590	2087	2623
Q (10 YR, 6 HR)	5.5	2.3	2.95

DITCH 51

FROM TRAPEZOIDAL CHANNEL FLOW CALC'S IT IS FOUND THAT RIPRAP IS STILL REQUIRED.

$D_{50} = 1.0'$

- MAY WANT TO CONSIDER USING CMP PIPE INSTEAD
- INSTALL AS AN EXTENSION TO CULVERT 5B.

CHECK EXTENSION POSSIBILITIES (PIPE FLOW)

$$\left.\begin{array}{l} DIA = 12'' \\ \Delta H = 90' \\ \Delta L = 400' \\ S = 0.23 \\ \eta = 0.024 \\ Q = 4.3\ cfs \end{array}\right\} \text{FOR EXTENSION ONLY}$$

$$\frac{Q\eta}{1.49 S^{1/2}} = 0.144$$

Y	$AR^{2/3}$
0.4	0.105
0.45	0.130
0.5	0.156
0.48	0.145 ⇒

A = 0.37
R = 0.24
V = 11.54

OK — FLOW WILL PASS

PROJECT : Cyprus Plateau Mining Company - Ditch #5 10 Yr. 6 Hr Runoff

AREA= 57.1 ACRES
AVERAGE BASIN SLOPE= 65.0 PERCENT
CURVE NUMBER= 76.0
DESIGN STORM= 1.50 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 3590. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1374 HOURS QPCFS= 314.39 CFS QPIN= 5.4602 INCHES
C3= 26.9135 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.25	.6254	.0000	.0000	.0	.00
2.28	.6558	.0002	.0002	15.8	.00
2.31	.6863	.0009	.0007	97.7	.03
2.33	.7168	.0022	.0013	208.7	.13
2.36	.7473	.0041	.0019	288.6	.37
2.39	.7778	.0065	.0024	314.4	.77
2.42	.8083	.0094	.0029	294.5	1.33
2.44	.8388	.0128	.0034	248.6	2.04
2.47	.8693	.0166	.0039	194.4	2.87
2.50	.8998	.0210	.0044	143.5	3.78
2.53	.9082	.0223	.0013	101.1	4.69
2.55	.9164	.0236	.0013	68.7	5.32
2.58	.9247	.0249	.0013	45.2	5.53
2.61	.9329	.0262	.0014	29.0	5.37
2.64	.9411	.0276	.0014	18.2	4.98
2.66	.9494	.0291	.0014	11.2	4.52
2.69	.9576	.0305	.0015	6.8	4.10
2.72	.9659	.0320	.0015	4.1	3.75
2.75	.9741	.0335	.0015	2.4	3.50
2.77	.9824	.0351	.0015	1.4	3.34
2.80	.9906	.0366	.0016	.8	3.25
2.83	.9988	.0383	.0016	.5	3.21
2.86	1.0071	.0399	.0016	.3	3.20
2.88	1.0153	.0416	.0017	.1	3.23
2.91	1.0236	.0433	.0017	.0	3.26

HYDROGRAPH PEAK= 5.53 cfs
TIME TO PEAK= 2.58 Hours
RUNOFF VOLUME= .89 Acre-Feet

PROJECT : Cyprus Plate[illegible] Mining Company - Ditch #[illegible] 10 Yr. 6 Hr Runoff

AREA= 16.3 ACRES
AVERAGE BASIN SLOPE= 65.2 PERCENT
CURVE NUMBER= 76.9
DESIGN STORM= 1.50 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2087. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0865 HOURS QPCFS= 142.43 CFS QPIN= 8.6658 INCHES
C3= 42.7138 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.22	.5842	.0000	.0000	.0	.00
2.23	.6034	.0000	.0000	7.1	.00
2.25	.6227	.0002	.0002	44.2	.00
2.27	.6419	.0006	.0004	94.6	.00
2.28	.6611	.0012	.0006	130.8	.04
2.30	.6803	.0021	.0009	142.4	.09
2.32	.6995	.0031	.0011	133.4	.18
2.34	.7187	.0045	.0013	112.6	.30
2.35	.7379	.0060	.0015	88.1	.45
2.37	.7571	.0077	.0017	65.0	.61
2.39	.7764	.0097	.0020	45.8	.80
2.41	.7956	.0119	.0022	31.1	.99
2.42	.8148	.0142	.0024	20.5	1.18
2.44	.8340	.0168	.0026	13.2	1.38
2.46	.8532	.0196	.0028	8.3	1.58
2.48	.8724	.0225	.0030	5.1	1.78
2.49	.8916	.0257	.0031	3.1	1.98
2.51	.9029	.0276	.0019	1.8	2.16
2.53	.9081	.0285	.0009	1.1	2.28
2.54	.9133	.0295	.0009	.6	2.28
2.56	.9185	.0304	.0009	.4	2.16
2.58	.9237	.0313	.0010	.2	1.96
2.60	.9289	.0323	.0010	.1	1.73
2.61	.9341	.0333	.0010	.0	1.52
2.63	.9393	.0343	.0010	.0	1.35
2.65	.9445	.0353	.0010	.0	1.21

