

UMC 817.44 - HYDROLOGIC BALANCE : STREAM CHANNEL DIVERSIONS

3/99 Addendum - North Diversion Channel Hydraulic Capacity Characteristics

The North Diversion Channel was originally referred to in a July, 1990 Permit Amendment in section UMC 784.13 as a component of Phase 4 Reclamation (completed in 1985-86). However, the design was never incorporated into the reclamation permit. This ditch has a dual purpose of both: 1) directing and conveying internal site drainage; and 2) sedimentation control. The conveyance of site drainage is dealt with in this section and its use as a sediment control facility is dealt with in section UMC 817.45. This channel was thoroughly cleaned in Nov. 1998.

Please review the accompanying map **JBK-4 As Built** for the general location of the North Diversion channel. The engineering firm of Hansen, Allen & Luce Inc. has analyzed the "as built" information of the cleaned out ditch and determined that this ditch has ample capacity for a 10 year storm event. This analysis is attached (*Appendix to UMC 817.44*) as a permanent part of the design characteristics for incorporation into the permit.

File in:  
 Confidential  
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Refer to Record No 0004 Date 03/01/1999  
In C 0150002 1999 Suborning  
For additional information

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APPENDIX TO UMC 817.44

**North Diversion Channel Hydrologic Characteristics**  
By Hansen, Allen & Luce Inc.

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SALT LAKE AREA OFFICE  
 6771 South 900 East  
 Midvale, Utah 84047  
 Phone: (801) 566-5599

February 24, 1999

Mr. E. M. Gerick  
 Vice President of Operations  
 Western States Minerals Corporation  
 250 South Rock Blvd., Suite 130  
 Reno, Nevada 89502

RE: **J.B. KING**  
 CAPACITY OF CLEANED NORTH DIVERSION CHANNEL

Dear Mr. Gerick:

As requested we have analyzed the "as built" information provided to us of the cleaned North Diversion Ditch. We find that the cleaned ditch has ample capacity for the 10 year storm event. Our analysis and findings are presented in two parts: hydrology and hydraulics.

**HYDROLOGY**

Storm runoff hydrographs tributary to the North Diversion Ditch were analyzed using the Soil Conservation Service (SCS) Curve Number methodology as outlined in SCS Technical Release 55. Hydrologic characteristics are summarized in the following table. The HYDRO computer program was used to compute runoff hydrographs (see appendix).

**TABLE 1**  
**NORTH DIVERSION CHANNEL HYDROLOGIC CHARACTERISTICS**

Tributary Area	4.5 acres
Time of concentration	0.33 hours
SCS Curve Number	90
10-year 6-hour storm depth	1.2 inches
10-year 24-hour storm depth	1.8 inches
10-year 6-hour Peak Runoff Flowrate	1.6 cubic feet per second
10-year 24-hour Peak Runoff Flowrate	3.7 cubic feet per second

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## HYDRAULICS

The capacity of the existing cleaned ditch was computed using the Mannings Equation and as built information provided by Western States Minerals (see computations attached). Hydraulic characteristics are summarized in the following table for the reach of minimum slope and for the reach of minimum channel flow area.

**TABLE 2**  
**NORTH DIVERSION DITCH HYDRAULIC CAPACITY SUMMARY**

REACH	Minimum Slope Reach	Minimum Channel Flow Area Reach
Station	5+50 to 6+00	4+00
Slope	0.011 feet/foot	0.023 feet/foot
Mannings N (assuming a vegetated condition)	0.035	0.035
Bank Full flow area	15.8 square feet	9.1 square feet
Flow area with 1 foot of freeboard	4.1 square feet	2.5 square feet
Capacity with 1 foot of freeboard	15 cubic feet per second	11.6 cubic feet per second

## CONCLUSION

The existing channel has capacity in excess of 10 cubic feet per second with one foot of freeboard. The existing channel has ample capacity for the 10-year storm runoff event (10-year 24-hour storm with SCS Type II distribution is predicted at 3.7 cubic feet per second).