HYDROGRAPH PEAK= 2.28 cfs
TIME TO PEAK= 2.54 Hours
RUNOFF VOLUME= .28 Acre-Feet

PROJECT : Cyprus Plate[redacted] Mining Company - Ditch #[redacted] 10 Yr. 6 Hr Runoff

AREA= 27.5 ACRES
AVERAGE BASIN SLOPE= 69.3 PERCENT
CURVE NUMBER= 75.9
DESIGN STORM= 1.50 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 2623. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .1038 HOURS QPCFS= 200.38 CFS QPIN= 7.2259 INCHES
C3= 35.6166 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.24	.6134	.0000	.0000	.0	.00
2.26	.6365	.0000	.0000	10.1	.00
2.28	.6595	.0002	.0002	62.2	.00
2.30	.6826	.0007	.0005	133.0	.02
2.32	.7056	.0015	.0008	183.9	.07
2.35	.7287	.0027	.0011	200.4	.17
2.37	.7517	.0041	.0015	187.7	.33
2.39	.7747	.0059	.0018	158.4	.55
2.41	.7978	.0079	.0020	123.9	.83
2.43	.8208	.0103	.0023	91.4	1.14
2.45	.8439	.0129	.0026	64.4	1.49
2.47	.8669	.0158	.0029	43.8	1.85
2.49	.8899	.0189	.0032	28.8	2.22
2.51	.9035	.0209	.0020	18.5	2.58
2.53	.9097	.0219	.0009	11.6	2.85
2.55	.9160	.0228	.0010	7.2	2.95
2.57	.9222	.0238	.0010	4.3	2.86
2.59	.9284	.0248	.0010	2.6	2.65
2.62	.9346	.0258	.0010	1.5	2.38
2.64	.9409	.0269	.0010	.9	2.12
2.66	.9471	.0279	.0011	.5	1.90
2.68	.9533	.0290	.0011	.3	1.73
2.70	.9596	.0301	.0011	.2	1.62
2.72	.9658	.0312	.0011	.0	1.54

HYDROGRAPH PEAK= 2.95 cfs
TIME TO PEAK= 2.55 Hours
RUNOFF VOLUME= .42 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client	: Cyprus Plateau Mining Co.	Date	: 16-Jun-92
Project No.	: 002.08.300	Time	: 03:31 PM
Channel Section:	Ditch #51	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	5.50	cfs
	Bottom Width:	3.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:		
	Assumed D50:	1.00	feet
	Calc n Value:	0.040	
	Used:	0.040	
	Min. Bottom Slope:	0.160	ft/ft
	Max. Bottom Slope:	0.290	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.28	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.78	feet
	Area:	0.98	ft2
	Perimeter:	4.23	feet
	Hydraulic Radius:	0.23	feet
	Velocity:	5.62	ft/sec
	Riprap Ck (V<5?):	Required	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.23	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.73	feet
	Area:	0.80	ft2
	Perimeter:	4.04	feet
	Hydraulic Radius:	0.20	feet
	Velocity:	6.84	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	3.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	16.0	%
	Max. Bottom Slope:	29.0	%
	Min Channel Depth:	0.78	feet
	Riprap (Min S):	Required	
	Riprap (Max S):	Required	

RIPRAP DESIGN - Using the RED BOOK (Applied Hydrology and for Disturbed Areas)

Client	: Cyprus Plateau Mining Co.	Date	: 16-Jun-92
Project No.	: 002.08.300	Time	: 03:31 PM
Channel Section	: Ditch #51	Computed	:DEH

DESIGN CRITERIA:			UNITS
	Design Flow:	5.50	cfs
	Bottom Width:	3.00	feet
	Side Slope1:	2.00	1/m1
	Side Slope2:	2.00	1/m2
	Friction Factor:	0.04	
	Min. Bottom Slope:	0.16	ft/ft
	Max. Bottom Slope:	0.29	ft/ft
	Freeboard:	0.50	feet
	Depth (Min. S):	0.28	feet
	Depth (Max. S):	0.23	feet
	Angle Repose (Ar):	42	degrees