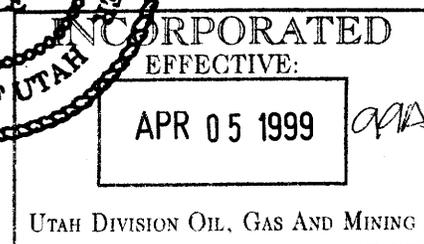
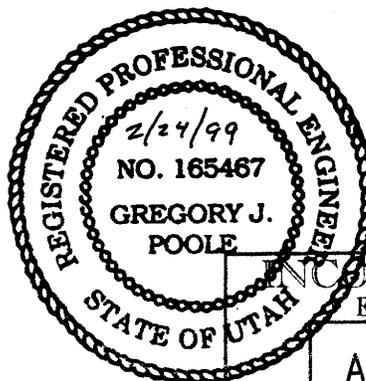
Please call if there are questions or if we may be of further service in anyway.

Sincerely,

HANSEN, ALLEN, & LUCE, INC.



Gregory J. Poole, P.E.  
Principal



North Diversion Ditch:

The North Diversion Ditch intercepts runoff from "disturbed area" (see attached figure for tributary area) and conveys flows to the "Catch Pond".

Tributary Area = 4.5 acres

Curve Number = 90

Time of Concentration  $T_c$ : Crk. SCS TR 55

$$T_c = T_{\text{sheet flow}} + T_{\text{travel time}}$$

$$T_{\text{sheet flow}} = \frac{0.007 (nL)^{0.8}}{2.48 S^{0.4}}$$

$n = 0.13$  for natural range

$L = 100'$

$S = 0.05 \text{ ft/ft}$

$P_2 = 2 \text{ yr } 24 \text{ hr rain} = 1.02''$

$$T_{\text{sheet flow}} = \frac{0.007 (0.13 \cdot 100)^{0.8}}{(1.02)^{0.5} (0.05)^{0.4}} = \underline{\underline{0.18 \text{ hrs}}}$$

$T_{\text{shallow concentrated}}$ :

200' @ 19% Fig 3-1  $\Rightarrow v = 7 \text{ fps}$

$$T_{\text{shallow}} = \frac{200 \text{ ft}}{7 \text{ ft/s}} \cdot \frac{1 \text{ hr}}{60 \text{ min}} = \underline{\underline{0.01 \text{ hrs}}}$$

$T_{\text{channel}}$ :

say 2.5' = bottom width

2:1 sides if  $Q = 2.7 \text{ cfs}$

$n = 0.35$   
 $S_{\text{avg}} = 3.2\% \Rightarrow v = 7 \text{ fps}$

$$T_{\text{channel}} = \frac{1050}{3} \cdot \frac{1}{60} \cdot \frac{1}{60}$$

$$T_c = \underline{\underline{0.29 \text{ hrs}}}$$

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J.B. King Mine - Dog Valley - RAINFALL - NOAA ATLAS 2  
 Volume IV - Utah  
 100 YR 6 HR 1.8"  
 10 YR 6 HR 1.2"  
 /  
 2 YR 24 HR 1.02"  
 10 YR 24 HR 1.8"

HYDRO (see attached printouts)

PEAK FLOW

10 YR 6 HR SCS 6 HR distribution  $\Rightarrow Q_{10} = 1.6 \text{ cfs}$   
 10 YR 24 HR SCS TYPE II 24 HR dist.  $\Rightarrow Q_{10} = 3.8 \text{ cfs}$

The SCS Type II storm distribution is a very severe synthetic storm distribution with most of the storm precipitation occurring within a half hour near the center of the 24 hour distribution.

CAPACITY OF EXISTING CLEANED OUT DITCH

Smallest slope:

Station 5+50 to 6+00  
 Channel depth = 2.38 ft

AREA = 15.8 ft<sup>2</sup>  
 AREA with 1' of free board = 4.1 ft<sup>2</sup>  
 (2.6 + 3.5) (1.35')

$Q = \frac{1.49}{n} A \left(\frac{A}{P}\right)^{2/3} \sqrt{S}$  Mannings Eqn

n = .035 for weedy ditch

A = 4.1 ft<sup>2</sup> with 1' of free board

P = 2.6' + 2.8' = 5.4'

S = 0.011 ft/ft

$Q = \frac{1.49}{.035} 4.1 \left(\frac{4.1}{5.4}\right)^{2/3} \sqrt{.011}$

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 15 cfs  
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CAPACITY (cont)

SMALLEST CROSS SECTIONAL AREA:

STATION 4+00

$$\text{BANK Full Area} = 9.1 \text{ ft}^2$$

Area with 1' free board =

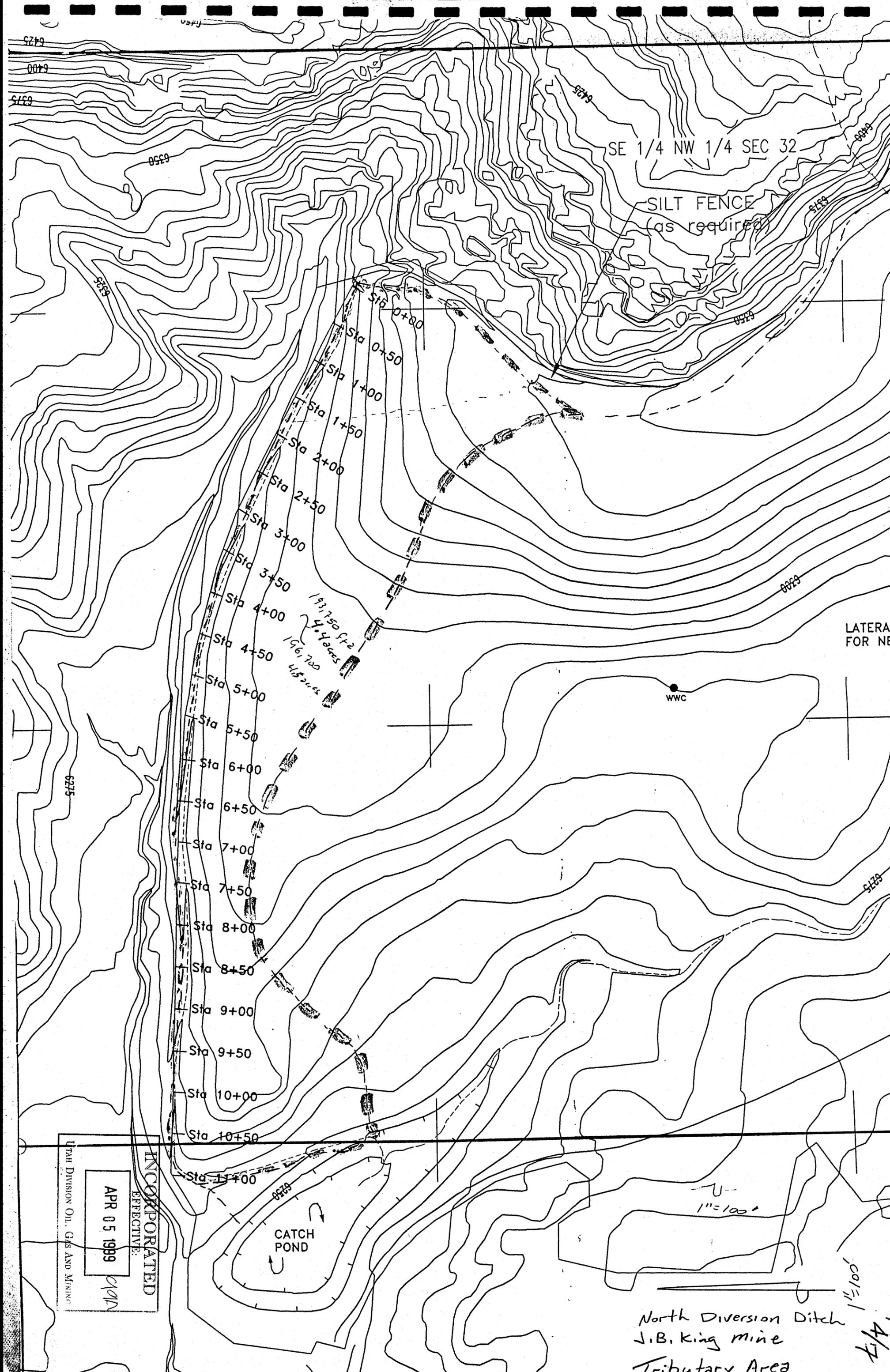
$$\left(\frac{2' + 2.7}{2}\right) 1.05 = 2.5 \text{ ft}^2$$

$$P = 2' + 2(1.05) = 4.1 \text{ ft}$$

$$\text{Slope} = \frac{6282.5 - 6279}{500 - 350} = 0.023 \text{ ft/ft}$$

$$Q = \frac{1.49}{1.035} (2.5) \left(\frac{2.5}{4.1}\right)^{2/3} \sqrt{0.023} = 11.6 \text{ cfs}$$