Nb = 21T/(G(SG-1)D)
SFb = (Cos a tan b)/(sin a + Nb tan b)
Tmax= 0.76GdS
Ns = 21Tmax/(G(SG-1)D)
A = Atan(1/m)
B = Atan(Cos(Ar)/(2Sin(A)/NsTan)Ar))+Sin(Ar))
n = Ns(1+Sin(Ar+B)/2)
SFs = Cos(A)Tan(Ar)/(nTan(Ar)+Sin(A)Cos(B))

	Smin	Smax	
D50	1.00	1.75	feet
T	2.75	4.20	lb/ft2
Nb	0.56	0.49	
Tmax	2.09	3.19	lb/ft2
Ns	0.43	0.37	
m Critical	2.00	2.00	
A (m crit)	26.57	26.57	degrees
B	21.66	18.04	degrees
Nsp	0.32	0.29	
SFb	1.34	1.19	
SFs	1.14	1.17	

HANSEN ALLEN & LUCE inc

CLIENT CPMC
PROJECT
FEATURE DITCHES 51, 57 & 58 RE-EVALUATION
PROJECT NO. 002.08.300

SHEET ___ OF ___
COMPUTED DEH
CHECKED
DATE 17JUN92

DITCH 57

FROM TRAPEZOIDAL FLOW CALC'S IT IS FOUND THAT RIPRAP IS NOT NEEDED FOR THE FLOW RATE IDENTIFIED.

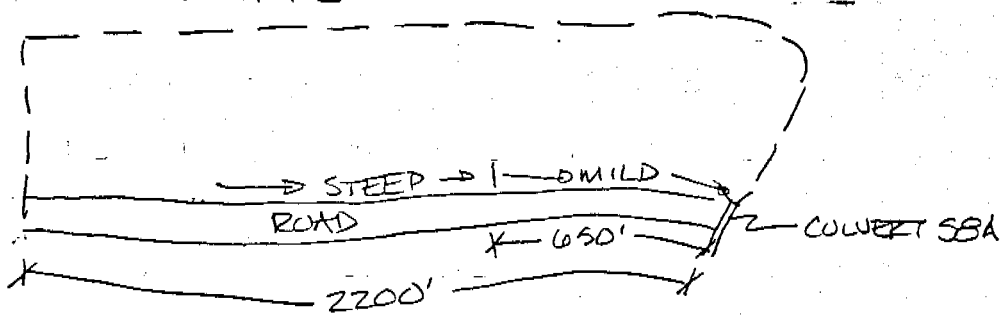
∴ RIPRAP NOT REQ'd

DITCH 58

FROM TRAPEZOIDAL FLOW CALC'S RIPRAP IS NOT REQUIRED ON THE SHALLOW SLOPE SECTIONS BUT IS ON THE STEEP SLOPE SECTIONS.

IT IS ALSO NOTED THAT LOWER DITCH SECTIONS ARE FLATTER THAN THOSE FOUND IN THE MIDDLE. BECAUSE TOTAL FLOW HAS NOT BEEN REACHED IN THE STEEP SECTIONS, ESTIMATE A REDUCED FLOW RATE AND RECALCULATE FOR STEEP SECTION.

SCHEMATIC



UPPER AREA

AREA ~ 27.5 * (2/3) = 18.3 ac
H_L = 2623 - 650 = 1973 ft

NEW FLOW IN UPPER 2/3 SECTION IS 2.13 CFS AND ACCORDING TO CALC'S DOES NOT REQUIRE RIPRAP

∴ NO RIPRAP REQ'd

Trapezoidal Channel Flow Calculations using Mannings Equation

Client	: Cyprus Plateau Mining Co.	Date	: 16-Jun-92
Project No.	: 002.08.300	Time	: 03:34 PM
Channel Section:	Ditch #57	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.28	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:		
	Assumed D50:	0.50	feet
	Calc n Value:	0.035	
	Used:	0.035	
	Min. Bottom Slope:	0.090	ft/ft
	Max. Bottom Slope:	0.090	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.23	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.73	feet
	Area:	0.55	ft2
	Perimeter:	3.01	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	4.13	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.23	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.001	Accuracy
	Required Depth:	0.73	feet
	Area:	0.55	ft2
	Perimeter:	3.01	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	4.12	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	9.0	%
	Max. Bottom Slope:	9.0	%
	Min Channel Depth:	0.73	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	