∴ Minimum capacity of the cleaned out ditch is greater than 10 cfs



SE 1/4 NW 1/4 SEC 32

SILT FENCE  
(as required)

LATERA  
FOR NE

WWC

1" = 100'

North Diversion Ditch  
J.B. King mine  
Tributary Area

1001/11  
4/7

- Sta 0+00
- Sta 0+50
- Sta 1+00
- Sta 1+50
- Sta 2+00
- Sta 2+50
- Sta 3+00
- Sta 3+50
- Sta 4+00
- Sta 4+50
- Sta 5+00
- Sta 5+50
- Sta 6+00
- Sta 6+50
- Sta 7+00
- Sta 7+50
- Sta 8+00
- Sta 8+50
- Sta 9+00
- Sta 9+50
- Sta 10+00
- Sta 10+50

193,750 Sq. ft.  
4.4 acres  
196,720  
4.5 acres

CATCH POND

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PROJECT : J. B. King Mine south drainage 10-year 6-hour

AREA= 4.5 ACRES  
 AVERAGE BASIN SLOPE= 3.0 PERCENT  
 CURVE NUMBER= 90.0  
 DESIGN STORM= 1.20 INCHES  
 STORM DURATION= 6.0 HOURS  
 HYDRAULIC LENGTH= 1500. FEET  
 MINIMUM INFILTRATION RATE= .00 IN/HR  
 USER INPUT TIME OF CONCENTRATION= .29 HOURS

TP= .1933 HOURS      QPCFS= 17.60 CFS      QPIN= 3.8792 INCHES  
 C3= 19.1204      ITERATIONS= 8      SCS 6-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
1.74	.2167	.0000	.0000	.0	.00
1.78	.2255	.0000	.0000	.9	.00
1.82	.2344	.0001	.0001	5.5	.00
1.86	.2432	.0004	.0003	11.7	.00
1.89	.2520	.0008	.0004	16.2	.00
1.93	.2608	.0013	.0005	17.6	.00
1.97	.2696	.0019	.0006	16.5	.01
2.01	.2855	.0034	.0015	13.9	.02
2.05	.3198	.0079	.0045	10.9	.04
2.09	.3541	.0140	.0061	8.0	.08
2.13	.3885	.0216	.0076	5.7	.15
2.17	.4228	.0307	.0090	3.8	.24
2.20	.4572	.0410	.0103	2.5	.37
2.24	.4915	.0525	.0115	1.6	.51
2.28	.5258	.0652	.0126	1.0	.66
2.32	.5602	.0788	.0137	.6	.82
2.36	.5945	.0934	.0146	.4	.97
2.40	.6288	.1089	.0155	.2	1.12
2.44	.6632	.1253	.0163	.1	1.26
2.47	.6975	.1424	.0171	.0	1.40
2.51	.7232	.1557	.0133	.0	1.52
2.55	.7325	.1606	.0049	.0	1.60
2.59	.7418	.1655	.0049	.0	1.61
2.63	.7510	.1705	.0050	.0	1.53
2.67	.7603	.1756	.0050	.0	1.39
2.71	.7696	.1807	.0051	.0	1.22
2.75	.7789	.1858	.0051	.0	1.07
2.78	.7882	.1910	.0052	.0	.93
2.82	.7974	.1962	.0052	.0	.83

HYDROGRAPH PEAK= 1.61 cfs  
 TIME TO PEAK= 2.59 Hours  
 RUNOFF VOLUME= .17 Acre-Feet

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6/7

PROJECT : J. B. King Mine south drainage 10-year 24-hour  
 AREA= 4.5 ACRES  
 AVERAGE BASIN SLOPE= 3.0 PERCENT  
 CURVE NUMBER= 90.0  
 DESIGN STORM= 1.80 INCHES  
 STORM DURATION= 24.0 HOURS  
 HYDRAULIC LENGTH= 1500. FEET  
 MINIMUM INFILTRATION RATE= .00 IN/HR  
 USER INPUT TIME OF CONCENTRATION= .29 HOURS

TP= .1933 HOURS QPCFS= 17.60 CFS QPIN= 3.8792 INCHES  
 C3= 19.1204 ITERATIONS= 8 SCS 24-hour

TIME HOURS	ACCUMULATED RAINFALL INCHES	RUNOFF INCHES	RAINFALL EXCESS INCHES	UNIT HYDROGRAPH CFS	OUTFLOW HYDROGRAPH CFS
8.12	.2212	.0000	.0000	.0	.00
8.16	.2229	.0000	.0000	.9	.00
8.20	.2245	.0000	.0000	5.5	.00
8.24	.2262	.0000	.0000	11.7	.00
8.27	.2279	.0000	.0000	16.2	.00
8.31	.2295	.0000	.0000	17.6	.00
8.35	.2312	.0000	.0000	16.5	.00
8.39	.2329	.0001	.0000	13.9	.00
8.43	.2345	.0001	.0000	10.9	.00
8.47	.2362	.0002	.0000	8.0	.00
8.51	.2380	.0002	.0000	5.7	.00
8.55	.2400	.0003	.0000	3.8	.00
8.58	.2421	.0004	.0000	2.5	.00
8.62	.2442	.0004	.0000	1.6	.00
8.66	.2463	.0005	.0000	1.0	.00
8.70	.2484	.0006	.0000	.6	.00
8.74	.2505	.0007	.0000	.4	.00
8.78	.2526	.0008	.0001	.2	.00
8.82	.2547	.0009	.0001	.1	.00
8.85	.2568	.0010	.0001	.0	.00
11.83	.9636	.2967	.0333	.0	2.68
11.87	1.0165	.3311	.0344	.0	2.96
11.91	1.0694	.3665	.0354	.0	3.21
11.95	1.1223	.4028	.0363	.0	3.43
11.99	1.1752	.4400	.0372	.0	3.61
12.03	1.2000	.4577	.0177	.0	3.76
12.06	1.2100	.4649	.0072	.0	3.79
12.10	1.2200	.4721	.0072	.0	3.62
12.14	1.2300	.4793	.0073	.0	3.28
12.18	1.2401	.4866	.0073	.0	2.84
12.22	1.2501	.4939	.0073	.0	2.38
12.26	1.2601	.5013	.0073	.0	1.88
12.30	1.2701	.5086	.0074	.0	1.65

HYDROGRAPH PEAK= 3.79 cfs  
 TIME TO PEAK= 12.06 Hours  
 RUNOFF VOLUME= .35 Acre-Feet

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**UMC 817.45 - HYDRAULIC BALANCE : SEDIMENT CONTROL MEASURES**

**3/99 Addendum #1 – North Diversion Channel** - This internal drainage channel intercepts surface overland flow within the disturbed area boundary, and directs that flow to the sedimentation impoundment. Since its inception in 1985-86 it has functioned properly and without incident. However, it became silted in prior to the fall of 1998 and a significant precipitation event caused the channel to breach and the flow to escape outside the disturbed area boundary. This was the basis of the issuance of NOV# N98-45-4-1. This has been terminated with clean-out work performed in Nov. 1998, and should remain fully functional for the remainder of its useful life.

**3/99 Addendum #2 – Silt Fence Removal** - An approximate 50 to 75 ft. section of silt fencing along the northeast boundary of the disturbed area, between the reclaimed vegetation test plot area and the diverted undisturbed surface drainage, was removed in Nov. 1998. This specific area no longer required silt fence protection; since the soils were stabilized through revegetation and natural rock armoring.

**3/99 Addendum #3 - Husbandry Practices** - Husbandry practices were incorporated into an approximate 0.67 acre parcel, located in the north-central portion of the disturbed area boundary; and directly south of the North Diversion Channel. During the Nov. 1998 site work plan, this area had the ground “roughened” using a hydraulic excavator and reseeded with the approved seed mix.

*Note- All of the above listed addenda are shown on the attached map JBK-4 AS BUILT*



**UMC 817.114 - REVEGETATION : MULCHING AND OTHER SOIL STABILIZING PRACTICES**

**3/99 Addendum – Husbandry Practices** - An approximate 0.67 acre parcel, located in the north-central portion of the disturbed area boundary (shown on map **JBK-4 AS BUILT**), received surface “roughening” and reseeding in Nov. 1998. The surface “roughening” was performed using a small hydraulic excavator, and then the area was hand broadcast seeded using an approved seed mix. This specific area was chosen to enhance vegetation and help prevent excessive precipitation run-off to adjacent slopes; which includes the slope contributing to the North Diversion Channel.

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