Trapezoidal Channel Flow Calculations using Mannings Equation

Client	: Cyprus Plateau Mining Co.	Date	: 17-Jun-92
Project No.	: 002.08.300	Time	: 09:00 AM
Channel Section:	Ditch #58	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.95	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:		
	Assumed D50:	0.50	feet
	Calc n Value:	0.035	
	Used:	0.030	
	Min. Bottom Slope:	0.070	ft/ft
	Max. Bottom Slope:	0.100	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.26	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.76	feet
	Area:	0.65	ft2
	Perimeter:	3.15	feet
	Hydraulic Radius:	0.21	feet
	Velocity:	4.57	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.23	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.73	feet
	Area:	0.57	ft2
	Perimeter:	3.04	feet
	Hydraulic Radius:	0.19	feet
	Velocity:	5.16	ft/sec
	Riprap Ck (V<5?):	Required	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	7.0	%
	Max. Bottom Slope:	10.0	%
	Min Channel Depth:	0.76	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Required	

PROJECT : Cyprus Plate[illegible] Mining Company - Upper D[illegible]ch #58 10 Y. 6 H Flow

AREA= 18.3 ACRES
AVERAGE BASIN SLOPE= 69.3 PERCENT
CURVE NUMBER= 75.9
DESIGN STORM= 1.50 INCHES
STORM DURATION= 6.0 HOURS
HYDRAULIC LENGTH= 1973. FEET
MINIMUM INFILTRATION RATE= .00 IN/HR

TP= .0826 HOURS QPCFS= 167.46 CFS QPIN= 9.0747 INCHES
C3= 44.7290 ITERATIONS= 8 SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
2.25	.6202	.0000	.0000	.0	.00
2.26	.6386	.0000	.0000	8.4	.00
2.28	.6569	.0001	.0001	52.0	.00
2.30	.6753	.0005	.0004	111.2	.01
2.31	.6936	.0011	.0006	153.7	.04
2.33	.7119	.0018	.0008	167.5	.10
2.35	.7303	.0028	.0010	156.9	.19
2.36	.7486	.0039	.0011	132.4	.31
2.38	.7670	.0053	.0013	103.6	.46
2.40	.7853	.0068	.0015	76.4	.63
2.41	.8037	.0085	.0017	53.9	.82
2.43	.8220	.0104	.0019	36.6	1.02
2.45	.8404	.0125	.0021	24.1	1.22
2.46	.8587	.0147	.0022	15.5	1.42
2.48	.8771	.0171	.0024	9.7	1.63
2.50	.8954	.0197	.0026	6.0	1.83
2.51	.9037	.0210	.0012	3.6	2.02
2.53	.9087	.0217	.0007	2.2	2.13
2.55	.9136	.0225	.0008	1.3	2.13
2.56	.9186	.0232	.0008	.7	2.00
2.58	.9236	.0240	.0008	.4	1.81
2.60	.9285	.0248	.0008	.2	1.61
2.61	.9335	.0256	.0008	.1	1.42
2.63	.9384	.0265	.0008	.0	1.26

HYDROGRAPH PEAK= 2.13 cfs
TIME TO PEAK= 2.53 Hours
RUNOFF VOLUME= .28 Acre-Feet

Trapezoidal Channel Flow Calculations using Mannings Equation

Client	: Cyprus Plateau Mining Co.	Date	: 17-Jun-92
Project No.	: 002.08.300	Time	: 08:59 AM
Channel Section	: Ditch #58	Computed:	DEH

			UNITS
GENERAL CRITERIA:	Design Flow:	2.13	cfs
	Bottom Width:	2.0	feet
	Side Slope1:	2.0	1/m1
	Side Slope2:	2.0	1/m2
	Friction Factor:		
	Assumed D50:	0.50	feet
	Calc n Value:	0.035	
	Used:	0.030	
	Min. Bottom Slope:	0.070	ft/ft
	Max. Bottom Slope:	0.100	ft/ft
	Freeboard:	0.50	feet
CALCULATION: (Channel Depth)	Depth (Min. S):	0.21	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.000	Accuracy
	Required Depth:	0.71	feet
	Area:	0.52	ft2
	Perimeter:	2.95	feet
	Hydraulic Radius:	0.18	feet
	Velocity:	4.11	ft/sec
	Riprap Ck (V<5?):	Not Needed	
CALCULATION: (Velocity Check)	Depth (Max. S):	0.19	feet
	Q-1.49AR(2/3)S(1/2)/n=	-0.001	Accuracy
	Required Depth:	0.69	feet
	Area:	0.46	ft2
	Perimeter:	2.86	feet
	Hydraulic Radius:	0.16	feet
	Velocity:	4.64	ft/sec
	Riprap Ck (V<5?):	Not Needed	

DESIGN CRITERIA:	Bottom Width:	2.0	feet
	Side Slope 1:	2.0	1/m1
	Side Slope 2:	2.0	1/m2
	Min. Bottom Slope:	7.0	%
	Max. Bottom Slope:	10.0	%
	Min Channel Depth:	0.71	feet
	Riprap (Min S):	Not Needed	
	Riprap (Max S):	Not Needed	